D-08 Thematic Poster - **Female and Sex-Specific Physiology**

Thursday, May 30, 2019, 1:30 PM - 3:30 PM
Room: CC-104B

1586 **Chair:** Saori Hanaki. *Weber State University, Ogden, UT.*
(No relevant relationships reported)

1587 Board #1 May 30 1:30 PM - 3:30 PM

Role Of Gender In Anti-oxidant Response To A Bout Of Aerobic Exercise In Healthy Adults

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Aerobic exercise acutely increases the production of reactive oxygen species (ROS), which creates an imbalance between free radicals and the body's antioxidant defenses, resulting in increased oxidative stress. Oxidative stress levels are reportedly higher in males compared to females, however there is limited knowledge regarding the role of gender in the antioxidant response following an acute bout of aerobic exercise. **Purpose**: To determine whether changes in serum antioxidant levels after an acute aerobic exercise bout differed between genders. **Methods**: The study comprised of 15 healthy adults (9 females, 6 males; age 27±8 years; BMI 24±3 kg/m^2) enrolled in the NIH Fatigue in Healthy Individuals Protocol (NCT00888563). During the first visit, subjects completed a treadmill cardiopulmonary exercise test (CPET) to volitional exhaustion. On a separate visit, subjects performed a vigorous-intensity continuous work rate (WR) test, to volitional exhaustion on the treadmill. Serum samples were collected before and immediately after the vigorous exercise bout. A Human Oxidative Stress Multiplex panel was used to determine serum peroxidase (PRX2) and catalase levels. Student's t-tests were performed between genders for WR and antioxidant levels. **Results**: Males performed vigorous-intensity exercise at a higher WR than females ($p<0.0001$). No difference was found in baseline PRX2 and catalase levels between males and females. Relative change in PRX2 (+32% in males; -17% in females) and catalase (+18% in males; -11% in females) was different between genders after a vigorous bout of aerobic exercise ($p=0.0136$, $p=0.0344$, respectively). This difference became insignificant when WR was accounted for. **Conclusion**: This study suggests that higher levels of oxidative stress in males may be explained by higher work rates. However, response to exercise-induced oxidative stress demonstrated that males (6 of 6) increased anti-oxidant levels, while females (8 out of 9) showed decreased levels. Previous studies have suggested that gender differences in oxidative stress may be related to an increased production of ROS by NADPH-oxidase in males, or antioxidant properties of estrogen which may assist in minimizing oxidative stress in females.
Funding: National Institute of Nursing Research, Division of Intramural Research

1588 Board #2 May 30 1:30 PM - 3:30 PM

Sex Differences in Anabolic Regulators during Development of Atrophic Pathology in Hindlimb-Unloading-Induced Disuse

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Muscle atrophy is a comorbidity in many disease conditions, contributing to accelerated disease progression/terminal outcomes. Muscle wasting results alterations in the ratio of protein synthesis to degradation, with wasting conditions favoring degradation. Atrophic conditions differentially affect discrete muscle types. For many diseases, onset and progression of muscle atrophy presents differently between muscle fiber types and sex; **PURPOSE**: To assess gene content outcomes of three established anabolic regulators Pgc-1α4, IGF-1, and Deptor, in female and male mice during initiation and progression of disuse atrophy across multiple fiber types. **METHODS**: 100 female and male C57BL/6J mice were hindlimb unloaded for 0h, 24h, 48, 72 and 168h, to induce muscle atrophy. At assigned endpoints, soleus and gastrocnemius muscles were excised and processed for mRNA analysis of Pgc-1α4, IGF-1, and Deptor using RT-PCR. Data were analyzed by one-way ANOVA within each sex, $\alpha=0.05$. Pre-planned contrast comparisons determined sex differences at each time point, $\alpha=0.01$. **RESULTS**: Soleus and gastrocnemius masses presented lower at 24h in female (-11.8%, -9%; $p<0.05$) and 48h in male (-16%, -13%; $p<0.05$) compared to control. In predominantly type I soleus, Pgc-1α4 mRNA content showed a decline from control across time in females, while spiking >9, >6-fold in males at 72h and 168h ($p<0.05$). In contrast, IGF-1 showed higher content in females at 72h and 168h (+77%, +27%; $p<0.05$) than males. In gastrocnemius, a more mixed fiber type, Pgc-1α4 content was 3-fold higher in females at 24h ($p<0.05$). Female IGF-1 content was significantly elevated compared to male at 72h ($p<0.05$). Deptor content in gastrocnemius was >3-fold from baseline at 24h in females and >2-fold from baseline at 48h in males ($p<0.05$) depicting the only mRNA content change aligning with the observed time course for appearance of loss in muscle mass. **CONCLUSION:** Anabolic regulator responses to atrophic stimuli differ across sex, muscle tissue and time course of muscle atrophy. These early findings could suggest Deptor as a novel therapeutic target to ameliorate muscle wasting conditions.
Supported by NIH Grant R15 AR069913/AR/NIAMS.Sponsoring Fellow: Stavros A. Kavouras; stavros.kavouras@asu.edu

1589 Board #3 May 30 1:30 PM - 3:30 PM

Similar Central and Peripheral Fatigue in Men and Women after Running

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PURPOSE: Women may be less fatiguable than men during prolonged endurance exercise. There are a paucity of studies which have compared fatigue in both sexes after moderately long duration running typical of marathon-type training. **METHODS**: We compared sex differences in peripheral and central fatigue in 8 men and 6 premenopausal women runners. Volunteers [38±2 and 32±2 yrs, $p=0.017$; VO_{2peak} 59±3 and 54±3, ml/kg/min, $p=0.202$, men vs women respectively] ate a standardized breakfast [6 Kcal/kg] 90 minutes prior to commencing testing. Water was provided at 1% of body mass/hr, during a 2-hr run at their ventilatory threshold [~65% VO_{2peak}], followed by a self-paced 2-km time trial. RPE and respiratory measures were determined every 20 minutes. Strength was tested in a semi-reclined position [75° hip flexion, to facilitate femoral nerve stimulation] pre-exercise, after the 2-hr run and post-time trial as follows: voluntary isometric quad strength was measured on the Biodex with the knee flexed 60°, and with superimposed peripheral magnetic stimulation [PMS] of the femoral nerve to determine central activation [CAR]. PMS was also applied in a 3-second pulse train on a relaxed muscle to measure peripheral fatigue. Changes in strength and in metabolic measures were analyzed with repeated measures ANOVA.
RESULTS: Following running, voluntary strength declined by ~16% in both sexes [effect of time $p<0.001$; sex X time $p=0.206$]. CAR also decreased in both men and women [effect of time $p=0.020$, time X sex $p=0.762$]. PMS-stimulated forces, our measure of peripheral fatigue, were unchanged after running: there was no effect of time [$p=0.10$] in men or women [time X sex, $p=0.322$]. Substrate use and RPEs did not differ between sexes.
CONCLUSIONS: We found that both sexes fatigued similarly after a 2-hr run plus a 2-km time trial, and that all of the fatigue was central in nature. While women may be more fatigue-resistant than men, those differences might not be apparent until a greater duration of running is engaged in, e.g. ultramarathon distances.

1590 Board #4 May 30 1:30 PM - 3:30 PM

The Effects Of Swimming On Bone Density In Female Collegiate Swimmers.

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(No relevant relationships reported)

Swimming provides numerous health benefits, but as a non-weight bearing activity research suggests it provides no constructive benefits on bone strength at dual energy x-ray absorptiometry (DXA)-measured hip and lumbar spine sites. However, little research has focused on skeletal sites stressed during swimming such as the upper arm. Purpose: To determine potential site-specific bone strength adaptations at the humerus among collegiate swimmers compared to sedentary controls.
Methods:
Bone geometry and strength were assessed by peripheral quantitative computed tomography (pQCT) in ten collegiate female swimmers (BMI 23 kg/m^2; mean 13.9±1.5 pool hours/week) and ten sedentary controls (BMI 24 kg/m^2; <150 minutes/week of physical activity) ages 18-23 years. Total volumetric bone mineral density (vBMD, mg/mm^3) and total bone area (ToA, mm^2) were assessed at the distal (4%) tibia. Cortical bone area (CoA, mm^2), cortical density (vBMD), cortical thickness

(CoTh, mm), bone bending strength (polar strength-strain index (SSIp, mm^3) were measured at the midshaft (66%) tibia, humerus (50%), and radius 33% sites. Using DXA areal BMD (g/cm^2) was assessed at the hip, humerus and radius sites.
Results:
There were no significant between-group differences in DXA outcomes at any site. PQCT-derived outcomes are presented in Table 1. At the 66% tibia site the control group had a 14.8% greater CoA and 6.1% greater CoD compared to swimmers (both $p<0.05$). However, no significant bone strength differences were found at the humerus, radius, or distal tibia sites.
Table 1: pQCT-derived Outcomes.

	Swim	Control	Significance ($p<0.05$)
Radius 33%			
Cortical Area (CoA, mm^2)	78.4±3.4	85.0±3.6	0.215
Cortical Density (vBMD, mg/cm^3)	1191.3±8.6	1163.6±9.1	0.051
Cortical Thickness (CoTh, mm)	3.1±0.1	3.5±0.1	0.097
SSIp (mg/mm^4)	215.4±13.2	227.0±14.0	0.574
Humerus 50%			
Cortical Area (CoA, mm^2)	178.0±6.8	172.5±7.2	0.596
Cortical Density (vBMD, mg/cm^3)	1170.5±12.3	1173.0±13.0	0.890
Cortical Thickness (CoTh, mm)	4.1±0.1	4.0±0.2	0.856
SSIp (mg/mm^4)	886.0±55.2	868.5±58.4	0.835
Tibia 66%			
Cortical Area (CoA, mm^2)	270.1±13.5	313.2±14.2	0.045
Cortical Density (vBMD, mg/cm^3)	1074.4±8.0	1143.1±8.4	0.000
Cortical Thickness (CoTh, mm)	4.6±0.2	5.0±0.2	0.179
SSIp (mg/mm^4)	2121.5±134.2	2178.6±134.3	0.764
Tibia 4%			
Total Area (ToA, mm^2)	139.4±25.4	141.6±26.9	0.953
Total Density (vBMD, mg/cm^3)	507.0±35.5	538.1±38.5	0.571

Conclusion:
Our results showed that swimming does not appear to improve bone microarchitecture or strength, even at loaded sites such as the humerus. This data suggests that swimming should be supplemented with weight-bearing and resistance exercises to preserve bone strength. Future research should investigate whether site-specific bone adaptations occur at skeletal sites not yet measured.

1591 Board #5 May 30 1:30 PM - 3:30 PM

Sex Differences in Recovery from Extreme and Severe Intensity Exercise

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Previous protocols investigating neuromuscular fatigue have typically discarded the first 2 of 6 electrical stimulation sets in recovery and have reported the average of the remaining force values. However, our lab has recently shown that central (as measured by maximal voluntary contraction force, MVC; and voluntary activation, VA) and peripheral fatigue (as measured by potentiated twitch force, Q_{tw}) had significantly recovered within 90 s following extreme intensity exercise and would otherwise be missed using contemporary protocols.**PURPOSE**: The purpose of this study was to test the hypothesis that MVC, VA, and Q_{tw} immediately following task failure of extreme intensity exercise would be significantly lower than those measured 2 min into recovery in both men and women, while remaining suppressed following severe exercise.
METHODS: Two men (26 ± 5 yrs; 109 ± 9 kg; 179 ± 1 cm) and two women (23 ± 2 yrs; 55 ± 3 kg; 159 ± 1 cm) performed 2 intermittent isometric knee extension tests to exhaustion at 40% (severe intensity) and 70% (extreme intensity) MVC in random order. Neuromuscular measurements were made every 30 s beginning immediately after task failure for a total of 6 sets. The last two MVC, VA, and Q_{tw} were averaged and compared to the first measurement immediately following task failure using paired t-tests.
RESULTS: Q_{tw} and MVC significantly decreased following severe and extreme exercise ($p<0.01$). However, VA was not different across severe or extreme exercise. VA was not different across recovery following severe or extreme exercise. MVC was not different following severe, however, had increased following extreme ($p=0.02$) exercise. Q_{tw} was significantly recovered after severe ($p<0.01$) and extreme ($p<0.02$) exercise. Further, qualitative analysis suggests women may be able to recover MVC and Q_{tw} faster than men following extreme exercise, while these differences may not be evident following severe exercise.
CONCLUSIONS: These current data suggest central fatigue (as measured by VA) does not significantly impact exercise tolerance during severe or extreme exercise. Importantly, these data suggest that the measurements typically used to represent the condition of the muscle are taken too far post-exercise such that much of the recovery of the muscle has already occurred, especially following extreme exercise.

1592 Board #6 May 30 1:30 PM - 3:30 PM

Skeletal Responses To An All-female Unsupported Antarctic Expedition

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Arduous training can result in an energy deficit, the consequences of which include impaired bone health and increased stress fracture risk, as determined by acute interventional or cross-sectional studies. Women are more prone to stress fractures than men, and possibly more susceptible to metabolic perturbations associated with reduced energy availability. No study has longitudinally examined the effect of a prolonged severe energy deficit on bone in women. **Purpose:** To investigate the skeletal effects of the first all-female trans-Antarctic expedition. **Methods:** Six women (mean ± SD, age 32 ± 3 years, height 1.72 ± 0.07 m, body mass 72.1 ± 3.8 kg) each hauled an 80 kg sledge over 1700 km in 61 days from coast-to-coast across the Antarctic. Whole-body areal bone mineral density (aBMD) (dual energy x-ray absorptiometry) and tibial volumetric BMD (vBMD), geometry, microarchitecture and mechanical properties (high-resolution peripheral quantitative computed tomography) were assessed 39 days before (pre-expedition) and 15 days after (post-expedition) the expedition. Serum and plasma markers of bone turnover were assessed pre-expedition, and 4 and 15 days after the expedition. **Results:** There were reductions in trunk (−2.6%), ribs (−5.0%) and spine (−3.4%) aBMD from pre- to post-expedition (all $P \leq 0.046$); arms, legs, pelvis and total body aBMD were not different (all $P \geq 0.075$). Tibial vBMD, geometry, microarchitecture and mechanical properties at the distal metaphysis (4% site) and diaphysis (30% site) were not different between pre- and post-expedition (all $P \geq 0.082$). Bone-specific alkaline phosphatase was higher 15 days post- than 4 days post-expedition (18.0 vs 16.3 $\mu g \cdot l^{-1}$, respectively, $P = 0.028$). Total 25(OH)D decreased markedly from pre- to 4 days post-expedition (112 vs 76 $nmol \cdot l^{-1}$, respectively, $P = 0.008$). Sclerostin, procollagen 1 N-terminal propeptide, C-telopeptide cross-links of type 1 collagen and adjusted calcium were unchanged (all $P \geq 0.154$). **Conclusion:** The deleterious effect of the expedition on aBMD may be due to indirect and direct effects of prolonged energy deficit on bone turnover. We propose that weight-bearing exercise was protective against the effects of low energy availability on tibial vBMD, geometry, microarchitecture and strength.
Supported by UK Ministry of Defence (Army)

1593 Board #7 May 30 1:30 PM - 3:30 PM

BMI as a Predictor of Bone Mineral Density Among Premenopausal Women

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Bone mineral density is an important women's health topic. Osteoporosis is one of the most common bone diseases and is expected to affect more than 61 million people in the U.S. by the year 2020. According to the International Osteoporosis Foundation, low body weight is associated with greater bone loss and increased fracture risk. Body Mass Index is a commonly assessed physical characteristic which has also been linked with bone health and could be a useful tool in osteoporosis prevention (Asomaning, Bertone-Johnson, Philip, Hooven, Pekow, 2006). Much of the existing research has historically focused on postmenopausal groups. **PURPOSE:** The purpose of this study was to assess whether BMI was a significant predictor of bone mineral density (BMD) among a group of premenopausal women. **METHODS:** A total of 42 premenopausal women (38.69 ± 7.95 years) participated in this study. Anthropometric

data were collected and BMD (g/cm^2) was measured at the hips and lumbar spine with a Hologic dual energy x-ray absorptiometry (DEXA) machine. **RESULTS:** Significant correlations ($p < .05$) were found between lumbar spine and hip BMD, and BMI ($r = .33$, $p = .031$), ($r = .35$, $p = .022$) respectively. Regression analysis confirmed that BMI was a statistically significant predictor of BMD for both the hips $F(1,41) = 5.71$, $MSE = .02$, $p = .022$, $Adj.\ R^2 = .10$ and lumbar spine $F(1,41) = 5.02$, $MSE = .03$, $p = .031$, $Adj.\ R^2 = .09$. **CONCLUSIONS:** Among this group of premenopausal women, BMI was positivity correlated with, as well as being a significant predictor of BMD at the hips and lumbar spine. Medical and fitness professionals may find it useful to advise clients about the importance of having a healthy BMI value not only for the management and prevention of obesity but also for healthy bone mineral density and osteoporosis prevention. Future research might establish more clear guidelines for the use of BMI as it relates to osteoporosis risk among men and women. IRB# 1213-0223

1594 Board #8 May 30 1:30 PM - 3:30 PM

Dynapenic Abdominal Obesity And The Incidence Of Falls In Older Women: An 18-month Follow-up Study

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PURPOSE: To assess the association between dynapenic abdominal obesity (DAO) and the incidence of falls over 18 months in older community-dwelling women.
METHODS: A total of 188 older women (67.97±6.02 years; 27.70kg/m^2) underwent waist circumference (WC) measurement and had handgrip strength assessed at the dominant arm using a hydraulic dynamometer. Dynapenia was classified using the lower tertile of handgrip strength as cut-off value (20.7kgf), while obesity was considered as a WC > 88cm. DAO was the combination of both aforementioned criteria. Therefore, volunteers were divided into 4 groups: Eutrophic, Dynapenic, Obese, and DAO. Participants were tracked by phone calls for ascertainment of falls during a follow-up period of 18 months. Chi-square and modified Poison regressions were conducted.
RESULTS: Proportions of each classification were 17.6%, 46.8%, 13.3%, and 22.3% for eutrophic, obese, dynapenic, and DAO, respectively. The incidence of falls over 18-month follow-up period was 24.5%. Thus, the proportion of fallers regarding each classification were 12.1%, 12%, 25%, and 40.5% for eutrophic, dynapenic, obese, and DAO, respectively (X^2=10.662; p=0.014). Noteworthy, only DAO was consistently associated with a higher risk of falls (relative risk: 3.339; 95% CI: 1.242-8.979), even after adjustments for age, body mass index, physical activity level, regular use of four or more medications, reduced peripheral sensation, presence of two or more chronic diseases, and history of lower-limbs pain.
CONCLUSIONS: These results provide support for the concept that the combination of abdominal obesity and dynapenia has clinical implications and might be an useful supplement to other routine falls risk assessment tools. These relationships were stronger than obesity or dynapenia alone.

D-09 Thematic Poster - Physical Activity & Behavioral Science during Pregnancy and Motherhood

Thursday, May 30, 2019, 1:30 PM - 3:30 PM
Room: CC-102B

1595 **Chair:** Sofiya Alhassan, FACSM. *University of Massachusetts, Amherst, MA.*
(No relevant relationships reported)

1596 Board #1 May 30 1:30 PM - 3:30 PM

Baseline Correlates Of Sedentary Behavior In The Health In Pregnancy And Postpartum (HIPP) Study

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(No relevant relationships reported)

Despite the benefits of physical activity and the potential risks of sedentary behavior (SB), few studies have examined sensor-measured SB in pregnant women.
PURPOSE: To report SB in a sample of women in early pregnancy and examine associations with sociodemographic and psychological variables.
METHODS: We analyzed baseline data from the HIPP trial, a RCT enrolling SC women who are <16 wks gestation, overweight or obese, white or African American, 18 to 44 yrs old, and without exercise contraindications. Participants wore a SenseWear armband ≥ 20 hrs/d for ≥ 5 days (including ≥ 1 weekend day). SB was defined as MET values < 1.5. Total time in non-sleep SB, # of SB bouts ≥ 30 min, and total time in SB bouts ≥ 30 min were calculated. Differences in SB by parity, race, education, marital status, and employment (t-tests), as well as BMI, age, depressive symptoms, perceived stress, and satisfaction with body function and appearance (Pearson rs) were tested.
RESULTS: To date, participants (n=202) randomized with usable armband data are 12±2 wks gestation, 42% nulliparous, 30±5 yrs old, 45% African American, 53% obese, 59% college educated, 67% married, and 61% employed full-time. On average, participants spent 12.0±1.7 hrs/d in non-sleep SB, representing 51% of total wear time and 75% of wake time. They averaged 6.2±1.9 SB bouts/d that were ≥ 30 min and spent 5.7±2.3 hrs/d in these bouts. Total SB time, SB time in ≥ 30 min bouts, and # of SB bouts ≥ 30 min were greater in African American (p<.0001), obese (p<.0001), and unmarried (p<.01) women, and in those without a college degree (total time & # bouts, p<.05). All three SB variables were strongly and positively associated with BMI (rs = .48 to .53, p<.0001). SB time in ≥ 30 min bouts and # of SB bouts ≥ 30 min were positively associated with depressive symptoms (rs =.15, p<.05) and negatively associated with satisfaction with body function (rs = -.17 p<.05). SB variables did not differ by parity, employment, age, perceived stress, or satisfaction with body appearance.
CONCLUSIONS: Total SB time, SB time in ≥ 30 min bouts, and # of SB bouts ≥ 30 min appear to be high in early pregnancy, with these behaviors of particular concern in several demographic subgroups. SB was also related to more negative psychological experiences. Interventions to target SB could benefit pregnant women.
Funded by NIH/NICHD.

1597 Board #2 May 30 1:30 PM - 3:30 PM

Sensor-measured Physical Activity In Overweight And Obese Women In Early Pregnancy

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Overweight and obese pregnant women may benefit from physical activity (PA) in pregnancy, yet few studies have examined sensor-measured PA in pregnancy.
PURPOSE: To evaluate sensor-measured PA in overweight and obese pregnant women and its sociodemographic and psychological correlates.
METHODS: We analyzed baseline data from an ongoing behavioral lifestyle intervention trial in Columbia, SC (n=202). PA was measured with the SenseWear Armband; compliance was set at wearing for 20+ hrs/d, 5+ days (including 1+ weekend day). PA measures were daily duration of light PA (LPA), moderate to

vigorous PA (MVPA), daily steps, and meeting MVPA guidelines (≥150 min/wk of MVPA in ≥10 min bouts). PA was presented as median (interquartile range). Subgroup differences in medians were examined with quantile regression models. Correlations of PA measures with perceived stress, depressive symptoms, PA social support, PA self-efficacy, and PA self-regulation were studied. A logistic regression model was used to examine correlates of meeting MVPA guidelines.
RESULTS: Participants (mean of 12.4 weeks gestation) had a median of 203 (154, 258) min/d LPA, 34 (20, 49) min/d MVPA, and 4,870 (3768, 6590) steps/d. LPA, MVPA, and steps were lower in African American and obese women ($p<.05$). LPA was lower in nulliparous women ($p<.05$). Participants with less than college education had lower MVPA and steps ($p<0.05$). Further, LPA, MVPA, and steps were positively associated with PA self-efficacy (r's ranging from 0.13 to 0.16, $p\leq.05$) and PA goal setting (r's ranging from 0.16 to 0.21, $p<.05$). MVPA was positively associated with PA planning ($r=0.16$, $p<.05$). Only 10.4% of participants met MVPA guidelines, which was more prevalent in white (17.1%) vs African American (2.2%) women and in overweight (17.9%) vs obese women (3.7%) ($p<0.05$). After adjusting for age, parity, and marital status, white women and overweight women had higher odds of meeting MVPA recommendation than their counterparts: white: 5.8 (1.2-28.6); overweight: 5.2 (1.6, 16.9).
CONCLUSION: Sensor-measured PA was low in overweight and obese pregnant women in early pregnancy with significant differences by race, education, parity, and pre-pregnancy weight status. Programs targeting PA are needed for this population. Funded by NIH/NICHD.

1598 Board #3 May 30 1:30 PM - 3:30 PM

The Association Between Type and Intensity of Physical Activity on Cortisol Levels Among Low-Income, Ethnic-Minority Mothers

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Physical activity has been linked to many health benefits such as reduced cardiovascular disease risk. Furthermore, the health benefits of intensity and type of activity varies (e.g., vigorous aerobic activity reducing cardiovascular risk more than moderate). During parenthood, mothers can experience increased levels of stress, such as the stress hormone cortisol, and are also less likely to engage in physical activity compared to other populations. However, few studies have focused on mothers and on the impact of type and intensity of physical activity on their cortisol levels. **PURPOSE:** The current pilot study examined whether different types and intensities of physical activity (walking, housework, fitness, recreational, occupational, and miscellaneous activity; moderate and vigorous activity) were associated with cortisol patterns among 30 low-income, ethnic-minority mothers (57% average annual income <$20,000; 53% Latina) and whether this association varied by the number of children the mothers had. **METHODS:** The majority of our sample were sedentary with only 3% meeting the national recommendations of daily aerobic activity (>30 minutes or more of moderate to vigorous aerobic activity). Mothers completed an activity log of their physical activity over three days. During this three-day period, mothers also collected their saliva at four times on one collection day (upon waking time, 30 minutes after waking, 4pm, and 8pm) to assess for cortisol levels. **RESULTS:** Multiple regression analyses found that mothers who engaged in greater minutes of vigorous recreational activity had higher cortisol levels, but only among mothers with more children ($\beta = 1.65$, $t(21) = 2.40$, $p = 0.03$). Additionally, mothers who engaged in greater minutes of moderate or vigorous miscellaneous (e.g., heavy lifting) activity had higher cortisol levels, but only among mothers with more children ($\beta = 6.93$, $t(21) = 3.12$, $p = 0.01$). No significant association was found with other types of activity. **CONCLUSION:** Despite the benefits of physical activity, results suggest that low-income, ethnic minority mothers with more children are not receiving these benefits and that number of children may be a stressor. Future research should consider family size when designing and implementing physical activity interventions in this population.

1599 Board #4 May 30 1:30 PM - 3:30 PM

Self-regulation Capacity Of Low-income Mothers In Community-based Nutrition Program

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(No relevant relationships reported)

Diet is strongly associated with many risk factors for chronic disease. Educational programs such as the Expanded Food and Nutrition Education Program (EFNEP) are designed to improve dietary behaviors among low-income populations. Although EFNEP has seen improvements, they do not yet meet recommendations. Self-regulation is the process of guiding thoughts, feelings, and behaviors to stay in line with perceived goals. Previous studies have been successful in eliciting behavior change when improving self-regulation in conjunction with dietary education.
PURPOSE: The purpose of this study was to examine self-regulation in EFNEP participants and its relationship to participants change in dietary behavior.
METHODS: All participants were currently enrolled in EFNEP and were asked to complete an additional self-regulation survey. This survey included five questions on a Likert scale from 1-5, with 5 indicating high self-regulation. These were averaged to assess overall self-regulation capacity pre- and post-program. Fruit and vegetable intake were measured using EFNEPs current diet-recall survey.
RESULTS: On average, the participants had low levels of self-regulation both pre- and post-intervention (2.74 ± 0.71 and 2.59 ± 0.78, respectively). Regarding vegetable intake, there was no statistically significant change from pre- to post-program (1.51 ± 1.36 and 1.42 ± 1.32 cups, respectively). However, there was a statistically significant different regarding fruit intake, increasing from 0.86 ± 0.94 to 1.39 ± 1.39 cups per day. Neither fruit nor vegetables increased to MyPlate recommendations.
CONCLUSIONS: Participants self-regulation capacity was on average low, and did not increased from pre- to post-program. Results also indicate that fruit and vegetable intake did not reach MyPlate recommendations. From these results, we can conclude that self-regulation training may be a necessary supplement to the program to see improvements in the participants dietary behavior.

1600 Board #5 May 30 1:30 PM - 3:30 PM

Physical Activity Does Not Moderate the Relationship Between Postpartum Body Satisfaction and Depressive Symptoms

Faith C. LaFramboise, Rebecca A. Schlaff, Samantha J. Deere, Meghan Baruth. *Saginaw Valley State University, University Center, MI.*
(No relevant relationships reported)

Postpartum depressive symptoms (PDS) are common among U.S. women and may be related to postpartum body image satisfaction (BIS). The effect of postpartum moderate to vigorous intensity physical activity (MVPA) on this relationship is less studied. **PURPOSE:** To examine the relationship between postpartum BIS and PDS, and to examine whether MVPA moderates this relationship. **METHODS:** Non-pregnant women who were ≤12 months postpartum and ≥18 years of age completed an online survey. Participants (n=256) self-reported 1) demographics, 2) pre-pregnancy height and weight, 3) current BIS via Body Attitudes Questionnaire (BAQ; six subscales: attractiveness, feeling fat, disparagement, strength and fitness, salience of weight/shape, and lower body fat), 4) PDS via the 10-item Center for Epidemiologic Depression Scale (CES-D), and 5) postpartum MVPA. Relationships between BAQ subscales and PDS were examined using linear regression, controlling for months postpartum. MVPA and the BAQ x MVPA interaction were added to the model to examine the moderating effects of MVPA on the relationship between postpartum BIS and PDS. An alpha level of 0.05 was used to determine statistical significance. **RESULTS:** On average, participants were 30.3±3.9 years of age and 5.6±3.8 months postpartum. A majority of the sample were Caucasian (96.1%), married (89.9%), and college graduates (75.2%). Four BAQ subscales were positively related to PDS (disparagement: $p<0.0001$, feeling fat: $p<0.0001$, salience: $p<0.0001$ and lower body fatness: $p=0.005$); two were inversely related (attractiveness: $p=0.0007$ and strength and fitness: $p=0.003$). MVPA did not moderate the relationship between BIS and PDS (BAQ subscale x MVPA interactions: attractiveness: $p=0.7998$, disparagement: $p=0.8842$, feeling fat: $p=0.4515$, salience: $p=0.1311$, lower body fatness: $p=0.9376$, and strength and fitness: $p=0.7429$). **CONCLUSION:** Postpartum BIS may be a significant factor that predicts PDS; however, our findings indicate that MVPA may not moderate this relationship. Future intervention research should include strategies that promote positive body image during the postpartum period. Although not a moderator, efforts aimed at promoting PA should continue, as it has numerous other benefits to pregnant and postpartum women.

1601 Board #6 May 30 1:30 PM - 3:30 PM

Impact of Weight Related Variables on Postpartum Depressive Symptoms

Samantha J. Deere, Meghan Baruth, Rebecca A. Schlaff. *Saginaw Valley State University, University Center, MI.*
(No relevant relationships reported)

Postpartum mental health issues are common, yet predictors are less understood. Pre-pregnancy weight and weight change during pregnancy through the postpartum period may be associated with postpartum mental health issues. **PURPOSE:** To investigate the associations between postpartum depressive symptoms and 1) pre-pregnancy body mass index (BMI), 2) weight gain during pregnancy, 3) weight loss at 6 months postpartum, and 4) postpartum weight retention (PPWR). **METHODS:** Women (n=323) who gave birth within the past 12 months completed an online survey assessing demographics, self-reported pre-pregnancy weight and height (to calculate pre-pregnancy BMI), weight gain during pregnancy, weight loss at 6 months

postpartum (to calculate weight retention at 6 months), and current weight (to calculate PPWR). The 10-item Centers for Epidemiological Studies Depression Scale (CES-D 10) measured postpartum depressive symptoms. Regression models examined the relationship between postpartum depressive symptoms and 1) pre-pregnancy BMI, 2) weight gain during pregnancy (controlling for pre-pregnancy BMI), 3) weight loss at 6 months postpartum (controlling for weight gain), and 4) PPWR (controlling for months postpartum). **RESULTS:** On average, women were 30.1±3.9 years of age and 5.5±3.7 months postpartum. Mean pre-pregnancy BMI was 27.5±6.8 kg/m^2, and weight gain was 29.8±14.1 pounds. A majority were Caucasian (97%), married (88%), and college graduates (77%). Results showed a significant, positive relationship between postpartum depressive symptoms and 1) pre-pregnancy BMI (p=0.04) and 2) PPWR (p=0.04). A significant negative relationship was identified between postpartum depressive symptoms and weight loss at 6 months (p=0.01). There was no significant relationship between postpartum depressive symptoms and weight gain during pregnancy (p=0.93). **CONCLUSION:** Women with a higher pre-pregnancy BMI, higher PPWR, and lower weight lost at 6 months postpartum, may be at a greater risk for postpartum depressive symptoms; weight gain during pregnancy was not associated with postpartum depressive symptoms. Understanding factors associated with postpartum depressive symptoms can help develop and implement appropriate screenings/follow-ups and interventions among those at greatest risk.

1602 Board #7 May 30 1:30 PM - 3:30 PM

Joint Influence Of Physical Activity And Quality Of Sleep On Pregnancy - Related Anxiety

Emma K. Wilsie[1], Christopher P. Connolly[1], Zoe Wright Osborn[1], Maria Gartstein[1], Sara Waters[2]. *[1]Washington State University, Pullman, WA. [2]Washington State University, Vancouver, WA.*

(No relevant relationships reported)

Pregnancy-related anxiety (PRA) is experienced by many women, given the physical and psychosocial challenges common during pregnancy and the prospect of childbirth. Some health behaviors, such as physical activity and quality of sleep (QS), are related to decreased PRA, but their joint influence is unclear. **PURPOSE:** We examined the individual and joint influences of physical activity behaviors and QS on PRA among pregnant women at two locations. **METHODS:** Third-trimester pregnant women (N=33) participated in a series of measurements between 28-36 weeks gestational age. Participants answered questions recalling their moderate and vigorous physical activity (min/wk) for prepregnancy, in the first and second trimesters, and concurrently. Moderate to vigorous physical activity (MVPA) was calculated for prepregnancy and for each trimester. Participants also wore a validated physical activity monitor (Modus StepWatch) for one week, and average steps/day were calculated. QS was evaluated with the Pittsburgh Sleep Quality Index (PSQI), calculating a global score. The Pregnancy Related Anxiety Questionnaire (PRAQ-R) was used to assess women's anxiety regarding childbirth and the health of the baby. Median split was used to categorize PRA as "high" [≥15.0 PRA scale] or "low" [<15.0]. Mann-Whitney U-tests were used to compare the distribution of MVPA for all timepoints, steps/day, and also QS between high and low PRA participants. Hierarchical logistic regression determined the joint influence of MVPA and quality of sleep on PRA. **RESULTS:** Mann-Whitney U-tests showed lower PRA participants had significantly superior third trimester global QS scores [p=0.048]. Likewise, global QS scores were related to increased odds of high PRA [β=1.34, 95% CI: 0.99-1.80]. Average steps/day and self-reported MVPA prior to pregnancy and at all pregnancy timepoints were not related to PRA. Hierarchical analyses did not reveal an interactive effect of steps/day and QS or MVPA and QS on PRA as hypothesized. **CONCLUSIONS:** Lower QS is related to higher PRA during the third trimester of pregnancy. Physical activity was not related to PRA and interactive effects with QS on PRA were not found. Larger samples are needed to confirm these findings.

D-10 Thematic Poster - Physical Activity Interventions in the Modern Age

Thursday, May 30, 2019, 1:30 PM - 3:30 PM
Room: CC-102A

1603 **Chair:** Jeremy Loenneke, FACSM. *The University of Mississippi, University, MS.*

(No relevant relationships reported)

1604 Board #1 May 30 1:30 PM - 3:30 PM

Effects of Four Types of Physical Activity Courses on College Students' Perceived Stress, Well-Being, and Social Support

Zhonghui He[1], SenLin Chen[2], Weiyun Chen[3], Linchen Kong[4]. *[1]Peking University, Beijing, China. [2]Louisiana State University, Baton Rouge, LA. [3]University of Michigan, Ann arbor, MI. [4]University of Virginia, Charlottesville, VA.*
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(No relevant relationships reported)

PURPOSE: Physical activity participation is associated with mental health benefits. The primary purpose of this study was to examine the effects of four types of physical activity classes on college students' perceived stress, well-being, and social support. The secondary purpose was to compare effects by gender and year of study. **METHODS**: The sample consisted of 548 college students (Males: n=294; Age: M=20.72 years old) who were voluntarily enrolled in the four types of courses in an academically prestigious university: fitness, team sports, net and individual sports, and Tai-Chi. They responded to validated scales to assess perceived stress (Sheldon Cohen, 1983), well-being (Diener & Biswas-Diener, 2009), and social support (Zimet, Dahlem et al., 1988) at three weeks prior to the start and then in the 15thweek of the semester. **RESULTS**: Significant decreases were observed for perceived stress in all groups: fitness group (ΔM=-0.79, p<0.01), team sports group (ΔM = -0.76, p<0.01),net and individual sportsgroup (ΔM= -0.77, p<0.01) and Tai-Chi group (ΔM = -0.57, p<0.01). Females experienced a greater drop in perceived stress than males (ΔM=0.08, p<0.01). Significant increase in well-being was observed in three types of courses led by team sports group (ΔM=1.55, p<0.01) followed by fitness group (ΔM=1.54, p<0.01), and net and individual sports group (ΔM=1.34, p<0.01). Senior students showed greater increase in well-being (ΔM=2.05, p<0.01) than younger students (ΔM=1.16, 1.07 and 0.85, respectively). The net and individual sports groups showed decreased perceived social support by 0.22 (p<0.01), while no changes were observed in other groups. **CONCLUSIONS**: All four types of physical activity courses showed significant effects on perceived stress reduction (especially in female students), while three types of courses showed increase in well-being (especially in seniors). Instructors of net and individual sports courses should increase social processing to increase perceived social support.

1605 Board #2 May 30 1:30 PM - 3:30 PM

The Effects of Peer Health Coaching for Lifestyle Behavior Change Among College Students

Kathryn J. DeShaw, Gregory J. Welk, FACSM. *Iowa State University, Ames, IA.* (Sponsor: Gregory J. Welk, FACSM)

(No relevant relationships reported)

PURPOSE: The transition from high school to college often leads to poor health decisions such as insufficient physical activity (PA) and poor eating habits. Health coaching (HC) may be an effective strategy to promote adoption and adherence to healthy lifestyle behaviors as well as aiding in accountability for behavior change among new college students.
METHODS: A sample of 69 Freshmen and Sophomore undergraduate students were recruited from a college campus to receive peer HC sessions (79% female; age 18.6 ± .9; BMI 25.1 ± 5.7). Participants received 4 HC sessions in an 8-week period and were encouraged through motivational interviewing (MI) techniques to work toward self-selected goals focused on either PA, healthy dietary habits (Diet), or stress management (Stress). Changes in each lifestyle outcome were assessed pre and post using established tools (PA with the International Physical Activity Questionnaire Short-Form, diet with the Eating Habits Confidence Survey, and stress levels via the Perceived Stress Scale).
RESULTS: Three group x time repeated measures ANOVAs were conducted to investigate differences in lifestyle behavior changes based on the selected goal. It was hypothesized that changes would be greatest in students based on the targeted goal (PA: n=37, Diet: n=15, Stress: n=17). Significant main effects of time were observed for all three behaviors with participants having a 21.1% gain in PA (p=0.02), 15.3%

decline in dietary habit (p=0.01), and 20.4% decline in stress levels (p=0.01). There were no significant group by time interactions, indicating that students had similar outcomes regardless of what behavior they were targeting.
CONCLUSIONS: HC seems to be an effective strategy for promoting healthy lifestyles in college students. Students had similar gains in PA and similar declines in stress, regardless of the behavior they reported focusing on. It is not clear why confidence in sticking with dietary changes decreased over time, but this may be due to participants possibly becoming more sensitized to their dietary habits through the HC sessions. Additional research is needed to understand student reactions to peer-led HC in college settings.

1606 Board #3 May 30 1:30 PM - 3:30 PM

Per-protocol Analysis Of BAILAMOS™ Dance Program On Self-reported And Device-assessed Physical Activity In Older Latinos

Guilherme M. Balbim[1], Susan Aguiñaga[2], Priscilla Vazquez[3], Isabela G. Marques[4], Jaqueline Guzman[2], Deborah Salvo[5], David X. Marquez, FACSM[1]. *[1]University of Illinois at Chicago, Chicago, IL. [2]University of Illinois at Urbana-Champaign, Champaign, IL. [3]University of California San Diego, San Diego, CA. [4]University of Victoria, Victoria, BC, Canada. [5]Washington University in St. Louis, St. Louis, MO.* (Sponsor: David X. Marquez, FACSM)
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(No relevant relationships reported)

PURPOSE: Test the impact of the BAILAMOS™ dance program on PA levels in older Latinos.
METHODS: Older Latino adults (n= 333; M_{age} = 64.89±7.08) were randomized into a dance (n=167) or health education (HE) (n=166) group. For purposes of per-protocol analysis, participants with attendance ≥75% in dance and HE classes, respectively, were included. The final analytic sample was 145 participants (dance = 63, HE = 82). The dance group participated in four months of Latin dancing, two times per week for one hour per session. The HE group participated in classes once per week for two hours per session for four months. Participants completed the CHAMPS PA Questionnaire and wore an ActiGraph™ GT3X+ accelerometer for seven consecutive days on their non-dominant wrist. Data was used if the participant wore for it at least 10 hours/day over three days. Wrist cut-points utilized were proposed by Kamada (2016) (moderate-to-vigorous PA (MVPA) ≥7500 counts per minute). We performed a fixed-intercept mixed model (p &lt .05), adjusting for baseline covariates of age, sex, education, income, and health status. Cohen's d effect sizes were computed.
RESULTS: Self-reported MVPA (minutes) increased significantly (t(1, 120)=3.2, p=0.002) from baseline (Dance: M=140.81±211.35; HE: M=115.48±182.65) to month-4 (Dance: M=29.11±20.45; HE: M=23.21±18.27), but no group*time interaction was demonstrated t(1, 121)=1.33, p=0.19, d=0.22. Total leisure-time PA (LTPA) (minutes) increased significantly from baseline (Dance: M=280.50±285.35; HE: M=360.71±361.05) to month-4 (Dance: M=579.72±346.10; HE: M=500.34±483.04), with significant group*time interaction t(1, 121)=2.16, p=0.03, d=0.33. Accelerometer-assessed MVPA did not increase significantly from baseline (Dance: M=24.43±22.67; HE: M=22.51±17.91) to month-4 (Dance: M=29.11±20.45; HE: M=23.21±18.27) and there was no group*time interaction t(1, 112)=1.53, p=0.13, d=0.43.
CONCLUSIONS: The BAILAMOS© dance program showed a positive impact on self-reported LTPA. This impact was not observed in device-assessed PA, however, there was a moderate effect. Supported by NIH Grant 1R01NR013151-01.

1607 Board #4 May 30 1:30 PM - 3:30 PM

Reducing the Uncertain Geographic Context Problem in Physical Activity Research: The Houston TRAIN Study

Deborah Salvo[1], Casey P. Durand[2], Erin E. Dooley[3], Ashleigh M. Johnson[3], Abiodun Oluyomi[4], Kelley P. Gabriel, FACSM[3], Alexandra E. van den Berg[3], Adriana Perez[3], Harold W. Kohl III, FACSM[3]. *[1]Washington University in St. Louis, Saint Louis, MO. [2]The University of Texas Health Science Center at Houston, Houston, TX. [3]The University of Texas Health Science Center at Houston, Austin, TX. [4]Baylor College of Medicine, Houston, TX.*
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PURPOSE: The Uncertain Geographic Context Problem (UGCP) arises when studying the effect of static area-level factors (e.g. parks within walking distance from home) on individual-level outcomes, like physical activity. The UGCP is largely due to temporal uncertainty, as people may spend significant portions of the day outside of the geographic area captured by static spatial measures. The aim of this study was to determine if spatial exposure indicators for physical activity research are improved by including measures of both the home and work neighborhood environments.
METHODS: Baseline data from the Houston TRAIN Study were used (n=153). Participant home and work addresses were geocoded, and two spatial exposure indicators were built per location: transit stops within 1.25 Km, and parks within 2.25 Km (counts). A categorical variable was built for each feature, with four levels based on median splits: high access at home & work, high access at home & low access at work, low access at home & high access at work, and low access at both locations. Weekly minutes of moderate to vigorous physical activity (MVPA) were measured with wGT3X-BT Actigraph monitors using Freedson cut-points. Linear regressions estimated the association between the combined 'home plus work' access variables and MVPA. Models were adjusted for sex, age, education, and race/ethnicity.
RESULTS: Relative to the 'low-low' group, having high access to transit in both the home and work neighborhood was associated with 3.7±1.2 additional weekly minutes of MVPA (p=0.039). Similarly, those having high access to parks both in their home and work neighborhood had 2.5±1.9 (p=0.044) more weekly minutes of MVPA than those with low access in both locations. Having high transit or park access only in one of the two studied neighborhood locations was not significantly associated with MVPA (p>0.05).
CONCLUSIONS: When examining the effect of both transport and leisure related urban infrastructure on MVPA, the UGCP is improved by incorporating measures of both the home and work environment. Pending confirmatory studies, our results suggest that approaches exclusively focused on improving the built environment of residential neighborhoods may have limited impact on physical activity. A citywide, systems level approach may be warranted. Supported by NIH R01DK101593

1608 Board #5 May 30 1:30 PM - 3:30 PM

Developing a National Network of Physical Activity Promotion: The Case of Germany

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Reported Relationships: **S. Peters:** *Salary; Stefan Peters works for the DVGS, which is one of the actors in physical activity promotion that have been a central part of the presented research.*

PURPOSE: Physical activity supports the health of human beings of every age group in various ways. However, the worldwide prevalence of physical inactivity is high and many people do not reach the amount of physical activity that is recommended by physical activity guidelines. National Action Plans (NAPS) and Initiatives try to counteract this situation but have not always been successful. To support targeted measures in such NAPs, it is necessary to gain knowledge of relevant actors, professionals groups and multiplicators as well as their structural connection. In Germany, an explorative study addressed 2 goals accordingly: (1) the identification of relevant actors, professional groups and multiplicators of physical activity promotion, and (2) the analysis of structural relations among these actors as well as the formulation of recommendations for the sustainable development of a national network of physical activity promotion.
METHODS: Qualitative expert interviews, a subsequent network visualization and an analysis for network development were carried out.
RESULTS: It became apparent that the field of actors in the area of physical activity promotion is very heterogeneous and extensive with regard to different forms of actors, sectors of society and administrative levels. Overall, 128 actors were identified, of which 22 actors are considered to hold key positions. Concerning the multiplicators, 19 current and 17 potential ones were identified. Structural relations among actors are sparse.
CONCLUSIONS: For carrying out a network development of physical activity promotion, various prerequisites, benefits, and barriers were revealed. Subsequently, recommendations that contribute to the development and effective governance are presented. The study provides a first detailed consideration of the structure of physical activity promotion in Germany and thereby offers a perspective, which can also inform NAPS around the globe.

1609 Board #6 May 30 1:30 PM - 3:30 PM

Exercise Interventions Improve Drug Abstinence at an In-Patient Rehabilitation Center

Emily L. Roessel[1], J. Mark VanNess[1], Mercedes K. Steidley[1], Ryan C. Bain[2], Courtney D. Jensen[1]. *[1]University of the Pacific, Stockton, CA. [2]Tree House Rehabilitation, Orange County, CA.*
(No relevant relationships reported)

Exercise training likely enhances coping skills and sobriety among patients with substance use disorder. Better examination of the mechanisms producing these changes may help identify more effective interventions. **PURPOSE:** To test the effect

of a vigorous exercise prescription on drug abstinence in voluntary rehabilitation patients. **METHODS**: 25 male subjects in a drug treatment program underwent a 12-week intervention, which included cardiovascular exercise, resistance training, and supportive psychotherapy. Five days a week, subjects were asked to participate in either yoga with mindfulness practices or action-based induction therapy lasting two hours; there was also a 90-minute exercise boot camp. Data collected were exercise adherence, exercise performance, sobriety and relapse rates, and an assessment of emotional coping skills. Chi-squared tests and t-tests compared exercisers to non-exercisers; logistic and linear regressions tested the effect of exercise behavior on measurements of coping and sobriety. **RESULTS:** Subjects had experienced frequent relapse (5±8 episodes) prior to the current admission. Across the sample, 84% were sober on completion of the program, 8% relapsed during treatment, and 36% relapsed after treatment. During the program, 84% exercised regularly, 68% practiced yoga, and 60% followed a disciplined diet. Bench press max improved over the program (39%; $p<0.001$), as did squat max (55%; $p<0.001$) and deadlift max (70%; $p<0.001$). Among patients who exercised regularly, 91% were sober on completion compared to 50% of patients who did not engage in regular exercise ($p=0.043$). Owing to a small sample of patients who relapsed during treatment (N=2), the difference in exercisers who relapsed during treatment (5%) and non-exercisers who relapsed (25%) was not significant ($p=0.171$). Following treatment, 29% of exercisers and 75% of non-exercisers relapsed ($p=0.076$). The odds of successfully managing adverse emotional states when they arose increased 20-fold in subjects who exercised regularly ($p=0.036$). Each additional session of yoga per week predicted a 20-day increase in the longest duration of sobriety ($p=0.016$). **CONCLUSION:** Exercise appears to exert a positive effect on drug and alcohol sobriety and coping skills in a population that struggles with frequent relapse.

1610 Board #7 May 30 1:30 PM - 3:30 PM

Effectiveness Of Aerobic Exercise Programs For Health Promotion In Metabolic Syndrome

Felix Morales Palomo, Miguel Ramirez-Jimenez, Juan Fernando Ortega, Ricardo Mora-Rodriguez. *UCLM, Toledo, Spain.*

(No relevant relationships reported)

The effects of different modalities of aerobic training on cardiorespiratory fitness (CRF) and metabolic syndrome (MetS *Z*-Score) have been previously studied in patients with different cardiometabolic diseases. Continuous (Jonhson et al., 2007) and interval (Mora-Rodriguez et al., 2014) training have been shown to be effective to improve MetS *Z*-Score. On the other hand, a recent metanalysis suggest that high-intensity interval training (HIIT) may be superior to traditional moderate intensity continuous training (MICT) to improve CRF (Milanovic et al., 2015) even when programs were matched by total work performed. However, to our knowledge no study has compared the capacity of three training modalities on improving MetS *Z*-Score and CRF in middle-aged MetS patients with low initial levels of CRF.
PURPOSE: To compare the improvement in CRF and MetS- *Z*-score of 3 modalities of aerobic exercise. **METHODS:** One hundred and twenty-one MetS patients (age, 57±8 yr; weight, 92±15 kg and MetS factors, 4±1 components) with low initial CRF (VO_{2PEAK}, 24.0±5.5 $mL \cdot kg^{-1} \cdot min^{-1}$) were randomized to undergo one of the following 16 week exercise program: *a)* 4x4-min high-intensity interval training at 90% of HR_{MAX} (4HIIT group; n = 32), *b)* 50-min moderate-intensity continuous training at 70% of HR_{MAX} (MICT group; n = 35), *c)* 10x1-min HIIT at 100% of HR_{MAX} (1HIIT group; n = 32) or *d)* no exercise control group (CONT; n = 22). We measured the evolution of all five MetS components (i.e., MetS *Z*-Score) and CRF (assessed by VO_{2PEAK}) before and after intervention. **RESULTS:** MetS *Z*-score decreased -41% after 4HIIT and -52% in MICT (both $P<0.01$) whereas it did not change in 1HIIT and CONT group (-24%; P=0.21 and 20%; P=0.22, respectively). However, the three exercise groups improved similarly their VO_{2PEAK} (4HIIT 11%; MICT 12% and 1HIIT 14%; all $P<0.001$). **CONCLUSION:** Our findings suggest that in sedentary individuals with MetS and low initial CRF level any of the three aerobic training modalities which were compared, provide sufficient stimulus to raise CRF. However, the more intense but shorter 1HIIT training program is not effective on improving MetS *Z*-Score and thus, its recommendation for health promotion purposes in this population should be done with caution.

1611 Board #8 May 30 1:30 PM - 3:30 PM

Use Of A Smartphone App To Improve Physical Activity In Insufficiently Active Adults: A Feasibility Sequential Multiple Assignment Randomized Trial (SMART)

Victor Z. Dourado[1], Bárbara Gonze[1], Maria do Socorro Simões[1], Neli Proença[1], Evandro Sperandio[1], Wesley Vieira[1], Vinícius Lauria[1], Marcello Romiti[2], Antônio Gagliardi[2], Rodolfo Arantes[2], Ricardo Padovani[1]. *[1]Federal University of Sao Paulo (UNIFESP), Santos, Brazil. [2]Angiocorpore Institute of Cardiovascular Medicine, Santos, Brazil.*
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(No relevant relationships reported)

The SMART design allows changes in the intervention during the research period. Despite its potential and feasibility for defining the best sequence of interventions, so far it has been utilized in a smartphone/gamified intervention for physical activity. PURPOSE: To investigate the effects of a SMART design on the behavior of the average number of steps/day in a smartphone app intervention for physical activity in insufficiently active adults. METHODS: We conducted a feasibility 24-week/2-stage SMART in which 18 insufficiently active participants (< 10000 steps/day) were first randomized to Group 1 (smartphone app only), Group 2 (smartphone app + tailored messages) and a control group. Participants were asked to increase at least 2000 steps/day on average each week. Based on the 12-week intermediate outcome, responders kept their interventions and non-responders were rerandomized to a subsequent treatment. In group 3 (Smartphone app + gamification), participants were instructed to form groups to use several game elements available in the chosen application (Pacer®). We fit linear regressions for each participant with the relationship between weeks and steps/day. We considered responders those with any positive slope at the end of the 1rst stage intervention. We compared the accelerometer-based steps/day before and after the intervention as well as the slopes of the app-based steps/day between the 1rst and second stages of treatment RESULTS: Twelve participants, five controls, finished the intervention. We identified two responders in group 1. We did not observe significant changes in the steps/day neither throughout the intervention nor compared to the control group. However, the rerandomization of the five non-responders was able to change the slope of the steps/day of a median, -198 steps/day (interquartile range, -279 to -103) to 20 steps/day (-204 to 145), p = 0.079. Finally, we observed in three participants in the group 2 an increase in the number of steps/day up to the sixth week and then an inflection to the baseline values or even lower (i.e., a quadratic relationship). CONCLUSIONS: The SMART design was feasible and changed the behavior of the steps/day after rerandomization. Our results suggest that the rerandomization should be implemented earlier to take advantage of the tailored messages.

D-11 Thematic Poster - Running Injuries

Thursday, May 30, 2019, 1:30 PM - 3:30 PM
Room: CC-101B

1612 **Chair:** Allison H. Gruber. *Indiana University Bloomington, Bloomington, IN.*

(No relevant relationships reported)

1613 Board #1 May 30 1:30 PM - 3:30 PM

Increased Ground Reaction Force Load Rates In Runners With Active Patellofemoral Pain

Caleb D. Johnson, Jereme Outerleys, Julia M. Reilly, Adam S. Tenforde, Irene S. Davis, FACSM. *Harvard University, Cambridge, MA.* (Sponsor: Dr. Irene Davis, FACSM)
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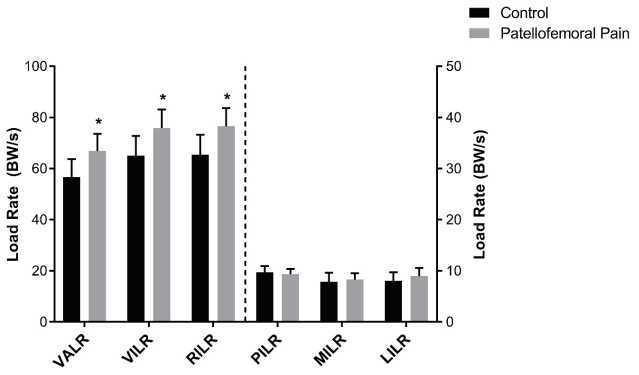
(No relevant relationships reported)

Increased vertical ground reaction force load rates have been associated with running injuries, and specifically with tibial stress fractures and plantar fasciitis. Inconsistent findings have been reported regarding the role of load rates in runners with patellofemoral pain (PFP), one of the most common injuries in runners. Limited studies in this patient population have been performed and prior investigators did not examine components of load rates beyond the vertical component. **PURPOSE:** To compare vertical, resultant, posterior, medial and lateral load rates, and peak vertical forces in runners with active PFP to healthy controls. **METHODS:** 30 runners with active PFP (16F, 14M, 40.2±12.8 yrs, 67.5±10.0 kg) and 30 healthy controls (CON) (18F, 12M, 34.8±10.9 yrs, 70.4±14.0 kg), all habitual rearfoot strikers, completed an instrumented treadmill assessment at a self-selected speed. Controls were matched for speed (PFP=2.50 m/s, CON=2.51 m/s). Load rates (vertical average and instantaneous

(VALR, VILR), resultant instantaneous (RILR), posterior instantaneous (PILR), medial instantaneous (MILR) and lateral instantaneous (LILR)) over the first 25% of stance and normalized to bodyweights. Peak vertical ground reaction forces (vGRF) were calculated over all of stance. Values were averaged across 10 consecutive strides. The injured leg was analyzed for the PFP group, and the right/left leg was randomly selected and counterbalanced for CON. **RESULTS:** Runners in the PFP group showed significantly higher mean VALR (p=0.036, d=0.56), VILR (p= 0.040, d=0.54) and RILR (p=0.036, d=0.55) than CON. No differences were found in PILR (p=0.668), MILR (p=0.193), and LIRL (p=0.367) (Figure 1), or in peak vGRF (Mean difference=0.03 BW, p=0.458). **CONCLUSION:** Runners with active PFP exhibit higher vertical and resultant load rates.

Figure 1. Mean load rates between patellofemoral pain and control groups



-VALR, VILR, RILR plotted on left axis; PILR, MILR, and LILR plotted on right

1614 Board #2 May 30 1:30 PM - 3:30 PM

Effects Of Running Biomechanics On The Occurrence Of Iliotibial Band Syndrome- A Prospective Study

Qipeng Song, Peixin Shen. *Shandong Sport University, Jinan, China.*

(No relevant relationships reported)

Iliotibial band syndrome (ITBS) is the second most common running injury, accounts for 1.6%-12% of all running-related injuries. The exact etiology of ITBS is unclear, but gait and posture are considered one of the factors. Most of studies on ITBS were retrospective cross-sectional in design and could not elaborate on the pathogenesis of ITBS.

PURPOSE: This prospective study aimed to determine the gait characteristics that easily induce ITBS and explore the posture changes after the occurrence of ITBS.

METHODS: 15 ITBS-stricken runners (I group) and matched 15 healthy runners (C group). All participants underwent two gait trials, namely, before the first day of running (trial1) and after 8-week running (trial2). An eight-camera motion capture system was used to collect kinematic data. Sub-group comparisons were assessed via respective 95% confidence intervals of mean difference.

RESULTS: In trial2, the ITBS group exhibited greater peak anterior pelvic tilt and hip flexion angle than the control group(Fig1a). The ITBS group showed increased peak trunk inclination angle , whereas the control group demonstrated lower peak hip flexion (Fig1b)and peak hip adduction than those at trial1(Fig1c).

Fig1. Comparison of joint activity between the two groups

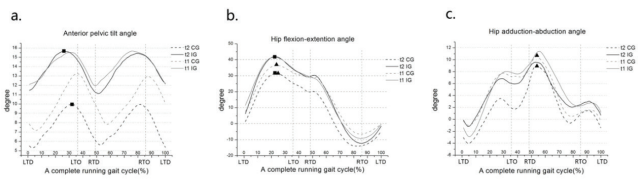
■■ Represent significant differences between the two groups in trial 2.

▲▲ Significant differences in the control group compared with trial 1.

Abbreviation: t1: trial1; t2: trial2 ; LTD=left foot touch down; LTO=left foot take off; RTD=right foot touch down; RTO= right foot take off;

CONCLUSION: Decreasing the peak hip flexion and peak hip adduction angle may be a reasonable strategy to avoid the occurrence of ITBS. Occurrence of ITBS may be due to the lack of timely gait adjustment. The posture of excessive trunk inclination and anterior pelvic tilt may be a risk factor in the development of ITBS during running.

This work was supported by the Project of Shandong Science & Technology Department (2017G006044).



1615 Board #3 May 30 1:30 PM - 3:30 PM

Achilles Tendon Loading Patterns During A 30-minute Steady-state Run In Patients With Achilles Tendinopathy

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(No relevant relationships reported)

Achilles tendinopathy is an overuse injury that commonly sidelines runners. During rehabilitation, return-to-sport (RTS) decisions are made with minimal guiding evidence. With reinjury rates as high as 44%, evidence is needed to improve clinical decisions. Aberrant loading patterns while running may partially explain reinjury rates.

PURPOSE: To determine if Achilles tendon loading patterns change during a 30-minute steady-state run in patients with Achilles tendinopathy and explore relationships between loading patterns and kinesiophobia.

METHODS: 12 runners (7M) with Achilles tendinopathy were included (age:44±11y; height:171±10cm; mass:70±12kg; VISA-A score:71±10; current mileage:40±29km/wk). Participants ran for 30 minutes at their endurance pace (2.9±0.3m/s) on an instrumented treadmill with retroreflective markers affixed to their lower limbs and feet. After a 6-minute familiarization period, marker trajectories and ground reaction forces were sampled during the 7th and 29th minute. Data was reduced to 10 gait cycles bilaterally. Sagittal plane ankle joint angles, moments and powers were calculated and a previously described musculoskeletal model was used to estimate Achilles tendon loads. Tampa Scale for Kinesiophobia (TSK) quantified the degree of kinesiophobia.

RESULTS: On the injured side, there was a significant decrease in peak concentric ankle power (7thmin=4.9±1.0W/kg·m; 29thmin=4.7±1.1W/kg·m; p=0.02) and peak dorsiflexion (7thmin=23.4±3.9º; 29thmin=22.7±3.7º; p=0.02), but no changes in peak plantarflexion moment, peak eccentric power, Achilles tendon peak load, loading rate or, impulse (p=0.12-0.65). No changes occurred on the uninjured side (p=0.17-0.90). There were significant relationships between the TSK scores (32±7) and changes in Achilles tendon impulse, peak concentric ankle power, and peak plantarflexion moment (r=-0.66-0.60;p=0.02-0.04), indicating increased unloading of the injured side during the run in patients with higher degree of kinesiophobia.

CONCLUSIONS: Ankle joint power and motion change during a 30-minute steady-state run in patients with Achilles tendinopathy. Additionally, changes in loading patterns are associated with kinesiophobia.

1616 Board #4 May 30 1:30 PM - 3:30 PM

Flexor Hallucis Brevis Morphology is Associated with Visual Reliance While Balancing in Previously Injured Runners

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(No relevant relationships reported)

Running related injuries to the foot and lower leg are pervasive and thought to be due to poor plantar intrinsic muscle (foot core) function. Previously injured runners have decreased cross sectional area (CSA) and thickness of the flexor hallucis brevis (FHB) and increased reliance on visual information while balancing relative to uninjured runners. However, it remains unknown if FHB morphology is associated with an increased reliance on visual information. **PURPOSE:** To determine if visual reliance while balancing is associated with FHB morphology in those with a history of running related injuries. **METHODS:** Twenty-four runners with foot and/or leg running injuries within the past three years but were currently asymptomatic (age: 21.66±2.44 years, mass: 66.84±10.03kg, height: 169.21±19.34cm, runs per week: 4.37±1.30, miles per week: 14.16±8.88) volunteered. Three, 10-second eyes open and eyes closed single leg stance trials on the injured limb were recorded. Center of pressure velocity (cm/s) for each condition was used to calculate %-modulation (%-modulation=[(eyes open-eyes closed)/eyes open]. Larger negative scores indicates greater reliance on visual information. While standing in a weight-bearing, subtalar neutral position, diagnostic ultrasound was used to image the FHB in a relaxed state and contracted state (while holding a short foot contraction). Images were processed to calculate CSA and FHB thickness. CSA was defined as the area (cm^2) within the fascial borders of the muscle. Thickness was the distance (cm) between superior to inferior fascia perpendicular to the muscle fibers. Pearson product moment correlations determined the strength of associations and an a priori alpha level of 0.05 was used for all analyses. **RESULTS:** Larger negative %-modulation was associated with the less contracted FHB thickness (r=0.451, p=0.027) and trended towards being associated with less relaxed FHB thickness (r=0.368, p=0.077). No association was noted with the FHB CSA (r=0.273, p=0.198). **CONCLUSIONS:** In previously injured runners decreased FHB thickness is associated with an increased reliance on visual information while balancing. Short foot exercises, aimed at increased FHB strength may decrease reliance on visual information but future research is needed to confirm this hypothesis.

1617 Board #5 May 30 1:30 PM - 3:30 PM

Joint Moment Contributions During Flat, Incline and Decline Running in Individuals with ACLR

Hillary H. Holmes, Katie Corona, Randall Fawcett, Jaimie A. Roper. *Auburn University, Auburn, AL.* (Sponsor: Mark Tillman, FACSM)

(No relevant relationships reported)

PURPOSE: To compare ankle, knee and hip joint moment contributions during flat, incline and decline running between limbs in ACLR individuals.
METHODS: 9 participants (4 males, 5 females, mean age 22 ± 2yrs) provided consent to participate. Participants ran during flat (0°), incline (10°) and decline (-10°) treadmill conditions, with predetermined speeds of 2.5m/s (0°) and 1.8m/s (10° and -10°). Kinematic and kinetic data were collected during the final 30s of each condition using 17 cameras (Vicon) and an instrumented split-belt treadmill (Bertec). Joint moment contribution percentages at the hip, knee and ankle were determined by dividing the peak, sagittal, external joint moments (N.mm/kg) by the sum of all three joint moments during stance. A 2x3 (limb x condition) ANOVA was used to evaluate interlimb differences across conditions with post-hoc Bonferroni adjustments.
RESULTS: There was no significant limb x condition interaction or main effect of limb, but there was a significant main effect of condition. Knee joint moment contributions were 35% greater in decline running when compared to incline running (50-15%), and 31% greater when compared to flat running (50-19%). Ankle contributions were 39% less in decline running when compared to incline running (24-63%) and 26% less in decline running when compared to flat running (24-50%).
CONCLUSIONS: Knee and ankle joint moment contributions are altered with flat, incline, and decline running in persons with ACLR. Individuals with ACLR did not display asymmetries in joint moment contributions between the involved and uninvolved limb.

1618 Board #6 May 30 1:30 PM - 3:30 PM

A Novel Approach to Investigate Running Kinematics in Achilles Tendinopathy Patients Using Inertial Sensors

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(No relevant relationships reported)

Mid-portion Achilles tendinopathy (AT) is a common injury in runners. Overloading the tendon results in pain, swelling and impaired running performance. Recovery involves rest and a gradual build up. Determining whether patients can resume training is difficult and currently rather qualitative. To provide quantitative data to the physician to assist clinical decision- making, we studied the between leg differences in running kinematics for AT patients using inertial sensors in the clinical setting.
PURPOSE: To investigate lower limb kinematics in AT patients during 5 minute treadmill running in the clinic, using inertial magnetic measurement units (IMUs).
METHODS:4 runners diagnosed with mild unilateral AT (4M , 48.8 ± 7.5 yrs, 188.8 ± 11.2 cm, 82.5 ± 11.1 kg) performed a 5 min. treadmill run in the sports medicine clinic, as part of a larger study, with 8 IMU's at the feet, tibia, upper legs, sacrum and sternum. Ankle and knee angles were determined at initial contact (IC) and mid stance (MS). Additional parameters that were calculated were the vertical lower leg angle at IC (VLL), peak tibial impact (PTA), peak sacral impact (PSA), push-off power (POP) (lin. velocity at toe off, TO) and internal rotation (IR) of the tibia (at TO). Parameters were determined for the injured and non-injured leg at 1-min. intervals. An independent Mann-Whitney U-test was used to test for differences within patients between the injured and non-injured leg.
RESULTS:
Table 1
CONCLUSIONS: The injured leg of these AT patients showed significantly different running kinematics. AT strongly affected ankle mechanics, possibly as a compensatory strategy, indicating non-full recovery of the patients. The use of IMUs to determine the recovery of AT patients quantitatively is promising. Using IMUs there is no need for 3d optical motion capture systems or an instrumented treadmill to quantify running kinematics. Future research should follow up on these measurements to identify fully recovered patients.

Table 1 Mean values ± standard deviation of the selected outcome parameters. Statistical differences was tested for using an independent Mann-Whitney-U-test.

	Ankle (IC) [°]	Ankle (MS) [°]	Knee (IC) [°]	Knee (MS) [°]	VLL [°]	PTA [m/s2]	PSA [m/s2]	POP [m/s]	IR [°/s]
Injured leg	5.6 ± 5.8	26.3 ± 9.3	23.4 ± 3.7	40.8 ± 4.6	2.5 ± 3.2	82.6 ± 18.7	29.5 ± 4.7	0.5 ± 0.3	-0.5 ± 1.1
Non-injured leg	1.3 ± 2.8	18.5 ± 4.8	24.3 ± 3.4	42.9 ± 3.7	3.6 ± 3.9	81.7 ± 10.6	34.2 ± 4.0	0.1 ± 0.7	0.0 ± 1.0
Statistical difference	**P<0.05**	**P<0.05**	P>0.05	**P<0.05**	P>0.05	P>0.05	**P<0.05**	**P<0.05**	>0.05

1619 Board #7 May 30 1:30 PM - 3:30 PM

Ankle Joint Kinetics in Runners with Medial Tibial Stress Syndrome

James Becker[1], Louis Osternig, FACSM[2], Stanley James[3], Li-Shan Chou[2]. *[1]Montana State University, Bozeman, MT. [2]University of Oregon, Eugene, OR. [3]Slocum Center for Orthopedics and Sports Medicine, Eugene, OR.* (Sponsor: Louis Osternig, FACSM)

(No relevant relationships reported)

Medial tibial stress syndrome (MTSS) is a common overuse running injury. While numerous studies have reported abnormal ankle kinematics in runners with MTSS, to date, no studies have evaluated ankle kinetics in this population. **PURPOSE:** To compare ankle kinetics in runners with and without MTSS**. METHODS**: Participants included eight runners with MTSS (sex: 7M/1F; age: 35 ± 11.3 years) and eight matched controls (CON; sex: 7M/1F; age: 35 ± 8.7 years). Kinematics and ground reaction forces were recorded while participants ran overground. Sagittal plane kinetics were calculated about an axis connecting the malleoli while frontal plane kinetics were calculated about an axis approximating the 23° medially deviated and 42° inclined orientation of the subtalar joint. Joint work was calculated by integrating the joint power curves. Paired *t*-tests were used to compare peak moments, powers, and work between MTSS and CON groups. **RESULTS**: Neither peak plantar flexor (MTSS: 2.14 ± 0.53, CON: 2.24 ± 0.57 Nm/kg) nor peak invertor (MTSS: 1.04 ± 0.34, CON: 1.16 ± 0.32 Nm/kg) moments were different between groups (p = .720, p = .472, respectively). There were no differences in sagittal plane powers or work between groups. In the frontal plane, the MTSS group demonstrated lower peak positive power (MTSS: 1.97 ± 0.38, CON: 3.05 ± 1.12 W/kg, p = .021), and performed less negative (MTSS: -0.09 ± 0.02, CON: -0.16 ± 0.07 J/kg, p = .032), positive (MTSS: 0.14 ± 0.03, CON: 0.22 ± 0.07 J/kg, p = .039), and total (MTSS: 0.23 ± 0.06, CON: 0.37 ± 0.15 J/kg, p = .032) work. **CONCLUSIONS**: Compared to healthy individuals, runners with MTSS are not able to generate as much energy to invert their foot during late stance. This may explain why previous studies have observed runners with MTSS have prolonged rearfoot eversion during stance.

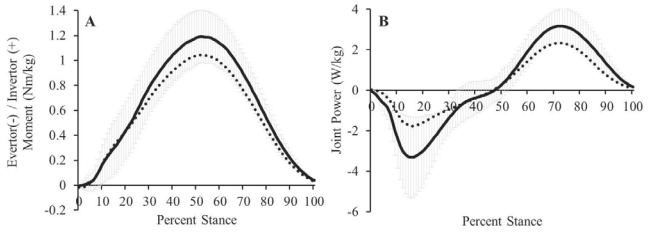

Figure 1. Frontal plane joint moments (A) and powers (B). The solid line represents the CON group and the dotted line represents the MTSS group. Error bars show one standard deviation above and below the mean curve for the CON group.

1620 Board #8 May 30 1:30 PM - 3:30 PM

Does Y-Balance Test Performance Predict Injury-Related Running Mechanics?

Scott Wilson, James Becker. *Montana State University, Bozeman, MT.*

(No relevant relationships reported)

The Y-balance test is commonly used to screen for injury risk in athletic settings. However, much of the research evaluating the predictive ability of this test focuses on multidirectional sports such as football or basketball. To date there is little evidence regarding the utility of the Y balance test for unidirectional sports such as running. **PURPOSE:** Determine whether performance on the Y-balance test predicts running variables previously linked to running injury. **METHODS:** 23 Division-I collegiate distance runners (9M/14F; age: 19.6 ± 1.0 years; weekly mileage: 59.4 ± 14.6 miles) participated in this study. Whole body kinematics during the Y-balance and while running were recorded using 10 and 6 camera motion capture systems, respectively. Ground reaction forces for running were measured using an instrumented treadmill. Maximum reach in the anterior (A), posterior lateral (PL), and posterior medial (PM) directions were used to calculate Y-balance composite scores (CS). Eleven specific kinematic and kinetic running gait variables which have been previously linked to running injuries were calculated (Table 1). Linear regressions were used to determine whether Y-balance CS predicted each running gait variable. **RESULTS**: Mean Y balance CS was 0.87 (± 0.09) with maximum reach distances of 0.84 ± 0.06, 0.93 ± 0.11 and 0.84 ± 0.06 % of leg length in the A, PL, and PM directions, respectively. Of all 11 variables, Y balance CS only significantly predicted peak knee flexion during stance phase of running, and even then only accounted for 12% of the variance (Table 1). **CONCLUSION:** Performance on the Y-balance test may not be useful for

predicting injury risk in runners as the test does not predict variables previously linked to running injuries. However, further prospective studies tracking occurrence of actual injuries as well as internal loading at common running injury sites are required to fully clarify whether the Y balance test is suitable for screening runners.

Table 1. Linear regression results comparing Y-balance CS to gait variables previously linked to running injuries; BW = bodyweight (kg); $p < 0.05$*

Variable	*p*-value	R^2	Lower 95%	Upper 95%	Coefficient
Hip adduction (°)	0.68	0.004	-14.81	9.79	-2.50
Hip Internal Rotation (°)	0.21	0.035	-33.94	7.97	-12.99
Knee Flexion (°)	0.01*	0.12	3.15	34.44	18.80
Knee Adduction (°)	0.46	0.01	-24.7	11.37	-6.67
Peak Eversion (°)	0.93	0.0001	-13.18	14.31	0.57
Eversion ROM (°)	0.21	0.035	-20.73	4.81	-7.96
Peak Eversion Velocity (m/s)	0.21	0.036	-109.47	476.79	183.66
Vertical loading rate (BW • s^{-1})	0.52	0.009	-51.76	101.61	24.92
Hip Abductor Moment (Nm/kg)	0.52	0.009	-0.94	1.81	0.43
Hip Abductor Impulse (Nm/kg*s^{-1})	0.96	0.00007	-0.23	0.22	-0.01
Knee Abductor Moment (Nm/kg)	0.13	0.05	-0.35	2.54	1.09
Knee Abductor Impulse (Nm/kg*s^{-1})	0.58	0.007	-0.29	0.52	0.11

D-12 Thematic Poster - **Soccer**

Thursday, May 30, 2019, 1:30 PM - 3:30 PM
Room: CC-101A

1621 **Chair:** Douglas J. Casa, FACSM. *University of Connecticut, Storrs, CT.*

(No relevant relationships reported)

1622 Board #1 May 30 1:30 PM - 3:30 PM

The Effect Of Acute Chronic Training Load Ratio On Daily Stress, Fatigue, And Soreness Level In A Ncaa Division 1 Soccer Players

Yasuki Sekiguchi[1], Ryan M. Curtis[1], Robert A. Huggins[1], Courteney L. Benjamin[1], William M. Adams[2], Shawn M. Arent, FACSM[3], Rajat K. Jain[4], John S. Miller[5], Chris A. West[1], James R. Hale[5], Douglas J. Casa, FACSM[1]. *[1]University of Connecticut, Storrs, CT. [2]University of North Carolina at Greensboro, Greensboro, NC. [3]Rutgers University, New Brunswick, NJ. [4]Northwestern University, Evanston, IL. [5]Penn state University, University Park, PA.* (Sponsor: Douglas Casa, FACSM)
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(No relevant relationships reported)

PURPOSE: To investigate the effect of acute chronic work load ratio (ACWL) on daily stress, fatigue, and soreness throughout a collegiate men's soccer season. **METHODS**: Sixty-four male collegiate soccer players (mean±SD; age, 20±2y; body mass, 77.3±6.7kg; height, 179.9±6.4cm; VO_{2max}, 53.0±5.0ml•kg^{-1}•min^{-1}) participated in this study, which took place during the 2016 and 2017 NCAA soccer season. During each training session and match, players donned a heart rate and GPS enabled chest strap to measure training impulse (TRIMP). Daily stress, fatigue, and soreness levels were collected using 1 to 10 Likert-scales before each training session and match. ACWL was calculated for TRIMP using the ratio of the previous 7-day average to the previous 28-day average. ACWL values were categorized into three groups: low, ACWL<0.8; medium, 0.8≦ACWL<1.5; high, ACWL≧1.5. Stress, fatigue, soreness levels were transformed to corresponding z-scores to account for individual differences. One-way ANOVA with Tukey pairwise comparison was used to assess stress, fatigue, soreness levels in different ACWL groups. Mean difference (MD), 95% confidence interval (95%CI) and effect size (ES), suggested by Cohen were calculated. **RESULTS**: Stress levels were significantly higher when ACWL was high compared to low (MD=0.47, 95%CI=0.34-0.60, ES=0.44) and medium (MD=0.37, 95%CI=0.25-0.48, ES=0.28) (p=0.001). Fatigue levels were significantly higher when ACWL was high (0.36±1.15) compared to low (MD=0.56, 95%CI=0.42-0.69, ES=0.55) and medium (MD=0.38, 95%CI=0.26-0.49, ES=0.36) (p=0.001). Fatigue levels were also significantly higher when ACWL was medium compared to low (MD=0.18, 95%CI=0.07-0.29, ES=0.20, p=0.001). Soreness level was significantly higher when ACWL was high compared to low (MD=0.51, 95%CI=0.37-0.64, ES=0.49) and medium (MD=0.38, 95%CI=0.26-0.50, ES=0.31) (p=0.001). **CONCLUSIONS**: ACWL could impact daily stress, fatigue, and soreness levels. A large change in ACWL (≧1.5) was associated with moderate to large changes in stress, fatigue, and soreness levels compared to low ACWL. Thus, ACWL may be used to manage athlete's daily stress, fatigue, and soreness levels and optimize periodization. However, other factors should be also considered, such as sleep.

1623 Board #2 May 30 1:30 PM - 3:30 PM

Sleep Quality Effects Mood, Anxiety And Disablement In Division I National Collegiate Athletic Association Men's Soccer Players

Courteney L. Benjamin[1], Ryan M. Curtis[1], Robert A. Huggins[1], Yasuki Sekiguchi[1], William M. Adams[2], Shawn M. Arent, FACSM[3], Rajat K. Jain[4], John S. Miller[5], Bruin C. Armwald[5], Jason M. Pullara[4], Douglas J. Casa, FACSM[1]. *[1]Korey Stringer Institute at the University of Connecticut, Storrs, CT. [2]University of North Carolina at Greensboro, Greensboro, NC. [3]Rutgers University, New Brunswick, NJ. [4]Northwestern University, Evanston, IL. [5]Penn State University, University Park, PA.* (Sponsor: Douglas Casa, FACSM)
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(No relevant relationships reported)

PURPOSE: To examine differences in mood, anxiety and physical health measurements between individuals who reported good sleep quality and individuals who reported poor sleep quality. **METHODS:** 110 male collegiate soccer players (mean±SD; age, 20±2y; body mass, 77.1±6.7kg; height, 179.9±6.3cm; VO_{2max}, 54.0±4.7ml•kg^{-1}•min^{-1}) participated in this study. During the 2016 and 2017 NCAA soccer seasons, the Pittsburgh Sleep Quality Index (PSQI), Profile of Mood States (POMS), Sports Anxiety Scale (SAS), and Disablement in the Physically Active Scale (DPA) questionnaires were administered at various timepoints throughout the season. Groups were classified as those who reported good sleep quality (PSQI ≤ 4) and those who reported poor sleep quality (PSQI ≥ 5). Multi-level linear mixed models were used to assess differences between a fixed sleep quality factor. Individual and time point were added as random intercepts to account for variance associated with these factors. Statistical significance was set a priori p<0.05. Results are reported as mean difference (MD) and effect size (ES). **RESULTS:** 47.4% of PSQI results yielded scores ≥ 5. Individuals with good sleep quality had significantly lower levels of depression (MD=-2.68, ES=-0.39; p<0.001), tension (MD=-1.36, ES=-0.33; p<0.001), anger (MD=-2.09, ES=-0.33; p<0.001), fatigue (MD=-1.95, ES=-0.56; p<0.001), confusion (MD=-1.26, ES=-0.38; p<0.001) and total mood disturbance (MD=-9.11, ES=-0.39; p<0.001) than those who reported poor sleep quality. Individuals who reported good sleep quality had significantly less concentration disruption (MD=-0.45, ES=-0.25; p=0.01) than those who reported poor sleep quality. Individuals who reported good sleep quality scored significantly lower on the DPA (MD=-2.73, ES=-0.26; p=0.01), indicating improved physical function and well-being, compared to those who reported poor sleep quality. **CONCLUSION:** Poor sleep quality is prevalent (almost 50%) in this sample of collegiate soccer players. Athletes with poor sleep quality appear to have increased negative mental health outcomes and higher ratings on a disablement scale. Establishing student-athlete wellness monitoring programs may provide a tailored approach to improve the collegiate athlete experience.

1624 Board #3 May 30 1:30 PM - 3:30 PM

The Influence of Match Congestion, Load and Wellness on Injury Risk in Collegiate Men's Soccer

Robert A. Huggins[1], Ryan M. Curtis[1], Courteney L. Benjamin[1], Yasuki Sekiguchi[1], Erin B. Wasserman[2], David A. Klossner[3], William M. Adams[4], Shawn M. Arent, FACSM[5], Rajat K. Jain[6], S. John Miller[7], Matthew J. Armistead[7], Stephen M. Borchik[8], Christopher D'Andrea[5], Andew P. Landry[9], Tyler Sylvester[6], Alan J. Walker[5], Douglas J. Casa, FACSM[1]. *[1]Korey Stringer Institute, University of Connecticut, Storrs, CT. [2]Datalys Center for Sports Injury Research and Prevention, Indianapolis, IN. [3]University of Maryland, College Park, MD. [4]Univeristy of North Carolina at Greensboro, Greensboro, NC. [5]Rutgers University, New Brunswick, NJ. [6]Northwestern University, Evanston, IL. [7]Penn State University, University Park, PA. [8]University of North Carolina at Greensboro, Greensboro, NC. [9]University of Connecticut, Storrs, CT.* (Sponsor: Douglas J. Casa, FACSM)
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(No relevant relationships reported)

The impact of match congestion, training load (TL), perceived stress, fatigue and soreness on the odds of injury remains unclear. **PURPOSE**: To examine the influence of: 1) days rest between matches on injury rate (IR) and odds of injury and; 2) TL on injury, perceived stress, fatigue and soreness. **METHODS:** A prospective multi-site study tracked daily exposures, TL (distance and duration), injury and perceptual data from six Division I NCAA men's soccer teams in one season. Overall and non-contact (NC) IRs expressed per 1000 athlete exposures (AEs), and odds ratios (OR) were determined by days before and after matches. Associations between injury and changes in both TL and perception were analyzed using a multilevel logistic regression. **RESULTS:** 132 players experienced 116 injuries in 125 matches and 75 injuries in 301 practices. Overall match and practice IRs (per 1000AEs [95%CI]) were 47.9 [39.1,

56.6] and 12.7 [9.8, 15.5], respectively. Match IRs [range = 0.0 to 57.9] were highest 1 to 5 days [range = 1 to 12] from the last match. While insignificant ($p > 0.21$), match IRs were highest 3 days between matches (IR= 57.9 [39.0, 76.8]). Players were at increased odds of being injured in a match with 1 to 5 days since the last match vs. 6+ days (OR [95%CI] = 1.85 [1.10, 3.12]). Practice IRs were highest in the preseason (IR = 26.8 [13.2, 40.3]). Players were at increased odds of be injured in practice 3 and 4 days before vs. 1 day before (OR= 6.19 [3.03, 12.66] and 3.89 [1.92, 7.88]). Players were at increased odds ($p < 0.001$) of feeling fatigue (> 5) (OR= 7.04 [3.75, 13.21]) and soreness (> 5) (OR= 4.00 (2.17, 7.37]) in practice with 1 vs. 6 days since the last game. For each additional 3500m covered on a day, odds of NC injury, stress, soreness and fatigue increased (OR = 1.70 [1.38, 2.10], 1.16 [1.02, 1.31], 1.55 [1.40, 1.72], 1.69 [1.52, 1.89]), respectively. For each additional hour of activity on a day, odds of NC injury, stress, soreness and fatigue increased (1.83 [1.59, 2.12], 1.08 [0.97, 1.20], 1.28 [1.17, 1.39], 1.34 [1.22, 1.47], respectively. **CONCLUSION**: Days between matches and acute TL increases on a given day had a negative impact on odds of injury and perception. The odds of getting injured in a match were greater with 1 to 5 days vs. 6+ days between matches. These data may be used to inform and guide the NCAA in determining optimal scheduling and recovery.

1625 Board #4 May 30 1:30 PM - 3:30 PM

Effect of Two Regimes of Sled Sprinting on 40m Sprint Performance in Collegiate Soccer Players

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(No relevant relationships reported)

Speed is one of the most important factors dictating athletic performance especially in field based team sports including soccer. Sports performance coaches continue to design training programs to enhance this ability. In addition to lower body resistance training and plyometrics, one method that is frequently employed is resisted sprinting (RS). However, data concerning the efficacy of RS is equivocal and there is much debate over the proper resistance to prescribe. Previous research has been conducted at loads near 10% of body weight (BW), but recent studies suggest the optimal load for power output in RS is 70 - 80% BW. **Purpose:** The purpose of this study was to compare the effects of two 5wk RS programs varying in load on sprint performance and jumping ability in male collegiate soccer players. **Methods:** At baseline, 20 collegiate male soccer players performed testing of 40m-sprint performance with split times at 10m and 20m and broad jump. They were matched and separated into a heavy RS group (n=10) or light RS group (n=10). Over a 5 wk period, they performed 10 sessions of progressive RS at 70-80% or 10-20% BW. Athletes simultaneously participated in 3 d/wk of full body resistance training and 2 d/wk of soccer specific conditioning. Sprint and jump testing performance tests were repeated 72 h after the final training session. **Results:** Results showed a significant effect of time for the 20m ($p=0.005$) and 40m distances ($p=0.008$) as well as for the broad jump ($p=0.002$). 10m sprint times remain unchanged ($p > 0.05$) and there was no groupXtime interaction for any variable. Very large effects were seen for 20m (2.82 ± 0.1 s to 2.77 ± 0.11 s) and 40m performance (5.02 ± 0.2 s to 4.95 ± 0.2 s) in response to heavy RS training, with a huge effect seen for broad jump. Large effects were seen at the 20m (2.85 ± 0.07 s to 2.81 ± 0.1 s) and 40m (5.02 ± 0.15 s to 4.97 ± 0.2 s) distances after light RS training, with medium effects seen in 10m sprint times and broad jump. **Conclusion:** A 5-week RS intervention significantly improves sprinting performance and broad jump in collegiate soccer players irrespective of magnitude of resistance, which suggests that both light and heavy RS is efficacious to enhance these outcomes.

1626 Board #5 May 30 1:30 PM - 3:30 PM

The Dose-Response Relationship of Neuromuscular Training to Prevent Lower Extremity Injuries in Young Soccer Players. A Cluster Randomised Controlled Trial

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(No relevant relationships reported)

The regular execution of neuromuscular training has been shown to reduce injuries of the lower extremities in youth athletes. However, to date there are inconsistent results on the dose-response relationship of neuromuscular training. **Purpose:** The aim of this study was to evaluate the optimal duration of neuromuscular training to prevent injuries of the lower extremities in young soccer players. **Methods:** 342 (15.4±1.7 years) male soccer players were included in the study, and cluster-randomized into two intervention groups. Both groups completed the same soccer specific warm-up program (FIFA 11+) twice a week, but for a different duration: one intervention group (INT10, n=175) twice a week for 10 minutes, the other (INT20, n=167) twice a week for 20 minutes. The player exposure hours (hrs) were collected monthly over six months during one soccer season. Primary outcome was the incidence of lower extremity (LE) injuries. Secondary outcomes were injury type, severity, mechanism and compliance to the intervention. **Results:** During the entire season 123 young soccer players sustained a total of 145 lower extremity injuries (INT 10: 55; INT 20: 90). (INT 10: 55; INT 20: 90). No significant group difference was found between INT10 (6.37 per 1000 hrs) and INT20 (7.20 per 1000 hrs) for the relative risk of injuries of the lower extremities (RR= 1.03, 95 % confidence interval 0.59, 1.79), nor for the distribution of injury location, type, severity, mechanism or conditions. **Conclusion:** The results suggest that performing preventive exercises for 10 minutes is just as effective as a performance of 20 minutes. Consequently, the implementation of a neuromuscular training for 10 minutes twice a week seems to be sufficient to reduce injuries of the lower extremities in young male football players.

1627 Board #6 May 30 1:30 PM - 3:30 PM

Importance of Position in Highly Talented Soccer Players: Peripheral Perception, Selective Attention and Reaction Abilities

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The importance of sports-specific cognitive and perceptual skills in soccer has already been examined in various studies (Ward & Williams, 2003). However, the role of general perceptual-cognitive abilities and the relation of position is not clarified in detail (Schumacher et al., 2018).
PURPOSE: To analyze the relation of position to peripheral perception, selective attention and reaction abilities in highly talented soccer players.
METHODS: 147 highly talented male soccer players (14.8 ± 2.6 yrs, age range 11 to 23 years) were involved. The subjects performed computer-based selective attention, peripheral perception and reaction tests (using Vienna Test System). In the peripheral perception test stimuli were presented left and right sided. The soccer players were subdivided into offensive player group (OPG: striker, midfielder) and defensive player group (DPG: goalkeeper, defender). They were recruited from a youth academy of a professional soccer club and played at the highest and 2nd highest national soccer competition for their age. Group differences were tested using the student t-test.
RESULTS: Significant differences for position groups were observed, with regard to correct answers (OPG: 216.1 ± 32.0; DPG: 231.3 ± 26.0) in selective attention test ($t(140) = 3.05$, $p < 0.01$) and peripheral reaction time left (OPG: 0.71 ± 0.09 sec; DPG: .67 ± 0.10 sec) in peripheral perception test ($t(141) = 2.32$, $p < 0.01$). No differences were found for variables in the reaction test.
CONCLUSIONS: Our results indicate that defender and goalkeeper outperform striker and midfilder in general selective attention tasks and in peripheral reaction tasks left sided. Additional research is needed to further clarify position-specific differences between left and right peripheral reaction time of highly talented soccer players.

1628 Board #7 May 30 1:30 PM - 3:30 PM

NCAA Preseason Demonstrates Greatest Impact on Heart Rate Variability, Training Load and Sleep In Men's Soccer

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PURPOSE: The purpose of this study was to compare training load (TL), sleep, heart rate variability (HRV) and resting (RHR) by season phase over a full NCAA collegiate men's soccer season. **METHODS:**Daily TLs (duration [min], distance covered [m], time spent in heart rate >80 % of the individual's max [min], number of sprints [n], and distance covered while running >14.4 $km \cdot h^{-1}$ [m]) were monitored in 31 male NCAA Division 1 male soccer athletes (mean ± SD; age, 20 ± 2 y; body mass, 79.92 ± 6.69 kg; height, 181.48±6.35 cm; VO_{2max}, 50.87 ± 4.38 $ml \cdot kg^{-1} \cdot min^{-1}$) using GPS-enabled player tracking devices during the Fall 2016 soccer preseason (PRE), regular season (REG), and post-season (POST). Sleep duration (min), sleep efficiency (%), and RHR and HRV z-scores (SD) were tracked using a multi-sensor wrist-worn deviceand a validated self-reported sleep questionnaire (Karolinksa Sleep Diary). Linear mixed effects models with a fixed factor of season phase and a random factor of participant was used. Mean differences (MD) were assessed post-hoc with a Tukey HSD, with alpha set at 0.05 for all analysis. **RESULTS:** During PRE, participants experienced an increased distance (1527 ± 177 m), time (31 ± 3 min) and sprints (8 ± 1) (all $p <$ 0.001) per session vs. REG, and increased distance (1793 ± 312 m), time (39 ± 6 min) and sprints (9 ± 1) per session vs. POST (all $p < 0.001$). A decrease in sleep efficiency was observed during PRE vs. REG (MD = -2.00 ± 0.05 %; $p = 0.004$). Self-reported sleep duration during REG was longer vs. PRE (MD = 45 ± 8 min; $p < 0.001$) and POST (MD = 32 ± 12 min; $p = 0.01$). No differences were observed for objective sleep duration or RHR at any point throughout the season ($p > 0.05$). RHR was found to be lower during PRE vs. REG (MD = -0.16 ± 0.06S D; $p = 0.02$). Finally, HRV during

REG was reduced vs. PRE (MD = -0.14 ± 0.06 SD; p = 0.05). **CONCLUSION:** This study indicates higher HRV, greater physical and physiological loading, decreased self-reported sleep and decreased sleep efficiency during PRE compared to REG. In this men's soccer team, PRE training was associated with significantly increased physical stress, adverse sleep characteristics and increased HRV. These responses should be considered when designing and implementing optimal training and recovery strategies.

1629 Board #8 May 30 1:30 PM - 3:30 PM

Relationship between the Different Energy Substrates and Skin Temperature Response in Professional Soccer Players

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Elite professional soccer players have high aerobic requirements throughout a game and extensive anaerobic demands during periods of a match leading to major metabolic and thermodynamic changes. Assessing skin temperature (Tsk); blood lactate concentration [La^-], fat and carbohydrate oxidation (FATox; CHOox) might provide an indirect method to assess metabolic flexibility and oxidative capacity during exercise.**Purpose**: To study the relationship between Tsk; [La^-] and substrate oxidation patterns. **Methods:** We used indirect calorimetry and [La^-] measurements, and monitored the Tsk to study the metabolic and thermodynamic response to exercise in twenty professional male soccer players (age 24.5±3.4 yrs.; VO_2peak 53.2±4 ml/kg/min) during a maximal incremental treadmill test.**Results:**The maximal FATox rate was 0.47±0.16 $g{\cdot}min^{-1}$, reached at 62.5±6.5% of the VO_2peak. A significant inverse correlation was found between average FATox rates and average blood [La^-] ($p<0.005$). A significant correlation was found between the average values of Tsk and FATox rates ($p<0.006$). Maximal values reached of FATox and CHOox rates were 0.80 and 6.82 g.min-1 respectively.**Conclusion:** These results indicate that FATox rates are inversely associated with blood lactate production; which may be due to a higher adrenergic activation that limits the increase of Tsk and the FATox capacity. Our data also show relationships between the Tsk and FATox rates, which may be associated to an increase of tissue blood flow. More research is required to determine how the thermodynamic and metabolic responses to affect performance in soccer.

Table 1. Subjects' characteristics

Variables	Age (years)	Height (cm)	Weight (kg)	BMI (%)	Body fat (%)	Fat free mass (%)	Max speed (km/h)
n=20	24.5± 3.4	180.6± 5.5	76.7± 6.2	23.54± 1.54	10.29± 1.85	46.58± 2.14	16± 1

Table 2. Maximal cardiorespiratory and metabolic data

VO2 peak (ml/min/kg)	HR peak (bpm)	RER	VE (L/min)	FATox peak (g/min)	CHOox peak (g/min)	Tsk peak (ºC)	[La^-] (mmol·L^-1)
53.25± 3.98	180.3± 7.9	1.06± 0.05	145.53± 24.13	0.47± 0.16	4.97± 0.62	37.12± 0.69	6.6± 1.7

Table 3. Average of fat and carbohydrate oxidation rates, blood lactate levels, skin temperature response and oxygen uptake in an incremental exercise test until volitional exhaustion in professional soccer players

Load (km/h)	FATox (g/min)	CHOox (g/min)	[La^-] (mmol·L^-1)	Tsk (ºC)	VO2 (ml/min/kg)
0	0.21±0.10	1.14±0.27	1.22±0.37	34.87±0.95	6.87±1.87
9	0.47±0.16	4.04±0.41	1.25±0.30	35.18±0.92	30.88±2.66
10	0.38±0.18	4.26±0.46	1.32±0.30	35.54±0.98	34.53±2.16
11	0.34±0.17	4.53±0.43	1.59±0.54	36.07±0.95	38.12±2.47
12	0.25±0.19	4.67±0.53	1.88±0.91	36.48±0.86	41.30±2.19
13	0.20±0.19	4.79±0.53	2.65±1.32	36.78±0.70	44.15±2.39
14	0.14±0.19	4.81±0.64	3.76±1.64	36.93±0.65	47.19±2.59
15	0.08±0.13	4.75±0.66	4.80±1.87	37.13±0.62	49.58±2.38
16	0.06±0.12	4.80±0.74	5.53±1.89	37.13±0.56	52.64±2.38
17	0.03±0.10	4.85±0.80	6.52±1.57	37.25±0.56	54.13±3.93

Values are mean ± standard deviation.

Abbreviations: BMI (body mass index); Max speed (maximal speed); VO2 peak (peak oxygen consumption), HR (heart rate); RER (respiratory exchange ratio); VE (ventilation); FATox peak (peak fat oxidation); CHOox peak (peak carbohydrate oxidation); Tsk peak (peak skin temperature)

D-13 Free Communication/Slide - Physical Activity Epidemiology: New Insights

Thursday, May 30, 2019, 1:30 PM - 3:30 PM
Room: CC-202C

1630 **Chair:** I-Min Lee, FACSM. *Harvard Medical School, Boston, MA.*
(No relevant relationships reported)

1631 May 30 1:30 PM - 1:45 PM

Composition of Movement Behaviors and Risk of Weight Gain

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Physical activity, sedentary behavior, and sleep are three movement behaviors that are mutually exclusive parts of a whole (i.e., a 24-hour day) and therefore may be related to weight in a co-dependent manner. Compositional data analyses (CoDA) provide the opportunity to analyze associations between constrained behaviors and health outcomes without violating statistical assumptions involving collinearity.
PURPOSE: To use CoDA to investigate the relationships between the composition of four movement behaviors (objectively-measured sedentary time [SED], light intensity physical activity [LPA], moderate-vigorous intensity physical activity [MVPA] and self-reported sleep duration) and one-year changes in body mass index (BMI) and waist circumference (WC).
METHODS: Participants were 716 adults from the Cancer Prevention Study-3 (mean age 52.2 [SD 9.9] years, 59% female, 66% white, 40% normal BMI). Self-reported weight, height, and self-measured WC were captured one year apart. Participants wore an accelerometer (Actigraph GT3x) for a minimum of 14 hours/day for three days and self-reported sleep duration via 24-hour diaries. CoDA was used to examine associations between all movement behaviors and change in BMI or change in WC. CoDA isotemporal substitution models estimated associations for the replacement of 30 minutes of SED for other behaviors in the composition. Models were stratified by sex and adjusted for age, race/ethnicity, smoking status, and average daily caloric intake.
RESULTS: Participants spent most of their time SED (mean proportion of time SED = 0.414), followed by sleeping (0.344), in LPA (0.195), and in MVPA (0.047). The overall composition of movement behaviors was associated with a one-year change in BMI ($p = 0.003$) and WC ($p = 0.048$) among men, but not among women ($p = 0.19$ and $p = 0.43$). Among men, compositional isotemporal substitution models suggested that replacing 30 minutes of SED with 30 minutes of MVPA while holding LPA and

sleep constant was associated with a one-year BMI decrease of 0.26 kg/m^2, while the replacement of SED with LPA and sleep were associated with smaller decreases in BMI (0.06 kg/m^2 and 0.12 kg/m^2, respectively).
CONCLUSION: Findings suggest that targeting all movement behaviors throughout the day may be an effective approach for weight loss, especially among men.

1632 May 30 1:45 PM - 2:00 PM

Cardiorespiratory Fitness and Years Lived Free of Cardiovascular Disease: Cardiovascular Lifetime Risk Pooling Project

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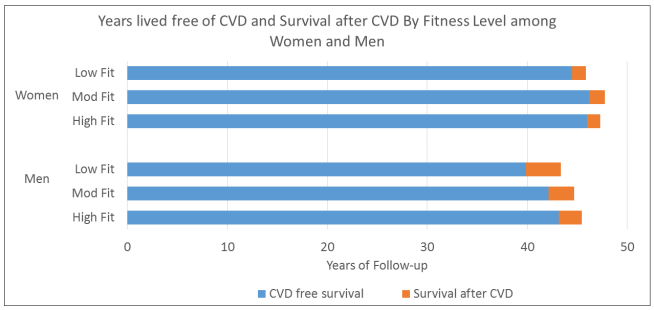
PURPOSE: Quantifying cardiorespiratory fitness (CRF) with years lived free of cardiovascular disease (CVD) allows for contextualization of the population burden of CVD and provides a metric for clinician-patient communication.
METHODS: CRF was measured with graded exercise treadmill tests in 8,129 adults in the Coronary Artery Risk Development in Young Adults and Framingham Offspring studies. Individual-level data were pooled. Cohort-specific z-scores for CRF were categorized into sex- and age- specific quintiles. We defined low fit as quintile 1, moderate (mod) fit as quintiles 2-3, and high fit as quintiles 4-5. Rates (person-years) of incident CVD and death were summed for participants up to age 85 years, or the oldest age of observation. Irwin's restricted mean was used to calculate years lived free from CVD and overall survival stratified by sex.
RESULTS: At baseline the mean age was 32.5±11.6 years, 43.6% women, and 30.8% black. Over 219,812 person-years of follow-up, 762 CVD events were observed. For total survival time, high fit men lived 2.1 years longer and mod fit men lived 1.4 years longer vs low fit men. Additionally, high fit men lived 3.3 more healthy years and mod fit men lived 2.3 more healthy years free of CVD vs the low fit group. Among men, relative follow up time spent with CVD was 5.0% for high fit, 5.7% for mod fit, and 8.0% for low fit groups. While high and mod fit women were similar, both had greater longevity and health span than low fit women. Mod fit women lived 1.9 total years longer and lived 1.7 more healthy years CVD-free vs the low fit women. Time spent with CVD was similar across fitness groups in women, ranging from 2.8-3.2% of follow-up time.
CONCLUSIONS: The benefits of higher fitness appear to extend multiple decades into older ages. Higher fitness in early adulthood is associated with longer overall and CVD-free survival. Men with higher fitness levels as young adults live less of their life with CVD, suggesting a compression of morbidity at older ages.



Low fit defined as quintile 1 (bottom 20%); Mod Fit defined as quintile 2-3 (middle 40%); High Fit defined as quintile 4-5 (upper 40%)
CARDIA measured fitness at baseline/Year 0 exam (1985-86) using a maximal treadmill test using a modified Balke protocol.
FOS measured fitness at exam cycle 2 (1979-83) using a submaximal treadmill test (85% of age- and sex- predicted max heart rate) using a modified Bruce protocol

1633 May 30 2:00 PM - 2:15 PM

Leisure-time Physical Activity And TV Viewing Associations With Life Expectancy With And Without Cardiovascular Disease

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PURPOSE: Although high levels of physical activity are associated with longer overall and cardiovascular disease (CVD) free life expectancy (years lived without CVD) research has been limited and sedentary behavior has not been considered. Therefore, we examined associations between leisure-time moderate-to-vigorous physical activity (LTPA) and television (TV) viewing with life expectancy overall and with and without three types of CVD.
METHODS: We included 13,534 participants from the Atherosclerosis Risk in Communities Study prospective cohort. LTPA in the past year (no LTPA, ≤ median (13.2 MET hours/week), > median) and TV viewing (often/very often, sometimes, seldom/rarely) were self-reported. Outcomes included all-cause mortality, and incident nonfatal coronary heart disease (CHD), stroke, and heart failure (HF). We used a multistate survival model to estimate associations of LTPA and TV viewing with life expectancy (95% confidence interval (CI)) with and without nonfatal CHD, stroke, and HF at age 50 separately for men and women. Models were adjusted for time-varying covariates (age, gender, race by study center, education, smoking, ethanol intake). Missing data were imputed with multiple imputation.
RESULTS: Over a median of 27 years of follow-up, the average life expectancy at age 50 was 26 years. Compared to participants who engaged in no LTPA, participants who engaged in LTPA above the median had greater overall life expectancy (1.8 years each for men and women), greater nonfatal CHD-free life expectancy (men 1.5 years (95% CI 1.0, 2.0), women 1.6 years (95% CI 1.1, 2.2)), greater nonfatal stroke-free life expectancy (men 1.8 years (95% CI 1.2, 2.3), women 1.8 years (95% CI 1.3, 2.3)), and greater nonfatal HF-free life expectancy (men 1.6 years (95% CI 1.1, 2.1), women 1.7 years (95% CI 1.2, 2.2)). For each type of CVD, life expectancy with disease was similar across three levels of LTPA. Watching less TV compared to more viewing was associated with longer overall and disease-free life expectancy of 0.8 years each. These findings were similar for CHD, stroke, and HF.
CONCLUSIONS: Engaging in more LTPA and less TV viewing were associated with longer overall and nonfatal CVD-free life expectancy. Increasing LTPA levels and limiting TV viewing could potentially increase longevity and years lived CVD-free.

1634 May 30 2:15 PM - 2:30 PM

Cardiorespiratory Fitness Incidence and Mortality from Lung Cancer in Male Smokers

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Cardiorespiratory fitness (CRF) is an established prognostic marker for many chronic diseases including lung cancer but, this association has not been assessed among smokers. **PURPOSE**: To evaluate the association between CRF, lung cancer incidence and cancer mortality in former and current male smokers. **METHODS**: Maximal treadmill exercise testing was performed in 2,979 men [former smokers (n=1,602), 39.6±25 pack/years and current smokers (n=1,377), 43±27 pack/years] aged 59.2±17.3 years, who were free from malignancy at baseline. Cox hazard models adjusted for cancer risk factors were analyzed. Population attributable risks (PARs%) of low CRF (<5 METs) for lung cancer outcomes were also determined. **RESULTS**: During 11.6±7 years follow-up, 99 lung cancers were diagnosed [46 (2.9%) among former smokers and 53 (3.8%) among current smokers]. Seventy-nine of those died from cancer (40 in former and 39 in current smokers) after 3.6±4.6 years from diagnosis. Among former smokers each 1-MET increase and categories of moderate and high CRF were associated with 16% (p=0.002), 60% and 83% (p trend=0.001) reductions in lung cancer incidence, respectively. Among current smokers who were later diagnosed with lung cancer, 1-MET increase and categories of moderate and high CRF were associated with 18% (p=0.008), 81% and 82% (p trend <0.001) reductions in cancer mortality, respectively. The PAR% for lung cancer incidence was 12.5% among former smokers and 21.5% for cancer mortality among current smokers. **CONCLUSIONS**: Higher CRF is associated with lower lung cancer incidence in former smokers. Current smokers who were diagnosed with lung cancer and were more fit exhibited reduced cancer mortality. These results suggest potential protective benefits of higher CRF for prevention of lung cancer outcomes among both former and current smokers. Eliminating low CRF as a risk factor could potentially reduce considerable lung cancer morbidity and mortality.

1635 May 30 2:30 PM - 2:45 PM

Is Leisure-time Physical Activity Before Pregnancy Associated With Risk Of Hyperemesis Gravidarum During Pregnancy?

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Hyperemesis gravidarum (HG) is characterised by excessive nausea and vomiting often leading to maternal weight loss, dehydration, electrolyte imbalance, and vitamin deficiencies. HG is the most common reason for hospitalisation in the first half of pregnancy and its prevalence varies depending on maternal country of birth. Women who experience excessive nausea and vomiting in early pregnancy are less likely to participate in leisure-time physical activity (LTPA) during pregnancy. Whether LTPA before pregnancy is associated with hyperemesis gravidarum has not yet been studied. Prepregnancy LTPA may lessen the risk of gestational diabetes, pelvic girdle pain, and hypertensive disorders including preeclampsia, all of which are associated with HG.
PURPOSE: To estimate associations between prepregnancy LTPA and HG in pregnancy.
METHODS: We present data from 37 442 primiparous women with singleton pregnancies enrolled in The Norwegian Mother and Child Cohort Study. Prepregnancy LTPA was self-reported by questionnaire in pregnancy week 17. HG was defined as prolonged nausea and vomiting in pregnancy requiring hospitalisation before the 25th gestational week. We estimated the crude and adjusted associations between LTPA and HG using multiple logistic regression. We assessed effect modification by prepregnancy BMI or smoking by stratified analysis and interaction terms.
RESULTS: A total of 398 (1.1%) women developed HG. Before pregnancy 76.4% conducted LTPA at least 3 times weekly, while only 7.3% of women conducted LTPA less than once a week. Compared to women reporting LTPA 3 to 5 times weekly, no LTPA or a frequency of 1 to 3 times a month had an increased risk of HG (adjusted odds ratio [aOR] 2.58; 95% confidence interval [CI], 1.29 to 5.18, and aOR 1.35; 95% CI, 0.95 to 1.92, respectively). LTPA-HG associations differed by prepregnancy BMI but not by prepregnancy smoking. The increase in risk of HG was more than 4-fold for women with BMI≥25 kg/m² reporting no LTPA prepregnancy (aOR 4.89; 2.13 to 11.22, test for trend, P=0.45).
CONCLUSIONS: Lack of LTPA before pregnancy was associated with an increased risk of HG. Inactive women with overweight or obesity before pregnancy may have the highest risk of HG during pregnancy.

1636 May 30 2:45 PM - 3:00 PM

Is Midlife Quadriceps Muscular Strength Protective Against Later Life Osteoarthritis and Subsequent Total Joint Replacement?

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Abstract:
We have previously shown a relationship between cardiorespiratory fitness/physical activity and the likelihood of developing hip/knee osteoarthritis (OA) later in life. Another possible predictor of hip/knee OA is weakness of the quadriceps musculature. Because it is unknown whether or not midlife quadriceps strength predisposes to OA and hip/knee total joint replacement (HKR) later in life, the current study was undertaken.
Purpose: The purpose of this study was to examine the relationship between midlife quadriceps muscle strength and the likelihood of developing OA and undergoing a HKR later in life
Methods: We linked strength and clinical data from 3944 (3431 men and 513 women) participants in the Cooper Center Longitudinal Study from 1981-1989 to Medicare claims from 1999-2009 (13% women, mean age 49 years). Quadriceps muscular strength was measured via 1-repetition maximum (1-RM) leg press assessment and expressed individually relative to body weight. Outcome measures for OA and HKR were obtained using Medicare administrative data. Proportional hazards regression was used to estimate the risk of incident OA and subsequent risk of HKR after developing OA.
Results: During 20,672 person years of Medicare follow up, 1100 OA events (913 events in men, 187 events in women) were observed. After controlling for age, sex and year of muscle strength assessment, a significant relationship was observed between 1-RM leg press and the likelihood of developing OA later in life (HR 0.76, 95% CI 0.59 - 0.98). Among those who developed OA, we observed 293 hip/knee total joint replacements (244 joint replacements in men, 49 joint replacements in women) during 4947 subsequent person years of observation. When adjusted for the same covariates, higher 1-RM leg press suggested a protective role against HKR, but the findings were not statistically significant (HR 0.80, 95% CI 0.49 - 1.29).
Conclusion: Midlife quadriceps muscular strength may play a protective role against onset of OA later in life. More research is needed to determine if increasing quadriceps muscle strength leads to a reduction in risk of undergoing HKR.

1637 May 30 3:00 PM - 3:15 PM

Measures Of Adiposity And Its Association To Physical Activity In Adults: The Tromsø Study

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PURPOSE: The purpose of this study was to examine the pattern and magnitude of associations between moderate-to-vigorous physical activity (MVPA) and three different methods for assessing adiposity: body mass index (BMI), waist circumference (WC) and dual-energy x-ray absorptiometry (DXA).**METHODS**: In the seventh wave of the Tromsø Study 2015-2016, 6289 women and men aged 40-84 years wore an accelerometer (ActiGraph wGT3X-BT) on the hip for eight consecutive days. Of these, 6125 participants provided valid accelerometer data, of which 5925 participants also provided data on BMI ($kg \cdot m^{-2}$) and WC (cm), and 2741 participants attended DXA measurement, providing data on total body fat (%). MVPA ($min \cdot d^{-1}$) was estimated from the vector magnitude (the square root of the sum of squared activity counts) of triaxial acceleration counts and defined as >2690 counts per minute. In order to compare the magnitude of the association between MVPA and the three adiposity measures, the associations were considered significantly different if the 95% CI of the standardized β`s overlapped by <50%. **RESULTS**: After adjustment for age, sex, body height, smoking and educational level, for every 10-minute increase in MVPA, BMI decreased with -0.29 $kg \cdot m^{-2}$ (95% CI: -0.25-0.33 $kg \cdot m^{-2}$), WC decreased with -0.94 cm (95% CI: -0.83-1.04 cm) and percentage total body fat decreased with -0.81% (95% CI: -0.72-0.90 %). The association between MVPA and percentage body fat (standardized β=-0.270, 95%CI: -0.236-0.296) were considered significantly larger than for WC (standardized β=-0.220, 95%CI: -0.189-0.235) and BMI (standardized β=-0.200, 95%CI: -0.163-0.214) ($p<0.05$). MVPA explained 6%, 20%, and 44% of the variance in BMI, WC and percentage total body fat, respectively, after adjustment for potential confounders.
CONCLUSIONS: Adiposity measured with DXA, explained more of the variation in the association with MVPA than WC and BMI, indicating that the association between adiposity and physical activity depends on the accuracy of the measurement. As DXA distinguishes between fat and fat-free mass, whereas BMI and WC acts as proxy measures of adiposity, DXA may be the best choice for expressing adiposity. Due to the cross-sectional design of our analyses, we cannot establish causality in the association between MVPA and adiposity.

1638 May 30 3:15 PM - 3:30 PM

Associations Between Steps Per Day And Mortality In A Representative Sample Of US Adults

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PURPOSE: Walking is the most popular form of physical activity among adults, but it's still unknown how many steps per day are necessary to reduce mortality risk. This study examined the relation between objectively measured steps/day and mortality using NHANES data. **METHODS:** Participants were a representative sample of US adults (n=4,840 adults; ≥40 years) assessed for physical activity in 2003-06 using an accelerometer device and followed through 2015 for mortality status and cause of death using ICD-10 codes. Accelerometer-derived steps/day were modelled against all-cause, cardiovascular disease (CVD), and cancer mortality using cox proportional hazard models [(Hazard Ratios (HR) and 95% CI)]. Hazard ratios were adjusted for: age, sex, race-ethnicity, education, alcohol consumption, diet quality, smoking, BMI, health status, reduced mobility, and self-reported diagnosis of diabetes, coronary heart disease, stroke, and cancer. The 10th percentile for steps/day (~4000 steps/day) was defined as the referent group. We conducted sensitivity analyses excluding participants

with reduced mobility, poor/very poor health condition, and excluding the first two years of follow-up. NHANES population sample weights and adjustments for the complex survey design were employed.
RESULTS: A total of 1,165 deaths occurred during follow-up (406 from CVD, and 283 from cancer). The relation between steps/day and mortality was non-linear (p<.01). When compared to our reference ~4000 steps/day, an increase of 2,000 steps/day was associated with 36% lower risk for all-cause mortality (HR=0.64, 95% CI: 0.59, 0.70), 46% lower CVD mortality (HR=0.54, 95% CI: 0.20, 1.43), and 21% lower cancer mortality (HR=0.79, 95% CI: 0.69, 0.91). There were negligible reductions in risk beyond 10,000-12,000 steps/day. Results from sensitivity analyses did not alter the activity-mortality associations. **CONCLUSIONS:** Modest increases in steps/day (2000 steps/day) are associated with reduced risk for mortality with no extended benefits beyond 10,000-12,000 steps/day. The steps/day-mortality associations described here can help setting public health/clinical goals.

D-14 Free Communication/Slide - **Physical Activity/ Exercise in Clinical Populations**

Thursday, May 30, 2019, 1:30 PM - 3:15 PM
Room: CC-105B

1639 **Chair:** Cemal Ozemek, FACSM. *University of Illinois Chicago, Chicago, IL.*

(No relevant relationships reported)

1640 May 30 1:30 PM - 1:45 PM

Examining the Impact of Obesity on Ventilatory Responses During Acute Exercise in Patients with HFpEF

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PURPOSE: Heart Failure (HF) is a major cause of morbidity and mortality worldwide. Ventilatory responses to acute exercise have important prognostic value in HF patients. This study examined baseline ventilatory measures to determine if obesity further impacts ventilatory responses in normal subjects and heart failure patients with preserved ejection fraction (HFpEF). Methods: All participants performed a cardiopulmonary exercise test to maximal effort to quantify ventilatory responses (tidal volume (TV), breathing frequency (Bf), and minute ventilation (VE)) at submaximal (25 watts) and peak exercise. Ventilation efficiency was determined by assessing VE/VCO_2 at submax and the VE/VCO_2 slope. Obese vs. non-obese HFpEF participants were categorized based on BMI $\geq$30 kg/m^2. One-way ANOVA was performed to determine if there were significant ($p<0.05$) differences between groups. Results: The obese HFpEF group had higher VE during peak exercise than the non-obese group ($p<0.05$), which was mainly due to greater Bf ($p=0.08$) versus TV ($p=0.24$). The VE/VCO_2 at the submaximal workload and VE/VCO_2 slope were significantly higher in the non-obese HFpEF group. Conclusion: As hypothesized, obese HFpEF participants exhibited worse ventilatory function than the non-obese HFpEF patient at similar levels of exercise. However, obese HFpEF participants demonstrate a similar degree of ventilatory inefficiency compared to normal weight HFpEF participants. Since ventilatory efficiency was not abnormal in obese HFpEF it appears that their prognosis is no worse than normal weight HFpEF participants.

1641 May 30 1:45 PM - 2:00 PM

Comparison of Two High-Intensity Interval Training Modalities on Cardiometabolic Health in Overweight/ Obese Women

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High-intensity interval training (HIIT) has been used to reduce risk factors for diabetes, obesity, cardiovascular diseases and metabolic syndrome (MetS). Few studies have compared resistance-HIIT (R-HIIT) to aerobic-HIIT (A-HIIT) in a worksite wellness program designed to reduce risk factors for the MetS. **PURPOSE:** To compare the effects of A-HIIT and R-HIIT to that of a control group (CON) on physical characteristics, cardiometabolic health, and self-reported well-being in women employees attending a worksite wellness program. **METHODS:** A total of 48 overweight/obese women possessing one or more MetS risk factors were randomly assigned to one of three groups with 31 women completing all testing and training procedures: A-HIIT (n=10), R-HIIT (n=10), and CON (n=11). A-HIIT and R-HIIT groups trained 3x/wk for 25 minutes in an 8-week program at an average training intensity of 81.0 ±1 $\%HR_{max}$ and 81.9 ±1 $\%HR_{max}$, respectively. ANCOVA was used to determine differences among groups on all dependent variables at post-testing after adjusting for baseline values. Post-hoc analyses were performed using Bonferroni adjustments. **RESULTS:** Both A-HIIT (M_{diff} = 23.9 m, p= 0.029) and R-HIIT (M_{diff} = 23.8 m, p= 0.029) had higher aerobic fitness than CON (M_{adj} = 190.9 m *SEM*= 6.3) using the 2-minute walk test following training. Only R-HIIT (M_{diff} = 45.3 W, p= 0.002) showed increases in upper body power over CON (M_{adj} = 94.9 W *SEM*= 8.2) while displaying lower fasting insulin (M_{diff} = - 5.6 µU/ml,p= 0.036) compared to CON (M_{adj}= 17.4 µU/ml, *SEM*= 1.4). R-HIIT also showed greater reductions in HOMA2-IR (M_{diff} = - 0.7, p= 0.046) than CON (M_{adj} = 2.2, *SEM*= 0.2). Furthermore, HOMA2-%B was lower in R-HIIT compared to both CON (M_{adj} = 159.3%, *SEM*= 8.8, M_{diff} = - 38.5%, p= 0.017), and A-HIIT (M_{adj} = 172.2%, *SEM*= 9.4, M_{diff} = - 51.4%, p= 0.002). Finally, R-HIIT had significantly higher scores on the physical function domain of Patient Reported Outcome Measurement System (PROMIS®)-57 well-being questionnaire compared to the CON group (M_{adj} = 51.8 *SEM*= 1.4, M_{diff} = 5.7, p= 0.035). **CONCLUSIONS:** Our study showed that R-HIIT can be considered as part of a risk reducing worksite-wellness strategy for improving physical characteristics, cardiometabolic health, and well-being in women possessing one or more components of the MetS. Supported by UM Citizens Board Grant

1642 May 30 2:00 PM - 2:15 PM

Short and Long term Effects of Exercise Intensity on Conduit Artery Function in Cardiac Rehabilitation Patients

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(No relevant relationships reported)

PURPOSE: Patients with coronary artery disease (CAD) commonly present with conduit artery dysfunction characterized by decreased brachial artery flow-mediated dilation (FMD). Reduced FMD of 1% is associated with an 8-13% increased risk of future cardiovascular events[1], and thus interventions designed to improve FMD in patients with CAD are warranted. Short-term supervised exercise training may improve FMD, however whether improvements are maintained longer term following cessation of supervised cardiac rehabilitation (CR), is unclear. We compared the short- and long-term effect of High Intensity Interval Training (HIIT) and Moderate Intensity Continuous Training (MICT) on FMD in patients with CAD commencing a 4-week CR program in a real world hospital-based setting.
METHODS:Patients with angiographically-proven CAD (Age: 64±7; 35 males, 3 females) completed 3 sessions per week (2 supervised, 1 home-based) for 4-weeks, randomized to either 1) HIIT (n=21): 4 x 4 minute high intensity intervals at a rating of perceived exertion (RPE) 15-18 interspersed with 3 minute active recovery periods or 2) MICT usual care (n=17): 40 minutes moderate intensity continuous exercise at an RPE 11-13. Patients then continued 3 unsupervised home-based sessions per week of their randomized training for a further 11 months. FMD was measured at baseline, 4 weeks, 3 months, 6 months, and 12 months. Data was analyzed using a linear mixed model with baseline diameter and shear rate as covariates. Data is presented as mean (95% CI).
RESULTS:Baseline FMD was not different between groups [HIIT: 3.1%(2.2 to 4.0); MICT: 2.9%(1.9 to 3.9), p=0.657]. FMD increased from baseline at 4 weeks, 6 months and 12 months in the HIIT group [4 weeks: +1.8%(0.8 to 2.7), p<0.001; 6-months: +1.6%(0.7 to 2.6), p=001; 12-months: +1.4%(0.4 to 2.3), p=0.007], with negligible changes in the MICT group [4 weeks: +0.4%(-1.1 to 1.0), p=0.94; 6 months: +1.0%(-0.1 to 2.1), p=0.063; 12 months: +0.3%(-0.7 to 1.3), p=0.52].
CONCLUSIONS: A 4-week CR program of HIIT, but not MICT (usual care), improved conduit artery function in patients with CAD. Improved FMD with HIIT was maintained long-term at 6- and 12 months with home-based training.
[1]Ras, R et al. (2013). *Int. J. Cardiology* 168:344-351
Supported by Wesley Medical Research Grant 2015-17 and NHMRC Scholarship APP1133622

1643 May 30 2:15 PM - 2:30 PM

Optimizing Utilization Of A Cardiac Rehabilitation Facility For Chronic Disease Prevention.

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(No relevant relationships reported)

PURPOSE: Cardiac rehabilitation (CR) involves delivery of structured exercise, education and risk reduction, in a cost-effective manner. Despite its benefits, and clinical practice guideline recommendations, CR programs are grossly underused due to multiple barriers. A large study of 2,67,427 patients showed that CR was used in 13.9% of patients hospitalized for AMI and in 31.0% of those who underwent CABG surgery.To help optimize utilization of resources, at our hospital, we utilised our cardiac rehabilitation facility to include other disease groups such as cancer, respiratory and stable cerebrovascular diseases, since the principles of exercise prescription for these disease groups are similar to CR and require similar infrastructure.The purpose was to utilise a cardiac rehabilitation centre as a chronic disease prevention centre for oncology, and pulmonary patients. To also assess the effects of the comprehensive program on physical fitness levels of these patients using the 6-minute walk test.
METHODS: 319 patients, which included those with cardiac disease (185), pulmonary disease (36) and cancer (98) were assessed as part of this study over a period of 3 years. The program comprised aerobic exercises, resistance training, yoga, and disease specific rehabilitation. The aerobic capacity was assessed before and after one month of rehabilitation by means of the 6 Minute Walk Test (6MWT).
RESULTS: The 6-minute walk test distance (6MWTD) in the cardiovascular group improved from 331.56 (± 99.68) to 413.99 (± 104.43) meters, 24.86% increase from baseline ($p<0.0001$); pulmonary group improved from 313.17 (± 100.90) to 339.31 (± 116.92) meters, 8.35% increase from baseline ($p=0.0002$) and oncology group improved from 380.29 (± 97.24) to 431.20 (± 96.44 meters), 13.39% increase from baseline ($p<0.0001$).
CONCLUSIONS:
A comprehensive CR facility can be successfully used to include other chronic disease group patients. It helps to improve overall aerobic capacity as indicated by significant increase in 6-minute walk test distance in cardiac, pulmonary and oncology patients. This can help hospitals deploy their rehabilitation services in an efficient and cost-effective manner.

1644 May 30 2:30 PM - 2:45 PM

Bidirectional Relationships of Daily Physical Activity and Sleep Among Patients with Heart Failure and Insomnia

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Physical activity is associated with better sleep quality across a wide range of populations, but the causal direction of this relationship is unclear due to lack of longitudinal and experimental studies. Patients with heart failure (HF) bear particular risk of poor sleep and low physical activity.
PURPOSE: Examine the relationships between within-person day-to-day fluctuations in physical activity and sleep quality among patients with stable NYHA Class I-IV HF and insomnia (insomnia severity index > 7).
METHODS: Patients wore a uniaxial wrist accelerometer (Actiwatch) for 14 consecutive days and nights to measure total daytime activity counts, total sleep time, sleep onset latency and sleep continuity (sleep efficiency and wake time after sleep onset (WASO)). Two-level multilevel models with daily and individual variation predicted daytime activity outcomes and sleep outcomes, separately. We adjusted for covariates within (day of the week) and between subjects (age, Charlson Comorbidity Index (CCI), NYHA HF Class, and body mass index (BMI)). Significance $p < 0.05$.
RESULTS: Participants (n=114, M = 62.4 ± 12.1years, female 43%, black 22%, white 75%, NYHA Class 1.9 ± 0.8) on average obese (BMI 31.4 ± 7.6 kg/m^2) with multiple comorbidities (CCI 3.2 ± 2.0). Daytime activity (177 ± 82 x 10^3 counts/day) was associated with younger age (β = -1.32 ± 0.50), fewer comorbidities (β = -10.57 ± 3.26), lower NYHA class (β = -17.99 ± 7.80), and a tendency for lower BMI (β = -1.58 ± 0.83, p = 0.06). Comorbidity was associated with poorer sleep efficiency (β = -0.98 ± 0.48) and more WASO (β = 5.94 ± 2.05). After adjustment for all significant covariates, daytime activity was not associated with sleep characteristics the next night, but every minute less total sleep time (β = -0.075 ± 0.015) or WASO (β = -0.114 ± 0.042) was associated with ~70 - 100 more activity counts the next day.
CONCLUSIONS: Similar to studies in other populations, less WASO and less total sleep time both was associated with more activity the next day, but these were not bidirectional relationships since activity the previous day was not associated with sleep characteristics. Future research should confirm these results by polysomnography and hip accelerometry and evaluate mechanisms.

Support: NIH- R01NR016191; Yale Center for Sleep Disturbance in Acute and Chronic Conditions.

1645 May 30 2:45 PM - 3:00 PM

Measuring Physical Activity in People with Heart Failure - An Accelerometer Calibration Study

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PURPOSE: To estimate acceleration values corresponding to light and moderate to vigorous intensity physical activity (PA) in people with heart failure via calibration with oxygen consumption (VO_2). **METHODS:** 21 adults with heart failure undertook a range of typical lifestyle activities (including laying down, and walking at different speeds) whilst wearing three accelerometers (each wrist and the left hip) and a portable gas analyser. Resting metabolic rate (RMR) was established and participants also undertook an incremental shuttle walk test (ISWT) to estimate fitness. Location specific activity intensity thresholds were established via Receiver Operator Characteristic (ROC) curve analysis. **RESULTS:** Participants had an average age of 71.1±14.3 years, the majority were male (24% female) and average BMI was 28.2±4.4 kg/m^2. Average distance walked during the ISWT was 279±192 m, and average RMR was 0.76±0.19 METS. The measured metabolic cost of slow paced walking (average pace 2.6 kph) was 4.09±1.08 METS - higher than estimates based on standard methods i.e. VO_2/3.5 ml/kg/min (3.03±0.63 METS) or the Compendium of PA (2.0 METS). Similarly, moderate paced walking (average pace 3.5 kph) averaged 4.65±1.08 METS using measured RMR compared to 3.46±0.78 METS via the standard methods and 2.8 METS via the Compendium. ROC curve analysis will be used to estimate acceleration values corresponding to light and moderate to vigorous intensity PA.
CONCLUSIONS: Using single accelerometer values for estimating PA intensity assumes energy expenditure is the same for specific activities irrespective of fitness level, which risks underestimating the PA levels of low fit populations such as people with heart failure. It may also risk precribing PA intensities that are too high for this population. Results of this study indicate that the measured metabolic cost of activities such as walking at a light pace are much higher than estimated METs reported in the PA compendium. Population specific accelerometer thresholds for estimating light and moderate to vigorous intensity PA will permit more precise measures of the prevalence of PA in people with heart failure.

1646 May 30 3:00 PM - 3:15 PM

The Effect Of A Personalized Multi-component Lifestyle Intervention Program In Stage 3 & 4 Ckd Patients.

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PURPOSE: We studied the effect of a comprehensive lifestyle intervention (nutrition, physical activity, pharmacy, and behavioral counseling) on health related outcomes in 42 stage 3 & 4 (eGFRs 15-59 ml/min/1.73m2) CKD patients (age 60.2 ± 9.2, BMI 34.5 ± 7.8). **METHODS**: Patients were assigned randomly to a treatment (T, n= 27) or usual care (UC, n= 15) group, and asked to attend four test sessions: baseline (BL), month 1 (M1), month 3 (M3) and month 6 (M6). Anthropometrics, medication use, three-day nutritional intake, central (cSBP/cDBP) & brachial blood pressures (bSBP/bDBP), augmentation index (AIx@75), Short Physical Performance Battery (SPPB) test, the six-minute walk test (6MWT), leg strength & power, self-efficacy to adhere to diet and physical activity (PA) recommendations, and the KDQOL were assessed at each visit. PA levels and inflammatory markers (IL6 & hsCRP) were assessed at BL and M6. Patients in T received individual counseling at BL, M1, & M3 with biweekly follow-up phone contact. Patients in UC were asked to follow the instructions of their nephrologist. **RESULTS**: All data are presented as means ± SD. Primary outcome variables were analyzed by 2 x 2 mixed factor ANOVAs. See table for some of the findings:

Variable	BL	M3	M6				
	T	UC	T	UC	T	UC	
bSBP mm Hg T, n=22, UC n=13	137.4± 14.3	128.2± 23.4	*127.6 ± 13.7	131.7 ±17.2	132.6 ± 15.0	124.7± 19.7	p=.01*
cSBP mm Hg T, n=22, UC n=13	124.2 ±12.6	116.1± 20.1	*115.6 ± 12.4	119.6 ±14.4	120.7± 14.1	112.9 ± 17.3	p=.01*
cDBP mm Hg T, n=22, UC n=13	78.9± 10.1	76.7 ± 12.3	*73.7± 9.7	77.7 ±9.7	76.9 ± 12.9	75.3 11.4	p=.02*
AIx@75 T, n=22, UC n=13	27.7 ± 8.0	26.9 ± 11.1	27.6 ± 11.4	26.9± 12.7	29.3± 12.2	*21.9± 9.98	p=.02*
SPPB T, n=23, UC n=14	10.± 2.1	10.± 1.4	9.9±2.3	10.3± 1.2	9.9±1.8	10.2±1.1	p=.53
Effect of CKD T, n=23, UC n=14	85.3± 20.9	88.2 ± 13.9	*88.9 ± 14.1	84.2± 17.3	*91.5± 14.6	85.3± 15.1	p=.02*
Kcals T, n=23, UC n=14	1809.7± 571	1630± 653	1422.8± 628.5	1418.4 ± 460.8	1463.8* ± 594.0	1768.4 ± 515.8	p=.03*

CONCLUSION: In conclusion, this program led to reductions in bSBP, cSBP and cDBP at M3 which were attenuated at M6. Patients in T felt less restricted by their disease than the UC group. This home- based program resulted in no improvements in functional outcomes (SPPB or 6MWT). Supervised, in-center programs are preferred when working with CKD patients.

D-15 Clinical Case Slide - **Chest Pain**

Thursday, May 30, 2019, 1:30 PM - 3:10 PM
Room: CC-304E

1647 **Chair:** Paolo Emilio Adami. *Universita Degli Studi Di Roma "Foro Italico", Rome, Italy.*
(No relevant relationships reported)

1648 **Discussant**
Hallie Labrador. *NorthShore University HealthSystem, Gurnee, IL.*
(No relevant relationships reported)

1649 **Discussant**
Shelley Street Callender. *Navicent Health System, Macon, GA.*
(No relevant relationships reported)

1650 May 30 1:30 PM - 1:50 PM
Chest Pain in a Football Strength Coach
Michael Anacker, Keri Denay, FACSM. *University of Michigan, Ann Arbor, MI.* (Sponsor: Keri Denay, FACSM)
(No relevant relationships reported)

HISTORY: A 29-year-old adopted, African American male football coach traveled with the football team to Colorado to hike Pikes Peak. At 14,000 feet, he developed mid-sternal chest pain that radiated to his left upper abdomen and left shoulder. The pain worsened with deep breathing and exertion. He presented to a local ED, where a CT abdomen/pelvis revealed splenomegaly. Routine labs revealed a mild anemia and thrombocytopenia. Upon returning home, the pain continued for 2 days so he presented to clinic. There, he denied calf pain, extremity swelling, fever, nausea, palpitations, vomiting, hematuria, and syncope. He denied taking medications, supplements, and alcohol/drugs. He reported developing similar symptoms in 2015, also when hiking. At that time, he was diagnosed with pericarditis with symptom resolution in a few days.
PHYSICAL EXAMINATION:
Temp 36.9F, BP 132/61, HR 67, RR 16, O2 sat 97%
At rest, he was alert and comfortable. Breathing comfortably with symmetric aeration; no wheezing or crackles. Heart had regular rate and rhythm, without murmur. Abdomen was soft and non-distended, though he was tender to palpation in the left upper quadrant. No lower extremity edema; calves were symmetric and non-tender to palpation.
DIFFERENTIAL DIAGNOSIS:
Pulmonary Embolus
Pericarditis
Mononucleosis
Sickle cell crisis in a patient with sickle cell trait
TEST AND RESULTS: A CT angiography chest, chest radiograph, and abdominal ultrasound were obtained and were notable for splenomegaly (14.3cm); otherwise unremarkable. An EKG revealed sinus bradycardia with sinus arrhythmia. Labs were obtained including CBCPD, CMP, CK, haptoglobin, LDH, and hemoglobin electrophoresis, and notable for a mild anemia (hemoglobin 12.2), thrombocytopenia (platelets 52), mild transaminitis (AST 42, ALT 37), and evidence of hemolysis (haptoglobin < 10, LDH 486, CK 348). Hemoglobin electrophoresis was consistent with sickle cell trait.
FINAL WORKING DIAGNOSIS: Sickle cell crisis in a patient with sickle cell trait
TREATMENT AND OUTCOMES:
1. Trended labs for 2 weeks.
2. Avoid strenuous activity until pain resolved.
3. Provide counseling regarding hydration, heat illness, and training especially at altitude.
4. Follow up with hematology.
5. Consider screening NCAA coaches/athletic trainers given NCAA athletes are screened for sickle cell.

1651 May 30 1:50 PM - 2:10 PM
Rib Pain - Football
Christopher Hicks. *University of Virginia, CHARLOTTESVILLE, VA.* (Sponsor: John M. MacKnight, M.D., FACSM)
Email: c.hickstwo@gmail.com
(No relevant relationships reported)

HISTORY: 21-year-old collegiate football defensive lineman complained of rib pain after a road game in Tennessee. Aside from a mild ankle sprain, he denied any specific injury to his torso/ribs. Pain began on the left side and then migrated to the right side with radiation to flank and sternum areas bilaterally. Had pain with deep breathing and sensation of tightness in the rib area. Took naproxen with some relief of his symptoms. Denied chest pressure, shortness of breath, palpitations, fevers or chills.
PMH: HTN, ADD
Meds: Amlodipine, Adderall
SH: No tobacco, social ETOH, no illicit drugs
FH: Non contributory
PHYSICAL EXAMINATION:
Well gentlemen in mild distress due to pain
Blood pressure 140/90, pulse 72, RR 14.
Neck- No JVD
CV: RRR, normal heart sounds. No gallop or rub. No murmur.
Pulmonary: No respiratory distress. Breath sounds normal. Good air movement. No wheezes or rales.
Chest: Tenderness to palpation along the flank areas greatest over ribs 5-7 bilaterally. No true focal pain noted.
Ext: DP and PT +2. No edema.
DIFFERENTIAL DIAGNOSIS:
1. Costochondritis
2. Rib fracture
3. Chest wall strain
4. Pneumothorax
5. Pulmonary Embolism
Interim History: Treated for chest wall injury with varying response over the next 4 days. Re-presented 2 hours before the next home game with shortness of breath, tachypnea, and worsening chest discomfort. Transferred to ER.
TEST AND RESULTS:
Chest x-ray- focal right lower lobe opacification
D-Dimer 774
CT PA- acute bilateral segmental and sub-segmental pulmonary emboli, without evidence of right heart strain
Factor V Leiden, Anti-Cardiolipin, and Prothrombin negative
Lupus anticoagulant, Protein S, Protein C and Antithrombin III pending

FINAL/WORKING DIAGNOSIS: Acute bilateral segmental and sub-segmental pulmonary emboli, unclear etiology.
TREATMENT AND OUTCOMES:
1. Anticoagulation therapy with Apixaban for minimum of 3 months with considerations for lifetime treatment.
2. No contact sports or activities while on anticoagulation.
3. Continued hematology follow-up of coagulation workup.
4. Ongoing discussion of importance of inclusion of PE on the differential for chest pain even in healthy athletes with no discernible risks.

1652 May 30 2:10 PM - 2:30 PM

10 Months of Dyspnea Following Long Runs in Marathon Athlete

Jay Shah, Jose Velasquez, James Pearson, Hamed Shalikar. *Citrus Valley Health Partners, West Covina, CA.* (Sponsor: Dr. Aaron Rubin, FACSM)
Email: jashah80@gmail.com

(No relevant relationships reported)

HISTORY:
A 51-year-old male marathon runner presented with pleuritic chest pain and increasingly
progressive shortness of breath at the end of his runs. At baseline, he was running a marathon in 3 hours, but his runs were reduced to less than 15 miles. He completed a 15k in 1 hour and 30 minutes but with severe dyspnea on exertion. Patient was referred to the Sports medicine clinic for further evaluation.
PHYSICAL EXAMINATION:
Vitals within normal limits
NAD, speaking in full sentences, no chest wall tenderness. CV: regular rate and rhythm. no edema. Pulmonary: normal respiratory effort without distress, absent of wheezes or rales.
DIFFERENTIAL DIAGNOSIS:
1) Overtraining syndrome
2) Asthma/Exercise induced bronchospasm
3) Viral syndrome
4) Pulmonary embolism
TESTS AND RESULTS:
8/2017: EKG nonspecific/chest X-ray reported small bilateral pleural effusion
8/2017: Non contrast chest CT - no pleural effusion
8/2017: TTEcho: EF 60-65%, unremarkable valves & chambers
8/2017: Treadmill test unspecific, high exercise tolerance
9/2017: CXR - persistence of bilateral pleural effusion.
1/2018: Myocardial perfusion scan - no evidence of stress induced ischemia
3/2018: Spirometry - normal, no response to Bronchodilators.
3/2018: Non Contrast chest CT - Diminished right lung pleural opacity, probably represented inflammatory change
9/2018: D-dimer 564
9/2018: CT-A - small embolus in a subsegmental branch of the pulmonary artery to the left lower lobe. Second pulmonary embolus in a segmental branch of the pulmonary artery to the right lower lobe.
FINAL/WORKING DIAGNOSIS
Bilateral unprovoked pulmonary embolism
TREATMENT AND OUTCOMES
1) Discussed indications, risks, benefits, and dietary & activity precautions of anticoagulation with Warfarin vs. Direct Oral Anticoagulant such as Pradaxa with patient in extensive detail. Patient opted for Pradaxa.
2) Hypercoagulable work-up sent and hematology referral

1653 May 30 2:30 PM - 2:50 PM

Chest Injury-football

Kendrick I. Watkins, Rehal A. Bhojani. *University of Texas Health Science Center, Houston, TX.* (Sponsor: Charles Chassay, FACSM)

(No relevant relationships reported)

HISTORY: 17 year old high school football wide receiver presented with left back and rib pain. He sustained a hit in that region during a football game the night before. He was taken out of the game due to pain and difficulty breathing which ultimately kept him from finishing the game. After the game he continued to have pain for which he took a muscle relaxant that he had from a previous injury and over the counter pain medication with minimal pain relief. The pain persisted through the night and into the following morning. His pain was worse with deep breathing and any pressure on his chest. He denied any shortness of breath, dyspnea with exertion, cough, wheezing or hemoptysis.
PHYSICAL EXAMINATION: Appeared in no acute distress,
Ecchymosis over the posterior lateral aspect of left lower ribs with tenderness to palpation, No crepitus, No palpable deformity, Symmetric chest expansion, posterior rib/back pain reproduced with deep inspiration, Equal bilateral breath sounds, No hyper-resonance to percussion, Normal respiratory rate, Negative anterior posterior compression test, Positive lateral compression test, Full AROM of the back
DIFFERENTIAL DIAGNOSIS: Rib fracture, Pneumothorax, Pulmonary contusion, Pulmonary embolism
TEST AND RESULTS: X-ray Rib series: Small left apical pneumothorax involving approximately 20% of the hemi thorax. Suspected nondisplaced fractures involving the posterolateral left eighth and ninth ribs with small linear lucencies within these regions. Chest CT scan: Small left-sided pneumothorax approximately 20%. No acute osseous injury.
FINAL WORKING DIAGNOSIS: Pneumothorax
TREATMENT AND OUTCOMES:
The patient was sent to ER after being seen in clinic to expedite getting a CT scan done after the X-rays. After the CT scan was obtained it was decided by the ED to admit the patient for observation. He obtained a subsequent x-ray that evening 12 hours after is initial which showed a slightly smaller left apical pneumothorax. He was discharged the next day. Repeat chest x-ray done three days after discharge showed improving pneumothorax. Patient was seen in clinic 2 weeks after his discharge from the hospital and was started on a graded exercise program with repeat x-ray at 1 week after clinic visit showed resolution of pneumothorax. He returned to full game play at 4 weeks after his initial injury.

1654 May 30 2:50 PM - 3:10 PM

Focal Chest Pain- Rugby

Joshua Martin, Prakash Jayabalan, Joseph Ihm, FACSM. *Shirley Ryan AbilityLab/ Northwestern, Chicago, IL.*

(No relevant relationships reported)

HISTORY: A 21-year old rugby-playing male presented with a one year history of worsening anterior chest wall pain. Pain was associated with a popping sensation in the anterior chest. Additionally, symptoms were aggravated by overhead movements and chest exercises. Pain was focal, without discomfort in the ribs or thoracic back. He denied shortness of breath, pain while coughing, and all other systemic symptoms.
PHYSICAL EXAMINATION: Local examination revealed a tender swelling at the manubriosternal joint (MSJ). Chest expansion was full and deep breaths did not elicit pain. Full painless range of motion at the shoulder, with strength intact to manual muscle testing throughout
DIFFERENTIAL DIAGNOSIS:
1. Strain of pectoralis major
2. Costochondritis
3. Inflammatory arthritis
4. Osteoarthritis of the MSJ
5. Pulmonary embolism
6. Pneumothorax
7. Pericarditis

TEST AND RESULTS:
Prior cardiology work-up did not reveal an eliciting cause
Lateral x-ray of the chest (sternal view)
- Bone resorption on both sides of the MSJ, and soft tissue swelling anterior to the joint.
Chest MRI
- Irregularity at the sternal and manubrial articular surfaces, along with a small effusion, compatible with osteoarthritis.
Further rheumatological workup for inflammatory markers
- Unremarkable CBC, ESR and CRP
FINAL WORKING DIAGNOSIS: Manubriosternal osteoarthritis
TREATMENT AND OUTCOMES:
1. Refrained from rugby for several months
2. Started on regular daily meloxicam 7.5mg for 1 month
3. Significant improvement in symptoms

D-16 Clinical Case Slide - **Foot and Ankle**

Thursday, May 30, 2019, 1:30 PM - 3:10 PM
Room: CC-305

1655 **Chair:** Stephen M. Simons, FACSM. *Saint Joseph Regional Medical Center, South Bend, IN.*
(No relevant relationships reported)

1656 **Discussant**
John Fraser. *Naval Health Research Center, San Diego, CA.*
(No relevant relationships reported)

1657 **Discussant**
Kirk McCullough. *Ortho Sports Medicine Kansas City, Kansas City, KS.*
(No relevant relationships reported)

1658 May 30 1:30 PM - 1:50 PM
Recurrent Foot Pain - A Case Series of Two Division 1 College Football Athletes
Elizabeth L. Albright. *Penn State Health, State College, PA.* (Sponsor: Peter Seidenberg, MD, FACSM)
(No relevant relationships reported)

HISTORY: Patient 1 (P1) is a 21 y/o white male who presented for pain over lateral aspect of his right foot after twisting on it during scrimmage. He had immediate pain with ambulation. He denied hearing/feeling a pop or paresthesias. Patient 2 (P2) is a 21 y/o African-American male who presented after feeling a pop in his lateral left foot during cutting maneuver at practice. He had significant pain with ambulation and denied paresthesias. Both were 5 months status post percutaneous screw fixation of Jones fracture of the ipsilateral foot. After initial injury, Vitamin D levels were 24 and 27 ng/ml respectively. They were started on Vitamin D supplementation and provided a bone stimulator. They remained non-weightbearing in CAM boot for 4 weeks followed by weightbearing in CAM boot for 2 weeks. At 6 weeks, they progressed back into regular shoes. They completed rehab with athletic trainer and had returned to full activity at time of reinjury. **PHYSICAL EXAMINATION:** Both: Skin intact. Full ankle ROM. TTP of Base of 5th metatarsal. Neurovascularly intact. No TTP of navicular, bilateral malleoli, ankle ligaments, Lisfranc joint, peroneal tendons, bifurcate ligament, calcaneus, or cuboid. Both had flexible, forefoot induced, inverted varus positioning of calcaneus with positive Coleman block test. P1 had equivocal fulcrum test and pes cavus. P2 had mild edema of lateral foot and pes planus. **DIFFERENTIAL DIAGNOSIS:** Repeat Jones Fracture, 5th Metatarsal shaft or Avulsion fracture, Peroneal Tendon Rupture, Bifucate Ligament Sprain, Cuboid Subluxation, Avascular Necrosis **TESTS AND RESULTS:** P1: New lucency at previously healed fracture site on XR, No hardware issues P2: Initially improved compared to previous XR but bone reabsorption evident at 2 weeks. No hardware issues **FINAL WORKING DIAGNOSIS:** Recurrent Jones Fracture **TREATMENT AND OUTCOMES:** Non-weight bearing in CAM boot. Restart bone stimulator. Continue Vitamin D. At 1 week, transitioned to weightbearing in CAM boot. At 4 weeks, P1 transitioned into regular shoe with custom clamshell orthotic to correct hindfoot deformity and started return to play progression. At 6 weeks, he returned to full activity with orthotic in cleats. P2 required an additional 2 weeks in boot for slow fracture remodeling but then started RTP with full return by 8 weeks

1659 May 30 1:50 PM - 2:10 PM
Heel Injury-Figure Skate
Naoko Onizuka, Suzanne Hecht, FACSM. *University of Minnesota, Minneapolis, MN.* (Sponsor: Suzanne Hecht, FACSM)
(No relevant relationships reported)

HISTORY: A nine year old female figure skater presented with 6 weeks of atraumatic right foot pain. She recently started training double jumps prior to the onset of pain. Pain was located on the plantar side of the right midfoot and she initially noticed it following practices. Weight bearing increased her pain and eventually it hurt during practice as well as after practice . No changes in training time or frequency. She has been figure skating for two years. No history of previous foot injuries or bone stress injuries. No family history of osteoporosis. Her past medical history is significant for chronic Lyme's disease.
PHYSICAL EXAM: Ht 4' 6" (1.372 m) | Wt 69 lb (31.3 kg) | BMI 16.64 kg/m2 (56 percentile), Healthy and NAD. Accompanied by her mother.
Examination:
Inspection: Neutral foot type. Normal alignment of lower extremities. There was no redness, swelling, or skin changes.
Palpation: moderate tenderness on the right plantar mid foot.
Range of motion: there was full active range of motion of the ankle, without significant pain.
Strength: Muscle strength (ankle plantarflexion, dorsiflexion, inversion, eversion) full.
Special tests: Fracture test (tap, percussion, bump) negative, squeeze test negative, anterior drawer test negative, Talar tilt test negative, Stress test negative, Thompson test negative.
DIFFERENTIAL DIAGNOSIS:
1.Navicular bone stress injury
2.Tarsal coalition
3.Anterior tibialis tendinopathy
4.Posterior tibialis tendinopathy
5.Bone tumor
6.Nerve entrapment
7.Heel pad syndrome
8.Sever disease
TEST AND RESULTS:
1.Ankle X-ray- No obvious fracture or callus
2.MRI Ankle- bone marrow edema in the neck of the calcaneus
3.DXA- Normal bone density
FINAL DIAGNOSIS: Calcaneus bone stress injury
TREATMENT AND OUTCOMES:
1.Decreased activity level
2.Non-weight bearing on crutches for 2 weeks
3.Walking boot for 3 weeks with partial weight bearing on crutches
4.PT 1-2x/ week for 2-3 weeks
5.Vitamin D 2000 IU everyday
6.Partial weight bearing to full weight bearing as tolerated
7.Gradual return to sports after 12 weeks of injury, when she did not have pain with ambulation, and repeat MRI showed no evidence of residual bone marrow edema.

1660 May 30 2:10 PM - 2:30 PM
Ankle Pain - Basketball
Mary Lynch, David Soma. *Mayo Clinic, Rochester, MN.* (Sponsor: Karen Newcomer, FACSM)
(No relevant relationships reported)

HISTORY: Our patient is a healthy 17 year old female basketball and softball player who had been treated for bilateral Achilles tendonitis. Two weeks prior to presentation, she jumped and created a moment of extreme plantar flexion of her left foot. She had immediate posterior ankle pain without edema or erythema. A physical therapist recommended heel cups. She did not consistently rest. Her basketball performance was poor over the next two weeks.
- **PHYSICAL EXAMINATION**: Normal gait and inspection. Tender deep to the Achilles tendon near the junction of the talus and calcaneus with mild tenderness along the Achilles tendon and musculotendinous junction. No tenderness of the calcaneus, medial or lateral malleolus, or midfoot. Active ROM preserved. Passive ROM limited a few degrees in both dorsiflexion and plantar flexion compared to the contralateral foot. 5/5 plantar flexion and dorsiflexion strength. Resisted plantar flexion and hopping on left foot caused significant discomfort. Normal Achilles squeeze test.
- **DIFFERENTIAL DIAGNOSIS**:
- 1. Achilles tendonitis
- 2. Retrocalconeal bursitis
- 3. Fracture of os trigonum
- 4. Tendonitis of flexor halluces or flexor digitorum tendon
- 5. Posterior facet arthritis of the subtalar joint
- **TEST AND RESULTS**:
- **X-ray:** Originally radiologist read as normal, but sports medicine interpretation was that there appeared to be a lucency extending through the lateral tubercle of the posterior process of the talus consistent with acute fracture.
- **MRI:** Nondisplaced fracture of the Stieda process of the talus with associated bone marrow edema. Additional findings include small effusions in the posterior facet of the subtaler and tibiotalar joints, minimal tendinopathy of distal Achilles tendon, and a tiny amount of fluid in the retrocalcaneal bursa.
- **FINAL WORKING DIAGNOSIS:** Fracture of Stieda process
- **TREATMENT AND OUTCOMES**:
- 1. After two weeks of rest in a boot, she began isometric exercises without the boot and stationary cycling in the boot.
- 2. After four weeks in the boot, she progressed to one week of light activity before returning to play at the end of her senior year of high school basketball and playoffs. She was counseled about the risk of non-union or re-injury given that she did not rest for a more prolonged period.
- 3. One year later, she remains pain free playing college basketball.

1661 May 30 2:30 PM - 2:50 PM

Atypical Ankle Pain In A 10-year-old

Robyn C. Knutson Bueling. *TRIA Orthopedics, Woodbury, MN.*
Email: robyn.knutsonbueling@parknicollet.com

(No relevant relationships reported)

HISTORY: Active 10-year-old non-athlete with acute onset of severe ankle pain and swelling for two days. Occurred while at school but can't recall injury during PE or recess. Taken to Children's hospital ER and treated with ice. Presented to Acute Injury Clinic for further evaluation.
PHYSICAL EXAMINATION: Significant TTP diffusely about R ankle. Moderate-to-severe R ankle joint effusion. Unable to weight-bear. Limited ROM secondary to pain. No rash. No fever. L ankle exam normal.
DIFFERENTIAL DIAGNOSIS: Occult injury. Lyme disease. Joint infection. Post-infectious septic joint. Tumor.
TEST AND RESULTS: -Aspirate normal CBC, elevated uric acid, normal CRP, negative culture, negative crystals, substantial RBC and some WBC, lyme negative. -MRI with large tibiotalar joint effusion with multiple large intra-articular masses consistent with polyvillous nodular sclerosis or other synovial metaplasia.
FINAL WORKING DIAGNOSIS: PVNS R ankle
TREATMENT AND OUTCOMES: -Very uncommon presentation of PVNS in atypical joint and atypical age-group. -Splinted for comfort. Narcotic pain medicines prn. -Evaluated by orthopedic oncology. Take for surgical intervention. -Patient has now had full return to full activity with ongoing surveillance.

1662 May 30 2:50 PM - 3:10 PM

A Poorly Timed Slapshot To The Foot in a Hockey Player

john gunel, Christopher Lutrzykowski. *Maine Dartmouth Sports Medicine Fellowship, Augusta, ME.* (Sponsor: James Dunlap, MD, FACSM)

(No relevant relationships reported)

History: This is a 16 year old female ice hockey player who is a senior at a boarding school. She presents with right medial foot pain. This occurred after blocking a slap shot with her instep three weeks prior. Being recruiting season, she continued to play on her painful foot, lift weights daily, and run 3 miles two times per week. She has changed her gait to reduce pain with these activities. NSAIDS and working with her AT on strengthening and range of motion have not improved her symptoms. Due to worsening pain with weight bearing, she received right foot xrays at an urgent care center and she would like to follow up on the results. She anxiously states that in two weeks, she will be returning to her boarding school where she seeks to participate in a showcase tournament where multiple scouts will be present. **PE**: Gen: NAD.
MSK: BL foot and ankles: Inspection: Soft tissue swelling in anteriolateral right ankle. Palpation: TTP over navicular. No TTP over 5th metatarsal or medial/lateral malleolus. Squeeze test positive. ROM: normal in all planes but painful at right at end ranges of motion. Strength: 5/5 in all planes. Special tests: negative drawer and false tilt. Sensation: intact Vascular: DP 2+, cap refill Proprioception: Single leg stance, heel raise: normal **Differential Diagnosis**: Stress fracture Bipartite navicular Osteochondritis dissecans Avascular necrosis Avulsion fracture Morton's Neuroma Tarsal coalition **Imaging**: 1) X-RAY, RIGHT FOOT - possible navicular fracture. No other bony abnormalities, malalignment, soft tissue abnormality.
2) MRI FOOT, RIGHT: Edema throughout the navicular, proximal diaphysis of the third metatarsal, and the base of the fourth metatarsal. **Final Diagnosis**: Stress fracture of the Navicular, third metatarsal, and fourth metatarsal. **Treatment**: Non weight bearing with boot for 5 weeks, then gradual return to weight bearing. **Outcome**: Onoing pain with weight bearing but no TTP at follow up. Her treatment was complicated by her boarding school not having a team physician for our office to release her to.
After a risk/benefit discussion, the patient elected to participate in a showcase tournament with pain in her navicular while playing. She otherwise complied with the treatment plan. Her pain resolved at 6 weeks and she signed a letter of intent with a D1 school for ice hockey.

D-17 Clinical Case Slide - **Running**

Thursday, May 30, 2019, 1:30 PM - 3:10 PM
Room: CC-306

1663 **Chair:** Adam S. Tenforde. *Stanford University, Palo Alto, CA.*

(No relevant relationships reported)

1664 **Discussant**

Emily Kraus. *Stanford University, Palo Alto, CA.*

(No relevant relationships reported)

1665 **Discussant**

Irene S. Davis, FACSM. *Harvard Medical School Spaulding-Cambridge, Cambridge, MA.*

(No relevant relationships reported)

1666 May 30 1:30 PM - 1:50 PM

A Rare Cause Of Pain In A Runner: The "Nail-Patella Syndrome"

Kenneth Vitale, Evelyne Fliszar. *University of California San Diego, School of Medicine, La Jolla, CA.*

(No relevant relationships reported)

HISTORY: 26-yo female presented with 1 year of anterior knee pain with running, worse on hills and squatting. Had seen multiple providers and diagnosed with patellofemoral pain but didn't improve with treatment. ROS was significant for elbow stiffness, unable to fully extend elbows since childhood. No known medical/family history but reports that multiple relatives have same problem. She also reported "unusual appearance" of thumbnails since childhood, covers with fake nails and polish. Had seen Orthopedics and Dermatology without clear answer. **PHYSICAL EXAMINATION**: 5' 5", 99lb, BMI 16.5. Bilateral knees no effusion, ROM 0-150° with patellar maltracking and palpably small patellae. Increased femoral anteversion and femoral adduction, but normal composite hip ROM. Hypoplastic thumbnails noted with ridging and splitting. Bilateral elbow flexion contractures ~45°. Normal neurovascular exam. **DIFFERENTIAL DIAGNOSIS**: Patellofemoral pain syndrome, Patellar subluxation/dislocation, Painful bipartite patella, Congenital deformity/dysplasia. **TEST AND RESULTS**: Knee x-rays showed severely hypoplastic patellae, trochlear dysplasia with prominent lateral femoral trochlea. Elbow x-rays revealed hypoplastic convex radial heads and capitellum with chronic posterior radial head dislocations. Due to these findings a pelvic x-ray was recommended which displayed iliac bone exostoses, confirming the diagnosis. **FINAL WORKING DIAGNOSIS**: Hereditary Osteo-Onychodysplasia, the "Nail-Patella Syndrome." **TREATMENT AND OUTCOMES**: Patient had been treated for individual manifestations of disease without recognition of the syndrome. Education was provided on diagnosis; as Nail-Patella is a syndrome of multiple abnormalities, including renal anomalies, a Nephrology referral was given to screen for renal dysplasia. Understanding of these congenital abnormalities is key to management of associated sequelae, and genetic counseling was further recommended as this is an autosomal dominant disorder. Elbow treatment option would be radial head resection, which may not improve elbow extension; patient declined. Focused leg strengthening and activity modification to accommodate knee abnormalities resulted in pain reduction, and in 2 months was able to return to light jogging (without hills) and modified yoga.

1667 May 30 1:50 PM - 2:10 PM

Barefoot Rehabilitation Of Arch Pain In A Veteran Foot Injury--Running

Matt Heindel[1], Kirsten Buchanan[1], Irene Davis, FACSM[2].
[1]University of New England, Portland, ME. [2]Harvard Medical School, Cambridge, MA.

(No relevant relationships reported)

HISTORY: The patient was a 39-year-old male veteran who complained of dull pain along the plantar portion of the left, medial longitudinal arch. This pain persisted for 3 months and was most noticeable during weight bearing activities. Most notably, the patient was unable to participate in recreational running of any duration secondary to pain. The patient was evaluated by his primary care physician who referred him to outpatient physical therapy after ruling out a fracture through x-ray examination. PHYSICAL EXAMINATION: The patient presented with increased pain along the left medial longitudinal arch during heel elevation, mild swelling along the medial

malleolus, decreased left dorsiflexion range of motion, decreased left plantarflexion and inversion strength, a flexible flatfoot deformity, and pain with any attempt to run recreationally.
DIFFERENTIAL DIAGNOSIS:
1. Posterior Tibialis Tendon Dysfunction
2. Eversion Ankle Sprain
3. Foot/ankle fracture
TEST AND RESULTS:
Strength: Manual muscle testing 3+/5 with pain on left foot plantarflexion and inversion
Range of motion: Left talocrural dorsiflexion 2º with knee extended and 5º with knee flexed to 90º
Ligamentous testing: Negative external rotation test, anterior drawer, and talar tilt
Neural testing: Negative sciatic nerve tension test with tibial nerve sensitization
Foot fracture: Negative Ottawa ankle rules
Functional Outcomes:
- LEFS 49/80
- Singe leg Heel Rise Test: 0 reps
FINAL/WORKING DIAGNOSIS: Stage II posterior tibialis tendon dysfunction
TREATMENT AND OUTCOMES:
1.Strengthening
a.Barefoot short-foot exercise - 3 sets of 10 reps 1x/day
b.Inversion strengthening with red resistance band - 150-600 reps for 3 sets per day
c. Double heel rise with unilateral descent - 3 sets of 10 reps 1x/day
d.Gluteal Strengthening
2.Stretching
a.Barefoot gastroc and soleus stretches. 3 sets of 30 seconds 1x/day
3.Joint Mobilization
a. Modified Mulligan technique into dorsiflexion for 3 sets of 30 seconds
4.Outcomes
a.LEFS score improved from 49/80 to 71/80
b.Single leg heel rise test increased from 0 to 16 reps
c.Range of motion with left dorsiflexion improved from 2º to 10º with full knee extension and from 5º to 15º with 90º of knee flexion
d.Strength improved from 3+/5 to 5/5 with PF and inversion
e.Patient reported 3 consecutive days of running 2 miles without pain

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1668 May 30 2:10 PM - 2:30 PM

Ankle Injury -- Running

Jaire N. Saunders MPH, MD, Kevin Mullins MD, Brandee Waite MD. *UC Davis, Sacramento, CA.* (Sponsor: Brian Davis MD, FACSM)

(No relevant relationships reported)

HISTORY
57yr old female with pmhx HTN, T2DM, HLD, previously seen in clinic for right knee OA secondary to remote injury. Presenting with 3-week history of acute onset right ankle pain. Occurred while running on treadmill after prolonged decrease in activity level due to BUE injuries. Receiving viscosupplementation in right knee with good relief. With the positive relief, three months prior to injury, patient started to increase frequency and intensity of exercise to help lose gained weight. Reports no obvious injuries to RLE.
PHYSICAL EXAMINATION
Heavy body habitus (BMI 34 kg/m2). Unable to walk on right ankle without significant pain. Antalgic gait.
INSPECTION- Significant soft-tissue swelling RLE. Right foot edema. No major bruising. No erythema in
PALPATION- Severe tenderness in all areas of the ankle limiting physical exam. Increased warmth around foot and ankle. Unable to palpate pulses in foot or ankle, but RLE warm.
RANGE OF MOTION- Limited active and passive ROM and in all planes due to swelling and pain
DIFFERENTIAL DIAGNOSIS
1.Ankle sprain or other ligamentous injury at ankle or foot
2.Ankle or foot fracture
3.Achilles injury
4.Gout
5.Other inflammatory arthropathy
6.Stress fracture
7.Avascular necrosis
TEST AND RESULTS
Ankle xray: negative
ESR: 6 (nl 0 - 30mm/Hr)
CRP: 0.7 (nl 0.1 - 0.8mg/dL)
Uric acid: 7.9 (2.2 - 7.7mg/dL)
CT Gout Study lower extremity: No evidence of monosodium urate deposition in ankle or foot.
MRI lower extremity joint: transverse fracture through distal tibial metaphysis
CT Scan Addendum (after MRI completed): Findings of a distal right tibial fracture
DEXA: pending
FINAL DIAGNOSIS
Tibia fracture (from stress fracture)
TREATMENT AND OUTCOMES
1.Non-weight bearing
2.Knee scooter
3.Activity modification/maintain cardiovascular exercise
4.Advance activities in 6-8 weeks
5.Awaiting DEXA for possible treatment

1669 May 30 2:30 PM - 2:50 PM

A Case For Running Without Toes!

Lindsay Wasserman, Irene S. Davis, FACSM. *Spaulding National Running Center, Cambridge, MA.* (Sponsor: Irene Davis, FACSM)
Email: lwasserman@partners.org

(No relevant relationships reported)

TEXT:
. HISTORY: 43 yr. old F runner training for her 1st half marathon had an amputation of all 10 toes distal to MTP on October 2014 due to a systemic infection. By October 2016, she started a run/walk program and began to develop L lateral ankle pain, due to increased inversion during gait. After undergoing surgery to remove scar tissue from her lateral foot and re-align the EHL tendon to resist inversion, the lateral ankle pain decreased. However, when she attempted to run or walk long distances, she experienced medial lower leg pain, L>R, that progressed to a 7/10 on the L. Despite being told she wouldn't be able run anymore, her goal was train for another half-marathon.
PHYSICAL EXAM:
1. Callus formation L 5th metatarsal, suggesting increased lateral loading
2. Pain/ tenderness noted on the medial lower leg BIL, L>R
3. Limited calcaneal eversion on the L and ankle DF on the R
4. Weakness of the inverters, everters, and plantarflexors BIL
5. Weakness of the Hip ABD, EXT and ER L>R. Lower abdominals were also very weak 6. Running Gait (w/custom orthotics and a cushioned running shoe)
Rearfoot striker BIL
Increased hip ADD, IR and pelvic drop BIL
L inverted and toed-in at foot strike
Increased L arch drop during mid support
Pain was 3/10 on the L. When cued to toe out on the L, symptoms reduced and shifted to the calf.
WORKING DIAGNOSIS
Posterior tibialis tendinosis L>R due to weakness and reduced mobility in foot/ankle, along with medialization of the leg due to Hip ADD and IR.
TREATMENT:
1. Weaned pt. slowly out of orthotics to reduce lateral loading
2. Transition to minimal shoes for walking to promote foot/ankle strength
2. Increase mobility of foot/ankle
3. Promote foot/ankle function and control with balance and plyometrics
4. Incr. hip/core strength to improve dynamic alignment
5. Gait retraining to reduce toe in, inv. at foot strike and improve alignment proximally
OUTCOME: Pt was discharged March 2018 running 30 min 3x/wk pain-free in a low profile partial minimal cushion shoe w/o orthotics. She exhibited improved foot alignment and reduced hip add, IR and CPD. Pt continued to wear full minimal shoes during her cross-training. She was able to wear high heels for the first time since her amputations without pain. In Sept 2018, she completed her half marathon pain-free
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1670 May 30 2:50 PM - 3:10 PM

Knee Pain - Running

Adam K. Willson, Joshua Berkowitz. *UNC Chapel Hill, Chapel Hill, NC.*

(No relevant relationships reported)

HISTORY: 19 year old female who developed right knee pain over two years ago during mile 23 of a marathon without specific, focal injury. She then consistently developed severe right posterior lateral knee pain after running around 2 miles, significant enough that she cannot continue running. Pain is improved with rest. She was a college athlete (running) but had to quit due to this pain. She had completed 3 courses of physical therapy without improvement. She did not report any other symptoms. She has no pain with activities other than running, or with running distances up to 1.5-2 miles. Prior MRI is normal with the exception of some slight signal in the distal biceps femoris tendon.
PHYSICAL EXAMINATION: Right knee – no erythema, swelling or ecchymosis. Mild to moderate tenderness to palpation at the posterior lateral fibular head and just proximally. No other abnormalities.
DIFFERENTIAL DIAGNOSIS:
1. Biceps femoris tendinopathy

2. Popliteus tendinitis
3. Popliteal artery entrapment syndrome
4. Common peroneal nerve entrapment

TEST AND RESULTS:
- PVL arterial duplex: No change in PT and AT artery waveforms with plantar and dorsiflexion. Not suspicious for popliteal artery entrapment
- MRI right knee: Suggestive of mild trochlear dysplasia. Visualized posterolateral corner right knee structures were normal. Intact right knee ligaments and menisci
- US-guided diagnostic (anesthetic) injection to the biceps femoris tendon sheath yielded no improvement in symptoms
- US-guided corticosteroid injection to the posterolateral corner (deep to the biceps femoris tendon) provided 3 weeks of complete symptomatic relief and she was able to run 5 miles without symptoms

FINAL/WORKING DIAGNOSIS:
- Low-grade posterolateral corner injury only symptomatic with prolonged exertion

TREATMENT AND OUTCOMES:
- Clinically has characteristics localizing to the posterolateral corner, deep to the biceps femoris tendon, possibly related to scar tissue formation or dynamic entrapment
- Ultrasound-guided corticosteroid injection deep to the distal biceps femoris tendon provided relief but only for 3 weeks
- Plan for PRP injection to the posterior lateral corner for further treatment and evaluation
- Possible consideration of exploratory arthroscopy if even transient response to posterior lateral corner treatment can be redemonstrated

D-18 Rapid Fire Platform - **Acute Hypoxia and Aerobic Performance**

Thursday, May 30, 2019, 1:30 PM - 2:40 PM
Room: CC-Hall WA2

1671 **Chair:** Nisha Charkoudian, FACSM. *USARIEM, Natick, MA.*
(No relevant relationships reported)

1672 May 30 1:30 PM - 1:40 PM

The Role of Ventilatory Responsiveness During Exercise in Performance Impairment in Acute Hypoxia

Keren Constantini, Anna C. Bouillet, Bruce J. Martin, Robert F. Chapman, FACSM. *Indiana University, Bloomington, IN.*
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(No relevant relationships reported)

The ability to increase exercise ventilation to defend arterial oxyhemoglobin saturation during hypoxic exercise is commonly viewed as an important factor contributing to large individual variations in the degree of performance impairment in hypoxia. While the hypoxic ventilatory response (HVR) could provide insight into the underpinnings of such impairments, it is almost exclusively measured at rest, under isocapnic conditions.
Purpose: 1) to determine in a cohort of highly trained athletes whether the integrated ventilatory response to progressive hypoxia at rest (HVR_{REST}) and during exercise (HVR_{EX}) are comparable, and 2) to determine whether HVR_{EX} is related to the degree of performance impairment in acute hypoxia.
Methods: Sixteen endurance-trained men (VO_2peak: 62.6 ± 6.2 ml·kg^{-1}·min^{-1}) performed two poikilocapnic HVR tests: 1) during seated rest (HVR_{REST}) where inspired O_2 fraction (FiO_2) was progressively reduced; and 2) while cycling at 40% of power at normoxic VO_2peak (HVR_{EX}) where FiO_2 was reduced in a square-wave fashion every 5 min (F_IO_2 = 0.21, 0.18, 0.15 and 0.12). On two separate visits, subjects (n = 12) performed a 10km cycling time trial (TT) while breathing either room air or a hypoxic gas mixture (F_IO_2 = 0.16), in a randomized order. Performance impairment was calculated as the percentage change in time to complete the TT between normoxia and hypoxia (ΔTT).
Results: HVR_{EX} was significantly ($p < 0.05$) greater than HVR_{REST} (1.51 ± 0.45 and 0.22 ± 0.14 l·min^{-1}·%$^{-1}$, respectively), and the two measures were not correlated (r = -0.05, p = 0.84). ΔTT was not correlated with HVR_{REST} (r = -0.06, p = 0.86) or HVR_{EX} (r = 0.36, p = 0.28). The percentage change in VCO_2 and ventilation between TTs was significantly ($p < 0.05$) correlated with ΔTT (r = -0.72 and r = -0.58, respectively), and these variables together explained 71% of the variance in performance impairment in acute hypoxia ($p <$ 0.01). **Conclusions:** 1) HVR_{REST} may not be an appropriate or applicable measure to utilize when studying ventilatory and other physiological responses to exercise and/or exercise performance; and 2) Although HVR_{EX} may explain little to the degree of performance impairment in acute hypoxia, (adequate) ventilation is likely essential for mitigating these expected hypoxia-induced impairments in performance, at least to some degree.

1673 May 30 1:40 PM - 1:50 PM

Sex Differences In Respiratory And Circulatory Cost And Arterial Oxygen Saturation During Hypoxic Walking

Masahiro Horiuchi[1], Yoko Handa Kirihara[1], Yoshiyuki Fukuoka[2], Herman Pontzer[3]. *[1]Mt. Fuji Research Institute, Fuji-yoshida, Japan. [2]Doshisya University, Kyoutanabe, Japan. [3]Duke University, Durham, NC.*
(No relevant relationships reported)

PURPOSE: Since women have smaller lungs and a decreased capacity for lung diffusion compared to men, these differences may increase the work required for women to maintain a given rate of pulmonary ventilation (V_E), resulting in greater exercise-induced arterial hypoxemia (EIAH). Previous studies have ignored the energy expenditure (EE) on circulation (i.e., heart rate; HR) and ventilation during exercise. **METHODS**: We sought to investigate sex differences in EE, V_E and HR in response to changes in SpO_2. We hypothesized that women would experience greater EIAH, and that the contribution rate of EE, V_E, and HR in response to changes in SpO_2 would be different between the sexes. We measured EE during walking on a level gradient under normoxia (room air, 21% O_2), and moderate hypoxia (13% O_2). Ten healthy young men and ten healthy young women walked on a treadmill at seven speeds (0.67-1.67 m s^{-1}). Each walking speed lasted for four minutes. EE was calculated using pulmonary oxygen uptake and carbon dioxide output. **RESULTS**: During walking, reductions in SpO_2 trended slightly greater in women under hypoxia (71.5 ± 4.5 % for men and 67.7 ± 6.1 % for women at the fastest gait speed, P > 0.05). Hypoxia-induced elevation in EE, HR, and V_E were calculated by the difference between values in hypoxia and normoxia. Using a multivariate model that combined EE, V_E, and HR to predict ΔSpO_2 (hypoxia-induced reduction), we obtained a very strong fit model both for men (r^2 = 0.900, $P < 0.001$) and for women (r^2 = 0.957, $P < 0.001$). We also tried to estimate the relative contributions of ΔEE, ΔV_E, and ΔHR to predict ΔSpO_2 by using standard partial regression coefficients. The contribution rate to predict ΔSpO_2 was markedly different between men and women. In women, the effect of ΔEE and ΔV_E were greater (EE: 28.1% in women vs. 15.8% in men; V_E: 4.1% in women vs. 1.7% in men). Conversely, in men the contribution of ΔHR was greater (82.5 % in men and 67.9 % in women). Moreover, significant sex differences in breathing frequency and tidal volume were observed (P < 0.05, respectively).
CONCLUSIONS: These findings suggested that high-altitude adaptation in response to hypoxemia has different underlying mechanisms between men and women. Our results can help to explain how men and women adapt high-altitude environments.

1674 May 30 1:50 PM - 2:00 PM

Hypoxia Reduces Steady State Cycling Workload

Charli D. Aguilar. *University of Nevada Las Vegas, Las Vegas, NV.* (Sponsor: James Navalta PhD., FACSM)
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(No relevant relationships reported)

Training in hypoxia is growing in popularity among athletes. Exercise in hypoxic conditions produces decrements in steady state and maximal workload capacity. **PURPOSE:** The purpose of this pilot study was to characterize the differences in steady-state exercise power between hypoxic and normoxic conditions. **METHODS:** 10 healthy adults (5 males, 5 females) mean age of 23.8 ± 4.5 years volunteered to participate in the study. Pretesting included a graded exercise test to determine cycle resistance at 75% of age predicted heart rate max for each condition. The two conditions are defined as, normoxia (F_IO_2 = 20.5%) and normobaric hypoxia (F_IO_2 = 14.4%). A Hypoxico 5570 Everest Summit II Altitude training system was used to create conditions. Intervention days were at least 72 hours apart but no more than one week. A single blinded and counterbalanced model was used. Steady state exercise was performed on a cycle ergometer (Watt bike Pro, Waukesha, WI, USA) at a rate of 60 RPM for 30 min. Heart rate (HR), blood oxygen saturation (SPO_2), cycling watts and mean power was recorded every minute. **RESULTS:** SPO_2 were significantly lower during hypoxic exercise than during normoxic exercise (average SPO_2 = 80.58 ± 4.3 in hypoxia and 95.23 ± 0.97 in normoxia) p < 0.001. Average cycle wattage was also significantly decreased during hypoxic exercise (110.7 ± 34.5, compared to 125.9 ± 49.6) p = 0.044. Mean HR was not significantly different between the two conditions. Mean power output in normoxia to wattage in hypoxia, r^2 = 0.7556. Pearson's correlation = 0.869 p < 0.001. **CONCLUSION:** Hypoxia reduced steady state power without changes in relative intensity. Mean cycling power in normoxic conditions and hypoxic positively correlate. These preliminary findings suggest that a predictive equation could be possible with further data collection.

1675 May 30 2:00 PM - 2:10 PM

Higher Muscle Tissue Oxygenation When Exposed To Hypobaric Hypoxia Than Normobaric Hypoxia

Ben Meister, Christina Angeli, Robert Shute, Dustin Slivka, FACSM. *University of Nebraska at Omaha, Omaha, NE.* (Sponsor: Dustin Slivka, FACSM)

(No relevant relationships reported)

PURPOSE: There has been recent debate on the potential difference in physiological response between exposure to simulated altitude (normobaric hypoxia) and terrestrial altitude (hypobaric hypoxia). Therefore, the purpose of this research was to determine the difference in the physiological response to normobaric and hypobaric hypoxia during exercise. **METHODS:** Eight recreationally active subjects (age: 27 ± 5 y, body weight: 73.1 ± 7.4 kg, height: 170.6 ± 6.7 cm, body fat: 19.3 ± 9.2 %) completed incremental cycling exercise to volitional fatigue in three separate environments, normobaric normoxia (NN; 350 m), normobaric hypoxia (NH; simulated 3094 m) and hypobaric hypoxia (HH; 3094 m). Heart rate, blood oxygen saturation, and muscle tissue oxygenation were measured at rest and continuously throughout the exercise trials. **RESULTS:** Blood oxygen saturation (SpO_2) was ~10% higher in NN compared to the two hypoxic conditions ($p < 0.001$) at rest and all exercise stages, with no difference between NH and HH ($p > 0.05$). Heart rate was higher at rest in HH (98 ± 13 bpm) compared to NN (83 ± 15 bpm, $p = 0.011$) and NH (84 ± 14 bpm, $p = 0.001$) which persisted until 165 watts at which point no difference was observed ($p > 0.05$). Muscle tissue oxygenation was 17% higher in HH compared to NN and 19% higher than NH throughout exposure ($p < 0.05$). **CONCLUSIONS:** This data indicates that the hypoxic stress resulting from normobaric and hypobaric hypoxia are not the same and that hypobaric hypoxia may not result in hypoxia at the level of the tissue.

1676 May 30 2:10 PM - 2:20 PM

Hypoxic Exercise Performance with an Antihistamine: Influence of Aerobic Fitness

Marissa N. Baranauskas[1], Cameron A. Nowrouzi[1], Chad C. Wiggins[2], Robert F. Chapman, FACSM[1]. *[1]Indiana University, Bloomington, IN. [2]Mayo Clinic, Rochester, MN.* (Sponsor: Dr. Robert Chapman, FACSM)
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(No relevant relationships reported)

At altitude, impairments in pulmonary oxygen diffusion and oxygen delivery have a detrimental effect on endurance exercise tolerance. Analogues of over-the-counter antihistamines have been shown to improve oxyhemoglobin saturation (S_pO_2) and oxygen delivery during heavy exercise, but hypoxic performance outcomes have not been studied. **Purpose:** To determine the effect of the antihistamine, cetirizine (Zyrtec®) on hypoxic exercise performance in recreationally active subjects. **Methods:** Eight subjects [6 men, 2 women; age = 22 ± 1y; $\dot{V}O_{2max}$ = 44.3 ± 8.3 ml·kg^{-1}·min^{-1} (range: 32.0-55.2 ml·kg^{-1}·min^{-1})] completed constant load exercise at 45% and 65% of normoxic VO_{2max} and an 8km time trial in conditions of normoxia (NORM), hypoxia with placebo (HYP+P), and hypoxia with cetirizine (HYP+C). Subjects inspired 15% oxygen to simulate an altitude of 2,500m for HYP+P and HYP+C and were given a 10mg fixed-dose of cetirizine one hour prior to exercise for HYP+C. Measures of S_pO_2 via pulse oximetry and muscle tissue oxyhemoglobin concentration ([OxyHb+Mb]) of the vastus lateralis via near infrared spectroscopy were continuously measured throughout exercise. **Results:** There was no significant difference ($P \geq 0.232$) in S_pO_2 between HYP+P and HYP+C during the 45% (89 ± 6% vs. 89 ± 4%) and 65% (87± 6% vs. 85 ± 5%) constant loads. The cetirizine intervention had a significant effect ($P = 0.005$) on Δ [OxyHb+Mb] (%) during the 65% constant load with a difference between HYP+P and HYP+C (-28 ± 45% vs. +14 ± 16%). There was no difference in 8km performance times between HYP+P and HYP+C (18.08 ± 2.87 min vs. 17.03 ± 1.92 min, $P = 0.112$, $d_z = 0.63$). However, when co-varied by $\dot{V}O_{2max}$, cetirizine had a significant effect ($P = 0.047$) on 8km time trial performance with a difference of 1.06 min (95% CI [0.01, 2.11]) between HYP+P and HYP+C. VO_{2max} accounted for 53% of the variance in time trial performance changes between interventions. **Conclusion:** Cetirizine improves endurance exercise performance in hypoxia with a larger effect on individuals with lower $\dot{V}O_{2max}$. The cetirizine intervention resulted in greater skeletal muscle oxygenation at 65% $\dot{V}O_{2max}$ with hypoxia. These results would suggest that cetirizine does not improve S_pO_2, but improves hypoxic exercise performance perhaps through enhanced oxygen delivery to the skeletal muscles.

1677 May 30 2:20 PM - 2:30 PM

The Influence of Acetazolamide on Endurance Exercise Performance at 3500 m

Karleigh E. Bradbury, Beau R. Yurkevicius, Katherine M. Mitchell, Kirsten E. Coffman, Charles S. Fulco, Roy R. Salgado, Robert W. Kenefick, FACSM, Nisha Charkoudian. *USARIEM, Natick, MA.* (Sponsor: Nisha Charkoudian, FACSM)

(No relevant relationships reported)

Members of the military and recreational athletes often rapidly ascend to altitude with the intention of completing physically demanding tasks. Rapid ascent can result in acute mountain sickness (AMS) which is commonly treated with acetazolamide (AZ). However, the side effects of AZ may impair exercise capability and previous literature regarding the impact of AZ on exercise performance is unclear. **PURPOSE:** To determine the impact of AZ on endurance exercise performance during a 30-hour exposure to hypobaric hypoxia equivalent to 3500 m altitude. **METHODS:** After completing three familiarization time trials (TT) at sea level (SL), six men (Age: 22.2 ± 3.2 yrs; Weight: 77.5 ± 11.5 kg; Height: 176.2 ± 7.1 cm; SL VO_2peak: 50.8 ± 6.5 ml·kg^{-1}·min^{-1}) completed two, 30 hr altitude exposures at ~3500 m. In a single blind, randomly assigned study design, subjects were given 250 mg of AZ twice a day during one exposure and a placebo during the other. Administration of the doses started 48 hr prior to entering the hypobaric chamber, and continued through the 30 hr exposure. Exercise testing was completed ~24 hr after ascent to altitude and consisted of 15 min steady state walking on a treadmill at 40-45% SL VO_2peak, followed by a 2 mile self-paced, treadmill TT. During the TT, subjects were blinded to treadmill speed and were only notified of distance completed at half mile increments. Heart rate (HR) and oxygen saturation (SaO_2) were recorded at baseline and every half mile. Rate of perceived exertion (RPE) was recorded at baseline and at the end of the TT. **RESULTS:** There was no difference in time to complete 2 miles between the AZ and placebo TT after ~24 hr of hypobaric hypoxia (22.3 ± 3.7 vs 22.0 ± 2.6 min, respectively; $P > 0.05$). Furthermore there were no differences in final TT HR (186 ± 13 vs 182 ± 16, $P > 0.05$) or RPE (17 ± 3 vs 17 ± 2, $P > 0.05$) between trials. SaO_2 was significantly higher at the end of the AZ TT vs the placebo TT (83 ± 4 vs 80 ± 4, $P < 0.05$). **CONCLUSION:** Our results suggest that AZ (500 mg/day) does not negatively impact endurance exercise performance at 3500 m and that its stimulatory effect on ventilation helped maintain higher levels of oxygen saturation. *Funded by USAMRMC; author views not official US Army or DOD policy.*

1678 May 30 2:30 PM - 2:40 PM

Influence Of Acetazolamide On The Physiological And Perceptual Responses To Steady-state Exercise At Altitude

Katherine Mitchell, Karleigh Bradbury, Beau Yurkevicius, Kirsten Coffman, Charles Fulco, Roy Salgado, Robert Kenefick, FACSM, Nisha Charkoudian, FACSM. *US Army Research Institute of Environmental Medicine, Natick, MA.* (Sponsor: Nisha Charkoudian, FACSM)

(No relevant relationships reported)

Acetazolamide (AZ) is a common prophylactic for acute mountain sickness (AMS), particularly during rapid ascent to moderate or high altitudes. However, its diuretic effect could have a negative impact on physiological responses during steady-state exercise; these potential influences are poorly understood.**PURPOSE**: To evaluate the impact of AZ on heart rate (HR), rate of perceived exertion (RPE), and oxygen saturation (SaO_2) during steady-state treadmill walking after ~24 hours exposure to hypobaric hypoxia equivalent to 3500 m altitude.
METHODS: After completing three sea level familiarization trials, six men (Age: 22.2 ± 3.2 yr; Weight: 77.5 ± 11.5 kg; Height: 176.2 ± 7.1 cm; SL VO_2peak: 50.8 ± 6.5 ml·kg^{-1}·min^{-1}) completed two 30 hr altitude exposures (AZ and placebo, single-blind randomized crossover design) in a hypobaric chamber equivalent to ~3500 m. After ~24 hr of exposure, volunteers completed exercise testing consisting of 15 min of steady-state treadmill exercise at 40-45% sea level VO_2peak. HR & SaO_2 were recorded at baseline and at minutes 5, 10, and 15 of exercise. RPE was recorded at baseline and at minute 15 of exercise.
RESULTS: There were no significant differences between AZ and placebo for post-exercise HR (AZ: 141 ± 11 bpm [mean ± SD] vs. Placebo: 145 ± 12 bpm; $p > 0.05$) or RPE (AZ: 9.5 (6-13) [median (range)] vs. Placebo: 9.0 (7-14); $p > 0.05$). SaO_2 was significantly higher in the AZ trial (AZ: 86 ± 3% vs. Placebo: 81 ± 4%, $p < 0.01$). Furthermore, the extent (delta) of desaturation from pre- to post- steady-state exercise was less in the AZ trial compared to the placebo trial (AZ: -5 ± 3% vs. Placebo: -7 ± 1%; $p < 0.05$). **CONCLUSIONS:** Our results suggest that AZ does not negatively impact physiological and perceptual responses during steady-state exercise. Indeed, AZ may be beneficial by helping to maintain oxygen saturation during steady-state exercise in hypobaric hypoxia. *Funded by USAMRMC; author views not official US Army or DOD policy.*

D-38 Thematic Poster - **Biomechanics after ACL Reconstruction**

Thursday, May 30, 2019, 3:45 PM - 5:45 PM
Room: CC-102A

1741 **Chair:** Robin Queen, FACSM. *Virginia Tech, Blacksburg, VA.*
(No relevant relationships reported)

1742 Board #1 May 30 3:45 PM - 5:45 PM

Effect of Lower Extremity Static Alignment on Dynamic Valgus in Adolescents Following ACL Reconstruction

Tishya Wren[1], Daniel Feifer[1], Natalya Sarkisova[1], Mia Katzel[1], Curtis VandenBerg[1], James L. Pace[2], Nicole Mueske[1]. *[1]Children's Hospital Los Angeles, Los Angeles, CA. [2]Connecticut Children's Medical Center, Hartford, CT.*
Email: twren@chla.usc.edu
(No relevant relationships reported)

PURPOSE: Knee abduction moments may lead to valgus collapse, potentially causing ACL rupture. The contribution of static lower extremity alignment to knee abduction moments is unknown. This study assessed relationships among lower extremity static alignment and dynamic kinematics and kinetics during side-step cutting in uninjured adolescent athletes.
METHODS: This retrospective study included 8 adolescents with recent unilateral ACL reconstruction (mean age 14.8 yr, SD 1.2; 3/8 female). Frontal plane hip to ankle imaging (EOS) was used to measure mechanical axis deviation (perpendicular distance from the center of the femoral condyles to the mechanical axis line connecting the center of the femoral head to the center of the talar dome) and tibial-femoral angle. 3D motion capture provided lower extremity kinematics and kinetics during quiet standing and loading (initial contact to peak knee flexion) of an anticipated 45° side-step cut; 2-3 trials per limb were averaged for analysis. Relationships among imaging, static motion capture and dynamic motion capture measures were investigated using correlation, and backward stepwise linear regression was used to evaluate potential predictors of average dynamic knee abduction moment.
RESULTS: Regardless of surgical status, standing knee abduction angle was correlated with standing hip adduction ($r=0.60$, $p=0.02$) and ankle eversion ($r=0.85$, $p<0.0001$) along with larger mechanical axis deviations ($r=0.83$, $p=0.0001$) and higher knee abduction on EOS ($r=0.44$, $p=0.09$). Dynamic knee abduction moment was best predicted by a combination of EOS knee abduction angle, standing ankle eversion, standing knee abduction, standing knee rotation, ankle eversion during cutting, along with ground reaction force and age ($R^2=0.94$; $p<0.004$). There was no significant relationship between knee abduction moment and side (surgical vs. contralateral) ($p=0.63$).
CONCLUSIONS: In this small group of adolescent athletes with recent ACLR, knee abduction moment during side-step cutting was related to age and anatomic lower limb alignment in addition to dynamic factors such as ankle positioning and ground reaction force. Anatomic alignment or standing posture with greater hip adduction, knee abduction, and ankle eversion may indicate a higher risk for injury during dynamic activities.

1743 Board #2 May 30 3:45 PM - 5:45 PM

Wearable Sensor-based Classification Of ACL Reconstructed Limbs During Exercise In Male And Female Patients

Joseph M. Hart, FACSM[1], Varun Mandalapu[2], Stephan Bodkin[1], John Lach[1], Nutta Homdee[1], Jiaqi Gong[2]. *[1]University of Virginia, Charlottesville, VA. [2]University of Maryland, Baltimore County, Baltimore, MD.*
Email: jmh3zf@virginia.edu
(No relevant relationships reported)

Purpose: Early identification of subtle, sub-clinical, aberrant motion characteristics in patients with ACL reconstructed knees can inform rehabilitation and return to sports decision making. Wearable sensors enable characterization of movement in native sport and activity environment. The purpose of the study was the ability of a machine learning algorithm to accurately classify male and female participants' reconstructed limb from the contralateral healthy limb using inter-limb movement variability from sensor data during walking and jogging. **Methods**: We evaluated 109 patients (23.5±10.2Yr, 172.6±9.6cm, 73.4±16.7kg) with primary, unilateral and uncomplicated ACLR at approximately 6 months from index surgery. All participants walked for 5 minutes at 3 mph and jogged for 3 minutes at 6mph on a treadmill. Subjects were fitted with 5 wireless sensors (Shimmer3 IMU Unit, Dublin, Ireland) secured bilaterally on the wrists and ankles and around the waist at the sacrum. Accelerations from the sensors were continuously monitored during the walking and jogging trials. The multi-dimensional time-varying biomechanical data captured by the sensors were processed to generate a graphical model and matrixes to represent the cause-and-effect relationship in inter-limb movement. The matrixes extracted from the sensor data were used to train machine learning algorithms and then these trained algorithms were evaluated to classify participants' ACLR limb from their contralateral healthy limb. The performance of these trained algorithms was calculated to generate the individual classification accuracy. **Results**: While walking, the trained algorithms were able to classify the ACLR limb in males with 81.5% accuracy and females with 73.7% accuracy. While jogging, ACLR limbs were classified with 76.7% accuracy in males and 83.0% accuracy in females. **Conclusion**: Cause-and-effect analysis of inter-limb movement variability demonstrated a high level of accuracy in classifying an injured ACLR limb from a healthy contralateral limb during exercise. The accuracy of classification may be influenced by gait speed and sex.

1744 Board #3 May 30 3:45 PM - 5:45 PM

The Impact of a Functional Knee Brace on Sports Performance Following ACL Reconstruction.

William E. Garrett, Jr, FACSM[1], Abigail C. Schmitt[1], Robin M. Queen, FACSM[2]. *[1]Duke University Medical Center, Durham, NC. [2]Virginia Tech, Blacksburg, VA.*
Email: william.garrett@duke.edu
Reported Relationships: **W.E. Garrett:** *Industry contracted research; Don Joy Orthopaedics.*

Up to 250,000 anterior cruciate ligament (ACL) injuries occur in the United States annually with most athletes undergo an ACL reconstruction. No literature has examined physical performance during return to sport (RTS) and the impact of a functional knee brace. Braces have been shown to improve mechanics, but compliance remains an issue due to performance concerns.
PURPOSE: To determine differences in performance between braced (B) and non-braced (NB) tasks across time (RTS and six weeks following RTS (RTS+6)). We hypothesize that performance will improve across time with no differences between brace conditions.
METHODS: ACL patients (n=40; 20 male, 20 female) were enrolled after being RTS. Participants were provided a custom fit knee brace and instructed to wear the brace for all activities more dynamic than walking. A series of tasks (40 yard dash, 5-10-5 shuttle run, vertical jump, broad jump, and a triple hop) were completed at RTS and RTS+6. Each participant completed three practice trials and two recorded trials. Task and brace condition order was randomized. The ACL-RSI, IKDC and a VAS pain scale were completed. A 2X2 (time: RTS, RTS+6 by brace: B, NB) repeated measure ANOVA for performance measures and a paired t-test for patient reported outcomes were performed ($p<0.05$).
RESULTS: Participants (height: 1.7±0.1 m, weight: 75±15 kg, age: 18.6±3 yr) demonstrated improvements in ACL-RSI ($p=.003$) and IKDC ($p<.001$) with no difference in VAS pain ($p=.297$). Performance declined during the 40yd Dash, vertical jump, and broad jump in the B condition. Performance improved across time for the broad jump and triple hop (Table 1).
CONCLUSIONS: Brace condition differences were small (40yd Dash: 0.1 sec, Vertical Jump: 0.5 in, Broad Jump: 0.9 in) or nonexistent and would not likely lead to noticeable sport deficits. Performance concerns should be minimal in ACL patients looking to RTS when wearing a knee brace.
ACKNOWLEDGEMENTS: This work was supported by a DonJoy Orthopaedics grant.

Table 1: Physical performance results for the Braced and Non-Braced conditions and between the two time points. (NS = Non-Surgical, S=Surgical)

Variable	Brace		Non-Braced		Interaction	ME Time	ME Brace
	RTS	RTS+6	RTS	RTS+6			
40yd Dash (sec)	6.3 ± 0.7	6.2 ± 0.6	6.1 ± 0.7	6.1 ± 0.7	0.068	0.680	0.011
5-10-5 shuttle (sec)	5.9 ± 0.5	5.9 ± 0.5	5.9 ± 0.5	5.9 ± 0.5	0.421	0.943	0.941
Vertical Jump (inches)	17.7 ± 3.4	17.9 ± 3.6	18.2 ± 3.7	18.4 ± 3.9	0.797	0.383	<0.001
Broad Jump (inches)	69.0 ± 10.4	71.2 ± 11.4	70.5 ± 11.5	71.5 ± 11.7	0.213	0.034	0.019
Triple Hop (NS) (inches)	162.8 ± 30.0	172.7 ± 35.7	162.9 ± 30.5	174.4 ± 32.7	0.653	<0.001	0.544
Triple Hop (S) (inches)	147.9 ± 32.0	157.7 ± 38.4	143.3 ± 32.4	158.3 ± 38.9	0.073	0.002	0.141

1745 Board #4 May 30 3:45 PM - 5:45 PM

Lower Extremity Kinetic and Kinematic Asymmetries 4, 6, and 9 Months Post-ACL Reconstruction In Elite Collegiate Athletes

Daniel G. Cobian, Mikel R. Stiffler-Joachim, Matthew D. Bjork, Jennifer L. Sanfilippo, Bryan C. Heiderscheit. *University of Wisconsin-Madison, Madison, WI.*
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(No relevant relationships reported)

Abnormal lower extremity (LE) biomechanics post-anterior cruciate ligament reconstruction (ACLR) may increase re-injury risk and reduce sports performance. Although most athletes return to sport (RTS) within 1 year from ACLR, the timeline for recovery of LE kinetics and kinematics during athletic tasks is not well defined. Identifying specific movement deficiencies will guide rehabilitation efforts to promote successful RTS and reduce re-injury risk.**PURPOSE**: To evaluate vertical ground reaction forces (vGRF) and hip, knee, and ankle kinematics during running and jumping in elite collegiate athletes 4, 6, and 9 months post-ACLR.
METHODS: Twelve Division I athletes (age 20.5 ± 1.2, BMI 25.9 ± 3.6, 6 female) performed maximal countermovement jumps (CMJ) and treadmill running at a maximally comfortable speed 4.0 ± 0.3, 6.1 ± 0.5 and 8.9 ± 1.5 months post-surgery while whole body kinematics were recorded. VGRF impulses, knee flexion excursion, and peak sagittal plane hip, knee, and ankle joint angles were obtained during the stance phase of running (RUN) and the eccentric, concentric (CON), and landing (LAND) phases of the CMJ. Limb symmetry indices (LSI) were computed for all variables and effect sizes (ES) were calculated. LSIs at each interval were evaluated using the Wilcoxon Signed-Ranks test.
RESULTS: At 4 months post-surgery, all CMJ and RUN asymmetries were significant (LSI: 69.5-95.9%, $p < .023$, ES: .46-.62). Involved limb CMJ CONC phase and RUN vGRF impulses were significantly less than uninvolved limb values at all intervals (LSI: 85.7-94.2%, $p < .005$, ES: .58-.63). RUN peak joint angle and knee flexion excursion asymmetries were significant at all intervals (LSI: 69.5-94.7%, $p < .013$, ES: .51-.62). Involved limb CMJ CONC phase knee (LSI: 90.6-98.6%, $p < .041$, ES: .42-.62) and ankle (LSI: 80.2-86.1%, $p < .010$, ES: .53-.62) angles were reduced throughout, while no CMJ LAND phase asymmetries were detected 9 months post-op.
CONCLUSIONS: Despite excellent surgical care and high volumes of rehabilitation, elite collegiate athletes present with LE kinetic and kinematic asymmetries 9 months post-surgery, after or close to typical RTS. In particular, knee joint kinematics during the stance phase of running and the CONC phase of the CMJ are categorically asymmetric and should be addressed with targeted interventions.

1746 Board #5 May 30 3:45 PM - 5:45 PM

Physical Factors Differentiate Pain-free Return To Play And Return With Knee Symptoms 9 Months After ACL Reconstruction

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(No relevant relationships reported)

Purpose
The aim of this study was to identify strength, power and biomechanical differences between male athletes who made a pain free return to play (RTP) and those that did not at 9 month post ACL reconstruction.
Methods
Nine months after ACLR 158 males athletes who had returned to pre-injury sport participation (64 reporting knee symptoms/94 reporting none) carried out strength testing using isokinetic dynamometry on quadriceps and hamstrings and 3D biomechanical analysis of single countermovement jump, single leg drop jump and planned and unplanned 90° change of direction (CoD) as well as an IKDC questionnaire. Differences in IKDC, strength and jump height measures on the ACLR side and in limb symmetry index (LSI) between groups were analysed with statistical parametric mapping (SPM, 0D unpaired t-test). The odds ratio for making a pain free RTP if LSI >90% was also calculated for the strength and jump variables independently and collectively. Biomechanical differences in the jump and CoD tests on the ACLR side and in symmetry between groups was analysed with SPM (1d, unpaired t-test). Effect size was calculated using Cohen's D for all analyses.
Results
There was a large effect size (ES) difference in IKDC score between groups (89 +/- 6 with no pain; 80 +/- 8 with pain; ES 1.1). There were medium effect size differences in quadriceps strength on ACLR side (ES 0.42) and LSI (0.45) with an odds ratio of 2.7. There were similar differences in SLDJ height on ACLR side (ES 0.3) and LSI (0.37) with an odds ratio of 3.5. The odds of making a pain free RTP when LSI >90% on all tests was 6.8. There were no biomechanical differences between groups on the jump tests. There were biomechanical differences on the more demanding CoD tests with differences on the on the ACLR side and symmetry in foot rotation angle, knee extension moment and hip rotation angle (ES 0.51 to 0.61) in the unplanned CoD and in symmetry of posterior and vertical ground reaction force and COM velocity at initial contact (ES 0.5 to 0.58) in the unplanned CoD with greater asymmetry in the painful group.
Conclusion
This study demonstrates strength, power and biomechanical differences in those that RTP with knee symptoms after ACLR with those achieving >90% LSI in all 4 strength and jump tests almost 7 times more likely to make a pain free RTP.

1747 Board #6 May 30 3:45 PM - 5:45 PM

A Long-term Follow-up Of Patients With Physeal-Sparing Iliotibial Band ACL Reconstruction: Kinetic Analyses

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(No relevant relationships reported)

Longer-term biomechanical implications of anterior cruciate ligament reconstruction with Iliotibial band autograph (ACLR-ITB) remain under-investigated. **PURPOSE:** To determine biomechanical parameters of knee function at various time intervals following the ACLR-ITB: 1-2 years, 2-5 years, 5-10 years, and >10 years post-surgically. **METHODS:** Patients who had undergone ACLR-ITB as skeletally immature children were recruited for testing, which included drop vertical jumps and vertical single-limb hops. A three dimensional (3D) motion analysis system with force plates was used to assess various parameters. The landing phase was defined as the moment of initial contact with the force plates, where the vertical ground reaction force (VGRF) exceeded 10 N, to 500 ms after initial contact. Major outcome variables included external knee moments (sagittal, frontal, and horizontal planes), VGRF, and vertical jump height. The knee moments and VGRF were normalized by mass (kg), and vertical jump height was calculated through following equation: ½ g(t/2)2, where g=9.81 m/s2 and t=time in seconds in the air. Peak values of each outcome variable were analyzed. Paired t-tests were employed to compare VGRF and vertical jump height between the two limbs by four groups (1-2 years, 2-5 years, 5-10 years, and >10 years) separately. **RESULTS:** Based on available data (N=38, 30 males, 8 females; 1-2 years: N=8; 2-5 years: N=10; 5-10 years: N=10; >10 years: N=8), paired t-tests showed no statistically significant differences in peak knee moment (sagittal plane: p=.613, frontal plane: p=.340 horizontal plane: p=.248) and peak VGRF (p=.106) in drop vertical jump test. Also, no statistical significant difference was detected in peak knee moment (sagittal plane: p=.101, frontal plane: p=.955 horizontal plane: p=.341), peak VGRF (p=.384) and peak vertical jump height (p=.876) in single-limb hops. The findings were consistent when the data was analyzed based on the 4 follow-up time groups. **CONCLUSIONS:** The biomechanical function of knees undergoing this procedure appears to be no different compared to the uninjured side at 1-2 years, 2-5 years, 5-10 years, and >10 years following ACLR-ITB procedure. The current data support a long-term safety of the ACLR-ITB procedure for skeletally immature athletes with complete ACL tears.

1748 Board #7 May 30 3:45 PM - 5:45 PM

Competing After ACL Injury: Profiles of Division 1 Athletes who Successfully Return to Sport

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(No relevant relationships reported)

Female athletes face significant risk of musculoskeletal injury when playing collegiate level sports. Sustaining injury, particularly to the ACL, can end an athlete's career. Prior research has evaluated individuals' movement profiles and patient reported outcomes (PROs) following ACL injury; however, there is a dearth of evidence evaluating the movement profile and PROs of those who successfully return to sport at an elite level following ACL injury. **PURPOSE:** To compare the movement profile and PROs of Division 1 women's college athletes who successfully return to sport following ACL injury to healthy athletes. **METHODS:** We conducted a cross-sectional analysis of baseline data on 66 participants collected as part of standard injury screening for Division 1 women's soccer, lacrosse, and field hockey teams (mean ± SD; Age = 19.9 ± 1.3 yrs, Ht = 166.6 ± 5.8 cm, Wt = 64.1 ± 8.1 lbs). We used health history and survey data to identify those who had previously sustained an ACL injury as well as single assessment numeric evaluation (SANE) scores for the knee. The Landing Error Scoring System (LESS) was used to evaluate each athlete's movement pattern while completing a jump landing task. The LESS and SANE scores for the injured and non-injured groups were compared using T-Tests with pooled variance

(α=0.05). **RESULTS:** T-Test results showed that those athletes who went on to play Division 1 sports following ACL injury (n=18) had significantly better ($p<0.02$) LESS scores than did their previously uninjured counterparts (Successful Return: 3.9 ± 1.4 faults, Previously Uninjured: 5.2 ± 2.0). SANE scores were significantly different ($p<0.03$) in the opposing direction (Successful Return: 89.8 points ± 7.6, Previously Uninjured: 95.3 ±9.1). **CONCLUSION:** Female athletes who successfully returned to compete in Division 1 sports following an ACL injury demonstrated a better movement profile than those without history of ACL injury; notably scoring below previously established cut points (5.0 faults) for increased risk of injury. This was in the setting of the lower PRO scores than their uninjured counterparts. This may indicate that athletes who sustain injury and wish to play at elite levels may need to improve their movement profile to a point better than their peers and care must be taken to balance PROs with an objective measure of movement.

1749 Board #8 May 30 3:45 PM - 5:45 PM

Altered Center of Pressure Dispersion and Regularity during Dual-Task Balance following Anterior Cruciate Ligament Reconstruction

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Athletes demonstrate neuroplastic changes and altered neuromuscular control after anterior cruciate ligament reconstruction (ACLR). Conflicting reports of impaired balance and cognitive performance exist for dual-task balance following ACLR. Thus, significant gaps remain in understanding altered postural control strategies in this population. **PURPOSE:** To understand altered postural control strategies in ACLR individuals in the presence of sensory, motor, and cognitive challenges. **METHODS:** Fourteen ACLR (20.7±2.0 yr, 76.9±19.1 kg, 1.7±1.4 m, 6.7±1.9 Tegner) and 14 matched healthy control participants (CON) (21.2±1.4 yr, 75.4±15.3 kg, 1.7±1.5 m, 7.4±1.4 Tegner) were analyzed. Three 20-second trials of single-leg balance (ACLR limb, matched side for CON) were performed under the following conditions: eyes open (EO), eyes closed (EC), dual cognitive (DC), and dual motor (DM). DC involved mental addition every two seconds and DM required participants to catch a ball from a ball machine every 2 seconds. Traditional center of pressure (CoP) measures of 95% confidence ellipse area (EA) and medial-lateral root-mean-squared excursion (RMS_ml) were calculated after a 5 Hz 4th-order Butterworth low-pass filter. These measures were log transformed to satisfy model assumptions. Sample entropy (SEn, unitless) was also calculated for increment resultant CoP data after downsampling to 50Hz, without filtering. Linear mixed models included subject pair as a random effect and ACLR status, trial type, and ACLR * trial type as fixed effects. **RESULTS:** The ACLR group had increased CoP dispersion (*e.g.,* **ln(EA):** ACLR: 7.74 ± 0.78 mm^2, CON: 7.47 ± 0.91 mm^2, $P = 0.003$) and increased CoP signal regularity (**SEn:** ACLR: 0.78 ± 0.20, CON: 0.86 ± 0.23, $P = 0.001$). Significant interactions were also observed for SEn, EA, and RMS_ml that suggest the ACLR group impairments are most pronounced during the DC condition (*e.g.,* 95% confidence interval for CON – ACLR for DC SEn: (0.03, 0.35), $P = 0.01$). **CONCLUSION:** Altered postural control is present following ACLR compared to healthy controls. A cognitively-challenging task resulted in greater ACLR-specific balance alterations compared to closing eyes or a motor dual-task. These findings are consistent with ACLR individuals adopting a more attentionally-focused approach to postural control.

D-39 Thematic Poster - **Blood Flow**

Thursday, May 30, 2019, 3:45 PM - 5:45 PM
Room: CC-101A

1750 **Chair:** Jamie Burr, FACSM. *University of Guelph, Guelph, ON, Canada.*
(No relevant relationships reported)

1751 Board #1 May 30 3:45 PM - 5:45 PM

Resistance Training with and Without Blood Flow Restriction to Repetition Failure: More Pain, Same Gain

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(No relevant relationships reported)

Evidence suggests blood flow restricted (BFR) resistance training performed with low-loads (20-40% 1-repetition maximum; 1-RM) is superior to low-load training when volume (load x repetitions) is matched. Since it has been shown using traditional resistance training that similar gains in muscle strength and hypertrophy occur between high- and low-load training when performed to repetition failure, it is of interest if this also occurs with low-load training with/without BFR. Moreover, the perception of pain at repetition failure between protocols and over time has not been examined in a training setting.
PURPOSE: To determine if low-load resistance training to repetition failure with/without BFR elicits similar muscular strength, hypertrophy and perceived pain. **METHODS**: Seven young (25±1 yr) males were recruited to perform single-leg Smith-machine squats 3 d/wk for 6 wk. Each leg was randomly assigned to perform 30% 1-RM with (BFR) or without BFR (RT) for 3 sets to repetition failure with 100s of rest after each set. Tourniquet pressure was set at 60-70% of the lowest occlusive pressure and remained inflated throughout the 3 sets. Leg strength (1-RM), muscle hypertrophy (leg lean mass; LLM) by dual-energy X-ray absorptiometry, and ultrasound derived vastus lateralis (VL) muscle thickness (MT), were measured before and after the 6-weeks. A visual analog scale (1000 point) was used to assess pain after each set and rest period for the 1st, 4th, 8th, 11th and 15th training session. **RESULTS**: 1-RM increased similarly in both groups after training (BFR 79±13 to 95±13 kg vs. RT 82±13 to 100±13 kg, $p<0.002$) and VL MT (BFR: 2.69±0.08 to 2.98±0.1 vs. RT: 2.75±0.16 to 2.96±0.1 cm, $p<0.016$) with non-significant changes in LLM (BFR 7.29±0.38 to 7.40±0.39 vs. RT 7.28±0.37 to 7.34±0.36 kg, $p<0.243$). There was an increase in perceived pain with BFR training compared to the RT group across all sessions following the first rest period (BFR: 288±25 vs. RT: 155±9 a.u., $p<0.05$) and second rest period (BFR: 433±31 vs. RT:160±9 a.u., $p<0.05$). While there was a trend for a decrease in pain over time with repeated training, this effect was non-significant. **CONCLUSIONS**: When performed to failure, low-load training with and without BFR have similar muscle strength and hypertrophy despite differences in perceived pain. Supported by NSERC, CFI and ERA

1752 Board #2 May 30 3:45 PM - 5:45 PM

Investigating The Use Of Vibration Platform And Blood Flow Restriction As A Warm-up Procedure

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to observe the combined effect of a whole body vibration (WBV) warm up and Blood Flow Restriction (BFR) on muscle temperature, flexibility, vertical jump height, and estimated VO_{2max}. **METHODS**: Nineteen subjects (8 males and 11 females; Mean ± STDEV age = 24.21± 3.47 years; height = 166.94± 8.82 cm) completed the study, which involved performing a warm-up protocol under 5 conditions. The conditions were: 5-min treadmill walking (C1), 5-min WBV at a low amplitude (C2), 5-min WBV at a low amplitude with BFR (C3), 5-min WBV at a high amplitude (C4), 5-min WBV at a high amplitude with BFR (C5). For the BFR sessions, cuffs were placed on the uppermost portion of the thighs. Cuffs were then inflated to 120 mmHg, and then increased in increments of 20 mmHg until the final pressure was achieved. Final pressure was found via thigh circumference and capillary refill time. The vibration plate was set at a frequency of 30 Hz. During the four interventions, the subjects performed 3 lower-body exercises (squat, sumo squat, calf raises) for 60 seconds each, with 30 seconds of rest between exercises. Thigh temperature was measured between exercises. Total training time with rest was 12 minutes. Following the warm-ups, vertical jumping height, flexibility, and aerobic fitness (via Queen's College Step Test) were assessed. **RESULTS**: Significant time and gender main effects for thigh temperature were seen ($p < .01$). Males had a higher mean thigh temperature than females. A significant condition main effect for average flexibility values was detected ($p< .01$). The C4 (compared to C1, C2, and C3) and C5 (compared to C1 and C2) protocols resulted in higher values in flexibility ($p<0.03$). There was also a significant condition*gender interaction for estimated $VO_{2\,max}$ ($p<0.04$). Females had the highest values for estimated VO_{2max} following the C1 protocol and the lowest for the C5 protocol, but males had the highest values for estimated $VO_{2\,max}$ following the C5 protocol. **CONCLUSION**: Based on our findings, the high amplitude WBV condition with or without BFR improved flexibility, but the effects of conditions on estimated $VO_{2\,max}$ values were different for each gender. The findings indicate that gender of individuals performing tests may be important and should be considered for testing different health/fitness variables.

1753 Board #3 May 30 3:45 PM - 5:45 PM

Effects Of Hyperoxic-Supplemented High Intensity Interval Training On Endurance Performance, Maximal Oxygen Consumption And Mitochondrial Function In Trained Cyclists

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(No relevant relationships reported)

PURPOSE: Hyperoxia (HYPER) increases O2 delivery to the working muscles together with an improved lactate metabolism, power output and endurance compared to normoxia (NORM) (Cardinale & Ekblom, 2017). Considering the O2 delivery limitation and the exercise induced hypoxemia at exercise intensities near to maximum it was hypothesized that muscle mitochondrial oxidative phosphorylation (OXPHOS) capacity would be upregulated along with a higher endurance performance following endurance interval training with HYPER compared to NORM. **METHODS**: 23 trained cyclists, age 35.3±6.4 years (mean ± standard deviation (SD)) body mass 75.2±9.6 kg, height 179.8± 7.9 m, and VO2max 4.5±0.7 L·min-1 performed 6 weeks endurance training on a cycle ergometer consisting of supervised HIIT sessions 3 days/week (3·8 min) and additional long slow distance training 2 days/week. Cyclists were randomly assigned to either HYPER (FiO2 0.30; n=12) or NORM (FiO2 0.21; n=11) breathing condition during training in a single blinded study design. VO2max, OXPHOS capacity in permeabilized fibers and in isolated mitochondria, and 20 min cycle performance were tested pre and post intervention. **RESULTS**: Over the intervention change in VO2max (HYPER 1.1±3.8%, NORM 0.0±3.7%; p = 0.55, ES= 0.08), mass-specific mitochondrial respiration (HYPER 27.3±46.0 %, NORM 16.5±49.1%; p= 0.21, ES= -0.06); intrinsic mitochondrial respiration (HYPER 26.1±80.1%, NORM 15.9±73.3%; *p* = 0.66, ES= 0.69) and mean power output during 20 min trial (HYPER 6.0±3.7%, NORM 2.4±5.0%; p = 0.073, ES= 0.32) did not statistically significantly differ between the groups. **CONCLUSIONS**: These data showed that 6 weeks hyperoxic-supplemented high-intensity interval-training on a cycle ergometer was not superior to conventional training at sea level in improving VO2max, intrinsic and mass-specific mitochondrial respiration and cycle performance in already trained cyclists. Therefore, despite the small meaningful positive effect in cycling performance that might be relevant in sport, considering the cost/benefit of performing hyperoxic-supplemented HIIT, it is questionable whether this strategy is worthwhile in maximizing endurance performance in already trained cyclists.

1754 Board #4 May 30 3:45 PM - 5:45 PM

Acute Effects of Blood Flow-restricted Exercise on Microcirculation, Neuromuscular Activation and Metabolite in Underweight Women.

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(No relevant relationships reported)

PURPOSE: This investigation measured local microcirculation, neuromuscular activation and systematic metabolite in underweight women during bilateral knee extension exercise in five conditions: high load [80% of one-repetition maximum (1RM)] without blood flow restriction [BFR, (HL)], low load (30%1RM) without BFR (LL) and low load (30%1RM) with 40%(BFR_{40}), 60% (BFR_{60}), 80% (BFR_{80}) of arterial occlusion pressure. **METHODS:**18 moderately active underweight women (17.63±0.68kg/m2) performed four sets of knee extension to failure with 60 s rest in five conditions. Variables of microcirculatory function [Oxygen saturation(SO_2), relative hemoglobin (rHb), blood flow (flow) and blood velocity (velo)] and neuromuscular activation of the vastus lateralis (VL) and the whole blood lactate (WBL) were measured across different time points. Finally, calculating the repetitions of five conditions. **RESULTS:** SO_2 in HL and LL were similar during whole process (HL: 79.2±19.1%, LL: 72.4±18.20%) which were significantly higher than the other three conditions (P<0.05). Flow was highest in BFR_{60} with the other conditions were similar (e.g., set3: 213.1 AU for BFR_{60} vs~196.3 AU for other conditions). After exercise, velo in BFR_{60} (56.8±1.2AU) was higher than the other conditions [~51.8±1.5AU, (P<0.05)]. rHb did not change in all conditions. LL resulted in greatest activation during the first two sets when exercise is taken to failure (e.g., set1: 69.3%MVIC in LL vs~47.9%MVIC in other conditions). After exercise, WBL was highest in BFR_{60} and lowest in HL (BFR_{60}>LL>BFR_{40}>BFR_{80}>HL). Changes in SO_2 and muscular activation were similar between pressures, while higher pressure led to fewer repetitions during exercise. **CONCLUSIONS:** Low-load exercise to failure results in a greater neuromuscular response to that of high-load exercise in underweight women. When different pressures are applied to low-load exercise, there are considerable changes in microcirculation and metabolite, among which BFR_{60} has the characteristics of greater perfusion and higher metabolic stress. *Funding: This study was supported by Major Natural Science Research Projects in Colleges and Universities of Jiangsu Province, China (18KJA320002) and Postgraduate Research and Practice Innovation Plan of Jiangsu Province, China (KYCX17_1367).*

1755 Board #5 May 30 3:45 PM - 5:45 PM

The Effect Of Blood Flow Restriction And Whole-body Vibration As A Warm-up Strategy

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to examine the effects of blood flow restriction (BFR) and whole-body vibration (WBV) on hemodynamics, muscle temperature, flexibility, and explosive power.
METHODS: Twenty-five subjects (14 females (age = 24 ±2.7 years) and 11 males (age = 24.5 ±3.5 years) completed the study, which involved following 6 sessions: a 5-min (5-WBV) and a 10-min (10-WBV) lower-body warm up on a vibration platform, a 5-min (5-BFR) and a 10-min (10-BFR) lower-body warm up using blood flow restriction cuffs, and a 5-min (5-CYC) and a 10-min (10-CYC) warm up on a cycle ergometer. For the BFR session, cuffs were placed on the uppermost portion of the thigh. Inflation began at 120 mmHg and progressively increased to a target pressure, which was based on the subject's thigh circumference and capillary perfusion. Squat exercises were performed between the knee angle of 90-180 degrees for 5 or 10 sets (each set lasted 60 s with a 60 s rest in between sets) on a vibration platform at 30 Hz with low amplitude or a flat surface while wearing BFR cuffs. Pre and post-exercise data for hemodynamics, quad and hamstring temperature, flexibility, and explosive power index were recorded. Explosive power was measured using a jump mat, where 60 maximal exertion jumps were performed, with mean ground contact time (GCT), mean vertical jump height (MVJ), and explosive power index (EPI) for the first 15 and last 15 jumps. Hemodynamics, muscle temperature, and flexibility were again recorded following the explosive power index test.
RESULTS: There was no condition*time interaction or condition main effect for GCT, MVJ, and EPI, but there was a time main effects for all three variables (p<0.01). There were significant condition and time main effects and condition*time interaction for heart rate (p<0.01), time main effect for systolic blood pressure (p<0.01) and flexibility (p<0.01). Significant time main effect and condition*time interaction were detected for quadricep (p<0.01) and hamstring muscle temperatures (p<0.01).
CONCLUSIONS: Our findings indicate that all the conditions and durations investigated resulted in similar responses in flexibility and jump performance. Future studies should examine different pressure settings of BFR and/or frequency/amplitude setting of WBV on the variables tested in the study.

1756 Board #6 May 30 3:45 PM - 5:45 PM

Physiological Responses to Intermittent Endurance Exercise with Blood Flow Restriction in the Moderate Intensity Domain

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(No relevant relationships reported)

Blood flow restriction (BFR) endurance training may induce both endurance and strength improvements. However, there is no consensus on the ideal BFR endurance exercise prescription in order to balance the physiological and perceptual responses. **Purpose:** The purpose of this investigation was to examine the physiological responses, as well as the perceived exertion in responses to a range of BFR endurance protocols. **Methods:** Participants randomly performed 7 exercise protocols: 50% of the difference between peak oxygen uptake (VO_2) and ventilatory threshold (VT) (Δ50%), 90%, 80%, and 70% of VT with and without BFR. Each protocol consisted of two sets of five work intervals (2 minutes work, 1 minute rest) separated by 5 minutes of recovery. Pulmonary VO_2 was recorded breath-by-breath, muscle activation (vastus medialis (VM), vastus lateralis (VL)) was assessed by surface electromyography (sEMG), microvascular oxygenation (tissue oxygenation index (TOI)) was assessed by near-infrared spectroscopy (NIRS), and level of perceived exertion (RPE) was assessed using the Borg scale. The last 30 seconds of intervals 5 and 10 were used for analysis. sEMG data were normalized to baseline cycling (20 watts). TOI during each condition was analyzed compared to baseline cycling and then expressed as change from baseline (arbitrary units) to compare between conditions. **Results:** The Δ50% protocol resulted in a higher end exercise (interval 10) VO_2 compared to all other conditions, no other differences in VO_2 were observed. No sEMG differences were observed between conditions (VL- p = 0.24, VM- p = 0.33) or between interval 5 and 10. All BFR conditions resulted in a decrease in TOI from baseline. TOI was greater for all BFR conditions (70%BFR = -36.4 ± 21.9, 80%BFR = -40.4 ± 6.5, 90%BFR = -44.7±7.25)

compared to the non-BFR conditions (70% = +4.3 ± 20.2, 80% = +11.8 ± 5.5, 90% = +7.25). No differences in TOI between Δ50 (-36.93 ± 10.8) and any BFR conditions were observed. RPE was greater during 90%BFR (18.0 ± 0) and 80%BFR (17.1 ± 1.1) compared to 70% (11.3 ± 0.6) and 90% (13.0 ± 0). No differences were observed between 70%BFR (14.6 ± 0.6) and non-BFR conditions. **Conclusion:** This study demonstrated that cycling with the addition of BFR at an intensity equivalent to 70% of VT may provide a balance between physiological strain and perceived exertion.

1757 Board #7 May 30 3:45 PM - 5:45 PM

Muscle Oxygenation Patterns during a 20-km Time Trial with Intermediate Sprints and Recoveries.

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(No relevant relationships reported)

PURPOSE: Pacing strategies are necessary during endurance events in which the goal is to finish in as little time as possible. Both anaerobic and aerobic attributable sources of ATP are used during such efforts. Rating of Perceived Exertion (RPE) increases linearly as heart rate (HR) and power output (PO) increases, however these markers of intensity are not instantaneous. Near infrared spectroscopy (NIRS) allows for the measurement of local muscle oxygen saturation (SmO_2) which may respond to short-term fluctuations in PO. Previously, SmO_2 has shown a moderate correlation with oxygen consumption (VO_2) and HR during an incremental exercise. The purpose of this study was to determine how SmO_2 changes with increases in PO during a non-incremental cycling time trial (20-km) with various interspersed sprints and if decrements in PO due to shorter rest times were associated with lower SmO_2.
METHODS: Well-trained cyclists (n=9) (VO_{2max}=55.4±10.4 ml·kg^{-1}·min^{-1}; PO_{max}=305±45 W), habituated to 20-km trial, performed a self-paced 20-km time trial and two time trials with 1-km sprints imposed, separated by 2- or 4-km of self-paced cycling. SmO_2 saturation, PO, and HR were measured. RPE was recorded each kilometer. Pearson's partial correlations were used to analyze relationship between SmO_2 and PO. A one-way analysis of variance was used to determine if there were differences in finishing times between trials.
RESULTS: There was a significant inverse relationship between SmO_2 and PO during all time trials (r = -0.263, $P < 0.0001$). There was no significant difference ($p = .572$) between the finishing times amongst 20-km protocols.
CONCLUSIONS: This study revealed that the imposed sprints caused reciprocal changes in the extent of SmO_2 and PO that are larger than the changes in a self-paced time trial. In other words, as the subjects were instructed to significantly increase their PO to simulate a break-away, the SmO_2 decreased in a reciprocal manner.

1758 Board #8 May 30 3:45 PM - 5:45 PM

Living In Confinement Conditions: Physical Training Can Improve Muscular Oxygen Uptake and Heart Rate Kinetics

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(No relevant relationships reported)

PURPOSE: Inside the NASA Human Exploration Research Analog (HERA) facility the effects of 45 d of confinement in combination with restrictions for sleep and a defined physical training on muscular oxygen uptake ($V'O_2$musc) kinetics and cardiovascular regulation during exercise was investigated.
METHODS: To date, fourteen healthy individuals (5 females, 9 males, 37±7 y, 23±3 kg·m^{-2}) were analyzed 8 d before (MD-8), during and 4 d after (MD+4) a simulated Space mission. A cycle exercise test with pseudo-random binary work rate changes (WR) of 30 W and 80 W and an incrementally increasing step protocol (25 W min^{-1}) to assess peak oxygen uptake ($V'O_2$peak) was applied. Heart rate (HR) and mean arterial blood pressure (MAP) were measured beat-to-beat and pulmonary oxygen uptake ($V'O_2$pulm) breath-by-breath. $V'O_2$musc was estimated from HR and $V'O_2$pulm. Kinetics responses were assessed by maxima of the cross correlation function (CCFmax) between WR and the respective parameter indicate faster kinetics (Hoffmann et al., Eur J Appl Physiol 113:1745-1754, 2013). During the mission, exercise training sessions were scheduled every second day with a maximal HR restricted to below 85% of the age-related maximum. Sleep was restricted to 5 h per weekday and 8 h at the weekends. Differences in $V'O_2$peak and kinetics from MD-8 to MD+4 were calculated and correlated with the values measured at MD-8 using the Pearson test. Level of significance was set to $\alpha = 5\%$.
RESULTS: $V'O_2$peak differed not significantly (P=0.221) between MD-8 (37.8±5.8 ml min-1 kg-1) and MD+4 (38.9±4.6 ml min-1 kg^{-1}). Changes in CCFmax(HR) correlated significantly with CCFmax(HR) at MD-8 (r = -0.839, P < 0.001), changes in CCFmax(V'O2musc) correlated significantly with CCFmax($V'O_2$musc) at MD-8 (r = -0.641; P = 0.014) and the difference in V'O2peak correlated with $V'O_2$peak at MD-8 (r = -0.614; P = 0.019).
CONCLUSIONS: Exercise training during forty-five days of confinement in combination with sleep restrictions, may prevent from losses in cardio-muscular kinetics. Those individuals who started with slow kinetics or a low $V'O_2$peak benefited from the exercise training during the mission. The volume and/or intensity of the exercise training intervention might have been higher during the HERA C4 missions compared to most of the crew members' everyday life activities.

D-40 Thematic Poster - Combined Environmental Stressors

Thursday, May 30, 2019, 3:45 PM - 5:45 PM
Room: CC-102B

1759 **Chair:** James A. Pawelczyk, FACSM. *Penn State University, University Park, PA.*
(No relevant relationships reported)

1760 Board #1 May 30 3:45 PM - 5:45 PM

Erythropoietin Response to Endurance Exercise under Heat and Hypoxic Conditions

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(No relevant relationships reported)

Hypoxic training has been shown to improve aerobic capacity because hypoxia stimulates erythropoiesis due to increased erythropoietin (EPO) production. However, it takes several weeks to increase hemoglobin mass during endurance training in hypoxia. In the present study, we have focused on the combined effects of "hypoxia" and "heat stress" for EPO production. Considering that endurance exercise under heat condition augments plasma volume, hypoxic and heat conditions may promote additively erythropoiesis.
PURPOSE: The purpose of the present study was to determine EPO response to endurance exercise under heat and hypoxic conditions.
METHODS: Twelve healthy males (21.5±0.3 yrs, 168.1±1.2 cm, 63.6±2.0 kg) participated. They conducted a 60 min pedaling exercise at 60% of VO_{2max} under either "heat and hypoxic condition (H+H) " [fraction of inspiratory oxygen (FiO_2) :14.5%, 32℃], "hypoxic condition (HYPO) " (FiO_2:14.5%, 23℃) or "normoxic condition (NOR)" (FiO_2 :20.9%, 23℃). After completing the exercise, subjects remained in the chamber for 3 h to evaluate metabolic and endocrine responses during post-exercise. We evaluated changes in muscle oxygenation (using NIRS) during exercise, blood variables, percutaneous oxygen saturation (SpO_2), muscle temperature during exercise and 3 h of post-exercise.
RESULTS: The SpO_2 was significantly decreased both under H+H and HYPO (P<0.01). Blood lactate level increased during exercise (P<0.05), but with no difference between the three conditions. Serum growth hormone level significantly increased (P<0.01), and H+H showed significantly higher level compared with HYPO (P<0.05). Serum EPO level was significantly increased in both H+H and HYPO 3 h after exercise, but no difference was observed between the two conditions.
CONCLUSIONS: Serum EPO level was significantly increased with endurance exercise under hypoxic condition. However, heat stress during endurance exercise in hypoxia (heat and hypoxic condition) did not augment the EPO response.

1761 Board #2 May 30 3:45 PM - 5:45 PM

Neuromuscular Responses to Combined Heat Stress and Hypoxia During 20-km Cycling Time Trials

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(No relevant relationships reported)

The effect of combined heat stress and hypoxia on exercise performance may be dependent on the modality of exercise. In response to constant-work exercise, combined environmental stressors demonstrate an interaction effect on time to exhaustion; however, similar combined stressors have an independent influence on cycling time-trial (TT) performance. Investigation of the neuromuscular responses to combined environmental stressors may clarify the underlying mechanism(s) that

contribute to apparent task-specific responses. **PURPOSE:**To examine the isolated and combined effects of ambient temperature [cool (18°C, 20% rh) vs hot (35°C, 20% rh)] and inspired oxygen content [normoxia (F_iO_2 0.21) vs hypoxia ($F_iO_2$0.16)] on neuromuscular function in response to a cycling TT. **METHODS:**Five physically active male participants (23 ± 6 y) performed four 20-km cycling TTs in different environmental conditions [cool/normoxia (COOL); hot/normoxia (HOT); cool/hypoxia (HYPO); hot/hypoxia (H-H)]. Neuromuscular responses of the soleus, as indicated by changes in isometric MVC (iMVC), M-wave, twitch force (Q_{tw}), and voluntary activation (VA), were assessed prior to and following each time-trial. Linear mixed model analyses were used to examine the neuromuscular responses, with fixed effects for each condition and a random intercept for participants. **RESULTS:**Time-trial performance was impaired during HOT (2211±85s; 192±18W), HYPO (2213±122s; 192±27W), and H-H (2214±117s; 192±27W) compared to COOL (2090±54s; 221±14W, p≤0.02). Similar reductions in iMVC (-9.0±12.0%) and VA (-14.0±9.6%) were observed across all conditions (p<0.05); however, no significant differences were observed in M-wave (p=0.09) or Q_{tw}(p=0.43). **CONCLUSION:** Neuromuscular impairments following 20-km cycling TT are attributed to central mechanism(s) (i.e., VA); however, neuromuscular adaptations were similar in conditions where heat stress and hypoxia were combined, to conditions where each environmental stressor was examined in isolation.

1762 Board #3 May 30 3:45 PM - 5:45 PM

Physiological Responses to Repeated Sprint Exercise under Combined Heat and Hypoxic Conditions

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(No relevant relationships reported)

During sprint exercise in hypoxia, anaerobic energy supply is increased with augmented blood volume in muscle. Exposure to heat stress also increases anaerobic energy supply and blood volume in the muscle. Therefore, the combined treatments of "hypoxic exposure" and "heat stress" may cause further increases in above responses. **PURPOSE**: To determine the effect of combined heat and hypoxic conditions on physiological responses to repeated sprint exercise. **METHODS**: Ten male athletes (19.6 ± 0.3 yrs, 173.3 ± 2.2 cm, 71.6 ± 1.8 kg) completed repeated sprint exercise (three sets of 3 × 10 s maximal pedaling exercise) under four different conditions: [1] control condition (CON, 20 ℃, F_iO_2: 20.9 %,), [2] hypoxic condition (HYP, 20 ℃, F_iO_2: 14.5 %), [3] hot condition (HOT, 35 ℃, F_iO_2: 20.9 %), [4] combined hot and hypoxic conditions (HH, 35℃, F_iO_2: 14.5 %). Power output, muscle oxygenation in vastus lateralis [evaluated by near infrared spectroscopy (NIRS)], respiratory variables and arterial oxygen saturation (S_pO_2) were continuously monitored throughout the exercise. We also measured skin and muscle temperature, heart rate, and blood variables (blood lactate, glucose, pH, PO_2, PCO_2 levels). **RESULTS**: HYP and HH showed significantly lower average oxygen uptake (CON: 2.3 ± 0.1 L/min, HYP: 1.9 ± 0.1 L/min, HOT: 2.4 ± 0.1 L/min, HH: 2.0 ± 0.1 L/min) and average S_pO_2 (CON: 94.8 ± 0.6 %, HYP: 89.5 ± 0.5 %, HOT: 94.8 ± 0.5 %, HH: 89.5 ± 0.4 %) compared with CON and HOT (p<0.05). Muscle temperature was significantly higher in HOT and HH compared with CON and HYP throughout the exercise (p<0.05). Furthermore, HOT and HH presented significantly greater peak power output in the first set of the exercise compared with CON and HYP (p<0.05). No significant difference among trials was observed for changes in blood variables, and muscle oxygenation in vastus lateralis. **CONCLUSIONS**: Peak power output was higher in HOT and HH, although HH showed lower oxygen uptake and S_pO_2. These results suggest that combined heat and hypoxic conditions (HH) would cause greater power output than control condition in spite of decreased aerobic energy supply.

1763 Board #4 May 30 3:45 PM - 5:45 PM

Downhill Running: An Effective Countermeasure To Limitations Of Exercise In Acute Hypoxia?

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(No relevant relationships reported)

Exercise stress that results in increased expression of heat shock protein 72 (Hsp72) is linked to physiologic adaptations. Adaptations to one environmental stressor, such as heat, increase Hsp72 and induce cross adaptations to other stressors (i.e. hypoxia). Previously, two bouts of downhill running (DHR) conferred classic markers of heat acclimation (lower Tc, earlier onset of sweating). We sought to increase Hsp72 through repeated DHR to potentially expedite the acclimation process. **PURPOSE**: To analyze the effect of DHR on exercise performance in normobaric hypoxia.
METHODS: 8 males (23.8 ± 5.8 years, VO_{2max} 54.1 ± 5.1 ml kg^{-1} min^{-1}, 13.6 ± 5.2% body fat) performed two 45-minute DHR bouts (-12.5% grade) separated by 5-7 days in the speed that elicited V_T while running downhill. Pre and post blood samples were collected to quantify monocyte Hsp72. Muscle soreness (DOMS) was assessed 24 and 48 hours after each downhill bout using a Likert scale. Two normobaric hypoxic (16% FiO_2) 5 km time trials (TT) were performed: one before any DHR and one 5-7 days after the last bout. Hydration was assessed before the TT while blood lactate was measured pre and post TT. During the TT, heart rate, RPE and O_2 saturation (SaO_2) were recorded every 1 km. **RESULTS**: Monocyte Hsp72 showed no change across time (p=0.53). Specifically, basal concentration from DHR I to DHR II were not different (3.5 ± 2.3 to 2.9 ± 1.5 AU). TT performance was similar between conditions (1377 ± 192 ; 1364 ± 174 sec). Hydration (1.018 ± 0.007; 1.013 ± 0.009 urine specific gravity), RPE (14.9 ± 1.1; 14.6 ± 1.3), HR (178 ± 8;178 ± 8), and blood lactate (post TT1 11.6 ± 1.8; post TT2 12.0 ± 3.1 mM) were similar in both TTs. However, SaO_2 significantly increased from TT1 to TT2 (84.5 ± 4.0; 87.2 ± 2.3%, p<0.05). DOMS was significantly lowered 24 (5.1 ± 0.8 to 3.5 ± 1.4, p = 0.00) and 48 (4.6 ± 1.0 to 2.6 ± 1.5, p = 0.00) hours following the second DHR trial when compared to the first trial. **CONCLUSIONS**: While no change in Hsp72 or TT time were observed, this could be due to large variations found in the data with these variables. The increase in SaO_2 after DHR may improve exercise capacity at elevation during moderate exercise intensities.

1764 Board #5 May 30 3:45 PM - 5:45 PM

Heat Acclimation Mediated Crosstolerance In C2C12 Myotubes

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(No relevant relationships reported)

Background. Heat acclimation enhances animal and human tolerance during subsequent novel hypoxic stress exposure. This heat-acclimation-mediated crosstolerance (HACT) is attributed to shared cellular stress response pathways. Although skeletal muscle is the largest organ (by mass) in the mammalian body, to our knowledge no research has been conducted examining HACT in skeletal muscle cells. **Purpose**. The timecourse of HACT and the mechanisms behind this response were examined in differentiated C2C12 myotubes. **Methods**. Heat acclimation (HA) was established by heating (40°C) C2C12 myotubes for 6 consecutive days (2h/d). Control myotubes were maintained for the same duration under control conditions (37°C). Control and HA myotubes were subsequently challenged with Hypoxia (1% F_iO_2) or Hypoxia + LPS (1% F_iO_2 + 500 ng/ml LPS) for 2h. Cell lysates were collected immediately post (+0h) and 12h post (+12h) challenge. Western blot was used to assess protein markers of the heat shock response (HSR), inflammation, and apoptosis. Data were analyzed with two-way ANOVA with Newman-Keuls post-hocs. **Results**. HA myotubes exhibited increased phosphorylation of HSF-1 [+59%, p=0.03] and reduced phosphorylation of IKBα [-56%, p=0.01) at +0h. Control myotubes exhibited reduced SIRT1 at +0h following challenge with Hypoxia [-36%, p=0.04] and Hypoxia + LPS [-47%, p=0.02]. By +12h Control myotubes that had been challenged with Hypoxia or Hypoxia + LPS exhibited increased phosphorylation of HSF-1 [+86%(p<0.01) and +77%(p<0.01); respectively] and HSP70 content [+158%(p<0.01) and +153%(p=0.04); respectively]. However, these changes occurred too late to afford cytoprotection, as Control myotubes that were challenged with Hypoxia + LPS also exhibited increased TLR4 (+77%, p=0.01) and NFκB (+117%, p=0.03), in conjunction with elevated phosphorylation of JNK [+55%, p=0.03] and Caspase 3 content (+25%, p=0.02). **Conclusion.** We present evidence of HACT in C2C12 myotubes. We speculate that through elevations in SIRT1 and activation of the HSR, HA confers lower inflammatory and apoptotic drive in skeletal muscle cells. We note that HACT is not evident until +12h following challenge, suggesting studies that do not follow an extended timecourse for cell lysate collection could potentially miss benefits associated with this response.

D-41 Thematic Poster - **Energy Metabolism and Health**

Thursday, May 30, 2019, 3:45 PM - 5:45 PM
Room: CC-104B

1765 **Chair:** Tanya M. Halliday. *University of Utah, Salt Lake City, UT.*
(No relevant relationships reported)

1766 Board #1 May 30 3:45 PM - 5:45 PM

Pre-intervention Endothelial Function and Hyperglycemia Modifies Flow-mediated Dilation Following Short-term Exercise Training in Adults with Prediabetes

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Purpose: Impaired glucose tolerance (IGT) elevates type 2 diabetes and cardiovascular disease (CVD) risk above and beyond impaired fasting glucose (IFG) alone. Hyperglycemia can impair endothelial function through increased inflammatory responses. However, it is unknown whether exercise training vascular function differently among prediabetes phenotypes. We examined whether improvements in endothelial function following 2-wks of aerobic training is affected different in adults with IFG+IGT compared to those with IFG alone. **Methods:** Middle-aged, obese adults with IFG (n=11 , 58.3±9yrs; 34.2±7.9 kg/m^2; FPG: 106.5±6.1mg/dl, 2-hr glc: 127.0±31.7mg/dl) and IFG+IGT (n=13, 61.6±8.1yrs; 32.8±3.1 kg/m^2; FPG: 104.2±10mg/dl, 2-hr glc: 162.2±29.6mg/dl) were randomized to 12-work matched cycling aerobic exercise bouts (~70% HRpeak, 60 min/d) over 2-wks. A 2-hr 75g OGTT was performed pre and post-intervention to determine glucose tolerance. Endothelial function was determined by brachial artery flow mediated dilation (FMD) prior to the OGTT. Aerobic fitness (VO_2peak), body composition (BIA), and vascular inflammation (VCAM, ICAM) were also assessed before and after training. **Results:** Training significantly increased VO_2peak (P=0.03), fat-free mass (P= 0.001) and VCAM (P=0.01) in both phenotypes. There was no effect of training on FMD in either IFG+IGT or IFG (0.33±3.9 vs. 1.13±4.7%, P=0.66 respectively). However, pre-intervention FMD (r=-0.45, P=0.04) and glucose total area under the curve (r=-0.56, P=0.007) were associated with increased FMD in response to training. Moreover, increased FMD adaptation was linked to decreased circulating VCAM after training (r=-0.52, P=0.02). **Conclusion:** These data highlight that impaired endothelial function and hyperglycemia prior to exercise treatment may affect improvements in endothelial function following short-term training in people with different prediabetes phenotypes. The mechanism by which people with prediabetes respond to exercise-induced vascular adaptation may relate to reduced vascular inflammation and warrants further investigation.

1767 Board #2 May 30 3:45 PM - 5:45 PM

Low-Calorie Diet With or Without Interval Exercise Reduces Post-Prandial Aortic Waveform in Obese Women

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(No relevant relationships reported)

Purpose: Arterial stiffness is considered a strong predictor of cardiovascular disease (CVD). Women have higher values of arterial stiffness than men, suggesting that females are at a greater risk of heart-related complications. While a low calorie diet (LCD) reduces arterial stiffness, in part through lowering metabolic syndrome (MetS) risk factors and/or increasing insulin sensitivity, no study has tested if interval exercise (INT) adds to the benefit of LCD on arterial stiffness in obese women. **Methods**: Twenty-four obese women (49.2 ± 2.4yrs; 37.9 ± 1.3kg/m^2) were randomized to LCD (n=12; mixed meals of ~1200 kcal/d) or LCD+INT (n=12; 60 min/d of supervised INT at 90% HR_{peak} for 3 min and 50% HR_{peak} for 3 min). An additional 350kcal was provided to LCD+INT post-exercise to equate energy availability between groups. Augmentation index (AIx, systemic aortic waveform adjusted for heart rate of 75 bpm) and carotid-femoral pulse-wave velocity (cfPWV, central index) were measured during a 75g OGTT before and after the intervention to assess arterial stiffness. MetS risk severity (z-scores) and insulin sensitivity (Si; simple index of insulin sensitivity) were also measured. **Results:** LCD+INT increased VO_2peak (L/min) and HDL compared to LCD (P=0.03 and P=0.04, respectively). However, both interventions decreased body fat, fasting SBP, TG, total cholesterol, MetS severity and LDL (all P<0.01) as well as improved Si (P=0.03). Despite no effect on fasting AIx (LCD: -3.2 ± 3.2 vs. LCD+INT: -2.7 ± 3.8%, P=0.32) or cfPWV (LCD: -0.22 ± 0.54 vs. LCD+INT: 0.73 ± 0.83 m/s, P=0.76), LCD and LCD+INT decreased AIx $tAUC_{120min}$ (-662.5 ± 263.3 vs. -801.0 ± 286.5, P=0.04, respectively). Pre AIx_{0min} correlated with pre fasting DBP (r=0.40, P=0.04) and decreased AIx_{0min} (r=-0.45, P=0.03). Further, this decreased AIx_{0min} correlated with increased Si after treatment (r=-0.44, P=0.03). **Conclusion:** Independent of exercise, LCD reduces post-prandial aortic waveform and MetS severity in obese women. Decreased systemic arterial stiffness appears to be related to insulin sensitivity following reduced energy availability, given no effect on cfPWV. Further work is warranted to determine how dietary manipulation, with and without exercise, impacts fasted vs. post-prandial arterial stiffness to optimize CVD risk reduction.

1768 Board #3 May 30 3:45 PM - 5:45 PM

Effects of Exercise Modality on Glycemic Control After 6 Weeks of Training in Middle Aged Men

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BACKGROUND: Glycemic control is impaired with age and is accompanied by an age-related decline in muscle mass. Regular exercise maintains muscle mass and improves glycemic control. Whether the mode of exercise training differentially affects glycemic control during middle-age is unknown.
PURPOSE: To investigate changes to glycemic control after a 6 week exercise training program in inactive, middle-aged men with overweight/obesity.
METHODS: Thirty-five men (39.6 ± 2.4 y, BMI: 28.8 ± 3.7 kg/m^2; mean ± SD) enrolled in a 6-week training study and were randomly stratified (by lean body mass) to one of three training groups (endurance cycling (END, n=12); high intensity interval cycling training (HIIT, n=12); resistance training (REX, n=11)) in a parallel groups design. Two-hour OGTTs were conducted as secondary analyses on two occasions (pre and post intervention) and total AUC (trapezoid method) was calculated. Statistical analyses were performed using linear mixed models (group × time), with significance set at P<0.05.
RESULTS: For glucose variables, there were no differences between groups at baseline (fasting glucose: 5.2 ± 0.6 mmol/L; AUC: 13.7 ± 3.2 mmol/L/h). A main effect of time for lower post-intervention total AUC glucose was observed (-0.7 ± 2.0 mmol/L/h, P=0.043). Fasting glucose concentrations showed a group × time interaction (P=0.008) where REX training increased fasting glucose levels post-training (+0.4 ± 0.5 mmol/L, P=0.005). Training modality had a similar effect on fasting insulin or total insulin AUC. However, a main effect of time was observed for the reduction in total AUC insulin from pre to post intervention (-15 ± 42 mIU/mL/h, P=0.046).
CONCLUSIONS: Regardless of modality, exercise training for 6 weeks induced improvements in total glucose and insulin AUC measures in response to an OGTT in middle-aged men with overweight/obesity. The small improvements in glycemic control are likely related to the normal glycemic tolerance at baseline. Future investigations of exercise modality should be performed in individuals with abnormal glucose tolerance to determine if exercise modality is an important factor in improving glycemic control.
ACKNOWLEDGEMENTS: This study was funded by ACURF grants to Dr Camera and Dr Parr.

1769 Board #4 May 30 3:45 PM - 5:45 PM

Effect of Exercise Training Intensity on Glycemic Control in Older Adults with Prediabetes

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INTRODUCTION: Older adults have the highest rates of prediabetes and diabetes in the US. Exercise is a well-established method to improve glycemic control, however, the optimal dose (duration and intensity) of exercise required to improve glycemic control among older adults is unclear. **PURPOSE:**To compare the effect of 12 weeks of moderate vs. high intensity exercise training on daily glycemic control in older adults with prediabetes. **METHODS**: 15 older adults (66.4 ±5.1 yrs) with prediabetes (HbA1c 5.7-6.4% or fasting glucose 100-125 mg/dl) participated in a 12-week supervised aerobic exercise training intervention. Participants were screened prior

to being randomized to the moderate (MOD: 60-65% HR_{max}) or vigorous (VIG: 80-85% HR_{max}) intensity training group. During the intervention, participants exercised 4 days per week (45 minutes/session) in their target heart rate range. Continuous glucose monitors (CGM) were worn for 1 week at baseline and during the 12thweek of supervised exercise training. Daily glycemic control was quantified over 24 hour periods (00:00 to 23:29) for each day the CGMs were worn during the week at baseline and after exercise training. We calculated mean, total area under the curve (trapezoidal method), and duration of hyperglycemia (percent time glucose ≥140mg/dL). Using linear mixed models with repeated measures, we determined the effect of exercise training and whether the effect of training varied by exercise intensity group. Significance was set at $p < 0.05$. Data are reported as mean±SD. **SUMMARY OF RESULTS**: There were no significant differences in any baseline participant characteristics (e.g. sex, age, BMI) between exercise training groups. At baseline, VIG had significantly lowermean (MOD: 136.0 ±18.4; VIG: 122.6 ±7.4 mg/dL), total area under the curve (AUC) (MOD: 3243.0 ±505.1; VIG: 2873.4 ±226.2 mg*hr/dL), and duration of hyperglycemia (MOD: 38.5 ±28.6%; VIG: 19.9 ±9.6%). After the intervention, there were no significant changes in mean glucose, AUC, or duration of hyperglycemia in either group. **CONCLUSION:** Regardless of exercise intensity,12 weeks of aerobic exercise training did not significantly change daily glycemic control in older adults with prediabetes, suggesting that changing other lifestyle factors may be needed to improve glycemic control in this population.

1770 Board #5 May 30 3:45 PM - 5:45 PM

Nutritional Intervention Increases the Likelihood of Menses in Exercising Women with Menstrual Disturbances

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Exercising women in whom energy intake is inadequate for energy expenditure develop low energy availability (EA) and are at risk for menstrual disturbances and poor bone health. The first line of treatment is an increase in energy intake to reverse low EA. REFUEL is the first randomized controlled trial (RCT) to assess the effectiveness of 12 months of increased energy intake on menstrual function and bone health in women with exercise-associated menstrual disturbances (EAMD).
Purpose: To determine if an intervention of increased energy intake improves menstrual regularity among women with EAMD.
Methods: Young, exercising women with EAMD were randomized into two groups. The treatment group (EAMD+Cal, n=32) increased energy intake 20-40% above baseline energy needs; whereas, the EAMD Control group (n=30) maintained exercise and eating habits. Menstrual function was tracked throughout the intervention with menstrual calendars and daily urine samples for reproductive hormones. A conditional recurrent events Cox Proportional Hazards model tested the effects of the intervention.
Results: The EAMD+Cal women (21.6 yrs, BMI: 20.2 kg/m^2) increased energy intake by 353 kcal/day ($p<0.001$ vs. Control) and gained 1.9 kg of body weight ($p=0.035$ vs. Control), which corresponded with a 1.2 kg increase in fat mass ($p=0.080$ vs. Control) and 64% increase in leptin ($p=0.074$ vs. Control); whereas, the EAMD Controls (20.9 yrs, BMI: 21.3 kg/m^2) had no change in energy intake (-32 kcal/day) and minimal change in body weight (0.8 kg), fat mass (0.4 kg), and leptin (21% increase). After controlling for BMI and menstrual status at baseline, the intervention had a positive effect on the likelihood of experiencing menses vs. the Control group ($p<0.001$). Women in the EAMD+Cal group were twice as likely (104% increase) to experience menses during the intervention than those in the EAMD Control group.
Conclusions: Exercising women with EAMD who moderately increased energy intake were twice as likely to experience menses vs. EAMD women who maintained their usual exercise and eating habits. The intervention was associated with a modest increase in body weight. This study is the first RCT to demonstrate the effectiveness of a nutritional intervention for the improvement of menstrual function in women with EAMD.
Supported by US DoD (PR054531)

1771 Board #6 May 30 3:45 PM - 5:45 PM

Sensitivity And Specificity Of Resting Metabolic Rate Measures To Predict Exercise Associated Menstrual Disturbances

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Energy deficiency in exercising women can lead to menstrual disturbances (MD). There is no gold standard to accurately estimate energy deficiency. Ratios of measured to predicted resting metabolic rate (RMR) have been used as a proxy to categorize women as energy deficient. **PURPOSE:** To evaluate whether measured to predicted RMR ratios are predictive of amenorrhea or other MD. **METHODS**: We performed a cross-sectional comparison of 223 exercising women (≥2 hrs/wk, age 18-35 years, BMI 16-30 kg/m^2) who were ovulatory (OV), amenorrheic (AMEN), or subclinical MD (sMD) (including oligomenorrhea, anovulation, and luteal phase defects). Menstrual status was determined using urinary measures of reproductive hormones and menstrual calendars. Body composition was measured with DXA and RMR with the SensorMedics Vmax. Harris-Benedict, Cunningham, and DXA equations were used to calculate predicted $_{HB}$RMR, $_{C}$RMR, and $_{DXA}$RMR and to calculate the measured to predicted RMR ratio. ANOVA and Kruskal-Wallis tests determined group differences and logistic regression determined predictors of AMEN or any MD. Calculations of sensitivity, specificity and positive predictive value (PPV) assessed accuracy of predictions. **RESULTS**: Groups did not differ in lean or fat free mass. AMEN had lower body mass ($p<0.01$) than sMD, and lower BMI, percent body fat, fat mass ($p<0.001$) and measured RMR (1172 ± 21 kcal/d) ($p<0.05$) than OV (1227 ± 20 kcal/d) and sMD (1233.68 ± 17 kcal/d). $_{HB}$RMR was lower in AMEN (1402± 8 kcal/d) vs sMD (1434 ± 9 kcal/d) ($p<0.05$). $_{C}$RMR ratio (0.84 ± 0.01) was lower in AMEN vs OV (0.88 ± 0.01) ($p<0.05$), but $_{DXA}$RMR ratio (0.90 ± 0.01) was lower in AMEN vs both OV (0.96 ± 0.01) and sMD (0.95 ± 0.01) ($p<0.01$). Each ratio predicted AMEN ($_{HB}$RMR: $\chi^2=4.822$, $p<0.05$; $_{C}$RMR: $\chi^2=8.708$, $p<0.01$; $_{DXA}$RMR: $\chi^2=14.068$, $p<0.001$), but only $_{DXA}$RMR ratio predicted any MD ($\chi^2=6.795$, $p<0.01$). $_{DXA}$RMR ratio correctly identified the most women with AMEN (ppv=0.5; sensitivity= 0.49, specificity= 0.74) and with any MD (AMEN+sMD: ppv=0.75; sensitivity= 0.39, specificity= 0.75). **CONCLUSIONS**: Each ratio may be used to predict AMEN, but only $_{DXA}$RMR significantly predicts MD, regardless of severity. Similarly, $_{DXA}$RMR ratio correctly identified the most subjects. $_{DXA}$RMR ratio can be utilized to correctly identify women with AMEN or MD secondary to energy deficiency.

1772 Board #7 May 30 3:45 PM - 5:45 PM

Effect of Interval Exercise Plus a Low-Calorie Diet on Endothelial Function in Obese Women

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PURPOSE: Low caloriediet (LCD) and interval exercise (INT) both improve endothelial dysfunction, in part, by reducing hyperglycemia. Whether adding INT to LCD raises endothelial function compared with LCD under energy available matched conditions though is unknown. **METHODS**: Obese women (47.2±2.6y, 37.5±1.3kg/m^2) were randomized to 2-wks of a LCD (n=12; mixed meals of 1000-1200kcal/d) or LCD+INT (n=13; 60min/d of supervised INT at 90% and 50% $HR_{peak}$for 3 min each). LCD+INT subjects received 350kcal post-exercise to equate energy availability with LCD. A 75g OGTT was performed pre- and post-test to examine fasting, 1 and 2h large conduit artery endothelial function (FMD; flow mediated dilation) and substrate use (respiratory exchange ratio (RER) via indirect calorimetry) as well as glucose and insulin incremental area under the curve (iAUC) and insulin sensitivity (IS; Matsuda Index). Fitness (VO_2peak), body composition (BodPod), and vascular inflammation (VCAM, ICAM) were also determined. **RESULTS**: LCD+INT increased VO_2peak ($P=0.02$) compared to LCD, and both treatments improved fat mass ($P<0.001$), IS ($P=0.02$), and ICAM ($P=0.002$). LCD+INT and LCD had no effect on fasting or iAUC FMD, but there was notable variation. In fact, low baseline fasting and iAUC FMD was linked to enhanced fasting and iAUC FMD post-treatment (r=-0.71, $P<0.001$; r=-0.89, $P<0.001$, respectively). When comparing subjects who increased fasting endothelial function after each treatment (>50%; LCD n=5, LCD+INT n=7), LCD+INT increased fasted FMD more than LCD (6.3 vs. 2.8%, P=0.04), and LCD+INT attenuated FMD iAUC compared to LCD (-499.3 vs. 64.6%, P=0.02). Enhanced fitness related to increased fasting FMD (r=0.43, P=0.03) and attenuated FMD iAUC (r=-0.44, P=0.03). Attenuated FMD iAUC correlated with reduced glucose iAUC (r=0.55, P=0.004), as well as increased fasting and 1h RER (r=-0.55, P=0.004 and r=-0.42, P=0.04, respectively). **CONCLUSIONS**: There was large FMD variation post-treatment. However, INT enhanced the effect of LCD on fasting FMD in those with low endothelial function, and this was mirrored by low post-prandial FMD stimulation. Low post-prandial FMD was linked to improved glucose tolerance and carbohydrate metabolism, suggesting INT enhanced nutrient delivery and utilization to lower type 2 diabetes and CVD risk.

1773 Board #8 May 30 3:45 PM - 5:45 PM

Effect Of Diurnal Exercise Timing On Postprandial Glucose Responses: A Randomized Controlled Trial

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PURPOSE: Postprandial exercise has been shown to reduce postprandial glucose (PPG) response to a greater degree than preprandial exercise, suggesting an important yet under-acknowledged role for exercise timing on glycemic control. Whether diurnal timing of exercise imparts additional benefits on PPG responses remains unclear. This study aimed to determine the diurnal effect of exercise timing on PPG response in individuals enrolled into a 12-week supervised multi-modal exercise training program.
METHODS: Forty sedentary overweight individuals (17 males, 23 female; age: 51 ± 13 years; BMI: 30.9 ± 4.2 kg/m2) with (n = 20) or without T2DM diagnosis were randomly allocated to either a morning (amEX) or evening (pmEX) exercise training group. All participants completed the 12-week supervised multi-modal exercise training program (3 days per week), which consisted of 30 minutes of aerobic exercise (walking protocol) and 4 resistance-based exercises (3 sets of 12-18 repetitions). The amEX and pmEX training sessions occurred in the postprandial state between 0700-0900h and 1700-1900h, respectively. Changes in postprandial glucose (PPG) and insulin (PPI) responses, during a mixed meal tolerance test (MMTT) were the primary outcome measures of the study assessed at baseline and post-intervention at 12 weeks. All data is displayed as mean differences ± SD.
RESULTS: Exercise training reduced (main effect of time, $p < 0.01$) PPG and PPI concentrations during the MMTT, with no group differences observed ($p = 0.69$). A significantly greater reduction in PPG-iAUC was observed for the pmEX group (-78.56 mmol/L) when compared to the amEX group (-33.22 mmol/L) at post-intervention ($p = 0.03$). Reductions in PPI iAUC (main effect of time, $p < 0.01$) were observed at post-intervention, with no group differences reported ($p = 0.18$)
CONCLUSIONS: Irrespective of the diurnal timing of exercise performance, 12-weeks of multi-modal exercise training significant improved PPG and PPI responses in both overweight non-T2DM and T2DM individuals.

D-42 Thematic Poster - Head Impacts and Concussion

Thursday, May 30, 2019, 3:45 PM - 5:45 PM
Room: CC-101B

1774 **Chair:** James Onate. *Ohio State University, Columbus, OH.*

(No relevant relationships reported)

1775 Board #1 May 30 3:45 PM - 5:45 PM

A Comparison of Head Impacts in Boys and Girls High School Lacrosse

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Purpose: The purpose of this study was to compare the number and severity of head impacts between high school varsity girls and boys lacrosse players. **Methods:** Twenty-four subjects (13 girls, 9 boys) were individually assigned a wearable sensor (gForceTracker) for one season to measure the number of head impacts and the corresponding linear and angular acceleration. The sensor was fixed via headband (girls) or attached via dual lock strip onto the inside of a helmet (boys). A total of 21 (10 practices, 11 games) events for girls and 16 (11 practices, 5 games) events for boys were monitored. A 10g threshold was used and false impacts were removed by observing the events. Previously established correction equations were applied to raw data. Data were analyzed by t-test ($p<0.05$). Institutional review board approval was received. **Results:** Boys experienced 33% more impacts per AE compared with girls, while girls had a higher average PLA than the boys ($p =0.007$). There were a wide range of impacts per AE when examining individual athletes. The female athletes ranged from 0-12 impacts per AE, while the range for males was 3-20 impacts per AE. The majority of the impacts recorded were below 20 g for both boys and girls across either event. Surprisingly, a higher percentage of impacts were below 20 g for games when compared with practices for both girls (75% vs 56%) and boys (73% vs 69%). Girls experienced more impacts above 90 g than boys across either event. **Conclusion:** Female athletes in similar or same sports sustain more concussions than males. The reason for this is unclear. Few studies have directly compared the number of impacts and head acceleration in boys and girls sports at the high school level. One previous study compared boys and girls hockey and also found that boys had a higher number of impacts but girls had a slightly higher average PLA, which is similar to our findings.

	Boys	Girls	P-val
Number Of Impacts Per Athletic Event			
Total	9.7	3.5	
For Games	9.1	4.4	
For Practices	9.9	2.5	
Peak Linear Acceleration (g)			
Total	19.6	21.1	0.007
For Game	19.4	20.1	0.327
For Practice	19.7	23.6	<0.001
Peak Angular Acceleration (rad/s²)			
Total	1208.3	1166.2	0.217
For Game	1089.2	1059.5	0.636
For Practice	1327.3	1442.5	0.435

1776 Board #2 May 30 3:45 PM - 5:45 PM

Evaluation of Concussion Prediction with Head Impact Density by Receiver Operating Characteristic

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(No relevant relationships reported)

PURPOSE: Head impact density has previously been introduced as a novel metric to evaluate the concussive risk of a series of head impacts. The originally proposed head impact density was calculated by summing the magnitude of a given impact divided by the time from the previous impacts for each of the 20 previous impacts. However, because the 20 previous impacts may occur over multiple days, this study computes density as the sum of head impact magnitudes divided by time since the previous impact for all impacts on a single day. The purpose of this study is to evaluate the predictiveness of a daily impact density and other head impact metrics using a receiver operating characteristic curve.
METHODS: 185 high school football players (n =185, age 16.3 ± 0.8 years, 180.8 ± 8.1 cm, 85.0 ± 18.3 kg) were outfitted with a head impact telemetry system that measured the magnitude, number, and location of head impacts sustained during all games and practices over a course of a football season. From the telemetry system, peak linear acceleration (PLA), peak rotational acceleration (PRA), kinematic impulse, daily PLA impact density, and daily PRA impact density were computed. A support-vector binary classifier (SVC) was fit to the data to predict whether or not a player had sustained a concussion on the given day. Receiver operating characteristic (ROC) and corresponding area under ROC (auROC) was computed using k-fold cross-validation with 5 folds.
RESULTS: Best auROC of 0.75 ± 0.11 was obtained using sum peak linear accelerations (PLA) for the day of impact, sum of peak rotational accelerations (PRA) for the day of impact, PLA impact density for the day, PRA impact density for the day, and the kinematic impulse density for the day as predictors. Despite a moderate auROC, the model's positive predictive value (PPV) was only 0.01 (f1-score = 0.02).
CONCLUSIONS: Prior work has shown that density based head impact metrics are correlated with the concussion risk. Nevertheless, a binary classifier based only on head impact metrics was not able to provide a high level of PPV (i.e., precision). While head impact metrics are likely important to predicting concussion risk, this work adds to a growing body of evidence that neither individual hit characteristics nor the characteristics of a series of hits are reliable predictors of concussion.

1777 Board #3 May 30 3:45 PM - 5:45 PM

Head Impact Biomechanics in Youth Flag Football: An Exploratory Analysis

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(No relevant relationships reported)

Youth flag football has been proposed as a safe alternative to tackle football due to rising concerns of neurodegeneration from repetitive blows, but the true head impact (HI) burden in youth flag football is unknown.
PURPOSE: To examine overall and age-specific HI exposure and magnitude in youth flag football.
METHODS: Five youth flag football teams (n = 35, age = 8.5 ± 1.1 yrs, height = 138.5 ± 10.5cm, mass = 35.3 ± 8.8kg) comprised of two age groups (7-8Us and 9-10Us) wore HI sensors (Triax Sim-G) during practice and game sessions over one season. Sensors recorded HI frequency, linear (g), and rotational acceleration (rad/s^2). Athlete exposure was calculated as one player participating in one practice or game session. Impact rates (IR) were calculated as impacts per 10 athlete exposures. Impact rate ratios (IRR) compared session type and age groups. Acceleration values were placed into low- and high-magnitude categories via median splits. Magnitude category frequencies were compared between age groups using χ^2 tests ($p<0.05$).
RESULTS: We observed 203 overall flag football HIs (127 game, 76 practice; 5.8 impacts/player; 0.56 impacts/exposure). Overall median linear acceleration was 32.7g (16.0g - 100.9g) and angular acceleration was 4,300 rad/s^2 (1,000rad/s^2 - 12,500rad/s^2). 90th percentile accelerations were 63.0g and 8,400 rad/s^2 during games and 49.5g and 8,200 rad/s^2 during practices. Players experienced significantly higher IRs during practices than games (IRR = 1.54, 95% CI: 1.16-2.05). There were no age group HI differences overall (IRR = 1.12, 95% CI: 0.83-1.51) or for games (IRR = 1.15, 95% CI: 0.80-1.64). Practices resulted in 1.80 times the IR (95% CI: 1.02 - 3.17) in the 9-10Us compared to the 7-8Us. No significant associations between age groups were observed for low- and high-magnitude HIs for linear ($p = 0.73$) or angular acceleration ($p = 0.32$).
CONCLUSIONS: Flag football players experienced a low-frequency of HIs and relatively high-impact magnitudes, but whether high-frequency or magnitude HIs contribute to neurodegeneration is unknown. Practices had greater odds for HI frequencies than games, suggesting practice modifications can further decrease total HI. The 9-10Us experienced greater HI frequencies, potentially indicating more aggressive or risky game play with age.

1778 Board #4 May 30 3:45 PM - 5:45 PM

Effect Of A Dynamic Dual-Task Paradigm And Concussion History On Motor And Cognitive Performance

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(No relevant relationships reported)

Prior to and following a concussion, athletes exhibit deficits in gait and cognitive performance between single-task (ST) and dual-task (DT) paradigms. Current motor tasks used in these divided attention paradigms may not be challenging enough to detect long-term changes following injury. **PURPOSE**: To determine if differences exist between ST and DT paradigms while performing a multi-directional gait task and Stroop test. **METHODS**: Fifteen male Big Ten Universities Rugby Conference athletes (20.53±1.60 yrs; 1.76±0.10 m; 86.11±9.47 kg) and 17 male American Collegiate Hockey Association athletes (20.06±1.75 yrs; 1.79±0.07 m; 85.96±10.25 kg) volunteered to participate. Two tasks were performed: 1) recite the color of the Stroop stimulus and 2) walk around a 3.05 x 3.05 m (10 x 10 ft.) box while maintaining forward gaze. Tasks were completed independently (ST) and concurrently (DT). Attempted responses were calculated as a percentage of attempted out of total possible responses (56 stimuli). The number of incorrect responses were calculated as ([incorrect responses / attempted responses]*100). Dual-task effect (DTE) was calculated as [(DT performance – ST performance) / DT performance * 100] for box distance and attempted responses. A paired samples t-test was performed to determine if differences in DTE existed between motor and cognitive performance. For all remaining outcome variables, 2 (paradigm) x 2 (concussion history) mixed-model ANOVAs were performed. Alpha level was set *a priori* at $p<0.05$. **RESULTS**: Participants walked a shorter distance under DT (10.49 m) compared to ST (11.66 m) ($p<0.01$). Athletes with a concussion history had a higher percentage of incorrect responses (2.73%) compared to those without a history of concussion (0.58%) ($p=0.01$). There were no differences in attempted responses between paradigms ($p=0.38$) or concussion history ($p=0.66$). DTE for box distance (-12.45%) and attempted responses (-3.80%) DTE were different ($p=0.02$). **CONCLUSIONS**: Motor and cognitive differences existed under a DT paradigm whereby DT elicited a greater degree of change from ST for motor performance than cognitive performance. Establishing a normative healthy DT baseline performance is warranted to better inform clinicians on appropriate return-to-play decisions following injury.

1779 Board #5 May 30 3:45 PM - 5:45 PM

The Relationship of Nonlinear Metrics of Postural Control Following Sport Related Concussion

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(No relevant relationships reported)

Postural control is a cardinal sign of sport-related concussion (SRC) and can be quantified via center of pressure (CoP) data using linear and nonlinear metrics. Recently, nonlinear metrics such as approximate (ApEn), sample (SampEn) and complexity index (CI) have been proposed as methods of analyzing the neurological organization or health of the postural control system. This is partially due to the properties of the signals being analyzed. Currently, research is divided about which of these nonlinear metrics are appropriate to use to quantify postural control deficits in neurological disorders, such as (SRC). However, these metrics have not been compared within the same sample of SRC. **PURPOSE:** The purpose of this study was to examine the relationship between ApEn, SampEn, and CI in a group of healthy match controls (CON) and sport-related concussion (SRC). **METHODS:** Sixteen Division 1 athletes with SRC and 16 CON performed 3 trials of feet together quiet upright stance in the eyes open (EO) and eyes closed (EC) conditions for 30 seconds on a force platform (100Hz) at 24-48 hours post-injury. SRC was diagnosed by the head team physician and verified by the presence of 2 or more vestibular/ocular symptom scores on Vestibular Ocular Motor Screening (VOMS) test. CON data were collected at pre-participation physicals. Raw CoP data were analyzed using ApEn and SampEn (m=2, r=0.2, N=300), and MSE (m=2, r=0.15, S=1-10, N=300-3,000). The data were analyzed using independent samples t-tests and Pearson's Product Correlations. **RESULTS:** A significant decrease in ApEn ($p=0.024$; SRC=0.59±0.11, CON=0.68±0.10 Cohen's d= 0.86) SampEn ($p=0.022$; SRC=0.65±0.14, CON=0.76±0.13, Cohen's d= 0.81), and MSE ($p=0.025$; SRC=41.86±8.79, CON=48.69±7.55, Cohen's d= 0.83) was noted in the EC AP direction for SRC. No other significant differences were noted. A significant relationship was noted between ApEn and SampEn ($p<0.001$, $r=0.99$), ApEn and MSE ($p<0.001$, $r=0.99$), and SampEn and MSE ($p<0.001$, $r=0.99$) in the EC AP direction for both SRC and CON. **CONCLUSION:** These results may indicate that ApEn, SampEn, and MSE are highly related to one another and may be viable in determining deficits postural control following SRC.

1780 Board #6 May 30 3:45 PM - 5:45 PM

Baseline Postural Control Measures: An Indicator For Increased Injury Frequency Following Sport-related Concussion

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Recent research indicates that within 1 year following sport-related concussion (SRC), those who have experienced a SRC are 1.97 to 3.5 times more likely to sustain an acute lower extremity (LE) injury with a risk rate that ranges from 2.88 to 6.22 per 1000 athlete exposures. These studies suggest that an association between SRC and LE injury exists, however, no known research has examined the potential cause. It has been suggested that lingering postural control deficits as a result of SRC, may play a role in the increased prevalence of injury. **PURPOSE**: The purpose of this study was to investigate the potential relationship between baseline postural control metrics and acute LE injury frequency in NCAA Division I athletes with a prior history of SRC. **METHODS:** Eighty-four NCAA Division I athletes (42 with a history of SRC [CONC]; 42 without a history of SRC [CTRL]) performed three trials of 30 seconds eyes open (EO) and eyes closed (EC) quiet upright stance during pre-participation baseline screening on a force platform (1000Hz). Acute LE injuries were prospectively tracked for a single athletic season following baseline. Raw center of pressure (CoP) data were further analyzed using a custom MATLAB code to obtain Root Mean Square (RMS), Mean Velocity (MEV), and Multiscale Entropy's Complexity Index (CI) for both anteroposterior (AP) and mediolateral (ML) directions. **RESULTS:** The results indicated that over the course of the season, 27.4% of the athletes reported an injury (CONC = 15, CTRL = 8 injuries) with a significant association between prior SRC history and incidence of injuries ($p=0.043$, relative risk=1.88 [CI_{95} – 1.09, 3.95]). In EO condition, RMS ($p=0.049$; CONC=5±0.28mm, CRTL=4.1±0.22mm: Cohen's d=3.6) and CI ($p=0.021$; CONC=10.25±0.52, CRTL=11.80±0.57: Cohen's d=2.9) in

the ML direction were significantly different between groups. Furthermore, in the EC condition, CI (p=0.026; CONC=14.08±0.63, NORM=15.93±0.52: Cohen's d=3.2) in the ML directions was significantly different between groups. No other significant differences were observed. **CONCLUSION:** These results indicate that a prior history of SRC is associated with a greater incidence of LE injury and postural control differences can be detected prior to injury occurrence using postural control variability.

1781 Board #7 May 30 3:45 PM - 5:45 PM

Laboratory Validation Of A Head Impact Sensor For Use In Water Polo And Non-helmeted Land Sports

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Repetitive head impact exposure can result in brain injury, and impact sensors are increasingly being used to quantify head impact kinematics and patterns of risk in sports. Water polo is a contact sport that carries a risk of head impact from the ball and contact between players. However, monitoring head impacts presents a challenge since the sensors must be waterproof and small enough to be worn in a water polo cap. The SIM-G (Triax Technologies) sensor meets these criteria, but a validation of the SIM-G in a water polo cap has not yet been published.
PURPOSE
To evaluate the accuracy and reliability of a head impact sensor, previously validated for use in non-helmeted land sports, mounted in a standard water polo cap.
METHODS
A SIM-G sensor was placed in i) a water polo cap and ii) a headband. Each headgear was fitted to a 50th Percentile Male Hybrid III head and neck (headform; HF). A linear impactor impacted the HF at seven sites and four velocities (1.7, 2.7, 4.7, and 6.4 m/s). 1.7 m/s did not consistently produce impacts large enough for the SIM-G to detect, thus 155 impacts (77 headband, 78 water polo cap) were analyzed. Peak linear acceleration (PLA), rotational velocity (PRV), rotational acceleration (PRA) were recorded for all impacts. SIM-G reliability was tested using a series of regression analyses to compare PLA, PRA, and PRV to HF values. Differences in the regression coefficients were tested by the interaction term (i.e., magnitude x headgear). Accuracy was tested using a mixed model ANOVA with sensor (HF, SIM-G) as a repeated measure and headgear (cap, headband) as a between-trial factor. Interactions were decomposed with *post hoc* Bonferroni-corrected t tests.
RESULTS
The SIM-G sensor reliably quantified PLA, PRA, and PRV relative to the HF [β>.559, t(151)>6.682, p<.001] independent of headgear (p>.191). Regarding accuracy, there were sensor x headgear interactions [F(1,153)>29.383, p<.001, η^2>.161]. Relative to the HF, the SIM-G overestimated PLA, PRA, and PRV when mounted in the water polo cap and underestimated PRV when mounted in the headband (p<.001).
CONCLUSION
The SIM-G sensor demonstrated sufficient reliability for quantifying in the water polo cap and headband. However, due to sensor inaccuracy, relative metrics, rather than absolute impact magnitudes, are advised when calculating head impact exposure.

1782 Board #8 May 30 3:45 PM - 5:45 PM

Biomechanical Analysis of Head Impacts during Real Time Soccer Play: a Preliminary Study

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Linear and angular head accelerations are recognized as the foremost mechanisms of head injuries in sports. However, in non-contact sports such as soccer, little is known about onfield head accelerations during soccer play, which limits the understanding of the risk and mechanism of head injury. **PURPOSE:** To assess the biomechanics underlying the risk of head injury during soccer play. **METHODS:** An instrumented headband was worn by 8 elite male (M) players (18 ± 0 yrs, 73.7 ± 9.5 kg, 1.73 ± 0.1 m) and 16 amateur female (F) players (24.1± 1.4 yrs, 63.5 ± 7.8 kg, 1.63 ± 0.1 m) during 7 (M) and 9 (F) games of a summer season. Head kinematics of each impact (peak linear and angular accelerations of the head) were grouped as heading techniques or involuntary impacts. Heading techniques were sub-categorized as jump, stable, head rotation or unstable. Involuntary impacts were sub-categorized as player-to-player contact, ball control (feet or chest), running (acceleration or deceleration), change-of-direction, ground impact, unstable or involuntary head-to-ball impact. Head kinematics were subjected to standard descriptive statistics. Wilcoxon signed-rank test was used to compare heading techniques and involuntary impacts kinematic. **RESULTS:** In total 239 head impacts were registered for M and 139 for F. Heading techniques accounted for 92 impacts for M (36g ± 15g; 4175 ± 2517 rad/s^2) and 97 for F (33g ± 13g; 3334 ± 1747 rad/s^2). Involuntary impacts accounted for 147 impacts for M (20g ± 9g; 1934 ± 1511 rad/s^2) and 42 for F (21g ± 11g; 2095 ± 1603 rad/s^2). For M and F, the average peak linear and angular accelerations of the head caused by heading techniques were associated with higher values than involuntary impacts ($p < 0.05$). For both M and F, the most frequent heading technique was the jump and player-to-player contact was the most frequent for involuntary impact. **CONCLUSION:** Preliminary results show that heading techniques can cause higher values of head accelerations than involuntary impacts and therefore, could cause a higher risk of head injury in two different populations of players.
Grant funding: this study was funded using NSERC and FRQNT research grants.

D-43 Free Communication/Slide - Cognition and Emotion

Thursday, May 30, 2019, 3:45 PM - 5:45 PM
Room: CC-105A

1783 **Chair:** Walter Bixby, FACSM. *Anne Arundel Community College, Arnold, MD.*
(No relevant relationships reported)

1784 May 30 3:45 PM - 4:00 PM

Executive Function Performance And Cortical Activation When Cycling On An Active Workstation In Young Adults

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BACKGROUND: Previous studies suggested that exercise on an active workstation while working may be a promising intervention strategy for reducing sedentary time at workplace. The influence of active workstation on cognitive function are not well studied and the existing studies yielded mixed findings.
OBJECTIVE: To investigate the effects of cycling on an active workstation on executive function and cortical activation in young adults.
METHODS: In a cross-over study design, 35 young adults (mean age = 21.4 ± 2.6 years, 45.7% females) were randomly assigned the following two task conditions separated by 48 hours: performing cognitive tests while sitting (SIT) and performing cognitive tests while self-paced cycling on an active workstation (ACTIVE). Executive function was assessed by a task-switching paradigm and Stroop Color and Word Test (SCWT) programed using E-Prime 2 professional (Psychology Software Tools, Inc., Sharpsburg, PA, USA), respectively. Global switch costs, local switch costs and Stroop effects were derived and used as the behavioral outcomes of the two tasks. Cortical activation during the two conditions was monitored using a 38-channel fNIRS (NIRx Medical Technologies LLC, USA).
RESULTS: There were no significant differences on Stroop effects (136.25 ± 125.67 vs. 101.61 ± 137.10, p = 0.19) between SIT and ACTIVE conditions. The global switch costs (463.19 ± 206.86 vs. 452.77 ± 167.05, p = 0.73) and local switch costs (-6.14 ± 147.22 vs. 9.97 ± 156.08, p = 0.70) also did not differ. For the fNIRS results, ACTIVE condition led to greater cortical activity in left-dorsolateral prefrontal cortex (left-DLPFC) related to Stroop effects (0.88 ± 17.75 vs. 13.85 ± 19.44 a.u, p = 0.02). For the task switch test, there were no significant differences in cortical activation between SIT and ACTIVE conditions.
CONCLUSION: The results suggests that the performances on Stroop task and task-switching were not impaired by self-paced cycling on a workstation. Importantly, cycling led to greater recruitment of sub-region of prefrontal cortex indicated by a greater cortical activation related to Stroop effects in the left-DLPFC.

1785 May 30 4:00 PM - 4:15 PM

Physical Exercise, APOE E4 Genotype And Cognitive Trajectories: The Mayo Clinic Study Of Aging

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PURPOSE: To investigate whether physical exercise (PE) is differentially associated with global and domain-specific cognitive trajectories (memory, language, visuospatial skills, attention) among Apolipoprotein E (APOE) ε4 carriers and non-carriers. **METHODS**: We included 2,060 community-dwelling individuals aged 70 years and older (50.5% males, 26.6% APOE ε4 carriers). Participants were cognitively unimpaired at baseline, and underwent serial cognitive testing and self-reported assessment of PE engagement in midlife (between 50-65 years of age) and late-life (within one year prior to assessment). We calculated linear mixed-effect models comparing three PE groups (light intensity such as leisurely walking or slowly dancing; at least moderate intensity such as hiking or swimming; at least vigorous intensity such as jogging or tennis singles) versus a none PE reference group (defined as each level of PE carried out less than once per week). Models were adjusted for age, sex, education and medical comorbidities, and run separately for mid- and late-life PE. **RESULTS**: Among APOE ε4 non-carriers, midlife light PE was associated with less decline in memory (time x PE interaction coefficient 0.044, p = 0.01); midlife vigorous PE was associated with less decline in memory (0.033, p = 0.05); and late-life vigorous PE was associated with less decline in visuospatial skills (0.025, p = 0.03) and global cognition (0.034, p = 0.03). Among APOE ε4 carriers, late-life vigorous PE was associated with less decline in memory (0.067, p = 0.03), attention (0.083, p = 0.01) and global cognition (0.073, p = 0.02); and late-life moderate PE was associated with less decline in global cognition (0.048, p = 0.05). **CONCLUSIONS**: Engaging in PE (light, moderate and vigorous) is associated with less decline in memory, attention, visuospatial skills and global cognition among community-dwelling older individuals, including those that are APOE ε4 genotype carriers who are at an increased risk of Alzheimer's disease.
Supported by NIH grants R01 AG057708, U01 AG006786, R01 AG034676; Robert Wood Johnson Foundation; Robert H. and Clarice Smith and Abigail Van Buren Alzheimer's Disease Research Program; GHR Foundation; Edli Foundation; Arizona Alzheimer's Consortium.

1786 May 30 4:15 PM - 4:30 PM

Effects of Acute High Intensity Interval Training on Information Processing Speed: An Electromyography Study

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Steady-state aerobic exercise has been shown to improve information processing speed. However, the effects of high intensity interval training (HIIT) on information processing speed using surface electromyography (sEMG) is limited. **PURPOSE:** The purpose of this study was to compare the effects of a single session of either aerobic HIIT (HIIT-A) or aerobic/resistance HIIT (HIIT-AR) to a resting control group on information processing speed. **METHODS:** Participants (N=57, mAge = 23.1) provided consent and were randomly assigned into the HIIT-A (n=20), HIIT-AR (n=18), or the control group (n=19). Information processing was assessed via a reaction time (RT) task using a serial response box, integrated with a Biopac MP100 system allowing for measurement of sEMG. The sEMG signals of the agonist synced with RT were temporally partitioned to assess central (premotor time (PMT)) and peripheral processing (motor time (MT)). A 3 (HIIT-A, HIIT-AR, & controlled) x 2 (pre-test & post-test) ANCOVA was performed for RT, PMT, and MT. **RESULTS:** For regular foreperiods (consistent time), the interaction between group and time for RT and MT was not significant ($p > .05$). There was a significant interaction between group and time for PMT, F(2, 51) = 4.194, p = .021, partial η2 = .141. This interaction was likely due to a simple main effect of time (pre to post) and not group allocation. For irregular foreperiods (variable time), the interaction between group and time for RT (F(2, 51) = 4.543, p = .015, partial η2 = .151) and PMT (F(2, 51) = 3.219, p = .048, partial η2 = .112) was significant while the interaction for MT was not ($p > .05$). For RT, there was a significant simple main effect of group, F(2, 53) = 7.271, p = .002, partial η2 = .215. Post hoc analyses revealed that both exercise groups had significantly faster RTs than the control group ($p < .01$). Additionally, for PMT, there was a significant simple main effect of group (F(2, 53) = 4.275, p = .019, partial η2 = .139). Post hoc analyses revealed that both exercise groups had significantly faster PMTs than the control group ($p < .01$). **CONCLUSION:** Improved RT appeared to be a result of reduced central processing rather than a significant change in peripheral processing. This study demonstrated that acute HIIT-A and HIIT-AR can significantly improve information processing speed in young adults.

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The Effects of Acute Bout of Aerobic Exercise on Cognitive Function in Older Adults

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Abstract: Age-related cognitive decline affects several aspects of cognitive performance, including processing speed, inhibition, executive function, and visual scanning. Aerobic exercise is a potential solution to mitigate age-related cognitive decline. Furthermore, older adults are more susceptible to benefits from the effects of both chronic and acute aerobic exercise compared to younger adults**. PURPOSE:** To determine the associations of life-long aerobic exercise as well as the effects of acute aerobic exercise on cognitive function among healthy older adults (65 - 84 years old). **METHODS:** Model-based cluster analyses were conducted based on parameters of the participant's cardiovascular health: (1) age; (2) VO_2max; (3) Carotid Augmentation Index; (4) Carotid-femoral pulse wave velocity (cfPWV); (5) Aortic systolic blood pressure (SBP); (6) Carotid intima-media thickness (IMT). A cross-sectional design was utilized to compare 27 active (A) with 31 inactive (I) older adults (70±5yrs). Cognitive function was measured at rest and after 15 minutes of moderate intensity exercise (55-65% HRR) via the trail-making test (TMT Form A and Form B). A series of one-way ANOVAs were performed on dependent variables. A repeated measures MANOVA was used to test differences on the TMT-A and TMT-B at rest compared to after an acute bout of exercise. Pearson's correlation analysis tested the associations among VO_2max, age, carotid IMT, cfPWV, and cognitive performance. **RESULTS:** VO_2max was not related to carotid IMT (r = .15, p = .27) or cfPWV (r = -.12, p = .38). Time to complete TMT-A (26±1 vs 23±1 seconds, $F(1,57) = 15.12$, p <.001) and TMT-B (57±2 vs 53±2, $F(1,57) = 7.20$, p *<.01*) increased after an acute bout of exercise compared to at rest. VO_2max (r = -.16, p = .23), carotid IMT (r = .17, p = .21), and cfPWV (r = .15, p = .26) were not significantly correlated with cognitive performance on the TMT-A and TMT-B. Age was correlated with cognitive performance on the TMT-A and TMT-B (r = .60, p <.01). **CONCLUSION:** An acute bout of aerobic exercise may diminish cognitive performance among healthy older adults.

1788 May 30 4:45 PM - 5:00 PM

Effects of Duration and Intensity of Aerobic Exercise on Cognitive Performance in Trained Individuals

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PURPOSE: This study explored the effect of acute aerobic exercise on cognitive performance in trained cyclists/triathletes. Specifically, it investigated the impact of different exercise durations (completed at a fixed moderate-intensity) and high/maximal intensity exercise (H/MIE) to volitional exhaustion (following a sustained bout of dehydrating activity) on simple and complex cognitive skills. **METHODS**: On two separate occasions, 21 trained cyclists/triathletes; 11 male (M) (age: 31±8 y; VO_{2max}: 57±9 mL·kg^{-1}·min^{-1}) and 10 female (F) (34±7 y; VO_{2max}: 51±9 mL·kg^{-1}·min^{-1}), completed 45 min of fixed-intensity cycling (M: 80±8%; F: 74±5% HR_{max}) followed immediately by an incremental test to volitional exhaustion. Cognitive function was assessed at Baseline, after 15 and 45 min of exercise (15EX; 45EX), and at Exhaustion using a 4-choice reaction time (CRT) and Stroop Word-Color Association test (Incongruent/Congruent Reaction Time [RT]). A placebo treatment ("*to improve cognition*") was administered after 15EX on one trial to determine if positive expectancy influenced cognitive responses. **RESULTS**: *Exercise Duration:* CRT, Congruent RT and Incongruent RT decreased (improved) at 15EX and 45EX compared to Baseline (p's<0.005). While CRT and Congruent RT were faster at 45EX than 15EX (p's<0.020), Incongruent RT was not (p=1.000). *Exercise Intensity:* The incremental test lasted ~11.4±2.8 min, with participants achieving a maximum heart rate (HR) equal to ~93±7% HR_{max}. CRT, Congruent RT and Incongruent RT decreased at Exhaustion compared to Baseline, (p's<0.005), despite large fluid losses (M: -2.3±0.3% BM; F: -1.7±0.3% BM). The placebo treatment did not affect cognitive responses to H/MIE (p's>0.05).

CONCLUSIONS: Acute aerobic exercise improves cognitive performance in trained athletes. These effects are more pronounced when exercising for longer durations (~1hr), employing higher exercise intensities and/or more complex cognitive tasks.

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Accelerometer-Measured Sustained MVPA Is Related To Higher Decision-Making Competence Among Young Adults

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More competent decision makers report greater success in avoiding negative decision outcomes irrespective of general cognitive ability. While physically active young adults show more optimal executive functions, the relationship between daily moderate-to-vigorous physical activity (MVPA) patterns and decision-making competence (DMC) remains under-examined. **PURPOSE:** In this study, we assessed the relationship between accelerometer-measured sporadic and sustained MVPA to DMC in young adults. **METHODS:** We analyzed pre-intervention data from 220 participants (115 (52%) females, M_{age}=24.3 ±5.4 yrs, BMI=24.4 ± 4.0 kg/m^2) from the INSIGHT randomized controlled trial. MVPA was measured over 7 days with a hip-worn wGT3X-BT accelerometer. Valid wear time was defined as ≥4 days, ≥10 hrs/d. Daily (min/d), bouts of sporadic (<10 consecutive min) and sustained MVPA (≥10 consecutive min; frequency and min/d) were estimated using NHANES cut points. DMC was measured with the Adult-Decision Making Competence (A-DMC) battery and expressed as individual subtest scores and an A-DMC index (z-score). The relationships between MVPA and A-DMC variables were assessed with Spearman's rho controlling for wear time, age, sex, education, intelligence, fat free VO_2max, BMI and sedentary time (ST; <100 counts/min). **RESULTS:**After controlling for daily MVPA, frequency and time spent in sustained MVPA bouts were positively related to the ability to recognize social norms (ρs=[0.15; 0.16], Ps≤0.04) and ignore unrecoverable costs when considering future decision outcomes (ρs=[0.14; 0.15], Ps≤0.04). In contrast, neither sporadic nor daily MVPA were related to A-DMC subtests (Ps≤0.08). **CONCLUSION:** The quality of decision making varied primarily as a function of *sustained* MVPA. Young adults who engaged in more sustained MVPA were able to use their experience more effectively and make more rational choices to optimize decision outcomes. Our data reveal a novel relationship between MVPA patterns and a distinct set of higher order cognitive skills which are relevant to real-world decisions. Funding: Office of the Director of National Intelligence (ODNI), Intelligence Advanced Research Projects Activity (IARPA); Contract 2014-13121700004

1790 May 30 5:15 PM - 5:30 PM

Alterations in Exercise-Affect between Those With Higher and Lower Intensity Preference and Tolerance

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(No relevant relationships reported)

High-intensity exercise results in a more negative affective response when compared to moderate- or low-intensity exercise. However, a large number of individuals continue participating in high-intensity exercise, in spite of these declines in affective state. **PURPOSE**: Determine whether differences exist in exercise-affect for those with higher versus lower exercise intensity preference and/or tolerance. **METHODS**: Undergraduates (n=245, 20.3±1.7yrs, 23.7±3.8BMI, 60.8% female, 82% regular exercisers) completed the Preference for and Tolerance of Exercise Intensity Questionnaire [Higher-intensity exercise preference, tolerance (HIP, HIT) ≥24; n=155, n=154; lower-intensity preference, tolerance (LIP, LIT) <24; n=45, n=51] along with completing 15-minutes of a high-intensity circuit (HIC), a walk, and a reading condition. Affective valence (via Feeling Scale) was taken prior to, every 3-minutes during, and 20-minutes post (P20) condition, while activity enjoyment was assessed immediately post. **RESULTS**: Multivariate ANOVAs revealed significant differences (P_s<0.05) for preference-intensity groups in valence during HIC at minutes 3 (HIP=2.4, LIP=1.4; d=0.615), 6 (HIP=2.5, LIP=1.1; d=0.772), 9 (HIP=2.5, LIP=1.2; d=0.659), 12 (HIP=2.3, LIP=0.9; d=0.625), 15 (HIP=2.4, LIP=0.9; d=0.632), and at P20 (HIP=3.1, LIP=2.0; d=0.554), and for enjoyment following HIC (HIP=95.6, LIP=85.3; d=0.545), but not for walking or reading conditions. For those with differing intensity-tolerance levels, differences (P_s<0.05) in exercise-affect were only observed during minutes 3 (HIT=2.4, LIT=1.5; d=0.535) and 6 (HIT=2.3, LIT=1.7; d=0.366), and enjoyment differed following HIC (HIT=95.8, LIT=86.5; d=0.492). **CONCLUSIONS**: These findings suggest the intensity-preference trait influences how an individual feels during exercise at high-intensity intensity, but is less important during moderate/lower intensities. These differences may be predictive of whether an individual will continue high-intensity exercise programming.

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Training Modulation using Heart Rate Variability Improves Daily Training Cognitions for High Intensity Functional Training

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Participants in group-based high intensity functional training (HIFT) maintain exercise enjoyment and intentions; those training ≥5 days/week report highest intrinsic and extrinsic motives. Yet, overtraining and overreaching concerns exist. A promising monitoring method is heart rate variability (HRV), which tracks cardiac autonomic nervous system activity. **PURPOSE:** To examine differences in daily training cognitions for HIFT participants. Participants with workouts modulated based on HRV status were expected to report significantly better daily training cognitions. **METHODS:** Participants included 55 healthy adults randomized to HIFT-HRV (intervention) or HIFT (comparison). HIFT-HRV participants (n = 26) were 23.7 ± 4.5 years, 46% female, body fat percentage (BF%) = 27.3 ± 9.8%, and VO_2max = 44.4 ± 6.4 mL/kg/min. HIFT participants (n = 29) were 34.1 ± 4.1 years, 58.6% female, BF% = 32.4 ± 10.7%, and VO_2max =42.1 ± 6.8 mL/kg/min. The 11-week study included 2 weeks baseline waking HRV, baseline testing week, 3 HIFT weeks (5 sessions/week), mid-point testing week, 3 HIFT weeks (5 sessions/week), and post-intervention testing week. HRV was recorded daily via photoplethysmography using a smartphone app. Self-reported motivation to train and fatigue, during HIFT weeks, were collected prior to training with performance satisfaction (PS) and perceived effort (RPE) collected immediately following. The training-related cognitions were assessed using the Visual Analog Scale and RPE using Borg's (6-20) scale. **RESULTS:** No significant differences were found between groups at baseline. HIFT-HRV participants reported cognitions for 674 daily training sessions and HIFT participants reported cognitions for 763. Average motivation was significantly higher for the HIFT-HRV than the HIFT group, t (1435) = 2.41, p = .016. Average fatigue [t (1361) = 3.22, p = .001] and RPE [t (1271) = 5.68, p < .001] were significantly lower for the HIFT-HRV than the HIFT group. No significant differences were found for PS. **CONCLUSIONS:** HRV modulation during HIFT training resulted in greater daily motivation and lower daily fatigue and perceived exertion. HRV status is a promising method to monitor and modulate HIFT training and may facilitate adherence; future work could focus on applied interventions for existing HIFT populations.

D-44 Free Communication/Slide - Understanding the Health Effects of Sitting, Fitness, and Physical Activity

Thursday, May 30, 2019, 3:45 PM - 5:45 PM
Room: CC-202C

1792 **Chair:** Sarah Keadle. *California Polytechnic State University, San Luis Obispo, CA.*
(No relevant relationships reported)

1793 May 30 3:45 PM - 4:00 PM

Sedentary Behavior Across Pregnancy, Gestational Age at Delivery, and Birthweight

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PURPOSE: Lower gestational age at delivery (GAD) and large for gestational age birthweight (LGA) are indicators of poorer maternal-fetal health. While physical activity during pregnancy has been associated with greater GAD and lower risk of LGA, the effects of sedentary behavior (SB) on these outcomes are unknown. We aimed to describe patterns of SB across pregnancy and associations with GAD and risk for LGA**METHODS:** In this cohort study, SB (activPAL micro3) and physical

activity (waist-worn ActiGraph GT3X-BT) were assessed in women for ≥ 4 days with ≥ 10 hours, in each trimester of pregnancy. This preliminary analysis (59% recruited) includes women with available birth records and valid activity data for ≥1 trimester (n=56). Birthweight (BW) and GAD were abstracted from medical records. BW was categorized as LGA if ≥ 90th percentile (n=18, 31%). Mean (SD) percent time spent sedentary was calculated in each trimester and differences across trimesters were tested using linear mixed models. The association of SB with continuous GAD and odds of LGA were estimated in separate regression models for each trimester. All beta coefficients were standardized (std β) per SD and adjusted for pre-pregnancy body mass index. If SB was associated with outcomes, further models estimated the effect of replacing SB with light physical activity (LPA) or moderate to vigorous physical activity (MVPA). **RESULTS:** Women spent a high percentage of time sedentary across trimesters: 1st (n=53) 64.0% (10.9); 2nd (n=50) 63.5% (9.5); and 3rd (n=47) 63.8% (10.4). SB did not differ across trimesters (p=0.792). Higher percent time spent sedentary in the first trimester was associated with lower GAD (std β=-0.45, p=0.038). Replacing first trimester SB with LPA (std β=0.48, p=0.037), but not MVPA (std β =-0.12, p=0.581), was associated with greater GAD. SB was not significantly associated with GAD in the 2nd (std β =-0.24, p=0.241**)** or 3rd (std β =-0.22, p=0.264) trimester. Odds of LGA was not significantly associated with SB in the 1st (OR=0.75, p=0.389), 2nd (OR=0.80, p=0.503), or 3rd (OR=1.03, p=0.932) trimester. **CONCLUSIONS:** Women in this study were highly and consistently sedentary across pregnancy. Higher LPA and lower SB during the first trimester may be advantageous for greater GAD, though risk for LGA offspring did not appear to be associated with SB.

1794 May 30 4:00 PM - 4:15 PM

Structured Exercise as a Potential Treatment Option for Prenatal Depression

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PURPOSE: Up to 20% of pregnant women experience prenatal depression and up to 19% will continue to have depressive symptoms in the postpartum. Previous research supports exercise during pregnancy as an effective way to prevent prenatal depression, however evidence is lacking regarding exercise as a potential treatment for women who enter pregnancy already at risk for depression. Therefore the purpose was to determine if exercise during pregnancy is an effective option to treat depression during pregnancy. **METHODS:** This is a secondary analysis of two randomized controlled trials that followed the same exercise protocol and study methodology in Madrid, Spain. Women <16 weeks pregnant were randomized to an exercise group (EG) or standard care control group (CG). The EG participated in group fitness classes three times per week. The classes included moderate intensity aerobics and resistance training in accordance to the American College of Obstetrics and Gynecology guidelines. All participants completed the Centre for Epidemiologic Studies Depression scale (CES-D) at baseline and at the end of the intervention (36-38 weeks gestation). Women who scored ≥16 on the CES-D at baseline (at risk for depression) were included in the current study. A One-Way ANOVA was performed to determine if there was a difference in post CES-D scores between the EG and CG. A Chi-Square Analysis was performed to determine if there was a difference between the two groups for the number of women who had a decrease in their score at the end of the intervention and also scored below 16 post-intervention. **Results:** Thirty-six women in the EG and 25 women in the CG scored ≥16 on the CES-D at baseline. Post-intervention, the EG had a significantly lower mean CES-D score (14.4±8.6) than the CG (19.4±11.1; p<0.05). Additionally, more women decreased their score in the EG (n=30, 83.3%) than the CG (n=14, 56%; p<0.05) however there was no difference in the number of women who went below the 16 point cut-off between the two groups. **CONCLUSION:** A structured exercise program offered during pregnancy may reduce depressive symptoms among women who begin pregnancy already at risk for prenatal depression. Therefore exercise may be a viable treatment option for prenatal depression.

1795 May 30 4:15 PM - 4:30 PM

Effects Of Breaking-up Prolonged Sitting With Stair-climbing On Vascular-metabolic Function After A High-fat Meal

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(No relevant relationships reported)

Frequent high-fat meal intake and prolonged sedentary time are prevalent in our modern society and associated with increased risk of cardiovascular disease. Alternatively, breaking up prolonged sitting is introduces health benefits, although not always practical.
PURPOSE: To test whether stair-climbing could be an effective way of breaking up prolonged sitting. **METHODS:** Twelve healthy adults (male=7) participated in two trials after a high-fat meal: 1)4-h uninterrupted sitting, 2)4-h sitting interrupted with 5-min of stair-climbing every hour (interrupted sitting). We measured triglycerides, glucose, brachial artery flow-mediated dilation, popliteal artery blood flow and shear rate. All variables were measured five times (before and every hours after high-fat meal), except for brachial artery flow-mediated dilation, which was measured before and after 4-h sitting. **RESULTS:** The intensity of 5-min stair-climbing was 66% of heart rate reserve. High fat meal increased glucose and triglycerides concentrations, without any significant differences between trials. Brachial artery flow-mediated dilation decreased in sitting trial, but increased in the interrupted sitting trial (uninterrupted sitting: 9.2±2.16 to 9.0±3.23, interrupted sitting with stair-climbing: 7.9±2.55 to 10.3±2.89, p=0.009). Popliteal blood flow and shear rate were increased in the interrupted sitting trial with a significant interaction effect (blood flow: p<0.001, shear rate: p=0.006). Also, interrupted sitting attenuated the prolonged sitting-induced increase of systolic blood pressure and pulse pressure. **CONCLUSION:** Stair-climbing appears to be an effective way of breaking up prolonged sitting to improve vascular function with easy accessibility in various settings.

1796 May 30 4:30 PM - 4:45 PM

Associations of Fast Walking with Sleep Quality and Duration in Older Adults

Angelique Brellenthin, Duck-chul Lee, FACSM. *Iowa State University, Ames, IA.* (Sponsor: Duck-chul Lee, FACSM)
(No relevant relationships reported)

Purpose: Poor sleep has been associated with negative health outcomes in older adults. Since walking is the most popular form of physical activity in older adults, we examined the effects of daily steps and fast walking on sleep quality and duration.
Methods: This cross sectional study included 402 older adults (56% women; 72 years old). Participants wore an accelerometer-based pedometer (Omron) during waking hours for 7 days. We used total average daily steps and average daily fast walking steps defined as ≥100 steps/min. Sleep duration and quality were measured using the Pittsburgh Sleep Quality Index (PSQI). Poor sleep quality (PSQ) was defined as a PSQI global score of >5, and inadequate sleep duration (ISD) was defined as <7 hours/night. Odds ratios (ORs) and 95% confidence intervals (CIs) for PSQ and ISD were calculated among 4 groups: no daily fast steps and tertiles (thirds) of fast steps. Covariates were sex, age, body mass index, smoking, heavy alcohol intake, depression, anxiety, diabetes, hypertension, hyperlipidemia, and sleep apnea.
Results: On average, participants took 5,764 steps, 1,598 fast steps (70% had at least 1 daily fast step), had a PSQI score of 4.6, and a sleep duration of 7.1 hours. Total steps were not associated with quality or quantity (both p>0.05). However, fast walking was associated with sleep quality with ORs (95% CIs) of 0.47 (0.24-0.90), 0.53 (0.27-1.04), and 0.82 (0.35-1.92) for <940 (lower third), 941-2600 (middle third), and >2600 (upper third) of fast steps, respectively, compared with no fast steps, adjusting for the confounders including total daily steps. Obtaining any fast steps was associated with 0.52 (0.30-0.90) reduced odds of PSQ compared with no fast steps. However, no associations were observed between fast steps and ISD. In a joint analysis, compared with those who took <5,000 daily steps and 0 fast steps, there were reduced odds of PSQ among those with <5,000 steps and >1 fast steps (0.43 [0.23-0.83]) as well as those with ≥5,000 steps and >1 fast steps (0.42 [0.24-0.74]), suggesting the benefits of fast walking on sleep quality regardless of total daily steps.
Conclusion: These results indicate that even small amounts of fast walking, rather than total daily steps, are associated with better sleep quality in older adults.
Supported by unrestricted research grant by Biospace.

1797 May 30 4:45 PM - 5:00 PM

Differences of Plasma Metabolites in Prediabetes with Different Cardiorespiratory Fitness and the Effects of Exercise

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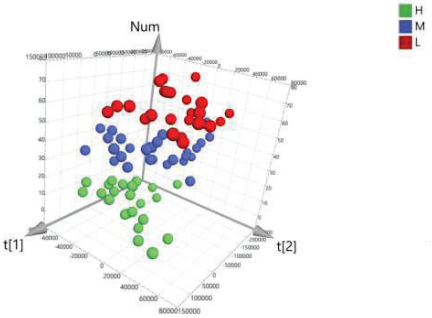
(No relevant relationships reported)

PURPOSE: To indentify the most significant plasma metabolites for higher and lower cardiorespiratory fitness (CRF) in pre-diabetes mellitus (PDM) , and the effect of aerobic exercise training on these metabolites. **METHODS:** All 80 PDM subjects were selected [age: (51.62±10.03) yrs; body mass index: (26.17±3.60) kg/cm^2; 24 males]. CRF was measured directly with a graded exercise test. Exercise intervention program: 3 times/week, 50 min per session at 46%-64% VO_{2max}, 3 month. Body composition was measured by dual-energy x-ray absorptiometry. Plasma metabolites were detected by ultra high performance liquid mass spectrometry(UPLC-MS), and analyzed by PCA and OPLS-DA. **RESULTS:** 1) Compared with lower CRF group, HOMA-IR, HOMA-β, LDL-C, BMI and Fat% of higher CRF group were lower, and the amount of low intensity activity was more. 2) There were different expressions of 7 metabolites in different CRF groups, including PC (20:1/14:1), PC(18:3/16:0), LysoPC(16:0), Valine, isocitric acid, Octyl carnitine and Linoleyl carnitine. 3) After 3-month exercise training, the fasting and OGTT-2h blood glucose of 61.11% of PDM subjects turned to normal; PDM subjects' VO_{2max} increased significantly(6.84%); but there was no significant correlation between the increase of VO_{2max} and 7 metabolites. **CONCLUSION:** PC, LysoPC, valine, isocitrate and acylcarnitine were different in different CRF groups, they may be potential biological markers of CRF. Exercise intervention improved the glucose metabolism and CRF of prediabetes mellitus, but we hadn't found the correlation between VO_{2max} increase and 7 metabolites expression change after exercise, which needs more study.Supported by Key Projects of State General Sports Administration of China (2014B007), the National Key Technology Research and Development Program of Prevention and Control of Major Chronic Non-communicable Diseases(2016YFC1300202)



PCA-DA model of UPLC-MS metabolomics data for different cardiorespiratory fitness PDM.

1798 May 30 5:00 PM - 5:15 PM

Longitudinal Associations of Physical Activity and Blood Lipid Levels in Midlife Women in SWAN

Sylvia E. Badon[1], Kelley Pettee Gabriel, FACSM[2], Barbara Sternfeld, FACSM[1], Ellen B. Gold[3], L. Elaine Waetjen[3], Monique M. Hedderson[1]. *[1]Kaiser Permanente Northern California, Oakland, CA. [2]University of Texas Health Science Center, Austin, TX. [3]University of California Davis, Davis, CA.*
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(No relevant relationships reported)

Decreasing levels of estrogen production, combined with the detrimental effects of aging, lead to large increases in cardiovascular disease (CVD) risk among midlife women. Physical activity has the potential to attenuate this increase in CVD risk; however, longitudinal associations of physical activity and blood lipid levels, important contributors to CVD, have not been studied in midlife women.
PURPOSE: To estimate the longitudinal associations of physical activity with blood lipid levels in midlife women.
METHODS: We used data from 3,230 participants in the Study of Women's Health Across the Nation (SWAN), a longitudinal cohort study spanning 14-17 years of nearly annual follow up. Women reported physical activity using the Kaiser Physical Activity Survey at 7 study visits. We used the sports and exercise physical activity index score to estimate leisure-time moderate to vigorous intensity physical activity. SWAN measured total cholesterol, triglycerides, HDL, and LDL in blood collected at 8 study visits. We used generalized estimating equations to estimate longitudinal associations of moderate to vigorous intensity physical activity with each blood lipid biomarker, adjusted for age, race/ethnicity, education, and body mass index category.
RESULTS: Women were 46 years old, on average, at study entry. Forty-seven percent were non-Hispanic white; 28% were black; 9% were Japanese; 8% were Chinese, and 8% were Hispanic. Each additional one-unit increase in the sports and exercise physical activity index score was associated with an average 1.9 mg/dl lower triglyceride level (95% CI: -3.5, -0.2) and 0.6 mg/dl greater HDL level (95% CI: 0.4, 0.9). The sports and exercise physical activity index score was not associated with total cholesterol (mean difference=0.3; 95% CI: -0.4, 1.0) or LDL (mean difference=-0.2; 95% CI: -0.8, 0.4).
CONCLUSIONS: Moderate to vigorous physical activity is longitudinally associated with lower triglyceride levels and higher HDL levels in midlife women.
Supported by NIH grants T32DK11668401, U01NR004061, U01AG012505, U01AG012535, U01AG012531, U01AG012539, U01AG012546, U01AG012553, U01AG012554, U01AG012495. The content of this abstract is solely the responsibility of the authors and does not necessarily represent the official views of the NIA, NINR, ORWH or the NIH.

1799 May 30 5:15 PM - 5:30 PM

Who Is The Reference Group? An Examination Of The Involuntarily Inactive And Mortality

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(No relevant relationships reported)

PURPOSE: Physical activity studies often use inactive participants as a reference comparison group implying that all inactive participants can become more active. However, it remains unclear how much of this group is involuntarily inactive due to physical function limitations. This study aims to examine the involuntarily inactive and the association with mortality among older adults. **METHODS**: Study participants were from the National Health and Nutrition Examination Survey (NHANES), a population-based study with mortality follow-up through 2011. Participants were 60+ years old and wore the accelerometer for 4+ days (N = 2415). Moderate-to-vigorous physical activity (MVPA) was derived using standard accelerometer cutpoints and categorized based on the US Federal Physical Activity Guidelines: 1) <15 minutes (inactive); 2) 15—37.5 minutes; 3) 37.5-150 minutes; 4) >=150 minutes per week (recommended). Participants self-reported limitations in walking, activities of daily living, and carrying objects and were classified as 1) no impairment, 2) some impairment, or 3) most impaired. To compare mortality rates, we calculated hazard ratios (95% confidence intervals), adjusting for relevant covariates. **RESULTS**: Over an average of 74.1 (SD = 23.8) months of follow-up, there were 572 deaths. Of the inactive participants (n = 719), 24.8% reported no impairment, 34.6% some impairment, and 40.6% were most impaired. There was no significant mortality rate difference between the inactive group and those participating in 15 to 37.5 minutes per week of MVPA in any of the function groups. Among those with no or some impairment, there was a significant decrease (39 to 62%) in premature mortality among those with at least 37.5 minutes per week of MVPA. Among those with the most impairment, a mortality rate reduction of 85% (HR = 0.15 (95% CI: 0.06, 0.35)) was observed among those with 37.5 – 150 minutes of MVPA, but no significant difference among those meeting the guidelines (HR = 0.72 (95% CI: 0.31, 1.67)), compared to the inactive group. **CONCLUSIONS**: Inactive referent groups may contain a disproportionate number of participants with physical limitations, however even among those with some or most impairment, greater levels of physical activity are associated with similar or greater mortality benefits.

1800 May 30 5:30 PM - 5:45 PM

The Use Of Resistance Exercises To Interrupt Sitting: Acceptability And Impact On Sleepiness, Discomfort, And Fatigue

Robert J. Kowalsky[1], John M. Jakicic, FACSM[2], Andrea L. Hergenroeder[2], Renee J. Rogers[2], Bethany Barone Gibbs[2]. *[1]Texas A&M University Kingsville, Kingsville, TX. [2]University of Pittsburgh, Pittsburgh, PA.*
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(No relevant relationships reported)

Emerging research suggests cardiometabolic benefit from using simple resistance exercises to interrupt prolonged sitting, yet it is unclear if such programming is acceptable and can affect discomfort, fatigue, and sleepiness. **Purpose:** To examine the acceptability of hourly, brief resistance exercise bouts and the effects on subjective

ratings of discomfort, sleepiness, and fatigue. **Methods:** Fourteen adults (age 53.4±9.5 years, BMI 30.9±4.8 kg/m^2) completed two 4-hour randomized simulated laboratory-based work conditions on separate days: prolonged sitting (SIT) and sitting with hourly resistance exercise breaks (REX). Acceptability was assessed after REX in 5 domains: 1) willingness to use REX, 2) confidence to use REX unsupervised, 3) co-worker acceptance of REX, 4) employer acceptance of REX, and 5) Feasibility of frequency and Amount of REX. During each 4-hr protocol, ratings of sleepiness (Karolinska Sleepiness Scale), discomfort, and fatigue (Physical Discomfort and Fatigue Questionnaire) were assessed at baseline and then hourly. Linear mixed models evaluated overall condition effects and differences at each hour following Boneferroni adjustment. Cohen's d estimated magnitude of effects. **Results:** A majority of participants reported high to very high acceptability on the 5 domains of REX (Table). Overall physical discomfort (β=-0.15 log-points, p=0.074, d=0.34), mental fatigue (β=-0.23 log-points, p=0.116, d=0.18), physical fatigue (β= -0.30 p=0.056, d=0.20), and sleepiness (β=-0.33 log-points, p=0.106, d=0.14) did not differ by condition. Mental fatigue was significantly lower (better) at 4 hours in favor of REX (β= -0.48 log-points, p=0.020, d=0.37). **Conclusion:** Hourly simple resistance breaks were rated as an acceptable method to interrupt prolonged sitting during work; however, REX did not improve discomfort, fatigue, or sleepiness compared to SIT. Investigating adaptations and acceptability with chronic usage are warranted.

Table. Acceptability of Simple Resistance Exercise Breaks to Interrupt Sedentary Behavior

Acceptability Questionnaire	*Frequency*	*Percentage*
Question 1: Willingness to Use REX		
Very low or Low	*0*	*0%*
Nether low or high	*2*	*14.2%*
High or Very high	*12*	*85.8%*
Question 2: Confidence to Use REX Unsupervised		
Very low or Low	*0*	*0%*
Nether low or high	*0*	*0%*
High or Very high	*14*	*100%*
Question 3: Coworker's Acceptance of REX		
Very low or Low	*1*	*7.2%*
Nether low or high	*3*	*21.4%*
High or Very high	*10*	*71.4%*
Question 4: Supervisor's Acceptance of REX		
Very low or Low	*1*	*7.2%*
Nether low or high	*5*	*35.7%*
High or Very high	*8*	*57.1%*
Question 5: Feasibility of Frequency and Amount of REX		
Very low or Low	*3*	*21.4%*
Nether low or high	*2*	*14.3%*
High or Very high	*9*	*64.3%*

D-45 Clinical Case Slide - **Chest Pain and Medical Issues**

Thursday, May 30, 2019, 3:45 PM - 5:25 PM
Room: CC-304E

1801 **Chair:** Poonam P. Thaker, FACSM. *Presence Resurrection Sports Medicine Fellowship, Chicago, IL.*

(No relevant relationships reported)

1802 **Discussant**

Philip F. Skiba. *Advocate Lutheran General Hospital, Park Ridge, IL.*

(No relevant relationships reported)

1804 May 30 3:45 PM - 4:05 PM

Chest Injury - Horseback Riding

Philipp J. Underwood, Bryan M. McCarty, Hillary Moss. *North Shore University Hospital, Manhasset, NY.*

(No relevant relationships reported)

Chest Injury - Horseback Riding
Philipp J. Underwood, Bryan M. McCarty, Hillary Moss, North Shore University Hospital, Manhasset, NY
HISTORY: A 56 year old female fell off of her horse, causing her to land on her right shoulder. She experience immediate severe pain in her right shoulder and chest. She denied any head, neck or spine injury or pain, and denied numbness, weakness, paresthesia or headache. She reported no shortness of breath, abdominal pain or extremity injury or pain.
PHYSICAL EXAMINATION: The patient reported pain of 10/10 on arrival and had an elevated blood pressure. Other vital signs were normal. Primary survey was unremarkable. On secondary survey, head, neck and spine were normal. Ribs and abdomen were also normal. Examination of upper extremity revealed deformity of the right shoulder girdle with tenderness and swelling over the proximal right clavicle. The neuro-vascular exam of the upper extremities were normal and symmetrical. She was not able to move the right shoulder due to severe pain. The lower extremities were normal. Neurological examination was normal as was examination of the skin.
DIFFERENTIAL DIAGNOSIS:
1.Clavicle fracture
2.Sterno-clavicular (SC) dislocation
3.Rib fracture
4.Pectoralis muscle tear
TESTS AND RESULTS:
Chest Xray, Clavicle Xray, Shoulder Xray - fracture medial right clavicle and possible dislocation of SC joint
CT of Head and Cervical spine - unremarkable and without acute injury
CT of Abdomen and Pelvis - unremarkable and without acute injury
CT of Chest - fracture and posterior dislocation of the right SC joint with compression of the brachiocephalic artery and vein
FINAL/WORKING DIAGNOSIS:
Fracture and posterior dislocation of the right SC joint with compression of the brachiocephalic artery and vein
TREATMENT AND OUTCOMES:
1.Evaluation by Trauma Surgery, Cardio-Thoracic Surgery with admission to Orthopedics for operative repair
2.Taken to OR and under general anesthesia and fluoroscopic visualization, reduction of SC dislocation
3.Reduction was unstable and ORIF performed with trans-osseous sutures and reconstruction of capsule
4.Discharged next day on Xarelto for 8 weeks and no weight bearing of right upper extremity
5.Physical therapy for 8 weeks begun 2 weeks post op.
6.Patient has returned to riding and experiences only minimal stiffness at right SC joint

1805 May 30 4:05 PM - 4:25 PM

Extremity Paralysis After Boot Camp Workout

Kulraj S. Dhah[1], Roger Mortimer[2], Robert Sallis, FACSM[1]. *[1]Kaiser Permanente Fontana, Fontana, CA. [2]University of California San Francisco, Fresno Medical Education Program, Fresno, CA.*

(No relevant relationships reported)

HISTORY: 37 y/o African American female with history of anemia presented to ED with severe abdominal pain, tachycardia and rapidly progressive bilateral upper and lower extremity paralysis. She reported recently starting Boot Camp style workouts with the last session two days prior to first admission. Patient admitted to using diet pills and intermittent fasting. She was admitted for 3 weeks initially and readmitted four days after being discharged with recurrence of symptoms.
PHYSICAL EXAMINATION: Vitals were within normal range. Normal respiratory effort but only able to speak 3-4 words per breath. Diffuse abdominal tenderness. Paralysis of upper and lower extremities bilaterally with minimal motor function of fingers and toes, full sensation intact, CN 2-12 intact, DTRs +2.
DIFFERENTIAL DIAGNOSIS: 1. Guillain-Barre Syndrome 2. Rhabdomyolysis 3. Amyotrophic Lateral Sclerosis (ALS) 4. Porphyria 5. Progressive Peripheral Neuropathy
TEST AND RESULTS: MRI Head and Spine negative for lesions, nerve root compression or myelopathy. Creatine Kinase levels were mildly elevated. CT Abdomen/Pelvis was negative. CSF analysis and EMG testing suggested variant of Guillain-Barre Syndrome. Negative Inspiratory Force (NIF) testing remained within normal limits. No improvement with IVIG. Labs that were sent out during first admission came back during her second admission (4 weeks later) with dramatically elevated Urine porphobilinogens at 1529 mg/L (ref: <2mg/L). Stool porphobilinogens were also elevated.
FINAL WORKING DIAGNOSIS: Variegate Porphyria
TREATMENT AND OUTCOMES: The patient was started on high volume D10 IV (125ml/hr) for 2 days until IV Hemin was obtained from the only lab in the US that manufactures it. The patient showed mild improvement in motor function within one hour of starting IV Hemin drip. She required a full 7 day course of IV Hemin with gradual increase in motor function but not back to baseline. She underwent a second course of IV Hemin with further improvement in motor function. NGT was replaced by PEG tube for adequate nutrition. Four weeks later, she was discharged from Medicine Service to Acute Inpatient Rehab floor. She continued to improve and was able to return to oral diet and perform ADLs with assistance from family. She was discharged home after two months and moved out of town to live with family.

1806 May 30 4:25 PM - 4:45 PM

Muscle Weakness: Boxing

Belmarie Rodriguez-Santiago, David Atkins, Brenda Deliz-Roldan, William Micheo, FACSM. *University of Puerto Rico, San Juan, Puerto Rico.*

(No relevant relationships reported)

History: A 50-year-old right-handed retired male boxer with no past medical history presented progressive weakness and muscle wasting of bilateral upper extremities. He denied any numbness, tingling or paresthesia, bowel or bladder incontinence, lower extremity weakness or dysphagia. Three weeks before symptoms started, he suffered a fall with impact in the forehead. The patient has a 17-year history of boxing career with a total of 250 combats.
Physical Examination: Generalized muscle atrophy and fasciculations observed in bilateral upper extremities. Full passive range of motion in bilateral upper extremities but limited active shoulder flexion and abduction and incomplete handgrip bilaterally. Strength was 2/5 in shoulder abduction, 3/5 in elbow flexion and extension, and in right wrist flexion and 0/5 in wrist extension. Sensation was intact to pinprick, soft touch and vibration. Deep tendon reflexes 1+ throughout upper and lower extremities.
Differential Diagnosis:
1.Cervical Polyradiculopathy
2.Central Cord Syndrome
3.Motor Neuron Disease: Brachial Amyotrophic Diplegia
4.Chronic Traumatic Encephalopathy
Tests and Results:
Cervical Spine MRI: Multilevel degenerative disc disease. Anterior cervical cord compression at C3-C4 and less prominent at C5-C6 without myelomalacia. No neural foraminal stenosis.
Electrodiagnostic Study: Normal sensory nerve conduction study (NCS). Motor NCS showed low amplitude in the right Median and Ulnar nerves. Electromyographic study revealed active denervation and reinnervation potentials in bilateral upper extremities. Fibrillation and positive sharp waves were observed in cervical and thoracic paraspinal muscles.
Brain MRI: Mild cerebral cortical atrophy. No other intracranial abnormality.
Final Working Diagnosis:
-Motor Neuron Disease: Brachial Amyotrophic Diplegia.
Treatment and Outcomes:
1.Physical therapy for light strengthening and aerobic training.
2.Occupational therapy for assistive device and activities of daily living evaluation and training.
3.Referred to Neuromuscular Clinics for multidisciplinary management.
4.Started in Riluzole.
5.Referred to Speech and Swallow evaluation.
6.Followed up every 3 months to monitor neurological symptoms and remained stable with no signs of neurological deterioration.

1807 May 30 4:45 PM - 5:05 PM

Syncope On The Green - Golf

Noor Alzarka, Mark Chassay, FACSM. *University of Texas Health Science Center at Houston, Houston, TX.*

(No relevant relationships reported)

HISTORY: 22-year-old female collegiate Division I golfer presents with intermittent dizziness, palpitations, and pre-syncope symptoms. She reports a history of syncope as well. She also describes episodes of palpitations or subjective tachycardia at rest and in association with exertion. Symptoms worsen during strenuous weight training exercises. She does not use any prescription medications, supplements, or recreational drugs. Her father has a history of a cardiac arrhythmia and cardiac arrest. She seeks a cardiology referral for diagnostic evaluation.
PHYSICAL EXAMINATION: BP 122/80, HR 91, RR 16, SpO2 99%, BMI 30.5. Well-appearing female. Unlabored respirations, lungs clear to auscultation bilaterally. Regular heart rate and rhythm, non-displaced PMI, without murmurs. Normal pulses in all extremities. Steady station and gait.
DIFFERENTIAL DIAGNOSIS: Reflex syncope. Arrhythmia. Structural cardiopulmonary disease. Dehydration. Orthostatic hypotension. Drug reaction. Dysautonomia. Seizure.
TEST AND RESULTS: EKG: normal sinus rhythm.
7-day Holter monitor: Average HR 93 BPM. No ventricular or supraventricular ectopics noted.
Tilt Table Test: Passive phase is non-diagnostic. Drug provocation phase with nitroglycerin challenge is positive for syncope, a HR decrease from 136 to 40, and then sinus arrest with a 6.1 second pause while blood pressure remains stable.
FINAL WORKING DIAGNOSIS: Vasovagal syncope with sinus arrest consistent with cardio-inhibitory component.
TREATMENT AND OUTCOMES: 1. The cardiac electrophysiologist cleared her for participation in golf and to work out with activity modifications in order to moderate her physical workload and avoid excessive strain that might trigger vasovagal syncope. 2. She was advised to self-monitor for pre-syncopal symptoms; to modify activities as needed, including using lighter weights, taking more breaks, and lying down to recover when needed; and to avoid pushing through symptomatic episodes.
3. The cardiac electrophysiologist also recommended optimizing hydration, including increased salt and electrolyte intake.
4. She was counseled about the possibility of serious injury resulting from syncope.

1808 May 30 5:05 PM - 5:25 PM

Assisted Breathing Manual Therapy for Soccer Chest-Trap Anterior Chest Wall Injury

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Email: feldenkrais.slo@gmail.com

(No relevant relationships reported)

Chest wall injury—Soccer
John C. Hannon, private practice, San Luis Obispo, CA
HISTORY: A17 year-old high school senior soccer left back, during the last quarter of a late-season game, chest-trapped a long and hard soccer ball experiencing instant breathlessness and incapacitating anterior chest pain aggravated by deep breathing, head, spine and arm movement. At the ED, she experienced less intense symptoms. Later, she, and her parents, worried her continued chest pain (which increased with exertion, coughing, and difficulty breathing when running) would ruin her chances to been seen favorably by college soccer scouts. The next day she presented for manual therapy.
PHYSICAL EXAMINATION: Examination revealed a mild pectus excavatum with bilaterally painful 2nd and 3rd sterno-chondral joints and diminished respiratory excursion, accessory breathing muscle activity and elevated shoulders. Muscle splinting interfered with overhead reaching and spinal twisting. Interestingly, marked pain relief occurred with manual skin stretch tangentially applied in the left midaxillary line along the path of the 5th rib with the stretch directed posterior-to-anterior. Similar relief was obtained by firm pressure over the left costal diaphragm muscle attachments. Pain-free palpation of spinal, costo-chondral and costo-vertebral joints. SC, AC and GH joint-play intact.
DIFFERENTIAL DIAGNOSIS: 1. Fracture 2. Sprain/strain 3. Infection 4. Primary tumor 5. Tietze's syndrome 6. Costochrondritis 7. Myofascial trigger points 8. Panic disorder 9. Exercise-induced asthma 10. Cardiovascular, gastrointestinal disease 11. Fibromyalgia 12. Seronegative spondyloarthropathies
TEST AND RESULTS: Normal AP and Lateral chest-xray
FINAL WORKING DIAGNOSIS: Sternocostal sprain-Diaphragm strain
TREATMENT AND OUTCOMES: 1. Tangential skin stretch resolved the breathing distress and relieved most of the chest pain. 2. Manually patterned breathing allowed pain-free but apprehensive ROM spinal twisting and arm overhead reaching. 3. Reassurance, explanation of the mechanics of injury, breathing exercises.
4. Symptom-free return to play 5 day post-injury. 1 month later, accepted 4-year athletic scholarship.

D-46 Clinical Case Slide - **Knee II**

Thursday, May 30, 2019, 3:45 PM - 5:25 PM
Room: CC-105B

1809 **Chair:** Matthew R. Gammons. *VT Ortho Clinic/Killington Medical Center, Rutland, VT.*
(No relevant relationships reported)

1810 **Discussant**
Mary Lloyd Ireland, FACSM. *University of Kentucky, Lexington, KY.*
(No relevant relationships reported)

1811 **Discussant**
Pierre L. Viviers, FACSM. *Stellenbosch University, Stellenbosch, South Africa.*
(No relevant relationships reported)

1812 May 30 3:45 PM - 4:05 PM

Knee Pain and Effusion in a Medically Complex Patient

Aubrey Armento. *University of Colorado Denver, Denver, CO.*
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(No relevant relationships reported)

HISTORY: An 8-year old female presents with a chief complaint of left knee pain and swelling. The pain started one month ago with no acute inciting injury. The pain is located over the anterior knee and is exacerbated with running and bike riding and alleviated with rest and ice. The knee swelling worsens after activity. She has no warmth or erythema of the joint. She denies fever, rash, or other joint complaints. The patient has a history of isolated Langerhans cell histiocytosis of the pituitary stalk and diabetes insipidus, which was diagnosed a year ago. She takes an oral steroid burst and receives vinblastine for chemotherapy every three weeks.
PHYSICAL EXAMINATION: There is a palpable joint effusion of the knee without erythema or warmth. There is diffuse peripatellar tenderness to palpation. She has limited knee flexion to 110 degrees but full extension. Patellar grind test is negative. There is no patellar apprehension. The Lachman test, anterior and posterior drawer tests, varus and valgus stress testing, and McMurray's test are all negative.
DIFFERENTIAL DIAGNOSIS:
1.Musculoskeletal lesion of Langerhans cell histiocytosis
2.Osteochondritis dissecans of the knee
3.Septic arthritis of the knee in an immunocompromised patient
4.New-onset juvenile idiopathic arthritis (JIA)
TESTS AND RESULTS:
-X-rays of the knee showed no acute bony abnormality.
-MRI of the left knee with and without contrast revealed a large joint effusion with enhancing synovitis but otherwise no abnormality.
-Labs including a complete blood count (CBC), erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP) were within normal limits other than the a slightly elevated CRP.
-The patient had an ophthalmologic evaluation and was diagnosed with right anterior uveitis, so she was referred to Rheumatology.
-Knee joint aspiration was performed, with synovial fluid analysis consistent with an inflammatory arthritis. Cultures had no growth.
FINAL/WORKING DIAGNOSIS: Juvenile idiopathic arthritis
TREATMENT AND OUTCOMES: The patient underwent a steroid injection of the left knee. Hopefully, her arthritis can be managed with naproxen and intermittent steroid injections. If not, further discussion must be had between Rheumatology and the Oncology teams about the risk and benefits of disease modifying anti-rheumatic drugs (DMARDs).

1813 May 30 4:05 PM - 4:25 PM

Knee Pain - Swimming in Dangerous Waters

Lauren Nadkarni[1], Kate Quinn[2]. *[1]Maine Medical Center, Portland, ME. [2]Maine Medical Partners, Portland, ME.*
(Sponsor: Heather Gillespie, FACSM)
(No relevant relationships reported)

Title: Knee Pain - Swimming in Dangerous Waters

Authors: Lauren Nadkarni, MD and Kate Quinn, DO (sponsored by Heather Gillespie, MD, MPH, FACSM)
History:
A 17-year-old male with a non-contributory past medical history developed acute pain in his left knee while swimming 3 days prior to presentation. He experienced a popping sensation with hyperextension of his knee while treading water and throwing a rope swing to his friends on the bank of a river. He had immediate swelling and felt pressure on the lateral and posterior parts of his knee, associated with sharp and stabbing pain when straightening his knee. His pain was worse with flexion beyond 90 degrees, straightening his leg, or walking, but was improved with rest and ice. He did not have any give-way or locking episodes.
Physical Exam:
Office examination of his left knee was limited by guarding but demonstrated a very subtle posterior sag sign and a positive effusion. There were no overlying skin changes. His range of motion was 5 degrees of hyperextension to 110 degrees flexion actively his flexion increased to 120 degrees passively. He also had mild posterior lateral joint line tenderness, negative patellar testing, and positive posterior drawer and lateral flexion pinch testing. His anterior drawer testing was negative, although he did exhibit guarding. His contralateral knee, ipsilateral hip/ankle, and neurovascular exams were unremarkable.
Differential diagnosis:
• PCL injury
• ACL injury
• Lateral meniscus injury
• Posterior lateral corner injury
• Patellar subluxation
• Lateral tibial plateau contusion or fracture
• Lateral femur contusion or fracture
Tests and results:
Left knee x-ray:
• Normal anatomy with small effusion
• No acute fracture
Left knee MRI:
• Isolated PCL rupture
Final/working diagnosis:
• Isolated PCL rupture
Treatment and Outcomes:
• Knee immobilizer for 3-4 weeks
• Physical therapy with initial avoidance of hamstring activation for the first 4 weeks
• Over the counter analgesics as needed
• Return to sport progression

1814 May 30 4:25 PM - 4:45 PM

Osteochondritis Dissecans With Loose Body In A Golfer

Krishna Israni, Daniel Montero. *Mayo Clinic, jacksonville, FL.*
(Sponsor: George Pujalte, FACSM)
Email: israni.krishna@mayo.edu
(No relevant relationships reported)

History:
A 63-year-old gentleman with no significant past medical history presented in sports medicine clinic due to left knee pain that began 3 months prior. He states that he stays physically active. Four months prior, he was on the golf range and noticed mild discomfort. He then noticed worsening discomfort with running. His symptoms improved with rest but then would return with activity. Mild pain relief with ibuprofen. Soon after, he started to have painful clicking and catching of the left knee. He returned to Montana where he saw an orthopedist who prescribed meloxicam and ordered x-rays that had essentially normal findings. He then underwent magnetic resonance imaging (MRI) which revealed cartilage defects. His pain improved but he still described occasional, sharp, left lateral knee pain, and less commonly, medial knee pain. He described the pain as aching, sometimes sharp, and measuring 4/10 on the pain scale. Running and walking exacerbated his symptoms; straightening his leg worsened the pain. He had occasional night pain also.
Physical Exam:
Healthy-appearing gentleman, had muscular legs, able to rise from a seated position without difficulty, with nonantalgic gait. Normal range of motion without restriction, minimally tender over the left lateral joint line, no ligament instability, no obvious effusion, positive McMurray, negative Lachman.
Differential Diagnosis:
Meniscal tear
Osteoarthritis
Plica syndrome
Osteochondritis dissecans
Tests and Results:
X-rays grossly unrevealing.

MRI: Large osteochondral defect in the left lateral femoral condyle, measuring approximately 1 cm across, with apparent loose body in the posterior fossa. Smaller osteochondral defect seen in the medial femoral condyle which appeared stable. Associated bony edema on the lateral femoral lesion.
Final Working Diagnosis:
Osteochondritis dissecans with loose body
Treatment and Outcomes:
-
Patient was very active and wanted to return to playing golf. His daily activities were much improved but still limited compared to prior level of activity.
-
Recommended modified activities and possible steroid injection if pain continued to limit activities.
-
Repeat MRI to reassess bony edema and loose body with further consideration of knee scope and other procedures, based on clinical response and imaging.

1815 May 30 4:45 PM - 5:05 PM

Biologically Repaired, Neurologically Prepared? Rethinking Knee Injury and a Novel Rehabilitation Model - Soccer

Corey Petersen, Kersten Schwanz, Sarah Wambheim. *University of Minnesota, Minneapolis, MN.* (Sponsor: Suzanne Hecht, FACSM)

(No relevant relationships reported)

HISTORY: A 21-year-old female NCAA Division I soccer defender sustained a non-contact right knee injury while chasing a ball in the 70th minute of an international spring season game. Her right foot caught on the turf and she felt a "pop" before falling. No previous history of knee injuries.
PHYSICAL EXAMINATION: Examination on the field by an ATC revealed no effusion or deformity, non-tender to palpation, full pain free ROM, a positive Lachman's and anterior drawer test, and no laxity of the MCL or LCL.
DIFFERENTIAL DIAGNOSIS: 1. Isolated ACL tear2. ACL with collateral ligament and/or meniscal injury3. Transient knee dislocation
TEST AND RESULTS: Right Knee MRI- Full thickness ACL tear with intact collateral ligaments and menisci- Subchondral edema present in lateral femoral condyle and lateral tibial plateau
FINAL WORKING DIAGNOSIS: Isolated complete ACL tear
TREATMENT AND OUTCOMES: 1. ACL reconstruction with BTB Patellar Tendon graft 2. Full ROM was achieved by week 3 post-op. Rehabilitation progression included traditional rehabilitation models. Additional focus on neurological rehabilitation was initiated week 3 and maintained throughout. 3. Triphasic training and movement progressions with concurrent sensory inputs and cognitive interference were employed, resulting in a multidisciplinary 3-fold rehabilitation model designed to target 3 injury-associated areas (motor, sensory, neuroplastic). Triphasic training utilizes block periodization of multi-joint movements to target each action of the stretch shortening cycle. Isometric movements increase motor unit recruitment and rate coding while eccentrics increase corticospinal signal. The resulting program combats the motor inhibition while simultaneous sensory overload and cognitive interference oppose neuroplastic changes through neural resource competition and may accelerate return to play.4. Cleared to play 5.5 months following ACL reconstruction by orthopaedic surgeon.

1816 May 30 5:05 PM - 5:25 PM

Bilateral Knee Pain in Pregnancy

Michelle Sriwongtong. *UCLA, Santa Monica, CA.* (Sponsor: Aurelia Nattiv, FACSM)
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(No relevant relationships reported)

HISTORY: 37F G3P2 @32w4d pregnant presents with nontraumatic right knee pain for 1 week. Right knee outside MRI showed extensive marrow edema in the medial femoral condyle, consistent with avascular necrosis. She was made non-weight bearing. Her pain progressed and she became wheelchair bound. She delivered a baby girl @39w5d via C-section. She came to our clinic 3 weeks postpartum for persistent right knee pain and 3 weeks of new left knee pain.
PHYSICAL EXAM: BMI 30. Unable to bear weight due to pain. Bilateral knee exam with tenderness to palpation on her proximal tibia, medial and lateral joint lines, ROM 0-135 degrees, no effusion. Quadriceps and hip abductor strength 3/5 bilaterally.
DIFFERENTIAL DIAGNOSIS:
- Transient osteoporosis of pregnancy
- Avascular necrosis of the femoral condyle
- Stress fractures bilateral distal femur and/or proximal tibia
- Osteoporosis with insufficiency fractures
TEST AND RESULTS:
1. MRI R knee (initial) 5/2018: Extensive marrow edema present in the medial femoral condyle extending over 2.5 cm possibly related to stress reaction or early avascular necrosis. No subchondral or cortical fracture.
2. XR knee bilateral 7/2018: patchy demineralization around the right knee. When correlating clinical history with outside MRI, findings suggest transient osteoporosis.
3. MRI L knee 7/31/18: Small subchondral insufficiency fracture of medial femoral condyle with very mild surrounding bone marrow edema. Faint bone marrow edema in the lateral femoral condyle without fracture.
4. MRI R knee (f/u) 7/31/18: New subchondral insufficiency fracture of the lateral femoral condyle with moderate surrounding bone marrow edema. Resolution of medial femoral condyle bone marrow edema.
5. Labs, 8/18: PTH 44, Free T4 1.3, TSH 5.7, BMP 143/4.7/103/21/0.83/23<88, Ca 9.7, Vit D-25 OH 35
FINAL WORKING DIAGNOSIS:
- Transient osteoporosis of pregnancy
- Left subchondral insufficiency fracture of the medial femoral condyle
- Right subchondral insufficiency fracture of the lateral femoral condyle
TREATMENT AND OUTCOMES
- Tylenol/Norco PRN
- Started weight bearing with crutches 5 months after initial injury
- PT
- Ca 500mg QD, plus 1000mg dietary for breastfeeding
- Vit D3 2000IU QD
- After discussion with her pediatrician, bisphosphonates were held because she was breastfeeding and improving on current therapy

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D-47 Clinical Case Slide - **Shoulder and Elbow**

Thursday, May 30, 2019, 3:45 PM - 5:45 PM
Room: CC-306

1817 **Chair:** David Jewison. *University of Minnesota Orthopaedics, Maple Grove, MN.*

(No relevant relationships reported)

1818 **Discussant**

Jason Pothast. *MedStar National Rehabilitation Network, Washington, DC.*

(No relevant relationships reported)

1819 **Discussant**

Robert H. Lutz. *Davidson College, Davidson, NC.*

(No relevant relationships reported)

1820 May 30 3:45 PM - 4:05 PM

Elbow Pain - Recreational Athlete

Shawn D. Felton[1], Arie J. van Duijn[2]. [1]*Florida International University, Miami, FL.* [2]*Florida Gulf Coast University, Ft. Myers, FL.* (Sponsor: Mitchell L. Cordova, FACSM)
Email: sfelton@fiu.edu

(No relevant relationships reported)

HISTORY: 21-year-old recreational athlete (185. 4cm, 93.44 kg) with no prior history of injury was participating at an extreme sports center performing acrobatic type activities when he completed a back flip on the trampoline and landed on his left outstretched arm. Athlete noted an audible "pop" and the inability to fully extend or flex his arm. He self referred to ED for immediate evaluation and stabilization.
PHYSICAL EXAMINATION: Athlete was examined in sports medicine research lab by licensed physical therapist and athletic trainer. Gross swelling was present on exam. Athlete unable to perform active ROM and complained of intense pain 6/10 on VAS. Athlete pt. tender along medial joint line and specifically distal attachment of the medical collateral ligament. Valgus Stress test performed revealing extreme laxity compared bilateral with minimal stress. Neurological examination and circulatory exam = WNL. Physical examination discontinued due to pain and point of care ultrasound imaging continued of the medial elbow.
DIFFERENTIAL DIAGNOSIS: 1. Medical Collateral ligament sprain 2. Medical Collateral Ligament Disruption 3. Common Flexor Tendon Pathology 4. Pronator Teres Strain 5. Medial Epicondyle Avulsion
TEST AND RESULTS:Elbow AP/Lateral/Oblique Radiographs: WNL; MRI w/o contrast:Complete tear of the proximal ulnar collateral ligament,Avulsion flexor tendon with bone marrow edema, Nondisplaced fracture of the radial head associated joint

effusion. MSK Diagnostic Ultrasound Imaging:1.07 cm widening of the medial joint space (MJS),1.49 cm hypoechocic disruption of the UCL, Discontinuity of the flexor pronator group
FINAL WORKING DIAGNOSIS : Grade 3 UCL Strain with pronator muscle group avulsion. **TREATMENT AND OUTCOME**: Athlete underwent surgery to repair the Grade 3 UCL Strain medial collateral ligament and reattachment of the flexor pronator group avulsion at the medial epicondyle. The diagnosis of such injuries are evident in clinical examinations and the management of the case is common among athletes suffering from traumatic UCL strains, this case clearly illustrated the use of point of care ultrasound imaging in identifying these types of lesions. It further allowed for a more detailed examination when the physical examination was limited as a result of pain. The athlete has made a full recovery.

1821 May 30 4:05 PM - 4:25 PM

Right Elbow Pain in a Teenage Softball Player

Shelby E. Johnson, Edward R. Laskowski, FACSM. *Mayo Clinic, Rochester, MN.*
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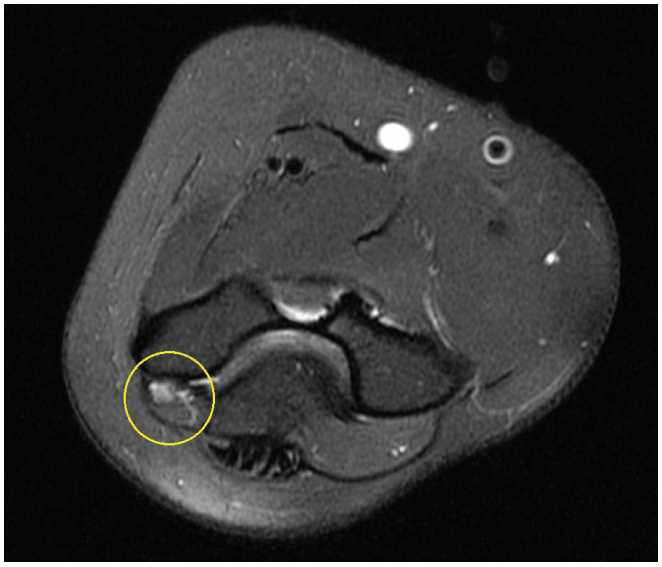
(No relevant relationships reported)

HISTORY:
A 16 year-old right-hand dominant softball player presented with right elbow pain after an overhead throw two months prior. During the initial throw she felt a pop and acute pain, swelling, and ecchymosis at her posteromedial elbow. Her pain improved with rest and range of motion exercises. However, two days prior to presentation, she performed an overhead throw and again felt a pop with immediate pain and recurrent ecchymosis. She had tingling in her fourth and fifth fingers immediately after the throw but denied ongoing sensory symptoms.
PHYSICAL EXAMINATION:
Inspection revealed ecchymosis at the medial elbow. She was tender to palpation over the ulnar nerve along the cubital tunnel and over the medial triceps with mild tenderness of the ulnar collateral ligament. Range of motion, strength, and sensation were normal. Resisted elbow extension reproduced her pain. Valgus stress testing was painful with slight asymmetric opening compared to the left. Dynamic elbow flexion and extension produced dislocation of the ulnar nerve and medial triceps. Tinel's sign at the cubital tunnel was positive.
DIFFERENTIAL DIAGNOSIS:
1. Ulnar neuritis secondary to dislocating ulnar nerve
2. Snapping medial triceps
3. Ulnar collateral ligament injury
4. Medial epicondylitis
5. Triceps tendinopathy
TEST AND RESULTS:
Elbow X-ray: Negative for effusion, fracture, or osseous abnormality.
Elbow MRI: Nonspecific increased T2 signal of the ulnar nerve within and just distal to the cubital tunnel. Collateral ligaments intact.
FINAL WORKING DIAGNOSIS:
Right ulnar neuritis with a dislocating ulnar nerve and snapping medial triceps
TREATMENT AND OUTCOMES:
The patient initially tried rest and physical therapy. Due to progressive pain the patient decided to pursue more definitive treatment and underwent a right ulnar nerve transposition with partial resection of the medial triceps. One month post-operatively her symptoms had largely resolved and she gradually returned to softball.



1822 May 30 4:25 PM - 4:45 PM

Arm Injury - Crossfit

Jeremy Hreha, Mohamad K. Shaath, Joseph C. Tauro, Irfan H. Ahmed, Michael M. Vosbikian. *Rutgers New Jersey Medical School, Newark, NJ.*
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(No relevant relationships reported)

HISTORY:
A healthy, thirty-year-old male without antecedent pain presented with anterior elbow pain and elbow flexion weakness in his dominant upper extremity. At the time of injury, the patient was performing the CrossFit "butterfly pull-ups" in which the forearm is pronated while the elbows are actively flexed to bring the body up to the bar with the body swinging to build momentum. During this movement, he felt immediate pain at his distal anterior brachium but did not hear a pop. Following the injury he noted swelling and pain exacerbated by motion of the elbow. Once the swelling had resolved, the patient noticed a cosmetic defect at the proximal lateral elbow. On presentation, two weeks after the initial injury, his chief complaint was weakness during elbow flexion without any weakness during supination.
PHYSICAL EXAMINATION:
On presentation, no edema or ecchymosis were present. There was a notable defect in the lateral aspect of the arm just proximal to the elbow joint. With flexion of his elbow, the biceps tendon was clearly visualized. No "reverse popeye deformity" was present. A Ruland biceps squeeze test demonstrated intact supination of the forearm, and a hook test demonstrated an intact biceps tendon. There was no appreciable weakness with elbow flexion or supination compared to the contralateral arm. He did not demonstrate fatigability in supination. His range of motion was symmetric to the contralateral side. Neurologic examination showed that there was intact motor function throughout the arm and no sensory deficits were noted.
DIFFERENTIAL DIAGNOSIS:
1. Brachialis muscle rupture
2. Distal Biceps Brachii muscle rupture
3. Proximal Biceps Brachii muscle rupture
TESTS AND RESULTS:
1. Elbow radiographs were negative for osseous pathology
2. MR imaging demonstrated edema at the brachialis consistent with intrasubstance muscle tear. The bicepts tendon was intact.
FINAL/WORKING DIAGNOSIS:
Isolated acute brachialis muscle rupture
TREATMENT AND OUTCOMES:
1. No immobilization given subacute presentation
2. Physical therapy: Initially maintenance of range of motion, then strengthening starting at 8 weeks post injury
3. At 1 year follow up, patient was pain free with full range of motion and no appreciable weakness with elbow flexion

1823 May 30 4:45 PM - 5:05 PM

Shoulder Pain-- Range of Motion

Nicole Messenger, Kelly Estes. *Washington University in Saint Louis, Saint Louis, MO.*
Email: messengern@wustl.edu

(No relevant relationships reported)

History: 49-year-old female with rheumatoid arthritis on methotrexate and oral prednisone presents to the walk-in orthopedic injury clinic for acute severe sharp pain in left shoulder radiating into left elbow and hand. No injury or trauma. Symptoms are constant, worse with overhead movements. She reports associated muscle spasms. She has tried acetaminophen and ice with limited relief. She notes her prednisone was increased to 10mg daily for worsening hand arthralgias recently.
Physical Exam: Patient is well appearing in no distress. Range of motion at the bilateral shoulders is 120 on the right, 110 on the left. She has 5/5 strength with supraspinatus and external rotators, as well as negative belly press and bear hug. 5/5 strength to bilateral upper extremities distally. Full range of motion of her cervical spine with pain only with left side bending. The left posterior cervical paraspinal area has a well-defined erythematous area with overlying vesicular lesions. There are few scattered lesions overlying the left shoulder extending down into the left arm.
Differential Diagnosis:
1. Cervical radiculopathy
2. Shoulder impingement syndrome
3. Varicella zoster virus
4. Herpes simplex Virus
5. Rotator cuff tendinopathy
Tests/Results:
Shoulder Xray
Final/working Diagnosis:
Varicella zoster virus in C6 Dermatome
Treatment and Outcomes:
1. Valacyclovir prescription: 1g tablet by mouth TID for 7 days
2. Pain control with Hydrocodone-acetaminophen 5-325mg per tablet QID PRN for pain
3. Rheumatology follow-up for discussion of modification of her immunosuppression regimen
4. Primary Care follow-up

1824 May 30 5:05 PM - 5:25 PM

Neck Pain and Arm Swelling in a Professional Dancer

Shannon Powers[1], Leda Ghannad[2]. *[1]Rush University Medical Center, Chicago, IL. [2]Midwest Orthopaedics at Rush, Chicago, IL.*

(No relevant relationships reported)

HISTORY: A 33-year-old female professional dancer presents to training room with three weeks of right-sided neck pain. The pain is located at base of the right neck and worsens with flexion. She denies an inciting trauma, but recently began performing new choreography involving repetitive overhead lifting. Associated symptoms include swelling in her right upper extremity and a prominence of her chest wall veins. She denies weakness or paresthesias. **PHYSICAL EXAMINATION**: Inspection reveals mild prominence of veins along the right side of the neck and chest wall, with mild swelling in the right forearm. There is tenderness to palpation at C7 spinous process, right-sided cervical paraspinal muscles, right upper trapezius muscle, and right pectoralis muscle insertion. There is full pain-free range of motion in the cervical spine, right shoulder, and right elbow. Spurling test is negative. Roos test is positive with venous engorgement in the right upper extremity after 30 seconds. Strength is 5/5, reflexes 2/4, and sensation is intact to light touch in the bilateral upper extremities. **DIFFERENTIAL DIAGNOSIS**: 1. Deep venous thrombosis 2. Vascular thoracic outlet syndrome 3. Cervical muscle strain
TEST AND RESULTS: —VAS Duplex Upper Extremity Veins: No DVT —Cervical Spine anterior-posterior and lateral radiographs: unremarkable, no cervical ribs. —VAS Functional Maneuvers Upper Extremity: Absent digital pulsatility with the right arm at 180 degrees. —VAS Duplex Upper Extremity Artery/Bypass Graft: Patent upper extremity arteries without stenosis **FINAL WORKING DIAGNOSIS:** Vascular Thoracic Outlet Syndrome/Paget-Schroetter Syndrome. **TREATMENT AND OUTCOME**: 1. Prescribed Medrol Dosepak and NSAIDs. 2. Started physical therapy and restricted arm motions in practice. 3. Consultation with cardiothoracic surgeon; recommended right first rib resection. 4. Prior to surgery, developed new occlusive DVT in right subclavian and axillary veins. Apixaban initiated. 5. Underwent transaxillary first rib resection, subclavian tenolysis and arteriolysis, and right brachial plexus neurolysis. 6. Returned to sport 6 weeks post-operatively and completed physical therapy. 7. Underwent right upper extremity venogram with angioplasty for chronic occluded central right subclavian vein 3 months post-operatively.

1825 May 30 5:25 PM - 5:45 PM

Arm Injury - Carpentry

Dylan Homen, Mimi Zumwalt, E.L. Domingo-Johnson, Matthew Helm, Melinda Schalow. *Texas Tech University Health Science Center, Lubbock, TX.* (Sponsor: Jacalyn Mccomb, FACSM)

(No relevant relationships reported)

HISTORY 70y/o M RHD presented to consultant hand clinic for R elbow evaluation 8 weeks post injury. He was building a deer hunting blind when the platform fell and landed on the posterior aspect of his right elbow. He noted immediate pain, swelling, and ecchymosis about the elbow at the initial traumatic episode. He also complained of a painful popping sensation whenever he ranged the elbow. He had difficulty straightening his arm, with pain and weakness upon attempted elbow extension. Past medical history included hand osteoarthritis and former 30-year smoker, quit in 2010. Denies history of pain, prior trauma at the site or exogenous corticosteroid use. **PHYSICAL EXAMINATION** R upper extremity-tenderness to palpation over olecranon tip, pain with elbow range of motion (ROM); unable to maintain active elbow extension against gravity or resistance. Unrestricted, passive ROM arc 0-140 with no blocks & full pronation/supination. Distally no neurological or vascular deficits. **DIFFERENTIAL DIAGNOSIS** Olecranon fracture Triceps bony avulsion Triceps tendon rupture **TESTS and RESULTS** Radiographs - elbow lateral view revealed a small osseous fragment ~5 cm proximal to the olecranon tip. MRI - showed complete tear of the triceps with hematoma at its insertion site and ~ 3 cm tendon retraction. **FINAL WORKING DIAGNOSIS** R triceps tendon rupture **TREATMENT and OUTCOMES** Underwent delayed primary repair 2 months post injury. Posterior splint x 2 weeks with elbow 60-70 degrees of flexion. Hinged elbow brace x 2 months with weight restriction of 5 lbs. Gradual increase in ROM progressing to strengthening exercises for another couple of months. Latest follow-up 4 months post-op after OT patient with near full elbow ROM, pain free and functional

D-54 Free Communication/Poster - Blood Flow

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

1845 Board #1 May 30 2:00 PM - 3:30 PM

No Relevant Relationship Between Muscle Flexibility and Blood Flow in the Lower Legs of Competitive Runners

Megan Battles[1], Rachel Bowden[1], Cameron Greene[1], Justin Stanek[2], Arbin Thapaliya[1], Jeffrey Williams[1]. *[1]Franklin College, Franklin, IN. [2]Illinois State University, Normal, IL.* (Sponsor: Kristen Lagally, FACSM)

(No relevant relationships reported)

Megan Battles[1], Rachel Bowden[1], Cameron Greene[1], Justin Stanek[2], Arbin Thapaliya[1], Jeffrey Williams[1]

[1] Franklin College, Franklin, IN
[2] Illinois State University, Normal, IL

Muscular adaptations in the upper limb from training are associated with hypertrophy, inflexibility, and diminished vascular perfusion. Despite these findings in upper extremity athletes, no studies have examined the relationship between peripheral vascular adaptations and muscle flexibility in the lower legs of runners. Through a better understanding of blood flow and muscle flexibility adaptations, clinicians can more accurately assess and treat running injuries.
Purpose: To examine the relationship between blood flow in the posterior tibial artery and sagittal plane ankle range of motion (ROM) among a sample of collegiate runners.
Methods: Blood flow in the posterior tibial artery and sagittal plane ankle ROM were measured bilaterally on 25, asymptomatic collegiate track athletes (16 males, 9 females, age = 20.0 ± 1.2 years, height = 171.5 ± 10.2 cm, mass = 66.7 ± 13.7 kg). Pearson correlation analysis was used to analyze the relationship between blood flow in the posterior tibial artery and ROM of the talocrural joint.
Results: Findings revealed no significant relationship between blood flow in the dominant leg's posterior tibial artery and dorsiflexion (r = .14, P = .52) or plantarflexion (r = -.32, P = .12) and no significant relationship between blood flow in the non-dominant leg's posterior tibial artery and dorsiflexion (r = -.02, P = .93) or plantarflexion (r = -.02, P = .92).
Conclusion: Although muscle inflexibility contributes to compromised blood flow in other body regions, findings of this study demonstrated no relationship between flexibility of the plantarflexor muscles and blood flow in the posterior tibial arteries of competitive runners. Future research should continue examining blood flow in the lower limb as one, among many, physical adaptations runners may experience from training.

1846 Board #2 May 30 2:00 PM - 3:30 PM

Effect of Increased Respiratory Muscle Activation on Blood Flow to Inactive and Active Limb Muscles

Kana Shiozawa[1], Kanako Goto[1], Kaori Shimizu[1], Mitsuru Saito[2], Koji Ishida[1], Luyu Zhang[1], William Sheel, FACSM[3], Keisho Katayama[1]. *[1]Nagoya University, Nagoya-shi Chikusa-ku, Japan. [2]Toyota Technological Institute, Nagoya-shi Tenpaku-ku, Japan. [3]University of British Columbia, Vancouver, BC, Canada.*
(Sponsor: A. William Sheel, FACSM)
Email: shiozawa.kana@k.mbox.nagoya-u.ac.jp
(No relevant relationships reported)

It is unclear whether blood flow to inactive and active limb muscles are altered when the respiratory muscle activation is increased during submaximal exercise. **PURPOSE**: The purpose of this study was to clarify the effect of increasing inspiratory muscle work on blood flow to inactive and active limbs. **METHODS**: Healthy young men (n=7, 20±2 yrs) performed two mild bilateral dynamic knee-extension and -flexion exercises for 10 min. The trials consisted of spontaneous breathing for 5 min followed by voluntary hyperventilation either with or without inspiratory resistance for 5 min (40% of maximal inspiratory mouth pressure, inspiratory duty cycle of 50% and a breathing frequency of 40 breaths/min). Mean arterial blood pressure (MAP) was monitored using finger photoplethysmography. Blood flow to the brachial artery (inactive limb) and in femoral artery (active limb) were recorded using Doppler ultrasound. **RESULTS**: MAP during exercise was higher (P<0.05) with inspiratory resistance (121±6 mmHg) than without resistance (98±6 mmHg). Brachial artery blood flow increased during exercise without inspiratory resistance (127±38 ml/min) as compared with resting level, while it decreased with inspiratory resistance (69±31 ml/min). Femoral artery blood flow increased at the onset of exercise and was maintained throughout exercise without inspiratory resistance (2426±573 ml/min) and was unchanged when inspiratory resistance was added (2517±663 ml/min) (P>0.05). **CONCLUSIONS**: These results suggest that sympathetic control of blood redistribution to active limbs is promoted, partly, by respiratory muscle-induced metaboreflex.

1847 Board #3 May 30 2:00 PM - 3:30 PM

The Effects of Recumbent Angle on Cardiac Responses and Hemodynamics during Bicycle Ergometer Exercise in Patients with Atrial Fibrillation

Ilgyu Jeong[1], Hee-Hyeok Lee[1], Myunghwa Kim[2], Jae-Hyun Lee[1], Seongdae Kim[1]. *[1]Hannam University, Daejeon, Korea, Republic of. [2]Woosong University, Daejeon, Korea, Republic of.*
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(No relevant relationships reported)

Recumbent cycling is well-established mode of exercise that is used in patients with cardiovascular disease to rehabilitate. However, through more hemodynamic researches for patients with atrial fibrillation, the necessity to establish the safety and availability of recumbent bicycle exercise has been required. **PURPOSE**: To determine the effects of recumbent bicycle ergometer exercise on hemodynamics in patients with atrial fibrillation. **METHODS**: In randomized, double-blind, crossover study, three female and eight male patients with atrial fibrillation (63.3±6.1yrs) were asked to perform the incremental bicycle ergometer exercise three times in the upright, 60° recumbent (R), and 30°R postures with a week interval, respectively. Exercise intensity was set initially at 10W and increased by 15W every 2 minutes to 70W. Cardiac output (CO) and systemic vascular resistance (SVR) measured at rest, 5 minutes during exercise and 10 minutes during exercise using electrical cardiometry. Rate pressure product (RPP) was calculated by systolic blood pressure (SBP) and heart rate (HR). All data were analyzed using two-way ANOVA (3 postures x 3 times) with repeated measures. **RESULTS**: HR in 30°R and 60°R was significantly lower than in upright postures at 5 minutes during exercise (88±6 and 84±12 vs. 98±16 bpm, p<.05) and 10 minutes during exercise (95±11 and 94±13 vs. 113±18 bpm, p<.05). RPP in 30°R and 60°R was significantly lower than in upright postures at 5 minutes during exercise (10414±1480 and 10620±2754 vs. 15115±5174 bpm × mmHg, p<.05) and 10 minutes during exercise (11757±1680 and 12195±2367 vs. 16186±3228 bpm × mmHg, p<.05). However, CO, SVR and stroke volume were not significant different between three postures. **CONCLUSIONS**: These results suggest that recumbent bicycle exercise have the advantage of reducing myocardial workload by regulating HR and SBP in patients with atrial fibrillation.

1848 Board #4 May 30 2:00 PM - 3:30 PM

The Influence of EMG-based MVC Intensity on Middle Cerebral Artery Velocity, Cardiac Output and Respiratory Variables

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(No relevant relationships reported)

It has been reported that cerebral blood flow velocity (CBFV) might be reduced according to the increase of exercise intensity determined by %EMG-based maximal voluntary contraction (MVC_{EMG}) during a static exercise test. But, how $\%MVC_{EMG}$ induced-changes of CBFV might be associated with cardiac output (CO) and respiratory response remains unclear. **PURPOSE**: To evaluate the influence of $\%MVC_{EMG}$ on middle cerebral artery velocity (MCA V_{mean}), CO and respiratory variables during isometric strength type exercise. **METHODS**: Eight healthy male (21.3±0.9yrs) were asked to perform the 45° knee extension isometric contraction during 60 seconds. All participants performed four times in random order at the isometric intensity of 100%, 90%, 80% and 70% MVC with a week interval. The intensity of %MVC was determined by root mean square (RMS) of EMG at right rectus femoris muscle. Each participant was asked to conduct and maintain the predetermined intensity of % MVC_{EMG} confirming the figures on a monitor. MCA V_{mean} was measured at rest, 30 and 60 seconds during exercise, 30 seconds recovery, 150 seconds recovery using transcranial-Doppler sonography. CO and respiratory variables were measured by electrical cardiometry monitor and gas analyzer. All data were analyzed using two-way ANOVA (4 intensities x 5 times) with repeated measures. **RESULTS**: MCA V_{mean} in 70% MVC_{EMG} was significantly higher than MCA V_{mean} in 100% and 80% MVC_{EMG} at 60 seconds during exercise (92±9 vs. 68±15 and 78±11 cm/s, p<.05). On the other hand, CO were not significant different between 100%, 90%, 80% and 70% MVC_{EMG}. Vco_2 in 70% MVC_{EMG} was significantly lower than in 100% MVC_{EMG} at 60 seconds during exercise (0.49±0.22 vs. 1.23±0.86 L/min, p<.05) and had significantly negative correlation with the changes of MCA V_{mean} (r=-.524, p<.01). **CONCLUSIONS**: These results suggest that MCA V_{mean} might have the tendency of decrement over the intensity of 70% isometric MVC_{EMG} and negatively relate to Vco_2.

1849 Board #5 May 30 2:00 PM - 3:30 PM

Blood Flow Patterns during Flow-Mediated Dilation

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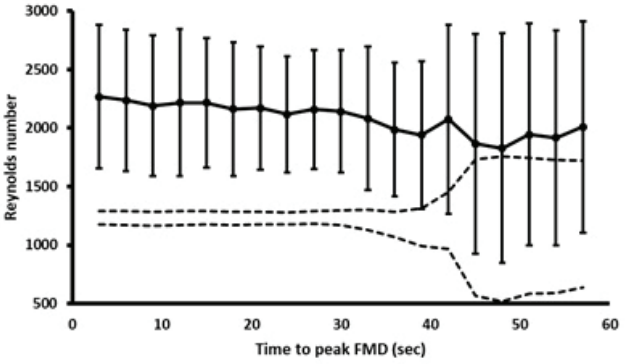
PURPOSE: Flow mediated dilation (FMD) has been the most common assessment of endothelial function in research but it has failed in obtaining a widespread use in clinical setting due to a lack of standardization and a large inter-subject variability. Normalization of FMD to endothelial shear stress (ESS) has been proposed to solve its technical limitations. However, studies have not considered the characteristic of the blood flow during FMD under pulsatile conditions in their ESS estimations. Therefore, the aims of this study were to quantify the magnitude of FMD-induced ESS and to characterize the blood flow under pulsatile conditions during FMD testing.
METHODS: A total of 26 young healthy subjects (15 females and 11 males) underwent FMD testing. Microhematocrit measurement was used to determine blood density (ρ) and viscosity (μ). ESS was calculated by Womersley's approximation, ESS = μ * 2K * Velocity/Diameter, where K is a function of Womersley's parameter (α). The presence of turbulent flow was determined by comparing Reynolds number (Re

= (V * D * ρ)/μ), to critical Reynolds ($Re_{peak(cr)}$ = 169 * $\alpha^{0.83}$ * $St^{-0.27}$, St = freq * D * V). Statistical analysis included repeated measures ANOVA to detect ESS differences during FMD until peak dilation. Significance was established at $p < 0.05$.
RESULTS: The mean (SD) FMD% and time to peak dilation were 7.4 (3.1) % and 35 (9.3) seconds, respectively. ESS was significantly reduced from ischemia release until peak dilation, ($F(3.83, 80.43) = 6.51$, $p < 0.001$, two-tailed). Turbulent blood flow was the only type of flow observed until peak dilation in 96.15% of the sample (Figure).



CONCLUSIONS: Peak dilation of the brachial artery during FMD testing in a young healthy population is triggered mostly by antegrade, high-ESS under turbulent flow conditions. Due to the pulsatile nature of blood flow and the appearance of a turbulent pattern during FMD, ESS should be estimated by Womersley's approximation rather than Poiseuille's law.

1850 Board #6 May 30 2:00 PM - 3:30 PM

Relationship Between Increased Resting Muscle Blood Flow And Muscle Force Loss After Repeated Eccentric Contractions

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Unaccustomed eccentric contractions (ECs) induce muscle force reduction and increased resting muscle blood flow. Whereas muscle force reduction has been well accepted as an index of exercise-induce muscle damage (EIMD), physiological meaning of increased resting muscle blood flow is not fully understood.PURPOSE: The purpose of the present study was to assess the relationship between the increased resting muscle blood flow and muscle force reduction after repeated ECs in healthy individuals.METHODS: Eight young healthy men (age, 20.9 ± 1.7 years; height, 172.1 ± 3.9 cm; weight, 64.5 ± 5.2 kg; body mass index, 21.8 ± 1.7 kg/m^2) participated in this study. Maximal voluntary contraction (MVC) force of isometric elbow flexion at elbow joint angle of 90°, heart rate, and blood pressure were measured before and after 24 h of repeated ECs task. Resting forearm blood flow as an index of muscle blood flow was also measured by plethysmography. Subjects performed five sets of 20 repetitions of eccentric contractions of elbow flexors (no contractions at concentric phase) with a load equal to 60% of MVC force with the use of dumbbells. Each action was performed through the same range of motion at a rate of 4-s.RESULTS: MVC force significantly decreased by 44% (17.4 ± 2.2 kg to 9.7 ± 3.2 kg, p< 0.01) after 24 h of repeated ECs. Resting forearm blood flow increased by 22% (5.8 ± 1.2 ml/ min/ 100 g to 7.4 ± 1.9 ml/ min/ 100 g, p< 0.05) after 24 h of repeated ECs. Resting heart rate and blood pressure were not significantly different between before and after 24 h of ECs. The change of resting forearm blood flow was negatively correlated with the change of MVC force (r= -0.88, p< 0.01).CONCLUSION: Increased resting muscle blood flow was associated with muscle force reduction after repeated ECs. Our results suggested that increased resting muscle blood flow could result from EIMD-induced inflammatory vasodilation after repeated ECs.

1851 Board #7 May 30 2:00 PM - 3:30 PM

Effects of Capsaicin on Leg Blood Flow in Response to Passive Limb Movement

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Given the high rates of cardiovascular disease morbidity and mortality in the United States, and worldwide, finding strategies that might mitigate CVD is paramount. Vascular dysfunction is a critical component and likely precursor measure to CVD. Recently, the passive leg movement (PLM) method has been developed to assess nitric oxide (NO)-dependent vascular function. The nutraceutical Capsaicin has been shown to have cardioprotective effects, enhancing vasorelaxation and attenuating sympathetic vasoconstriction in an endothelium dependent manner via activation of transient receptor potential vanilloid type 1 (TRPV1) channels; this however has only been demonstrated using *in vitro* or animal models. PURPOSE: In this study, a single-blind, crossover design was used to examine the potential effects of capsaicin-induced improvement of leg blood flow in response to PLM. METHODS: Femoral artery blood flow and microvascular perfusion of the vastus lateralis were examined in 12 young, healthy men, using Doppler ultrasound and multi-distance frequency domain based near-infrared spectroscopy. Central hemodynamics (stroke volume, SV; heart rate, HR; cardiac output, CO; and mean arterial pressure, MAP) were measured using finger photoplethysmography. Hemodynamic measurements were continuously taken at rest and during a single bout of PLM (sPLM), a variant of PLM which minimizes the central hemodynamic response. RESULTS: A significant hyperemic response was recorded in response to PLM under both conditions (Capsaicin and Placebo); however the microvascular perfusion response to PLM was not significantly altered ($p > 0.05$) following ingestion of Capsaicin compared to Placebo (Capsaicin: 10.4±3.1%, Placebo: 14.1±3.9%). Femoral artery blood flow was also not significantly augmented ($p > 0.05$) under Capsaicin (Capsaicin: 362±119% Placebo: 295±61% in response to PLM). Expectedly, there were no significant differences in basal microvascular perfusion, basal femoral blood flow, and central hemodynamic responses (HR, SV, CO, MAP) between conditions (p>0.05). CONCLUSION: These results indicate Capsaicin does not further augment hyperemia in response to sPLM in young healthy males. Further study of this nutraceutical is warranted in populations at high risk, or prevalence, of cardiovascular disease.

1852 Board #8 May 30 2:00 PM - 3:30 PM

Does Capsaicin Ingestion Affect Functional Sympatholysis And Vascular Functions?

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During exercise, heat and metabolites (e.g. H+, etc.) attenuate sympathetically-mediated vasoconstriction in contracting muscle, known as functional sympatholysis, remains poorly understood. Previous work has shown that activation of transient receptor potential vanilloid type 1 channels (TRPV1) with Capsaicin (CAP, spicy ingredient in peppers), elicits a sympatholytic effect in vitro in humans. **PURPOSE:** To determine if acute ingestion of CAP elicits or enhances sympatholysis at rest and during exercise in vivo in humans. **METHODS:** In a single blind crossover design, in 10 young healthy males we measured forearm microvascular responses (oxyhemoglobin and myoglobin HbO_2+MbO_2) using near infrared spectroscopy (NIRS) and central/peripheral hemodynamic (cardiac output, CO, and mean arterial pressure, MAP, via Finometer) responses at rest, lower body negative pressure at rest (rLBNP), rhythmic handgrip (HG) exercise at 30% MVC and during HG with LBNP (HG+LBNP) under placebo (PL, 800 mg fiber) and Capsaicin (780 mg pepper extract). **RESULTS:** No differences (P>0.05) were found between PL and CAP in microvascular and central hemodynamics at rest. At rest the LBNP-induced change in HbO_2+MbO_2 (-1.5 ± 2.3 vs 0.3 ± 2.3 %Δ) or conductance index (HbO_2+MbO_2/MAP: 5.5 ± 2 vs 6.0 ± 3 %Δ) were not different (P>0.05). During exercise, HbO_2+MbO_2 were not different (105 ± 28 vs 105 ± 21 uM), though tissue oxygen saturation tended to be higher (64 ± 16 vs 70 ± 13 %, P=0.07), and deoxyhemoglobin lower in CAP (44 ± 5 vs 37 ± 4 uM, P=0.05). The LBNP-induced change during exercise in HbO_2+MbO_2 (-0.1 ± 7.1 vs 1.3 ± 7.2 %Δ) or conductance (5.6 ± 3 vs 2.8 ± 4 %Δ) were not significant (P>0.05), but tended to be better in CAP. Systemic vascular conductance was not significant different at rest between conditions (5.3 ± 0.2 vs. 4.8 ± 0.4 L/min/ mmHg). The LBNP-induced change in SVC at rest (5.6 ± 5.5 vs 6.1 ± 5.7 %Δ) and during exercise (5.2 ± 2.4 vs 1.7 ± 5.2 %Δ), were not different, despite a tendency to be attenuated during exercise with CAP. **CONCLUSION:** Acute CAP does not affect resting hemodynamics or the response to sympathoexcitatory LBNP. During exercise, CAP seems to improve microvascular responses, but does not impact the response to LBNP, despite trends for CAP to mitigate the LBNP-induced reductions in both systemic and local conductance.

1853 Board #9 May 30 2:00 PM - 3:30 PM

The Effect Of The Speed And Range Of Motion Of Movement On The Hyperemic Response To Passive Leg Movement

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(No relevant relationships reported)

PURPOSE: Passive leg movement (PLM)-induced hyperemia is used to assess the function of the vascular endothelium. This study sought to determine the impact of movement speed and ROM on the hyperemic response to PLM and determine if the currently recommended protocol of moving the leg through a 90° ROM at 180°/s provides an optimal peak hyperemic response to PLM.
METHODS: 11 healthy adults underwent multiple bouts of PLM, in which either movement speed (60-240°/s) or ROM (30-120° knee flexion) were varied. Femoral artery blood flow (Doppler Ultrasound) and mean arterial pressure (MAP; photoplethysmography) were measured throughout.
RESULTS: Movement speed generally exhibited positive linear relationships with the hyperemic response to PLM, eliciting ~20-30% increase in hyperemia and conductance for each 60°/s increase in speed (P<0.05). However, increasing the movement speed above 180°/s, which was physically difficult, did not elicit significant increases in hyperemia in many cases. ROM exhibited curvilinear relationships (P<0.05) with hyperemia and conductance, which peaked at 90°, such that a 30° increase or decrease in ROM from 90° resulted in a 10-40% attenuation (P<0.05) in the hyperemic response. Alterations in the balance of antegrade and retrograde flow appear to play a role in this attenuation.
CONCLUSIONS: Movement speed and ROM have a profound impact on PLM-induced hyperemia, as well as the feasibility of the test. When using PLM to assess vascular endothelial function, it is recommended to perform the test at the traditional 180°/s with 90° ROM, which offers a large hyperemic response, while maintaining test feasibility.

1854 Board #10 May 30 2:00 PM - 3:30 PM

The Relationship Between Left Ventricular Systolic Function And Cerebral Blood Flow

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(No relevant relationships reported)

PURPOSE: The positive relationship between cardiac output and cerebral blood flow (CBF) has been indicated in healthy individuals and patinets with cardiovascular diseases. Previous studies reported that the reduced cardiac output was related with a low brain volume and an increased risk for Alzheimer's disease. Also, compromised left ventricular (LV) diastolic function was reported to be associated with a cerebral white matter lesions. Therefore, cardiac function may play an important role for the maintenance of CBF. However, the relationship between LV systolic function and CBF is still unclear. The purpose of this study was to test our hypothesis that the LV systolic function would be associated with CBF.
METHODS: Sixty-three outpatients who presented to our hospital due to transient loss of consciousness were enrolled (59 ± 22 years old, rang 17 to 93 years old, 31 females). LV function was assessed by stroke volume (SV), LV ejection fraction (LVEF) and mass (LVmass) by echocardiography, and preejection period (PEP), ejection time (ET) and ET/PEP by phonocardiogram. ET was corrected by heart rate (ETc). On the other hand, CBF was estimated from systolic, diastolic and mean blood flow velocity in middle cerebral artery (MCA), measured by transcranaial Doppler ultrasound. The multiple linear regression analysis was performed using MCA blood flow velocities (MCAv) as independent variables, and age, sex and each LV funtion as dependent variables.
RESULTS: SV, LVEF, LVmass and PEP were not correlated with MCAv. In contrast, ETc was significantly correlated with both systolic (β = 0.32, P = 0.01) and mean (β = 0.25, P = 0.02) MCAv. ET/PEP was significantly correlated with systolic MCAv (β = 0.22, P = 0.04) only.
CONCLUSIONS: These results indicated that LV systolic function evaluated by phonocardiogram may play more siginifcant role for regulating CBF as compared with that by echocardiography such as LVEF.

1855 Board #11 May 30 2:00 PM - 3:30 PM

Differential Cardiovascular Responses to Acute Exercise in Children with Autism Spectrum Disorder

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(No relevant relationships reported)

Autism Spectrum Disorder (ASD) is a complex neurological disorder identified in early childhood and is characterized by impaired social interaction and atypical behaviors. A very few studies reported that children with ASD tend to have higher heart rate (HR) and blood pressure (BP) at rest compared to typically developing children (TDC). Although structural abnormalities have been identified in the brain stem where cardiovascular control center is located, the physiological basis for ASD has not been established. Furthermore, whether there are alterations in cardiovascular responses to exercise in ASD is unidentified. **PURPOSE:** To determine differential cardiovascular responses to acute handgrip exercise in children with ASD. **METHODS:** Total of 23 adults, TDC and children with ASD participated in the study. HR from ECG, beat to beat arterial BP from Finapres and brachial BP, and respiration from pneumobelt were continuously measured before, during and after 2 minutes of dynamic handgrip exercise at 50% of maximal voluntary contraction. In addition, diameter, blood flow velocity, and flow of the brachial artery were measured using Doppler Ultrasound on the contracting arm throughout the experiment. **RESULTS:** Mean BP was significantly increased to exercise from resting baseline in all groups with no group differences (Δ10.0±1.5 adults, Δ8.2±1.4 TDC, and Δ6.9±1.8 ASD mmHg; P>0.05). HR was significantly increased to exercise from rest in adult and TDC groups (58±2 adult vs. 78±2 TDC at rest, 65±2 adult vs. 85±2 TDC exercise bpm; P<0.05); however, there was no change in HR to exercise from rest in children with ASD (77±4 at rest, 78±5 exercise bpm). Both adult and TDC groups had similar increase in blood flow velocity during exercise compared to rest (Δ17.6±3.2 adult vs. Δ13.5±2.2 TDC cm/s; P<0.05). However, blood flow velocity in ASD did not change from rest to exercise (Δ0.6±2.2 ASD cm/s). **CONCLUSION:** While HR increased to exercise in both adult and TDC groups in similar fashion, HR did not change in children with ASD. It suggests that higher total peripheral resistance may contribute to increase BP during exercise in ASD. Such increase in BP can be attributed to attenuated vasodilation in contracting skeletal muscles during exercise in children with ASD. Supported by CASA RSCA Infusion and Undergraduate Research Grant, SJSU

1856 Board #12 May 30 2:00 PM - 3:30 PM

Altered Blood Flow in Lower Legs of Runners Over the Course of a Competitive Season

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(No relevant relationships reported)

Forceful and repetitive motions in sport lead to adaptations in various tissues. Hypertrophy and inflexibility of muscle tissue are common adaptations associated with decreased vascular perfusion and injury. Such findings have been validated in the upper limbs of throwers over the course of competitive seasons. To date, no studies have examined the influence of a competitive season of running on blood flow in the lower legs of runners. A more comprehensive understanding of blood flow adaptations may advance clinicians' abilities to predict and prevent running related injuries.
Purpose: To examine blood flow in lower legs of collegiate runners over the course of a competitive season.
Methods: Blood flow in the posterior tibial artery was measured bilaterally on 25 asymptomatic collegiate track athletes (15 males, 10 females, age= 20.0±1.2 years, height= 171.5 ± 10.2 cm, mass= 66.7 ± 13.7 kg). Measurements were performed in one session at pre-season and immediately following the season. An independent t-test was used to compare blood flow in dominant versus non-dominant limbs at the start of season. Repeated measures t-tests were used to compare changes in blood flow from pre- to post-season in the dominant and non-dominant limbs.
Results: At pre-season, blood flow in the dominant (123.34±43.73) and non-dominant (112.64± 40.31) posterior tibial arteries was not significantly different (t_{48}=.90, P=.373). Blood flow in the dominant legs, however, significantly decreased from pre- (118.26±46.52) to post-season (102.99±30.76) (t_{19}= 2.089, P= 0.05). No significant difference was seen in blood flow in the non-dominant leg between pre- (109.53±42.03) and post-season (102.55±33.21) (t_{19}= 1.1017, P= 0.322).
Conclusion: This study reveals blood flow significantly decreased in the dominant posterior tibial arteries among runners over the course of a competitive season. Such findings support the idea of limb lateralization and asymmetrical adaptions among this population. Changes in blood flow may predispose runners to injury. These changes may be due to factors in running gait and potentially disproportionate use of one limb during the stabilization and propulsive phases of gait. Further research should examine mechanisms underlying changes in blood flow and its influence on injury incidence among runners.

1857 Board #13 May 30 2:00 PM - 3:30 PM

The Temperature Surface Radiation Pattern - A non-invasive Insight into Skin Blood Flow Response to Exercise

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Infrared thermography (IR-T) is a non-invasive and mobile tool to measure and portray changes of the body surface radiation (T_{sr}) or the surface radiation pattern (T_{srp}) in real-time. **PURPOSE:** The comparison and examination of the T_{srp} of the back of the legs during an exercise test, between endurance athletes and patients with cystic fibrosis (CF). **METHODS:**7 CF patients (G1) and 14 male endurance athletes (G2) performed a step-wise incremental exercise test on a treadmill. T_{sr} was measured via IR-T with a high-resolution detector. T_{srp} was calculated as the difference in temperature (°C) between the 10% of the darkest and 10% of the lightest pixels in the region of interest. T_{srp} data were analyzed at "resting condition" (rest), "individual anaerobic threshold" (IAT) and "maximum load" (max), by repeated measures ANOVA. **RESULTS:** By looking at the complete optical information of temperature patterns over time in high-resolution, we were able to recognize the anatomy of subcutaneous arterioles and their sensitive adjustments due to exercise over time. For G1 global testing for T_{srp} was significant across all measuring points (rest: 2,1°C; IAT: 2,7°C; max: 3,0°C SD: 0,2°C; $p<0.05$), with a significant group difference between rest and max, only ($p=0,022$). For G2 global testing was highly significant (rest: 2,3°C; IAT: 3,4°C; max: 3,8°C SD: 0,1°C; $p<0.01$), and all between-group comparisons were highly significant ($p<0,01$). The course of the T_{srp} during the load does not differ significantly between G1 and G2 ($p=0.124$). **CONCLUSION:** The T_{srp} increases across groups during an exercise test. The T_{srp} can be distinguished between rest, IAT and max for endurance athletes. In the chronically ill patients, the increase in the difference in T_{srp} appeared to be less pronounced, which could be due to the limited capacity of the patients. The adjustment of arterioles during exercise was therefore dependent on the intensity of exercise and on individual prerequisites. High-resolution IR-T measurement has the potential to become a performance diagnostic tool, to generate sensitive insights into individual exercise physiology. Technological innovations like improved algorithms, automated data processing as well as deep learning should be applied in further research studies to improve IR-T diagnostics and the detection of the T_{srp}.

1858 Board #14 May 30 2:00 PM - 3:30 PM

Effects of External Calf Compression on Microvascular Oxygenation in the Lower Limb of Young Men

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(No relevant relationships reported)

Compression garments are used in clinical and sports settings to improve blood flow. Pressure applied by the compression garments varies widely with some garments applying as little as 5 mmHg and as much as 60 mmHg of pressure. Although compression can increase blood flow, compression to a pressure of 60 mmHg for short periods of time (~30 min) has been shown to cause endothelial damage. This is important because endothelial dysfunction is a precursor of atherosclerosis and may impair microvascular oxygenation. **PURPOSE:** Examine the effect of lower versus higher external compression pressures on microvascular oxygenation in healthy, young men. **METHODS:** Near-infrared spectroscopy (NIRS) was used to measure vastus medialis muscle oxygen saturation (SMO_2) and total hemoglobin (THB) in 29 healthy, young men (22 ± 5 years of age, body mass index 23 ± 2 kg·m^{-2}). Oxygenation was measured continuously for 10 min at rest and during external compression, which consisted of inflation of a cuff applied to the calf to 5 mmHg and 60 mmHg in a randomized order. There was a 5 min recovery period between conditions. Each compression condition was maintained for 30 minutes. Data were binned into 5 min epochs and analysed using a 2 (condition) x 9 (time points) ANOVA with repeated measures. **RESULTS:** A significant time effect was detected for SMO_2. When comparing the final epoch (min 25-30) to baseline, SMO_2 increased 5.75% and 5.86% with compression to 5mmHg and 60 mmHg, respectively ($p<0.001$). No condition by time interaction was detected ($p=0.89$). A significant time effect was detected for THB. When comparing the final epoch (min 25-30) to baseline, THB increased 1.08% and 1.15% with compression to 5 mmHg and 60 mmHg, respectively ($p<0.001$). No condition by time interaction was detected ($p=0.76$). **CONCLUSION:** Although previous studies suggest that higher compression pressures of 60 mmHg lead to endothelial dysfunction, our findings suggest that there were no subsequent detrimental effects on microvascular oxygenation. Compression increased microvascular oxygenation and increases were similar between the 5 mmHg and 60 mmHg conditions. These findings suggest that both lower and higher compression pressures may have similar modest beneficial effects on microvascular oxygenation.

1859 Board #15 May 30 2:00 PM - 3:30 PM

Blood Pressure, Body Composition, and Plasma Lipids Are Not Related to Indices of Vascular Health

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(No relevant relationships reported)

Blood pressure, body composition and plasma lipoprotein concentrations are important markers for cardiovascular disease (CVD) risk.
PURPOSE: To examine potential relationships between blood pressure, body composition, plasma lipoprotein concentrations and indices of vascular health as assessed with carotid-femoral pulse wave velocity (PWV) and flow mediated dilation (FMD).
METHODS: Fourteen male subjects (age 32 ± 13 yrs, height 177.6 ± 6.6 cm, weight 83.3 ± 9.0 kg, lean mass 61.7 ± 6.3 kg, fat mass 18.4 ± 6.8 kg) volunteered for lab testing as part of a health assessment program, which included resting blood pressure, dual energy x-ray absorptiometry (DXA), FMD, PWV, and blood analysis. All testing was completed on the same day after an overnight fast. The vascular measures were taken via ultrasound, in a temperature controlled room with dim lighting. Each subject would lay supine for 10 minutes prior to the vascular measures. FMD was assessed in the brachial artery in response to a 5-minute distal occlusion. FMD results are given as a percent change from baseline. The PWV measure was assessed on the carotid and femoral arteries using 80% of the total distance between measure sites. PWV results are given in meter per second. All PWV and FMD measures were completed according to previously published procedures (Bortel, 2011; Corretti, 2002.). Body composition was assessed via DXA. Relationships among the data were analyzed with Pearson's r ($\alpha = 0.05$).
RESULTS: No significant relationships were found with PWV or FMD and any of the CVD risk factors measured. The strongest correlations for PWV and FMD are listed in Table 1.

Table 1.

	Lean Mass	% Body Fat	% Android Fat	LDL Particle Size
PWV	R = - 0.32	R = 0.26	R = 0.28	R = 0.27
	Lean Mass	**Triglycerides**	**LDL**	**HDL**
FMD	R = 0.23	R = -0.37	R = 0.31	R = -0.34

CONCLUSION: Based on our results, accepted risk factors for CVD, including blood pressure, plasma lipoproteins, and body composition, are not related to indices of vascular health as assessed with PWV and FMD.

1860 Board #16 May 30 2:00 PM - 3:30 PM

Greater Forearm Blood Flow is Associated with Better Walking Economy and Gait Speed in Older Adults

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(No relevant relationships reported)

Gait speed decline is a well-established predictor of disability and mortality in older adults. Compromised energetic efficiency (i.e. walking economy) is a strong contributor to gait speed decline, but the underlying mechanisms influencing walking economy are undefined. Impaired vascular function is common with aging and thus may be an important contributor to the development of compromised walking economy and slow gait speed, yet the relationships among blood flow within skeletal muscle, walking economy, and gait speed in older adults are unknown. **PURPOSE:** To examine the relationship between measured forearm blood flow and (i) walking economy and (ii) gait speed in older men and woman. **METHODS:** Resting arterial inflow and reactive hyperemic blood flow (RHBF) of the left forearm was measured in 55 participants of the Longitudinal Aging Study at Towson (LAST; 53% male, mean age 70, range 51-91 years) using venous occlusion plethysmography. Walking economy was measured as the average rate of oxygen consumption during the final 2 minutes of a 5 minute standardized treadmill-based walking test at 1.5 mile per hour. Gait speed was assessed during 2.5 minutes of normal-paced walking over a 20-meter course. The association between RHBF and walking economy and RHBF and gait speed was modeled using linear regression, adjusting for age, height, and fat-free mass. Sobel tests were used to assess possible mediating effects. **RESULTS:** In fully adjusted models, RHBF (mean RHBF: 18.0 ± 5.9 mL•100mL tissue^{-1}•min^{-1}) was negatively associated with oxygen consumption ($\beta = -7.5$, $p < 0.01$), indicating that walking economy was 7.5 mL/min lower for each one-unit increase in blood flow. Gait speed (mean 1.3 ± 0.2 m/s) was positively associated with blood flow ($\beta = 0.01$, $p = 0.05$), indicating that gait speed was 0.01 m/s faster for each one-unit increase in blood flow. Mediation analyses further suggested that blood flow may mediate the association between walking economy and gait speed ($p=0.06$). **CONCLUSION:** RHBF is

a significant predictor of both walking economy and gait speed in older adults, suggesting that better overall vascular health is related to enhanced walking economy and gait speed. Therefore, interventions aimed at improving vascular health in the aging population may be beneficial in maintaining gait speed and mobility with age.

1861 Board #17 May 30 2:00 PM - 3:30 PM

Racial Differences In Vascular Function And Blood Flow Responses During Upper And Lower Limb Exercise

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PURPOSE: Recently, it has been shown that young African American males display lower hyperemic responses, but preserved shear-induced dilation, in response to dynamic handgrip exercise when compared to Caucasian American counterparts; however, it is unknown whether this blunted exercise hyperemia is also present in the lower limbs.
METHODS: Young African American (AA) (n = 4) and Caucasian American (CA) (n = 3) males performed two separate incremental exercise bouts of rhythmic handgrip and plantar flexion exercise while blood flow and diameter were evaluated in the brachial and superficial femoral arteries, respectively. Mean arterial pressure (MAP) and blood flow/vascular function variables (blood flow, shear rate, flow-mediated dilation) were measured in the last minute of each 3-minute workload.
RESULTS: The data revealed no significant group differences during handgrip exercise when examining blood flow (e.g. 24 kg: AA: 666 ± 52; CA: 711 ± 60 $mL.min^{-1}$; p = 0.5), MAP (e.g. 24 kg: AA: 109 ± 5; CA: 99 ± 6 mmHg; p = 0.3), or vascular conductance (e.g. 24 kg: AA: 6.2 ± 0.7; CA: 7.4 ± 0.8 $mL.min^{-1}.mmHg^{-1}$; p = 0.3) across all workloads. During plantar flexion exercise, no group differences were reported when evaluating blood flow (e.g. 32 kg: AA: 993 ± 83; CA: 713 ± 97 $mL.min^{-1}$; p = 0.2), MAP (e.g. 32 kg: AA: 104 ± 4.9; CA: 106 ± 4.8 mmHg; p = 0.3), or vascular conductance (e.g. 32 kg: AA: 9.6 ± 0.8; CA: 7.1 ± 0.8 $mL.min^{-1}.mmHg^{-1}$; p = 0.6) across all workloads. Slopes derived from the relationship between shear rate and arterial dilation across all exercise workloads were not different between groups when examined in the brachial (AA: 0.00136 ± 0.00034; CA: 0.00004 ± 0.00003; p = 0.7) or superficial femoral artery (AA: 0.0013 ± 0.0003; CA: 0.0002 ± 0.0007; p = 0.6).
CONCLUSIONS: Preliminary data revealed no differences in exercise-induced blood flow or vascular responses in the upper or lower limbs when comparing young African American and Caucasian American males.

1862 Board #18 May 30 2:00 PM - 3:30 PM

Improved Maximal Oxygen Uptake Following High-intensity Interval Training Relates To An Increase In Blood Volume

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Improved maximal oxygen uptake following high-intensity interval training relates to an increase in blood volume
High-intensity interval training (HIT) is an effective training mode for improving maximal oxygen uptake (VO_2max). As past research has focused on peripheral adaptations to HIT, little is known about central factors governing cardiac output and thus VO_2max. **PURPOSE:** The aim of this study was to test the hypothesis that HIT-induced improvements in VO_2max are accompanied by increases in blood volume (BV) and cardiac stroke volume. Further, we investigated if inter-individual differences in the increase in in VO_2max could be attributed to changes in BV. **METHODS:** Twenty subjects (10 females, 10 males) participated in a 6-week long training intervention consisting of 3 HIT sessions per week. Each session comprised of three 30 s all-out sprints against a breaking force equivalent to 7.5% of body weight. The sprints were separated by 2 min rest. VO_2max, peak exercise cardiac output and BV (measured with carbon monoxide rebreathing) was assessed before (PRE) and after (POST) the intervention. **RESULTS:** VO_2max increased by 9% (44.9±7.9 to 48.7±7.8 mL/min/kg) from PRE to POST ($P < 0.05$) and the increase in BV was 5% (5.4±0.8 to 5.7±0.9 L, $P < 0.05$) with a corresponding increase in peak exercise stroke volume. Accounting for inter-individual variance, approximately 60% of the change in VO_2max could be attributed to changes in BV. **CONCLUSION:** This is the first study to show that improvements in VO_2max with HIT are associated with increased blood volume. This suggest that a large part of HIT-induced improvements in VO_2max are mediated by increased oxygen delivery, which at least in part is due to increased blood volume.

1863 Board #19 May 30 2:00 PM - 3:30 PM

Visceral Adiposity is Associated with Lower Cerebral Blood Velocity in Older Adults

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Aging is associated with an increased prevalence of obesity and preferential increase in visceral adiposity. Visceral adiposity has detrimental effects on vascular function, which may contribute to reductions in brain blood flow with aging, thereby contributing to stroke risk and cognitive decline. The impact of visceral fat and other components of body composition (total body fat, lean mass) on cerebral blood velocity in older adults has yet to be elucidated. **Purpose:** To evaluate the effects of lean mass (LM), fat mass (FM), and visceral fat (VF), on middle cerebral artery (MCA) mean velocity and conductance in older adults. **Methods:** Twenty-five older adults (60 ± 6 years; 30 ± 5 kg/m^2) completed body composition assessments via dual x-ray absorptiometry (Lunar iDXA, GE, Waukesha, WI). Absolute LM, FM, and VF values were obtained and also made relative to total body weight, i.e. LM (kg)/ total body weight (kg). Mean MCA velocity (MCAv) was assessed using a 2-MHz transcranial Doppler ultrasound probe on the right temporal window. Mean MCA conductance (MCAc) was calculated as MCAv /mean arterial pressure (MAP), with MAP obtained from finger photoplethysmography. **Results:** The range of values for this sample were: MCAv (30 - 105 cm/s), MCAc (0.30 - 1.05 cm/s/mmHg), MAP (79 - 116 mmHg), LM (30.73 - 68.80 kg), FM (15.55 - 63.25 kg), VF (020 - 3. kg), and body weight (51 - 123 kg). Absolute LM and VF were negatively associated with MCAv and MCAc, however, only VF remained after controlling for body weight ($p < 0.05$; Table). No relationship was observed for relative LM or FM (either absolute or relative). **Conclusion:** These results indicate that increased visceral adiposity is negatively related to cerebral blood flow in older adults, whereas whole body fat mass was not as sensitive. This suggests the importance of visceral adipose interacting with cerebrovascular physiology in contrast to whole body fat mass among older adults.

	MCAv	MCAc	MAP
	r	r	r
Lean Mass	**-0.53****	**-0.54****	0.15
Lean Mass relative	-0.14	-0.18	0.22
Fat Mass	-0.35	-0.33	-0.03
Fat Mass Relative	-0.098	-0.11	-0.07
Visceral Fat	**-0.47***	**-0.46***	0.06
Visceral Fat relative	**-0.41***	**-0.41***	0.05
MCAv, mean cerebral artery velocity; MCAc, mean cerebral artery conductance; MAP, mean arterial pressure.	**p<0.01	*p<0.05	

D-55 Free Communication/Poster - Cardiorespiratory Disease

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

1864 Board #20 May 30 2:00 PM - 3:30 PM

An Exaggerated Muscle Metaboreflex In Diabetic Rats Is Mediated By Potentiated Skeletal Muscle Afferent Responsiveness

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(No relevant relationships reported)

Patients with type 2 diabetes (T2D) exhibit an excessive increase in blood pressure during exercise. Evidence suggests that the skeletal muscle metaboreflex is exaggerated in T2D. However, the underlying mechanisms remain poorly understood. Metaboreflex sensory signals from exercising muscle are generated by activation of chemically-sensitive group IV afferent neurons. It is logical to suggest, therefore, that heightened metaboreflex function in T2D may be caused by enhanced muscle afferent responsiveness to chemical stimulation. **PURPOSE**: The purpose of this study was to

1) examine whether the heightened cardiovascular response to exercise in T2D results from muscle metaboreflex overactivity *in vivo*, and 2) investigate the impact of T2D on neuronal responses to chemical stimulation in skeletal muscle afferents *in vitro*. **METHODS**: For 14-16 weeks, rats were given either a normal diet (control group) or a high fat diet in combination with a low dose (35 mg/kg) of streptozotocin (T2D group). *In vivo*, we measured changes in renal sympathetic nerve activity (RSNA) and mean arterial pressure (MAP) in response to capsaicin administration (0.3 and 1.0 µg/100 µl) in the hindlimb arterial supply. *In vitro*, the function of chemically (1 µM capsaicin) activated group IV neurons were assessed by obtaining single-fiber recordings using a muscle-nerve preparation. **RESULTS:** T2D rats exhibited hyperglycemia after overnight fasting (104±5 vs. 161±10 mg/dL, *P<0.05*). Compared to control, capsaicin administration evoked significantly greater increases in RSNA (0.3 µg: 36±25 vs. 92±17 %; 1.0 µg: 55±26 vs. 246±72 %, *P<0.05)* and MAP (0.3 µg: 15±8 vs. 45±9 mmHg; 1.0 µg: 23±9 vs. 70±5 mmHg, *P<0.01*) in T2D rats. The discharge of group IV muscle afferents to 1µM capsaicin exposure was likewise significantly greater in T2D rats compared to control (0.8±0.3 vs. 2.9±0.7 Hz, *P<0.05*). **CONCLUSIONS**: These findings suggest that the heightened cardiovascular response to exercise in T2D may be caused by an exaggerated muscle metaboreflex made overactive via a potentiation in muscle afferent responsiveness to chemical stimulation. *Supported by Lawson & Rogers Lacy Research Fund in Cardiovascular Disease and the Southwestern School of Health Professions Interdisciplinary Research Grant Program.*

1865 Board #21 May 30 2:00 PM - 3:30 PM

Change In Cardiorespiratory Fitness And Prevalence Of Metabolic Syndrome After An Exercise Program

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Metabolic syndrome (MetSyn) is defined as the clustering of multiple risk factors associated with an increased risk for cardiovascular disease (CVD) and type II diabetes. We, and others, have shown that cardiorespiratory fitness (CRF) is associated with the prevalence of MetSyn, however, it is unknown if a change in CRF with exercise training is related to reduced prevalence of MetSyn. **PURPOSE**: To examine the relationship between the change in CRF and the change in number of MetSyn risk factors following a self-referred exercise program. **METHODS**: Maximal cardiopulmonary exercise (CPX) tests and MetSyn risk factors were analyzed prospectively from 364 adults aged 46.1 years (45% women). MetSyn was defined according to the National Cholesterol Education Program- Adult Treatment Panel III criteria as updated by the American Heart Association/National Heart, Lung, and Blood Institute. Correlations and logistic ordinal regression were used to assess the relationship between the change in CRF and the change in number of MetSyn risk factors following ~6 months of participation in a self-referred, community-based exercise program. **RESULTS**: Overall prevalence of MetSyn decreased from 25% to 15%, while CRF improved 15% (30.9 ±8.1 vs. 35.5 ±8.9 mL/kg/min, P<0.001) following the exercise program. Measured change in CRF had a significant, inverse relationship with the change in number of MetSyn risk factors (r= -0.211; P<0.001). Subjects who improved CRF had a 52% reduction in likelihood of gaining MetSyn risk factors when compared to subjects who did not improve CRF (Odds ratio=0.474; P=0.030). **CONCLUSION**: This prospective analysis indicates that there is an inverse relationship between the change in CRF and the change in MetSyn risk factors in a self-referred cohort participating in an exercise program for approximately 6 months. Participating in a community-based, self-referred exercise program yields significant improvements on CRF, the MetSyn risk factors, and the overall prevalence of the MetSyn and therefore should be emphasized as a primary prevention strategy for MetSyn.

1866 Board #22 May 30 2:00 PM - 3:30 PM

Effects of High Intensity Resistance Training on Cardiac Autonomic Modulation in Hypertensive Women

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Individuals with arterial hypertension often have an autonomic nervous system (ANS) imbalance with predominance of sympathetic ANS. This predominance can lead to injury of several organs affecting its functioning. There is evidence that performing high intensity resistance training (RT) with heavier loads and a lower number of repetitions results in lower cardiovascular stress when compared with lighter loads and a higher number of repetitions. However, the effects of different protocols of RT in autonomic modulation are not known specially using nonlinear analyses methods. **PURPOSE**: Analyze and compare the effects of different protocols of high intensity of effort RT on autonomic cardiac modulation of hypertensive women using nonlinear methods. **METHODS**: A randomized crossover design clinical trial was conducted with 15 postmenopausal hypertensive women who underwent a control session and two high intensity RT protocols involving 6 and 15 repetition maximum (RM). The nonlinear variables that compose Heart Rate Variability (HRV) were collected pre, immediately post, 1 h post, and 24 h post each protocol. Repeated-measures ANOVA were used.
RESULTS: The SD1 indices that represent parasympathetic activity in the system were lower in 15RM protocol immediately after the exercise (9.32±11.40) when compared with 6RM (16.38±13.15) and control (19.39±13.40) (p<0.05). The SD2 indices that represent a global variability in the system also were lower in 15RM protocol especially immediately after (13.84±9.57) the exercise when compared with 6RM (24.19±17.50) and control (29.32±17.41) (p<0.05). For the 6RM protocol no relevant clinical changes were observed.
CONCLUSIONS: Performing high intensity RT with lower loads and a higher number of repetitions decreases parasympathetic ANS activity, which may be related to an increased cardiovascular stress. On the other hand, heavier load and lower repetition RT did not have a significant impact upon autonomic modulation when compared to a control session.

1867 Board #23 May 30 2:00 PM - 3:30 PM

Effects Of Sleep-inducing Mixed Juice On Sleep Quality And Cardiac Vagal Regulation In Adults With Disturbed Sleep

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PURPOSE: To investigate whether the consumption of sleep-inducing juice would effect on sleep quality and cardiac vagal regulation in adults with sleep disorders. **METHODS**: This randomized and cross-over design study was conducted on twenty-three adults (24.26±1.39 yrs; 15 females, 8 males) who complained with difficulty in initiating and/or maintaining sleep (PSQI ≥ cutoff score of 5). On feeding session (FS), subjects had received sleep-inducing juice (250ml) twice a day for 8 wks while non-feeding session (N-FS) maintained usual daily life without no juice intake. 2 wks washout was given between two sessions. Anthropometrics and hemodynamic index were taken before and after FS and N-FS. Sleep parameters (e.g. sleep latency) and amount of physical activity had recorded through Actigraph GTX3+ while Pittsburgh sleep diary has completed for consecutive 7 days. For evaluation of cardiac autonomic regulation, heart rate variability (HRV) at resting and during sleep had recorded through Polar RS800CX. In addition, self-reported Pittsburgh sleep quality index (PSQI) and fatigue severity scale (FSS) had completed before and after FS and N-FS. **RESULTS**: Anthropometrics, hemodynamic index, and amount of physical activity had no significant differences between sessions including baseline. Sleep latency, total counts/night, and sleep fragmental index had significant decreases after FS whilst total sleep time and sleep efficiency had significant increase (p<.001, respectively) compared to post N-FS. Moreover, PSQI had significantly decreased after FS (p<.001) coincided with significant decline of FFS (p<.001). Furthermore, vagal activity index (e.g. HF, rMSSD, and SD1) had significant improvement followed by FS (p<.05, respectively) yet there were no significant differences in N-FS. On the contrary, sympathetic nerve activity index (LF/HF ratio) had significant decrease after FS while there was no significant difference after N-FS. **CONCLUSIONS**: Major findings has suggested that consumption of sleep-inducing juice is effective to improve sleep quality accompanied with enhancement of cardiac vagal tone at resting and during sleep. Thus, sleep-inducing juice might be of benefit for managing sleep in adults with disturbed sleep.

D-56 Free Communication/Poster - **Basic Science Applications in Skeletal Muscle**

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

1868 Board #24 May 30 2:00 PM - 3:30 PM

Effect of Short-Term Concurrent Exercise Training on Skeletal Muscle Exosomal miRNAs in Lean and Obese

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(No relevant relationships reported)

Obesity is associated with chronic inflammation characterized by increased levels of inflammatory cytokines. Exosomes are small microvesicles secreted by cells that contain a variety of molecules including microRNAs (miR), mRNAs, and proteins. Typically, miRs act through post-transcriptional regulation of mRNA targets via mRNA degradation and/or translational repression. Exercise training reduces chronic inflammation. **PURPOSE**: The current study examined if obesity and concurrent exercise training alter skeletal muscle: (1) exosomal miR content, and (2) inflammatory signaling. **METHODS**: Vastus lateralis biopsies were obtained from sedentary lean (LN) and obese (OB) (N=8/group) men and women for analysis of targeted whole skeletal muscle mRNA, miR, and protein; and skeletal muscle derived exosomal miR (via small RNA-seq) before and after seven days of concurrent aerobic and resistance training. Significance at $p \leq 0.05$. **RESULTS:** Pathway analysis of skeletal muscle derived exosomal miR indicated: 1) obesity increases miR targeting cancer, Wnt/β-catenin, and neuroinflammation in which transforming growth factor β receptor 1 (TGFβR1) is common; 2) exercise training decreases miR targeting IL-10, IL-8, toll like receptor signaling (TLR), and NF-κB pathways in which RELA, an NF-κB subunit, is common. In whole skeletal muscle, IL-8 mRNA was reduced 50% (LN: Pre=1.0, Post=0.57; OB: Pre=0.89, Post=0.37) and Jun mRNA was reduced 25% after exercise training (LN: Pre=1.0, Post=0.75; OB: Pre=0.98, Post=0.76) consistent with the anti-inflammatory effects of exercise on skeletal muscle. **Conclusion:** These data suggest that obesity and seven days of exercise training both alter skeletal muscle-derived exosomal contents. The target cells for skeletal muscle derived exosomes and the physiological relevance requires further investigation.

1869 Board #25 May 30 2:00 PM - 3:30 PM

Acute Alcohol Ingestion After Resistance Exercise Does Not Alter Phosphorylation Of Upstream Proteins In The mTOR Signaling Pathway

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Consumption of alcohol after resistance exercise (RE) is a common practice and might have negative effects on muscle recovery. Separately, alcohol and RE have opposite effects on signaling through mTOR complex 1 in skeletal muscle, a key pathway involved in muscle protein synthesis. **Purpose:** To investigate the effect of alcohol consumption after heavy RE on the phosphorylation of key proteins upstream of mTOR in skeletal muscle of resistance trained men. **METHODS:** Eleven recreationally resistance-trained men (24 ± 2 y, 178 ± 7 cm, 78.3 ± 8.6 kg) completed 2 sessions of 6 sets of 10 repetitions of Smith machine back squats at 80% of 1 repetition maximum with 2 min of rest between sets. Immediately after exercise participants consumed 30 g of whey protein, followed by a drink (10 min after exercise) containing either alcohol (ALC: 1.09 g EtOH·kg fat free body mass^{-1}) or no alcohol (PLA). Muscle samples were obtained using biopsy before exercise (PRE) and 2 hrs after exercise (2H) and analyzed for phosphorylation at mTOR^{S2448}, TSC2^{S939}, TSC2^{S1387}, and AMPK^{T172} using western blotting. Blood was collected at PRE and 24 hours after exercise (24H) and analyzed for creatine kinase (CK) activity. **RESULTS:** Significant ($p< 0.05$) main effect of time was observed for mTOR^{S2448}. mTOR phosphorylation was (2.9 ± 1.3) times greater at 2H compared to PRE ($F_{(1,10)} = 77.758$, $p < 0.001$, $\eta^2 = 0.774$). No significant main or interaction effect was observed for TSC2^{S939}, TSC2^{S1387}, or AMPK^{T172}. A significant main effect of time with a large eta squared effect size was observed for CK activity. CK activity was greater at 24H (312 ± 137 U·L^{-1}) compared to PRE (135 ± 69 U·L^{-1}) ($F_{(1,10)} = 28.856$, $p < 0.001$, $\eta^2 = 0.558$) indicating that the exercise protocol effectively induced a modest amount of muscle damage on both trials. **CONCLUSION:** Ingestion of a large bolus of alcohol after heavy resistance exercise did not affect phosphorylation at mTOR^{S2448}, TSC2^{S939}, TSC2^{S1387}, or AMPK^{T172} at 2 hours after exercise in resistance-trained men. Supported in part by grants from the National Strength and Conditioning Association Foundation and the Texas Chapter of the American College of Sports Medicine

1870 Board #26 May 30 2:00 PM - 3:30 PM

Autophagy is Stimulated by Acute High-Intensity Interval Training Exercise in Human Skeletal Muscle

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Autophagy is an evolutionary conserved cellular degradation system implicated in maintaining health and promoting longevity. Few human data exist investigating the autophagic response to exercise; however, acute moderate-intensity, continuous exercise (MICT) has been shown to stimulate autophagy in skeletal muscle. Presently, it is unknown whether high-intensity interval training (HIIT) exercise induces autophagy. **PURPOSE:** The purpose of this study was to compare the autophagy response of an acute bout of HIIT exercise (treadmill running) to MICT exercise in human skeletal muscle. **METHODS:** Using a crossover design, ten recreationally-active males (n=5) and females (n=5) performed a bout of MICT (60 minutes at 55% of max velocity [V_{max}]]) and HIIT (6 bouts of 1 minute at 100% V_{max} and 1 minute at 3 MPH, followed by 5 minutes at 3 MPH, followed by 6 bouts of 1 minute and 100% Vmax and 1 minute at 3 MPH). Muscle biopsies from the *vastus lateralis* were taken pre- and 3 hours post-exercise. Exercise bouts were separated by ≥72 hours and performed after abstaining from alcohol for ≥24 hours and food and caffeine for ≥8 hours. Subjects also refrained from food, energy-containing beverages, and caffeine during the 3-hour post-exercise period prior to the muscle biopsy. Muscle tissue was analyzed for protein expression of markers of autophagy (LC3I, LC3II) and autophagy signaling (p38MAPK) via western blot analysis. **RESULTS:** No differences were detected for LC3I, LC3II, and p38MAPK protein content measured 3 hours post-exercise compared to pre-exercise in both HIIT and MICT bouts ($p>0.05$). LC3II:LC3I ratio increased 3 hours post-exercise in HIIT (162.4 ±: 45.9%), which was significantly higher than MICT at 3 hours post-exercise which decreased from pre-exercise (48.8± 9.4%; $p<0.05$). **CONCLUSION:** Our findings show that despite discrepant durations and intensities, HIIT stimulates autophagy in human skeletal muscle, however, in a distinct fashion compared to MICT. Our data also add to the current literature demonstrating that autophagy is activated by continuous (≥ 60 minutes), moderate-intensity (55 – 70% VO_{2max}) exercise.

1871 Board #27 May 30 2:00 PM - 3:30 PM

Senescent Skeletal Muscle Satellite Cell Exosomes Induce Endothelial Cell Senescence and Impair Angiogenesis

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(No relevant relationships reported)

Introduction: Cellular senescence is a state of irreversible cell cycle arrest associated with aging that occurs in many cell types including endothelial cells (EC) and skeletal muscle satellite cells (SC). Senescent cells exhibit an increase in secretion of cytokines and chemokines, often referred to as the senescence associated secretory phenotype (SASP). SCs and ECs co-exist in the muscle niche and cross-talk occurs between the two cell types. Small extracellular vesicles (exosomes) have been implicated as important contributors to the SASP. **Purpose:** Determine if exosomes from human, primary, senescent muscle satellite cells impact human endothelial cell growth, angiogenesis, and senescence. **Methods:** Senescence in primary human skeletal muscle satellite cells (n=6) was induced via incubation with 200μm hydrogen peroxide (H_2O_2). Exosomes were collected from normal and H_2O_2 treated satellite cells (NML-EXO and SEN-EXO, respectively). Human umbilical vein endothelial cells (HUVECs) were treated with 50 μg/ml of NML-EXOs or SEN-EXOs. HUVEC growth and senescence was evaluated using EdU and β-galactosidase staining. HUVEC angiogenesis was measured via matrigel tube formation, wound healing and transwell migration assays. **Results:** After 48-hours, there was a decrease in proliferation (NML-EXOS: 22% vs SEN-EXOS: 18% EdU^+ cells) and an increase in senescence (NML-EXOS: 40% vs SEN-EXOS: 53 % $β\text{-}gal^+$ cells) in the SEN-EXO treated HUVECs. SEN-EXOs also impaired HUVEC wound healing following a scratch assay by 32.4%. There were no differences in HUVEC tube formation or transwell migration between the two EXO treatments. **Conclusion:** Exosomes harvested from senescent muscle satellite cells appear to transfer a senescent phenotype to HUVECs, resulting in impaired growth and

migration. This study provides evidence that exosomes function as part of the SASP in satellite cells and may propagate a senescent phenotype to neighboring endothelial cells in skeletal muscle with aging.

1872 Board #28 May 30 2:00 PM - 3:30 PM

Effects Of Different Doses Of D-galactose On Skeletal Muscle In C57bl/6j Mouse

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(No relevant relationships reported)

PURPOSE: Pharmacologically inducible models of aging could help to understand the pathogenesis of sarcopenia and to establish better exercise prescriptions for the elderly. Administration of D-galactose (50-150 mg/kg) has been used to induce aging phenotype including accumulation of oxidative stress, muscle atrophy, and cognitive impairment. A recent paper has shown that a higher dose of D-galactose (500 mg/kg/day) accumulated greater oxidative stress, compared with the commonly used dose (100 mg/kg/day). These observations suggest that there might be room to reconsider the optimal dose of D-galactose. We hence examined whether higher dose of D-galactose (above 100 mg/kg/day) exacerbate skeletal muscle atrophy. **METHODS**: Male C57BL/6J mice (8 weeks old) were divided into 4 groups as follow: 1) Control (0 mg/kg/day, n=10), 2) D-Galactose (150 mg/kg/day, n=10), 3) D-Galactose (1000 mg/kg/day, n=10), and 4) D-Galactose (2000 mg/kg/day, n=10). We intraperitoneally injected D-galactose solution at indicated dose every day for 8 weeks. On the day before tissue collection, we performed grip strength measurement. Twenty-four hours after the final injection, we collected and weighed gastrocnemius muscle, and then conducted histochemical analysis to measure cross-sectional area. **RESULTS**: We first confirmed that body weight and food intake during the intervention were not different among any doses of D-galactose. There were also non-detectable changes in muscle mass and grip strength among groups. We found that D-galactose injection decreased muscle fiber cross-sectional area at 150 mg/kg/day (-13.7%, P=0.03), but not at 1000 mg/kg/day (-11.5%, P=0.10) and 2000 mg/kg/day (-9.8%, P=0.19).**CONCLUSIONS**: Daily injection of D-galactose at 150 mg/kg/day sufficiently induces muscle fiber atrophy. Even if the dose was increased up to 1000 or 2000 mg/kg/day, the muscle fiber atrophy was not aggravated but rather alleviated.

1873 Board #29 May 30 2:00 PM - 3:30 PM

Exercise Activate Tendon Cells through HGFA

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(No relevant relationships reported)

Regular exercise enhances the musculoskeletal systems including tendon strengthening. Tendon cells, consisting of tendon stem/progenitor cells (TSCs) and tenocytes, are essential for the maintenance and repair of tendinous tissues when injured. Previously, we showed that TSCs increase in their number and quality after mice underwent moderate treadmill running. However, the molecular mechanisms underlying the activation of tendon cells by exercise are unknown. Hepatocyte growth factor activator (HGFA) is known to be a systemic factor that can activate skeletal muscle stem cells. **PURPOSE:** To test the hypothesis that HGFA is elevated and activates tendon cells in response to exercise. **METHODS:** Total 18 mice were equally divided into cage control and exercise groups. Exercise was mimicked by one-time treadmill running (OTR), with which mice ran at 13 meter/min for 6 hrs. Twelve hours before OTR, both groups of mice were injected with 1 mg of bromodeoxyuridine (BrdU) per mouse to determine cell proliferation. One day after OTR, all mice were sacrificed and Achilles and patellar tendons were harvested. The HGFA levels in both tendons and serum were measured using ELISA, and BrdU incorporation was assayed by immunofluorescence staining. Student *t*-test was performed to assess statistical significance. **RESULTS:** OTR increased HGFA levels in both Achilles and patellar tendons of OTR mice compared to cage control mice (**Fig. 1A**). HGFA levels in serum were also significantly increased after OTR (data not shown). Moreover, more BrdU positive cells were present in patellar tendons in OTR group than control group (**Fig. 1B**), indicating that quiescent tendon cells were activated from G_0 to G_{Alert} by exercise, possibly through HGFA. **CONCLUSION:** Exercise-elevated HGFA possibly may be responsible for the activation of tendon cells. This new molecular mechanism may explain the beneficial effects of exercise on tendon strengthening by stimulating synthesis.

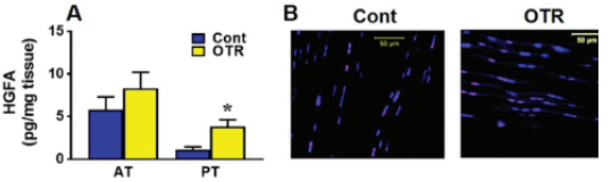

Fig. 1 (**A**) HGFA is elevated by exercise (OTR) in Achilles (AT) and patellar (PT) mouse tendons (* $p < 0.05$); (**B**) OTR increases the number of tendon cells that incorporated BrdU, indicating that many tendon cells are activated from G_0 to G_{Alert} at one day after exercise.

1874 Board #30 May 30 2:00 PM - 3:30 PM

Ischemia-reperfusion Injury Remodels Skeletal Muscle Motor Unit, Myonuclear-, And Mitochondrial-domains

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Peripheral artery disease (PAD) is a significant medical condition caused by blockages in the arteries of the leg. Some PAD patients progress to critical limb ischemia (CLI) and major amputation. While recent regenerative medicine approaches on collateral vessel formation have made some progress, the myopathy and dysregulation of the skeletal muscle in CLI have not been thoroughly investigated. **PURPOSE:** To determine the regenerative mechanism of the muscle stem cell (MuSC) and its niche components in response to ischemic insults, we assessed interactions between MuSC, vascular- and neural-network, and myofibers at different times points. **METHODS:** The femoral artery ligation mouse model of PAD on different reporter mice were used in the study. Immunofluorescence, single fiber staining, and biochemistry blotting from harvested hindlimb muscles were used for data analysis. One-way ANOVA with Tukey's *post hoc* test and a paired two-tailed *t*-test were performed to determine differences following CLI injury. **RESULTS:** Skeletal muscle regeneration persisted up to 56 days while the number of $eMHC^+$ fibers ($p<0.01$) was highest 14 days following CLI surgery compared to the contralateral sham control. In addition, muscle regeneration was accompanied by significant alterations in the motor unit, as demarcated by the presence of denervated synapses, regeneration of the neuromuscular junction (NMJ), and increased number of subsynaptic nuclei ($p<0.05$). Furthermore, the size of the myonuclear domain was decreased at 7 and 14 days ($p<0.01$), corresponding to greater RNA content ($p<0.001$) and MuSC frequency ($p<0.05$) while the mitochondrial domain was increased 28 days ($p<0.01$) following CLI injury. **CONCLUSION:** Overall, these data indicate that as a regenerative response to critical limb ischemia, the neurovascular network of myofibers are remodeled and newly regenerated myofibers exhibit MuSC-derived myonuclear expansion to allow enhanced transcriptional support and an increase in mitochondrial content for a bioenergetic need of the energy-demanding tissue regeneration.
Supported by NIH R21AR072287 (YCJ) and Regenerative Engineering and Medicine research grant.

1875 Board #31 May 30 2:00 PM - 3:30 PM

Increased Muscle 5alpha-dihydrotestosterone By Acute Resistance Exercise Contributes To Muscle GLUT4 Signaling In Diabetic Rats

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(No relevant relationships reported)

Our previous study showed that 5α-dihydrotestosterone (DHT), an active androgen, can be synthesized in skeletal muscle by 5α-reductase. Recently, we revealed that the increase in muscle DHT level by resistance training was associated with improvement of glycemic control in type 2 diabetic rats. Acute resistance exercise activates signaling pathway such as AMPK/TBC1D1 and Akt/AS160 in skeletal muscle, resulting in enhancement of GLUT4 translocation. However, it is still unclear whether an increase in muscle DHT secretion by acute resistance exercise contributes to up-regulation of

these signaling pathways in type 2 diabetes. **PURPOSE**: This study aimed to clarify whether acute resistance exercise-induced increase in muscle DHT level contributes to muscle glucose metabolism-related signaling pathway in type 2 diabetic rats.
METHODS: Male 20-week-old type 2 diabetic (OLETF) rats were randomly divided into 8 groups: resting control and immediately, an hour and three hours after acute resistance exercise (climbing ladder) with and without treatment of 5α-reductase inhibitor (N=6 each group).
RESULTS: Muscle 5α-reductase protein expression and DHT level were significantly increased immediately and an hour after acute resistance exercise ($p<0.05$), whereas these exercise responses were significantly suppressed by the treatment of 5α-reductase inhibitor ($p<0.05$). Muscle AMPK$^{(Thr172)}$, TBC1D1$^{(Ser237)}$ and Akt$^{(Ser473)}$ phosphorylation were significantly increased at immediately and an hour after acute resistance exercise ($p<0.05$). In addition, muscle AS160$^{(Thr642)}$ phosphorylation and GLUT4 translocation were significantly increased one and three hours after resistance exercise ($p<0.05$). However, the treatment of 5α-reductase inhibitor was significantly suppressed the up-regulations of GLUT4 translocation and Akt/AS160 phosphorylation ($p<0.05$), but did not alter the AMPK/TBC1D1 phosphorylation.
CONCLUSIONS: These results suggest that the increase in DHT secretion by acute resistance exercise may partially contribute to enhancement of muscle GLUT4 translocation via activation of Akt/AS160 phosphorylation in type 2 diabetic rats.
Supported by Grants-in-Aid for Scientific Research (#17H02182 and #16K13059, M. Iemitsu).

1876 Board #32 May 30 2:00 PM - 3:30 PM

The Development of Cancer Cachexia Negatively Impacts Skeletal Muscle Extracellular Matrix Remodeling

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(No relevant relationships reported)

Cancer-cachexia is the largely irreversible wasting of lean body mass as a result of cancer progression, affecting ~80% of all cancer patients with as much as ~40% of cancer-related deaths being attributed directly to cachexia. Cachexia has been associated with increased fibrosis and reduced physiological function in cardiac muscle, but the possible role and development of fibrosis and associated extracellular matrix (ECM) remodeling in skeletal muscle has lacked evaluation. **PURPOSE:** To examine the effects of cancer cachexia on ECM remodeling and the development of fibrosis in skeletal muscle. **METHODS:** 40 C57BL6/J mice were injected with either Lewis Lung Carcinoma cells or a PBS control into their hind-flank at 8 wks of age. The tumor was allowed to develop for 1, 2, 3, or 4 wks (n=8 per group). Tibialis anterior (TA) muscle was extracted and immediately frozen for morphology and mRNA abundance analysis using RT-qPCR. **RESULTS:** There were no changes in TA muscle weight until 4 wks post-tumor implantation which resulted in a ~22% lower muscle wet weight compared to PBS control ($p<0.05$). Sirius Red staining of TA muscle sections resulted in no change in collagen abundance in all groups with the exception of a 2-3-fold increase at 4 wks relative to all other groups ($p<0.05$). Collagen 1 gene expression was ~50 % and ~60 % lower than control at 3 and 4 wks post tumor injection, respectively. ($p<0.05$). Collagen 1 gene expression was ~2-fold higher at 1 and 2 wks but there was no difference at 3 or 4wks, all relative to control ($p<0.05$). The ratio of Collagen 3:1 gene expression decreased ~30-50% from 1-3wks compared to control ($p<0.05$), but there was no difference at 4-wks. MMP-2 gene expression was ~50% higher at 1-wk compared to control ($p<0.05$), but was not different 2-4wks from control ($p<0.05$). MMP-9 gene expression was 3 and 6-fold greater than control at 3 and 4-wks post-injection, respectively ($p<0.05$). There was a main effect of tumor implantation to reduce TIMP-1 gene expression ~20-70% ($p<0.05$). **CONCLUSION:** The development of cancer cachexia results in dysregulation of ECM remodeling and increased collagen deposition within skeletal muscle. This dysregulation could negatively affect skeletal muscle's ability to maintain muscle mass and respond to other environmental stressors.

1877 Board #33 May 30 2:00 PM - 3:30 PM

Skeletal Muscle Kir6.2 Protein Expression Correlates To Ion Transport Capacity And Exercise Performance In Athletes

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(No relevant relationships reported)

Skeletal muscle ion regulation may affect exercise tolerance during intense muscle work. However, the inter-play between different sarcelemmal ion transport proteins is not well described in trained skeletal muscle. **PURPOSE:** To examine associations between protein expression of Kir6.2, a key subunit of the ATP-sensitive K^+ channel (K_{ATP} channel), and exercise performance, as well as different ion regulators and fiber type profile in trained skeletal muscle. **METHODS:** Seventeen competitive women soccer players (age; 23±4 yrs; height; 166±5 cm, weight; 60.2±7.5 kg; VO_{2max}; 50.5±5.1 $ml \cdot min^{-1} \cdot kg^{-1}$), participated. Participants has a muscle biopsy obtained from m. vastus lateralis. The Western Blot technique was applied to determine muscle protein expression of Kir6.2, different ion transporters involved in Na^+, K^+, Cl^-, H^+ and La^- sarcolemmal transport, a myriad of metabolic enzymes and muscle fiber type character. Finally, exercise performance capacity was assessed with a VO_{2max} test, a repeated sprint test (RST), as well as the Yo-Yo Intermittent Endurance, level 1 (YYIE1). Inter-individual relationships between selected variables were evaluated by Pearson's product-moment correlation coeffcients. **RESULTS:** Muscle Kir6.2 and monocarboxylate transporter 4 (MCT4) correlated ($r=0.59$; $P<0.05$) with MCT4 explaining 35% of the variance in Kir6.2 protein. Moreover, the ratio of MCT4/Kir6.2 muscle protein expression correlated ($r=0.50$; $P<0.05$) to YYIE1 performance. Kir6.2 protein expression also correlated ($P<0.05$) with muscle Na^+-K^+ATPase β1 and the FXYD1 subunits ($r=0.42$ and 0.50, respectively). Kir6.2 correlated to the expression of Myosin Heavy Chain I (MHCI; $r=0.51$) and Phosphofructokinase (PFK) protein ($r=0.45$). In contrast, no relationship was observed between Kir6.2 and oxidative enzymes. ΣNa^+-K^+ATPase subunits correlated ($r=0.46$; $P<0.05$) to Kir6.2 protein expression. The sum of all ion transporters correlated to VO_{2max} ($r=0.58$), RST ($r=0.45$) and YYIE1 performance ($r=0.42$). **CONCLUSIONS:** Skeletal muscle K_{ATP} channel abundance appears to associate with the capacity to regulate ions such as H^+ and K^+. Moreover, the capacity to regulate ion homeostasis is associated with exercise tolerance in trained human skeletal muscle.

1878 Board #34 May 30 2:00 PM - 3:30 PM

LINE-1 Retrotransposition Increases with Age in Rodent Skeletal Muscle

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(No relevant relationships reported)

Long interspersed nuclear element-1 (LINE-1 or L1) is termed a genomic parasite due to its ability to randomly copy and paste itself back into the genome. Studies have shown that L1 accounts for roughly 17-18% of the total human genome. However, due to various mutations in most of the L1 elements, only approximately 100 copies are functionally active. L1 has been shown to increase with age in mice skeletal muscle tissue. However, there is no data regarding the effects of aging on L1 activity in rat skeletal muscle tissue. **PURPOSE**: To identify the effects of aging on L1 expression in rat skeletal muscle tissue. **METHODS**: Sedentary male fischer 344 rats were fed ad libitum and were aged to 3, 12, and 24 months (mo) (n=9 per age group) and then sacrificed. Primer sets for qPCR were designed for the youngest most active form of L1 (L1.3), and older L1 elements (L1.Tot). Gastrocnemius skeletal muscle was harvested and then processed for RNA and DNA isolation. Thereafter, the following analysis ensued: L1 mRNA expression, L1 DNA copy number, L1 promotor methylation and ORF1 protein. Additionally, a subset of the tissues from 3 mo (n=8) and 24 mo (n=8) were shipped to LC Sciences for RNA sequencing to analyze L1 related genes. **RESULTS**: Primer sets designed for both L1.3 and L1.tot significantly increased with age (L1.3, $p=0.003$; L1.Tot, $p=0.003$), and was higher at 24 mo compared to 3 mo ($p<0.01$). L1.3 integration into the genome was significantly higher at 24 mo compared to 3 mo ($p=0.021$). ORF1 protein expression significantly increased with age ($p<0.001$), and was higher in both the 12 and 24 mo compared to 3 mo ($p<0.05$). There was no statistical difference for L1 promotor methylation. From RNA sequencing CTCF was significantly higher in 24 mo compared to 3 mo ($p=0.011$). **CONCLUSION**: L1 gene expression appears to increase with age, which leads to more random insertions back into the genome. This may be a result of an increase in

CTCF binding, acting as a co-activator at the L1 promotor, but this hypothesis needs validation. Additionally, L1 promotor methylation, while not statistically significant, was numerically lower with age and this decrease could be contributing to the increase in L1 gene expression. Thus, we provide novel insight as to how L1 gene regulation is altered with age, but more research is need to test how L1 is affecting skeletal muscle health.

1879 Board #35 May 30 2:00 PM - 3:30 PM

Exercise-induced Changes In Circulating Follistatin And GDF-15 Are Intensity- And Duration-dependent

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(No relevant relationships reported)

Follistatin inhibits the actions of the TGFβ family to oppose inhibition of skeletal muscle growth, whereas growth and differentiation factor (GDF) 15 may inhibit muscle growth. The **PURPOSE** of this project was to determine if predominately aerobic exercise can induce changes in concentrations of circulating follistatin and GDF-15, and if these changes are dependent on exercise intensity and/or duration. **METHODS**: Fifteen recreationally trained young (28.3±2.0 years) males (n=8) and females (n=7) participated in two bouts of treadmill running: a vigorous intensity/short duration (ViSd) bout at +15% ventilatory threshold for 30 minutes and a moderate intensity/long duration (MiLd) bout at -5% ventilatory threshold for 90 minutes. Blood was collected pre-exercise, 15 minutes from the start of exercise, mid-exercise, and immediately, 1hr-, 2hr-, and 3hr-post exercise. Serum was analyzed with commercially available ELISA kits for follistatin and GDF-15.
RESULTS: At 15 minutes into the exercise bout follistatin was higher ($p<0.0001$) in MiLd (8.12±4.7 ng/mL) than ViSd (5.28±4.3 ng/mL), and GDF-15 was higher ($p=0.0002$) in MiLd (209.3±40.8 ng/mL) than ViSd (183.7±31.2 ng/mL). Follistatin was higher in ViSd 1hr post-exercise (MiLd 9.7±3.1 ng/mL vs. ViSd 12.1±7.3 ng/mL; $p<0.0001$), and higher in MiLd 2hr post-exercise (MiLd 11.2±3.4 ng/mL vs. ViSd 7.6±4.2 ng/mL; p0.0008) and 3hr post-exercise (MiLd 10.1±3.3 ng/mL vs. ViSd 8.8±4.9 ng/mL; $p<0.0001$). GDF-15 was higher in MiLd immediately post-exercise (MiLd 335.0±75.9 units vs. ViSd 193.5±34.0 units; $p=0.0265$), 1hr post-exercise (MiLd 461.0±84.7 ng/mL vs. ViSd 225.2±45.7 ng/mL; $p<0.0001$), and 3hr post-exercise (MiLd 338.2±70.2 ng/mL vs. ViSd 224.3±44.8 ng/mL; $p<0.0001$).
CONCLUSIONS: The differences at the 15 minutes into exercise time point suggest that the exercise-induced follistatin and GDF-15 response is intensity-dependent. The differences post-exercise imply that there may also be a duration effect. Intensity and duration need to be considered to increase follistatin in response to running.

1880 Board #36 May 30 2:00 PM - 3:30 PM

Effect of Mechanical Loading of Aged Myotubes on their Myogenic Lineage Progression and Apoptosis

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(No relevant relationships reported)

PURPOSE: The process of myogenesis is gradually declined and cells apoptosis increases with aging. However, mechanical loading of aged skeletal muscle can ameliorate its impaired myogenic and survival potential. Yet, the molecular responses of aged muscle cells τo mechanical loading are still elusive. This study examined the effects of mechanical loading of aged differentiated myoblasts (myotubes) on the signaling and gene expression responses associated with the progression of their myogenic lineage and survival. **METHODS**: C2C12 myoblasts were cultured for 50 consecutive days (68 cell cycles) in order to acquire aging properties, while normal myoblasts were used as a control condition. Subsequently, control and aged C2C12 cells were cultured on elastic membranes until their 9th day of differentiation (myotubes) and then underwent a passive, cyclic stretching (2.2% elongation, at a frequency of 0.25Hz, for 12h). Phosphorylation of signaling proteins ERK1/2 and Akt, as well as the expression of the myogenic factor MyoD were determined by immunoblotting of cell lysates derived from stretched and non-stretched myotubes. Real Time-PCR was used to measure changes in expression levels of the myogenic regulatory factors (MRFs; MyoD, Myogenin, MRF4), growth factors (IGF-1 isoforms: IGF-1Ea, IGF-1Eb), apoptotic factors (Foxo, Fuca, p53) and atrophy factors (Murf1, Atrogin, Myostatin) in response to mechanical loading of the differentiated C2C12 cells. **RESULTS**: Mechanical loading of the myotubes resulted in significant activation of Akt and increase in MyoD protein levels ($p<0.05$). mRNA expression levels of IGF-1 isoforms (IGF-1Ea: 2.1-fold, IGF-1Eb: 1.2-fold) and MRFs (Myogenin: 11-fold, MRF4 1.2-fold) were increased significantly ($p<0.05$), while MyoD (0.8-fold), apoptotic factors (FOXO: 0.7-fold, FUCA: 0.3-fold, p53: 0.6-fold) and atrophy factors (Atrogin: 0.09-fold, Myostatin: 0.7-fold, Murf1: 0.09-fold) decreased ($p<0.05$).
CONCLUSIONS: Upregulation of myogenic and anabolic factors, along with the downregulation of apoptotic and atrophy factors by mechanical loading suggests an amelioration of myogenic and survival ability of the aged myotubes.

1881 Board #37 May 30 2:00 PM - 3:30 PM

Nutrients Stimulate Mitochondrial Biogenesis Via PGC-1α-targeting MiRNAs In C2C12 Myotubes.

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(No relevant relationships reported)

Purpose: Several studies have demonstrated that small nutrients, such as Caffeine (CAFF) and branched chain amino acids, especially Leucine (Leu), induce mitochondrial biogenesis through diverse mechanisms that converge in the activation of PGC-1α, leading to enhancing transcriptional activity and mitochondrial remodeling. Micro-RNAs (miRNAs) have been known to act as powerful negative modulators of gene expressions involved in essential cellular processes. Recent evidence suggests that miR-494, miR-696, and miR -761 are involved in mitochondrial biogenesis by negative modulation of PGC-1α signaling. However, it remains unclear whether these miRNAs are regulated individually or cooperatively by nutrients stimulation. Therefore, our study was focused on the effect of Leu and CAFF on these miRNAs functions and how it affected its downstream effectors, and ultimately, mitochondrial biogenesis. **Methods:** Following 5 days of differentiation period, C2C12 myotubes were treated with Leu (1 and 3mM) or CAFF (3mM) containing Dulbecco's modified Eagle's medium (DMEM) without serum and Leu for 24h. The serum and Leu-Free DMEM with a 2% H_20 was used as a control. After 24h of each treatment, the cells were harvested and then, DNA, RNA, and protein (whole fraction) were isolated for immunoblotting and qPCR analyses. Micrographs of four fields per condition were randomly captured before and 24h after treatment to measure myotube diameter. **Results:** Mitochondrial DNA copy number increased significantly 24h after Leu addition, and especially in the CAFF treatment ($p < 0.05$), compared with the control cells. Similarly, myotube diameter was significantly larger in two Leu-treated groups ($\geq 20\%$, $p < 0.05$), as well as CAFF supplementation (~10%, $p < 0.05$), than in control and pre-treatment groups. PGC-1α protein level and phosphorylation rate of p70S6K were also augmented in both treatment groups. Conversely, miR-494, miR-696, and miR-761 levels were downregulated in the Leu-treated groups, but only miR-761 levels were decreased in the CAFF-treated group. **Conclusion:** These results suggested that nutrients such as Leu or CAFF can regulate the expression of PGC-1α-targeting miRNAs, which then leads to inducing mitochondrial biogenesis.

1882 Board #38 May 30 2:00 PM - 3:30 PM

Changes In Phb1 Modulate Effects Of Different Exercise Modes On Skeletal Muscular Mitochondrial Function in rats

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(No relevant relationships reported)

PURPOSE: ATP synthesis plays the most important role. ATP synthesis is closely related to the structural and functional integrity of mitochondria. To investigate the effects of PHB1 expression changes on skeletal muscle mitochondrial function in rats of different exercise modes. **METHODS**: 160 healthy male SD rats were randomly divided into four groups: normal control(NC),moderate intensity exercise(MIE),excessive fatigue exercise(EFE), and acute exhaustive exercise(AEE) groups.NC and AEE:routinely raised.MIE: 10 minutes per day at 10m/min for the first week and increased for 10 minutes every day until the end of the second week.From the third week, rats run at 15m/min for 60min every day until the end of the 8th week. Slope:10%. EFE: From the first week of training, the speed of the running platform is 15m/min, increased by 5m/min per week to 30m/min.Training time is 30 minutes and increased by 20 minutes per week until 110 minutes. Slope: increase by 5% per week until 15%. The EFE and AEE groups were trained for 6 days per week for 8 weeks. AEE:The rats were subjected to acute exhaustive exercise after 8 weeks. They were killed after 48h of the last experiment. Mitochondrial respiratory control rate (RCR), ATP content, ROS level, complex V activity and PHB1 expression were measured. **RESULTS**: Compared with NC, in MIE group , RCR (+73%,$P<0.001$), ATP content (+48%,$P<0.05$), complex V activity (+79%,$P<0.05$), PHB1 expression (+42%,$P<0.01$) were increased, and ROS level (-75%,$P < 0.001$)was reduced; In OFE group , RCR (-39%,$P<0.01$), ATP content (+50%,$P<0.05$), complex V activity (+293%, $P<0.001$), PHB1 expression (+28%,$P<0.01$) and ROS level (+62%, $P<0.001$) were increased; In AEE group ,the RCR (-58%, $P<0.05$), ATP content (-55%,$P<0.05$), complex V activity (-56%,$P<0.001$), PHB1 expression (-31%,$P<0.01$)decreased, and ROS (+79%,$P<0.05$) level increased. Correlation analysis showed that PHB1 expression was positively correlated with ATP content in three groups. **Conclusion**: Changes in PHB1 expression were consistent with changes in mitochondrial function under different motion modes.

It is suggested that there may be interaction between PHB1 and ATP synthase. PHB1 participates in the stabilization of mitochondrial structure, changes mitochondrial function and affects the body's ability to exercise.

1883 Board #39 May 30 2:00 PM - 3:30 PM

Resistance Exercise And Doxorubicin Treatment: Effects On Antioxidant Enzyme Expression In Type Ii Muscle

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Doxorubicin (DOX) is a chemotherapy drug used to effectively treat a variety of cancers. Its clinical use, however, is limited by its toxicities commonly attributed to increased oxidative stress in cardiac and skeletal muscle. The DOX-induced rise in oxidative stress can overwhelm endogenous antioxidants yet exercise (both endurance and resistance) has shown promise in attenuating this decline. Little information, however, is available on how DOX and resistance exercise affect antioxidant enzymes in type II skeletal muscle. **PURPOSE**: To determine the effects of resistance training before and during DOX treatment on superoxide dismutase (SOD) 1 and SOD2 expression in the primarily type II extensor digitorum longus (EDL) muscle. **METHODS**: Thirty-six male Sprague-Dawley rats were randomly assigned to one of four groups: sedentary+saline (SSS), sedentary+DOX (SSD), resistance training+saline (RRS), or resistance training+DOX (RRD). The resistance training protocol incorporated a raised cage model where food and water were elevated progressively which provided hind limb loading 10 weeks prior to DOX injection and 4 weeks during DOX treatment. Groups treated with DOX received 3 mg/kg DOX weekly for 4 weeks (12 mg/kg cumulative), and saline-treated groups received 0.9% NaCl as a placebo. Five days following the final DOX or saline injection, EDL muscles were excised, and Western blotting was performed to quantify SOD1 and SOD2 expression. **RESULTS**: Although no significant drug effects, activity effects, or drug x activity interactions were observed with SOD1 and SOD2 expression ($P > 0.05$), a trend toward SSD expressing less SOD1 and SOD2 than SSS was observed (-25% and -37%, respectively). This same trend in SOD1 and SOD2 expression, however, was not observed in RRD (+3% and -3%, respectively vs SSS). **CONCLUSIONS**: The DOX dosing regimen used in the current study had no effect on SOD1 and SOD2 expression in the EDL muscle, and the resistance training protocol also did not affect SOD1 and SOD2 expression. These results suggest that resistance exercise may play a limited role in modulating oxidative stress of DOX in type II skeletal muscle.

1884 Board #40 May 30 2:00 PM - 3:30 PM

Mechanisms Through Which Agents Of Muscle Fatigue, Acidosis And Phosphate, Inhibit Muscle Myosin Function.

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PURPOSE: During muscle fatigue from intense activity, elevated concentrations of hydrogen ions (acidosis) and inorganic phosphate (Pi) inhibit muscle's ability to generate force and motion. However, it is not clear exactly how these metabolic by-products reduce the force and enzymatic function of muscle's molecular motor, myosin. **METHODS**: To determine these mechanisms we directly measured the effect of these fatigue agents on the force generating capacity of isolated myosin in a laser trap assay and on its ability to hydrolyze ATP in an ATPase assay. **RESULTS**: Acidosis (pH 7.4 vs. 6.5) in a mini-ensemble laser trap assay reduced myosin's average force production by 20% ($p < 0.05$) due to a slowed rate of actomyosin binding. This conclusion was supported by the observation that acidosis slowed myosin's ability to hydrolyze ATP by roughly 90% ($p < 0.05$) in a solution assay. By contrast elevated levels of Pi (0 vs. 10-15mM), in the presence of low pH (6.5), caused a similar reduction in force. However, this was likely due to an accelerated rate of myosin's detachment from actin, because myosin's ATPase rate also recovered back toward the control value (pH 7.4, no Pi) when Pi was added. **CONCLUSION**: Thus, these data provide unique insight into the molecular mechanisms that underlie the loss of muscle function during fatigue. In our current work we are using these findings to explore methods to mitigate these effects *in vitro* in a first step toward attenuating fatigue in diseases such as chronic heart failure.

1885 Board #41 May 30 2:00 PM - 3:30 PM

Molecular Implications of Active and Passive Recovery Following High Volume Resistance Training

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PURPOSE: Deloading is widely practiced in the strength and conditioning community as a method to augment recovery; however, there is little molecular signaling data to fully explain the details of why this practice is beneficial.
METHODS: Recreationally-trained, college-aged males (n = 30) underwent 6 weeks of volume based training, after which the participants were split into active recovery (AR) and passive recovery (PR) groups with delaod lasting 7 days. Participants donated a muscle biopsy from the vastus lateralis prior to week 1 (PRE), post training (POST), and post deload (DL). Protein expression for mTOR, AMPk, 4EBP1, and p70S6k was evaluated via western blotting. Additionally, blood was obtained via venipuncture, and serum levels of creatine kinase (CK), testosterone (TEST), and cortisol (CORT) were evaluated using commercially available assay kits.
RESULTS: There was an effect of time for phosphorylated (p) 4EBP1 ($p = 0.014$) where PRE ($p = 0.003$) and POSTDL ($p = 0.004$) expression of p-4EBP1 were significantly higher than POST. CK activity also had an effect of time ($p = 0.016$) where CK at POST was significantly higher than at DL ($p = 0.007$). There was a significant group*time interaction of proteasome activity ($p = 0.040$) where post-hoc analysis revealed the AR group exhibited higher proteasome activity DL than the PR group ($p = 0.051$). Differences in protein expression for pan and phosphorylated mTOR, AMPk, p70S6K, and pan 4EBP1 were not significant ($p > 0.05$). Additionally, there were no significant differences in serum testosterone and cortisol levels ($p > 0.05$)
CONCLUSION: AR may stimulate the PI3K/AkT pathway resulting in the phosphorylation of 4EBP1 potentially allowing hypertrophic adaptation to occur. Additionally, proteasome activity being upregulated with AR POSTDL may be beneficial in cleaving damaged protein structures. More research is needed to further investigate molecular signaling after deloading paradigms.

1886 Board #42 May 30 2:00 PM - 3:30 PM

PGC-1/ERR-Induced Regulator in Muscle (PERM1) Increases Mitochondrial Respiratory Capacity in Culture Muscle Cells

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Peripheral arterial disease is the third leading cause of death of atherosclerotic cardiovascular mortality in the United states and the incidence of PAD increases age. Previous studies have shown that PAD displays impaired mitochondrial respiration, decreased expression of mitochondrial enzymes, increased oxidative stress, and mitochondrial DNA mutations within their ischemic limb muscles. We identified a potential transcriptional regulator of mitochondrial gene expression, PGC-1/ERR-induced regulator in muscle (PERM1) which is reduced 85% in patients with severe PAD. Interestingly, PERM1 regulates the expression of only a subset of genes induced by PGC-1a or ERRs expression in C2C12 myotubes, suggesting that PERM1 selectively functions in specific PGC-1/ERR-driven pathways. **Purpose:** The purpose of this study is to determine whether PERM1 is a potential gene target to aid in tissue recovery and regeneration from hypoxia in C2C12 myotubes. **Methods:** We generated AAVs to overexpress the PERM1 gene or a green fluorescent protein (ZsGreen1). Following AAV infection, C2C12 myoblasts were differentiated into mature myotubes for assessments of mitochondrial biogenesis, mitochondrial respiration, and myogenesis were performed. To determine if PERM1 plays a role in recovering myotube respiration and myotube atrophy from hypoxia, C2C12 myotubes infected AAV-PERM1 were placed in hypoxia for 6-hours and mitochondrial respiratory function, content, and myosin heavy chain area were assessed during the recovery from hypoxic insult. **Results:** AAV-PERM1 resulted in a ~16-fold increase in mRNA expression which drove a ~20% increase in complex I-supported respiration compared to the control cells ($P<0.05$, n=6). Increased Expression of PERM1 did not change the myotube fusion index (an indicator of myogenesis) (P=0.32, n=4). **Conclusion:** Our results indicate that PERM1 is a strong regulator of mitochondrial biogenesis in skeletal muscle cells, capable of increase both mitochondrial content and respiratory function. Based on these observations, future studies should be aimed at understanding the therapeutic potential of PERM1 for improving muscle energetics in conditions with impaired muscle metabolism, including peripheral arterial disease. Partially supported by AHA Grant 18CDA34110044 to TER.

1887 Board #43 May 30 2:00 PM - 3:30 PM

Xbp1 Promotes Skeletal Muscle Regeneration And Growth In A Cell Non-autonomous Manner

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(No relevant relationships reported)

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Purpose: Skeletal muscle exhibits a remarkable capacity for regeneration following injury. However, the molecular mechanisms governing skeletal muscle regeneration remain poorly understood. X-box binding protein (XBP1) is a downstream target of the endoplasmic reticulum (ER) stress inducer inositol-requiring enzyme 1 (IRE1). The purpose of this study was to determine the role of XBP1 in regulation of skeletal muscle regeneration and growth.
Methods: To investigate the role of XBP1 in the regulation of skeletal muscle regeneration and growth, we generated muscle-specific knockout (KO) mice of XBP1. Control and KO mice were then injected with 100 µl of 1.2% $BaCl_2$ into the tibialis anterior muscle to induce a necrotic injury. In a separate experiment, control and KO mice were subjected to the synergistic ablation model of overload hypertrophy of the plantaris muscle. Skeletal muscle was collected and analyzed using histological and biochemical techniques.
Results: Protein levels of XBP1 are increased in regenerating muscle fibers (1 ± 0.21 vs. 17.66 ± 13.9, $p < 0.05$). Moreover, genetic deletion of XBP1 inhibits regeneration due to reducing the number 2 or more centrally nucleated fibers (44.2 ± 2.8 vs. 30.7 ± 1.7, $p < 0.05$) and the number of satellite cells per 100 myofibers (26.5 ± 2.4 vs. 19.3 ± 1.4, $p < 0.05$). Furthermore, targeted ablation of XBP1 inhibits increases in cross-sectional area of myofibers due to a functional overload in adult mice (2266.3 ± 304.4 µm² vs. 1779.5 ± 150.9 µm², $p < 0.05$). Interestingly, XBP1 does not affect the rate of protein synthesis during muscle growth. Rather, deletion of XBP1 prevents skeletal muscle hypertrophy through reducing the total number of satellite cells per 100 myofibers (9.5 ± 1.1 vs. 5.8 ± 0.8, $p < 0.05$).
Conclusions: The results of the present study suggest that XBP1 is necessary for skeletal muscle regeneration and adult skeletal muscle hypertrophy. Furthermore, XBP1-mediated signaling in myofibers promotes satellite cell proliferation and fusion in a non-cell autonomous manner. More investigations are needed to further understand the mechanisms, especially gene network that XBP1 regulates during skeletal muscle formation and growth.

1888 Board #44 May 30 2:00 PM - 3:30 PM

Effects of Obesity and Acute Resistance Exercise on Skeletal Muscle Intercellular Communication Pathways

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Obesity (OB) disrupts cellular communication consistent with lower skeletal muscle capillarization. Exosomes, small microvesicles, transport and deliver mRNA, miRNA, and proteins in an endocrine manner and are released by muscle during aerobic exercise. The effects of resistance exercise (REx) on exosome biogenesis is unknown.
PURPOSE: Investigate if resistance exercise increases skeletal muscle exosome biogenesis pathways and if this response is impaired in obesity.
METHODS: Lean (LN) and obese (OB) (n=8/group) sedentary men and women performed 3 sets of 8-12 repetitions/set of acute, single leg knee extension resistance exercise at 80% of 1-RM. Vastus lateralis biopsies were obtained at rest and at 15 min, and 3 hr post-exercise. Muscle mRNA, protein expression, fiber typing, and capillary staining were measured.
RESULTS: The gene expression of the exosome biogenesis components hepatocyte growth factor-regulated tyrosine kinase (HGS) and vacuolar protein sorting mutant (VPS4a) were lower in OB than LN at rest (~25%) and at 15 min post- (~20%), but not 3 hr post-exercise. Expression of exosome surface markers apoptotic linked gene-2 interacting protein X (Alix) was lower (OB ~35% and LN ~20% 15min post-exercise) and tumor susceptibility gene-101 (TSG-101) was higher (OB ~50% and LN ~40% 3hr post-exercise) in response to REx in both groups. Acute resistance exercise increased vascular endothelial growth factor (VEGF) mRNA similarly in LN and OB. Interestingly, anti-angiogenic thrombospondin-1 (TSP-1) mRNA was increased by acute REx only in OB (~230% 3hr post-exercise). miR-130a (angiogenesis), miR-206 (myoblast to myotube differentiation) and miR-503 (repressor of cell proliferation) were increased in OB at rest and following exercise. Type II fiber size was greater and capillary density was lower in OB.
CONCLUSION: Obesity alters skeletal muscle exosome biogenesis, angiogenic, and muscle differentiation pathways possibly contributing to greater muscle fiber size and lower muscle capillarization. Resistance exercise alters skeletal muscle exosome marker expression similarly in both lean and obese.

1889 Board #45 May 30 2:00 PM - 3:30 PM

Preliminary study: Leucine Supplementation Exacerbates Muscle Wasting Independent of the Ubiquitin-Proteasome System

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Cancer Cachexia is a devastating syndrome that affects around 50-80% of cancer patients and is characterized by a rapid, drastic fat and muscle mass loss. The $APC^{Min/+}$ mouse strain is a well-studied mouse model of human colorectal cancer and cancer cachexia. The branched-chain amino acid leucine is known to stimulate muscle growth/maintenance through activation of mTOR and protein synthesis.
PURPOSE: To examine the effects of chronic leucine supplementation on cancer cachexia development in $APC^{Min/+}$ mice. **METHODS:** 7 $APC^{Min/+}$ mice (APC) and 11 wild-type (WT) were used for this study. The animals were assigned to the following groups: WT no leucine (WTNL, n=5), WT leucine (WTL, n=5), $APC^{Min/+}$ no leucine (APCNL, n=5) and $APC^{Min/+}$ leucine (APCL, n=2). Mice were given ad libitum access to food and water. Mice in the leucine groups received 1.5% leucine-rich water. Plantaris muscles and tibias were excised at 20 weeks of age. Tissue was immediately frozen for morphology and gene expression analysis using RT- qPCR. **RESULTS:** The number of polyps increased in $APC^{Min/+}$ compared to WT (46.57 ± 2.44 vs 0.00 ± 0.00). The number of polyps < 1 mm was increased (14.33 ± 1.45 vs. 7.75 ± 2.05) in APCL compared to APCNL ($p<.05$). There was a main effect for $APC^{Min/+}$ to have lower body mass than WT ($p<.0001$). There was a main effect of genotype to decrease plantaris weight/tibia length in $APC^{Min/+}$ mice vs. WT mice ($p<.0001$) and a main effect of leucine to decrease plantaris weight/tibia length in $APC^{Min/+}$ mice ($p<.05$), which appeared to be driven by the APC (interaction $p=.0841$). There was an ~8-fold increase in *atrogin-1* gene expression in APCNL compared to WTNL ($p<.05$). *Atrogin-1* gene expression was ~7-fold lower in APCL compared to APCNL ($p<.05$). There was a main effect of genotype to increase *MuRF1* expression in $APC^{Min/+}$ mice compared to WT ($p<.05$) and a main effect of leucine to decrease *MuRF1* expression ($p<.05$), which appeared to be driven by the APC genotype (interaction $p=.0560$). No difference was found in *MyoD* or *Myogenin* gene expression. **CONCLUSION:** The preliminary data suggest deletory effects of leucine in cancer cachexia, which need to be affirmed by further studies. Based on gene expression of the E3 ubiquitin ligases, this loss in muscle mass may be independent of protein degradation.
Supported by the Arkansas Biosciences Institute

1890 Board #46 May 30 2:00 PM - 3:30 PM

Skeletal Muscle Antioxidant Antioxidant Capacity Correlates With Both Oxidative And Glycolytic Profile In Trained Women Athletes

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Muscle antioxidant enzymes may be upregulated in parallel with increased exercise training status and capacity for reactive oxygen species (ROS) formation. **PURPOSE:** To examine associations between antioxidant protein expression and different physiological markers of endurance exercise in trained women athletes. **METHODS:** Seventeen competitive women soccer players (age; 23±4 yrs; height; 166±5 cm, weight; 60.2±7.5 kg; VO_{2max}; 50.5±5.1 ml·min^{-1}·kg^{-1}) participated. Participants had a muscle biopsy taken from m. vastus lateralis, which was analyzed for protein expression of superoxide dismutase 1 and 2 (SOD1 and 2), several metabolic enzymes and muscle fiber type profile. Participants also performed a VO_{2max} test, a repeated sprint test (RST), as well as the Yo-Yo Intermittent Endurance, level 1 (YYIE1) and Recovery test, level 1 (YYIR1). Inter-individual relationships between selected variables were analysed using Pearson's product–moment correlation coefficients. **RESULTS:** VO_{2max} and SOD2 correlated ($P<0.05$) with VO_{2max} explaining 24% of the variance in SOD2 protein expression. Myosin Heavy Chain I (MHCI) and IIa (MHCIIa) explained 26 and 25%, respectively, of the variance in SOD2 protein. Oxidative enzymes such as citrate synthase, isocitrate dehydrogenase and cytocrome

c oxidase correlated (P<0.05) with SOD2 explaining 24, 31 and 17% of the variance, respectively. Finally, SOD2 protein expression correlated (P<0.05) to monocarboxylate transporter 4 (MCT4; r=0.67) and phosphofructokinase (PFK; r=0.62). No statistical relationship was observed between SOD2 protein and neither Na^+-K^+ATPase subunits, Na^+/H^+ exchanger, Acetyl-CoA carboxylase, PECAM-1, nor YYIE1, YYIR1 and RST performance. SOD1 protein expression displayed an inverse correlation with MHCIIa (r=0.61; P<0.05), but did not correlate with any other variable assessed in muscle or physical capacity. **CONCLUSIONS:** Skeletal muscle antioxidant capacity associates with markers of endurance exercise such as maximal aerobic power, type I and IIa muscle fibers, and mitochondrial function. However, strong relationships were additionally observed between antioxidant profile and lactate production as well as transport capacity, supporting a link between lactate and ROS generation.

1891 Board #47 May 30 2:00 PM - 3:30 PM

Determining The Role Of Cellular Senescence In Skeletal Muscle Regeneration

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Satellite cells drive skeletal muscle regeneration in response to injury, a process regulated by factors released into the local muscle environment. However, the cellular sources of this trophic support are poorly defined. In this regard, recent work on skin and bone repair has revealed a surprising supportive role for cells termed "senescent cells" which are commonly associated with aging and pathology. However, the role of senescence in skeletal muscle repair is currently unknown. The **PURPOSE** of this study is to determine the presence and contribution of senescent cells in skeletal muscle repair following acute injury. **METHODS:** The tibialis anterior (TA) of C57BL6 mice was injured with cardiotoxin (CTX) and collected 5, 7, 10, 14, and 21 post-injury for histological/ immunohistochemical (IHC) and gene expression analysis. To examine the function of senescent cells during muscle repair, mice were treated with a senolytic compound (ABT-263) following injury to selectively ablate senescent cells. **RESULTS:** Senescent cell number (as revealed using the senescence-associated beta-galactosidase (SA-β-gal) assay) increased significantly following injury ($p < 0.05$) and returned to baseline by day 21 post-injury, a time-course that is coincident with the repair process. In agreement with this, qPCR analysis of putative senescence pathways including p16 and p21 and p53 as well as secreted factors commonly secreted by senescent cells such as IL1 and MMP13 were significantly upregulated in injured compared to control tissue ($p < 0.05$). Preliminary IHC analysis demonstrated that at 5 days post-injury, 58% of senescent cells were positive for macrophage marker F480, while at 10 days post-injury, 43% of senescent cells were F480+ and 9% were CD31 positive; an endothelial cell marker. Identification of other cell types is under investigation. Senolytic treatment was effective at removing senescent cells as a significant 44% reduction in the number of SA-β-gal+ cells was observed, the consequences of which on muscle repair are currently under analysis. **CONCLUSION:** Senescent cells are a newly identified component of the muscle repair environment which may influence skeletal muscle repair and satellite cell function.
Supported by NSERC discovery grant and The Canadian Foundation for Innovation and ACOA.

1892 Board #48 May 30 2:00 PM - 3:30 PM

Skeletal Muscle Stress Protein mRNA Response to Aerobic Exercise in Different Environmental Temperatures

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Stress proteins protect skeletal muscle from internal and external stress. Heat shock proteins respond to temperature, exercise and oxidative stress. Cold shock proteins respond to temperature and hypoxia in animals or in cell cultures but have not been studied in humans. The response of cold shock proteins to exercise and physiologically-relevant environmental temperature in human skeletal muscle is not known. **PURPOSE:** The purpose of this study was to determine the early mRNA response of human cold shock and heat shock stress proteins to endurance exercise and environmental temperatures. **METHODS:** Seven recreationally trained males (age: 24 ± 1.2 years; height: 178 ± 1.7 cm; weight: 76.8 ± 1.9 kg; VO_{2peak}: 4.5 ± 0.2 $L \cdot min^{-1}$; W_{peak}: 290 ± 7.8 W) cycled for 1 hour at 60% W_{peak} in 7 °C, 20 °C, and 33 °C environmental temperature. Gene expression for heat shock and cold shock proteins were analyzed using qRT-PCR on muscle biopsy samples taken from the *vastus lateralis* pre- and 3 hours post-exercise. **RESULTS:** RBM3 mRNA was reduced 1.43 ± 0.10 fold ($p = 0.006$) and there was a trend for CIRP to decrease 1.27 ± 0.14 fold ($p = 0.059$) from pre- to 3 h post-exercise. CIRP and RBM3 mRNA were not different between temperatures ($p = 0.273$ and $p = 0.686$, respectively). HSP70 mRNA was 2.27 ± 0.23 fold higher 3 h post-exercise when compared to pre-exercise ($p = 0.002$) but was not significantly different between temperatures ($p = 0.103$). HSP27, HSP90, and HSF1 mRNA did not change from pre- to post-exercise ($p = 0.052$, $p = 0.324$, $p = 0.795$) and were not different between temperatures ($p = 0.247$, $p = 0.134$, $p = 0.808$). **CONCLUSIONS:** These data indicate that exposure to mild heat and cold during aerobic exercise have limited effect on the skeletal muscle mRNA expression of heat shock and cold shock proteins. However, this novel study found cold shock protein mRNA of skeletal muscle decreases, whereas HSP70 mRNA increases in response to a low to moderate intensity aerobic exercise bout. Supported by the National Institute for General Medical Science, Nebraska IDeA Networks for Biomedical Research Excellence (INBRE), and the University of Nebraska at Omaha Committee on Research and Creative Activity.

1893 Board #49 May 30 2:00 PM - 3:30 PM

Elucidation for Underlying Mechanisms of Chronic Diseases and Potential Applications through Exercise-induced Autophagy

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Purpose: It is well known that "**Exercise is Medicine**". Exercise is a publically recognized and effective intervention strategy for a series of chronic diseases including obesity, diabetes, sarcopenia, and aging-related cognitive dysfunction. However, its molecular mechanisms for the beneficial prevention and treatment of chronic diseases and health promotion have not been systematically explored and elucidated. Since autophagy has been gained extensive attention in the field of medical science, the Nobel Prize in Medicine has been awarded to Yoshinori Ohsumi in 2016 as the pioneer scientist due to his achievements of autophagy in the prevention and treatment of diseases, health promotion, anti-aging, and lifespan extension. Therefore, elucidating the mechanisms of chronic diseases through exercise-induced autophagy and exploring its potential applications are highly desired.
Methods: A series of animal models were established for evaluating exercise intervention efficacy of chronic diseases, and exploring the underlying mechanisms and potential applications through western blotting, RT-PCR and TSM techniques.
Results: Our studies have confirmed that appropriate exercise intervention is a promoter of autophagy, which can rescue the dysfunctional status of autophagy and abnormal mitochondrial energy metabolism in chronic diseases. The autophagy or microRNA-mediated autophagy regulates insulin sensitivity and increases mitochondrial quality control, thereby realizing the prevention, treatment and rehabilitation of chronic or aging-related diseases.
Conclusion: Exercise-induced autophagy is benefit for the prevention and treatment of chronic diseases and health promotion. These promising studies also provide clear targets to develop novel drug candidates, food supplements, or mimic exercise pills for the prevention and treatment of chronic diseases, and health promotion.

1894 Board #50 May 30 2:00 PM - 3:30 PM

Mitochondrial Ant2 And Ucp2 Expression In Mouse Liver During Colon-26 Tumor-induced Cachexia

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Cancer cachexia is a life-threatening paraneoplastic condition characterized by unintended weight loss and skeletal muscle atrophy. Recent frameworks describe cancer cachexia as a systemic disease in which several non-muscle organs are reprogrammed or remodeled. The liver exerts major control over systemic metabolism yet has been relatively unexplored in cancer cachexia. Previous reports indicate loss of oxidative phosphorylation (OXPHOS) coupling efficiency in the cachectic liver, through currently undefined mechanisms. **PURPOSE:** To investigate mitochondrial Ant2 and Ucp2 expression in the liver during colon-26 tumor-induced cachexia, and their relationship to OXPHOS coupling efficiency. **METHODS:** Balb/c males (10 wks) were assigned to receive an injection of sterile PBS or 10^6 colon-26 (C26) tumor cells. Tissues were collected from PBS-injected weight-stable mice (PBS-WS), C26 mice that were weight-stable (C26-WS), and C26 mice with moderate (10% weight loss, C26-MOD) and severe cachexia (20% weight loss, C26-SEV) (n=4-7 per group). The liver was analyzed by high-resolution respirometry and immunoblotting to determine mitochondrial respiration and protein expression, respectively. Citrate

synthase activity was assayed as a proxy for mitochondrial density. The respiratory control ratio (RCR), an index of OXPHOS coupling efficiency, was determined in the complex I-linked state. **RESULTS:** RCR was ~25-60% lower in all C26 groups compared to PBS-WS ($p<0.05$). C26-SEV also had lower RCR than C26-MOD ($p<0.05$). Together this may signify an early loss of liver OXPHOS coupling efficiency due to cancer, that subsequently worsens when severe cachexia develops. Citrate synthase activity was not different between groups ($p>0.05$), suggesting the impairment of respiratory function to be independent of mitochondrial mass. Ucp2 expression was not different between groups ($p>0.05$). However, Ant2 expression was greater in C26-SEV compared to PBS-WS, C26-WS, and C26-MOD, by 15-30% ($p<0.05$). Ant2 expression related inversely with RCR in the liver ($r=-0.547$, $p<0.05$), implying higher liver Ant2 content to be associated with uncoupling of OXPHOS. **CONCLUSION:** We highlight an under-recognized role of liver mitochondria in cancer cachexia, and suggest hepatic mitochondrial function to be a therapeutic target.

1895 Board #51 May 30 2:00 PM - 3:30 PM

Leptin Gene Polymorphism, Plasma Leptin Levels And Aerobic Capacity In Response To Intense Exercise

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PURPOSE: The aim of the present study was to determine the association between single nucleotide polymorphisms (SNPs) in the leptin (LEP) and leptin receptor (LEPR) genes, and body composition, plasma leptin levels, and aerobic capacity in response to 48 h of intense exercise.
METHODS: Male Brazilian Army cadets (n=163; 21.6±0.4 years) were genotyped for the LEP 19G>A (rs2167270) and -2548G>A (rs7799039), and LEPR 668A>G (rs1137101) polymorphisms. Anthropometric, hormonal and aerobic capacity parameters were measured 48 h after intense military exercise.
RESULTS: Sixty-seven percent of participants were classified as having superior aerobic conditioning (VO2max=55.2±0.2 mL·kg-1·min-1), and had lower plasma leptin levels (36%, P=0.008) than subjects classified as having excellent aerobic conditioning. Considering all subjects VO2max correlated negatively with fat mass (r=-0.212; P=0.007), whereas plasma leptin level correlated positively with body fat (r=0.642, P=0.005) and fat mass (r=0.723, P=0.001), and negatively with VO2max (r=-0.223, P=0.005). Only individuals homozygous for the wild-type homozygote for LEP -2548G>A SNP had higher plasma leptin values (59%), body fat (85%), and fat mass (82%) (P<0.05) compared to those with a GA genotype. LEP -2548G>A SNP was a positive predictor for plasma leptin levels (B=0.217, P=0.02), after adjusting for fat mass, and therefore, genotype effects may affect leptin levels.
CONCLUSIONS: Polymorphism in the leptin promoter gene may influence plasma leptin levels, but not aerobic capacity, in response to intense physical exercise. Additional studies are needed to show the precise contribution of the SNPs on aerobic capacity. Financial support FAPERJ.

D-57 Free Communication/Poster - **Body Composition and Integrative Physiology**

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

1896 Board #52 May 30 2:00 PM - 3:30 PM

Agreement Between Dual-Energy X-Ray Absorptiometry and a New Standing Bioimpedance Spectroscopy Device for Detecting Changes in Fat-Free Tissue

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(No relevant relationships reported)

Dual energy X-Ray absorptiometry (DXA) determined lean tissue mass has long been regarded as a criterion method for determining and monitoring changes in whole body and appendicular skeletal muscle mass. However, its utility is limited and restrictive due to patient size limitations, cost, specialized operator training and patient radiation exposure. **PURPOSE:** Herein, we sought to compare measurements of whole-body fat free tissue mass (FFTM) determined by a new standing bioimpedance spectroscopy (BIS) device as well as DXA before and after six weeks of progressive resistance training. **METHODS**: Twenty-three resistance-trained males (mean ± SD, age: 21.6 ± 2, height: 178.4 ± 7.8cm, weight: 80.9 ± 10.5kg) underwent six weeks of resistance training. DXA (Lunar Prodigy iDXA, G.E.) and BIS (SOZO, ImpediMed Inc.) were administered pre and post-intervention with participants in a fasted and normally-hydrated state wearing a t-shirt and athletic shorts for determination of whole body FFTM. Agreement between methods for determination of whole body FFTM at each time point and across time were determined by Bland and Altman plot analysis (mean difference and 95% limits of Agreement), bivariate linear regression analysis and dependent samples t-tests with statistical significance set at $p\leq0.05$. **RESULTS**: Bland and Altman plot analysis revealed good agreement between methods producing a mean difference and 95% LOA of 1.9 ± 2.3 kg, respectively. Regression analysis revealed a strong and significant relationship ($r=0.96$, $r^2=0.92$, SEE=2.2kg, $p<0.001$) between DXA and BIS-derived FFTM. Both DXA and BIS-derived FFTM significantly ($p<0.001$) increased post-training (pre vs post, 63.2±7.9 vs 65.8±7.4 and 65.2±8.3 vs 67.6±7.2 kg, respectively). Importantly, mean FFTM delta scores were not statistically different between DXA and BIS (2.6±1.4 vs 2.4±2.6 kg, $p=0.57$). Furthermore, regression analysis revealed a significant relationship between DXA and BIS-derived FFTM delta scores ($r=0.72$, $r^2=0.0.52$, SEE=1.01kg, $p<0.001$). **CONCLUSIONS:** BIS-derived FFTM agrees well with DXA-derived FFTM for single measurements as well as following resistance training-induced skeletal muscle hypertrophy and is an accurate and acceptable alternative to DXA.
Funding provided by ImpediMed, Inc
Jordan R. Moon is an employee of ImpediMed Inc

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Body Composition and Aerobic Capacity in NCAA Division I Cross-country Athletes Across a Season

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Body composition has several implications for the overall health and performance of athletes. Changes in body composition can serve as indication of the physical demands of a competitive season as well as provide valuable feedback of the training adaptations from different training regimens. **PURPOSE:** To evaluate the pre- to post-season changes in body composition and maximal aerobic capacity in male (MXC) and female (WXC) Division 1 cross-country athletes. **METHODS:** Eleven MXC (age: 18±1yrs; body fat: 9.8±4%) and 13 WXC (age: 18±1yrs; body fat:19.8±4%) participated. Body composition [(lean mass, LM; leg lean mass (LLM); fat mass, FM, body fat% and bone mineral density, BMD) were measured pre- and post-season by DXA. Regional BMD of the total body, lumbar spine (L1-L4), hip (femur), LM and FM were obtained for analysis. The appendicular skeletal muscle adjusted by squared height (ASM index; kg/m^2) and the lean mass index (LMI = (LMpost-LMpre)+(FMpre-FMpost)) were calculated to assess body composition changes. A self-paced maximal oxygen uptake (VO_{2MAX}) test was used to assess aerobic capacity. Participants completed 5 × 2-min stages at a self-selected speed for each stage corresponding to ratings of perceived exertions of 11, 13, 15, 17 and 20, respectively. ANOVAs were used for analysis with significance accepted at $p<0.05$. **RESULTS:** Total body LM increased significantly in both MXC and WXC, with MXC increasing to greater extent than WXC (+1.37±0.9 vs +0.56±0.9 kg; $p<0.05$). The ASMI and LLM increased significantly in both MXC and WXC from pre- to post-season ($p<0.05$), with no differences between genders. Further, the LMI did not differ between groups (+2.15±3.9 vs +1.33±3.7 kg). There were no gender by time and no time effects for FM, body fat% and regional BMD. There were no pre- to post-season changes in VO_{2MAX} for both MXC (70.3±4.3 to 69.5±3.9 ml/kg/min) and WXC (56.6±3.9 to 58.3±5.3 ml/kg/min). **CONCLUSIONS:** Results suggest highly trained cross-country athletes experience positive changes in total and regional LM with no changes in FM, body fat% and BMD. Aerobic capacity was maintained across the season despite increases in LM. Results highlight the seasonal changes in body composition in collegiate distance runners that may inform strength and conditioning coaches and athletic trainers.

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Low Carbohydrate Diet On Body Composition Of Trained Crossfit Individuals

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Effects of low carbohydrate diet on body composition of trained Crossfit individuals

Purpose: To evaluate the influence of low carb diet on body composition of trained individuals. **Methods:** Twenty eight CrossFit practitioners (M:13, W:15, age range: 19-59 years) for at least 6 months followed a personalized diet plan for 2 months. The diet had 27% of energy from carbohydrate, 50% of energy from fat and 23% of energy from protein, and consisted of 5 meals per day, comprising mainly of fruits and vegetables, complex carbohydrates (cereals and tubers) and animal proteins (red meat limited to 3 times/week). The body weight was measured to the nearest 0.01 kg using electronic scales and body composition (including percent body fat, muscle, and fat mass) was evaluated by portable ultrasound during the days 1, 30 and 60 of the dietetic program. The collected measures were chest, triceps, subscapular, medial axillary, suprailiac, abdomen and medial thigh. The equations developed by Jackson and Pollock were used for the calculation of body density. Waist and hip circumference were also measured. Samples were tested for normal distribution and groups were compared by either paired Student's t-test or Mann-Whitney test. The type 1 error was set at $p<0.05$. **Results**: There was a significant reduction in body weight and hip circumference after 30 (weight: 79.8±15.4 vs 77.5±14.4, $p<0.001$; hip circumference: 107.6±6.9 vs 104.9±7.3, $p=0.007$) and 60 days (weight: 79.8±15.4 vs 77.0±14.6, $p<0.001$; hip circumference: 107.6±6.9 vs 105.58±8.3, $p=0.007$) of dietary intervention. Additionally, was observed a significant reduction of total fat and %body fat after 30 (total fat: 23.8±16.1 vs 20.4±15.6, p=0,004; % body fat: 25.1±6.5 vs 21.5±5.3, p<0,001) and after 60 days (total fat: 23.8±16.1 vs 19.9±15.3, p<0,001; %body fat: 25.1±6.5 vs 20.0±5.5, p<0,001) and a significant gain of body fat-free mass after 60 days (59.1±12 vs 60.9±13, p=0,01). When subgroup analyses were performed by sex, it was found that the relative loss of body fat was similar. Thus, there was no difference between lean mass gain between men and women. **Conclusion:** The low carbohydrate diet promoted body weight, total fat and % body fat reduction and fat-free mass gain, independently of sex, after 30 and 60 days, in trained Crossfit individuals.

1899 Board #55 May 30 2:00 PM - 3:30 PM

Body Composition and Muscle Contractile Properties in Male Professional Soccer Players

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(No relevant relationships reported)

PURPOSE: Lower limb muscle injury accounts for >50% of all injuries in professional soccer. Despite this, there is an absence of body composition and muscle function reference ranges in professional players. The purpose of this study was to generate lower limb reference ranges for lean tissue mass (LTM) and muscle contractile properties, which could be used to monitor associations with injury risk in prospective cohort studies. **METHODS**: Professional soccer players (n=193; age: 21.6 ± 4.4 years, height: 180.2 ± 10 cm, weight: 78 ± 11.2 kg), free from illness and injury, from the English Soccer League participated in this study. Whole body and lower limb LTM (n=130) was estimated using Dual X-Ray Absorptiometry (DXA; Lunar iDXA™; GE Healthcare, WI). Lower limb (Adductor Magnus (AM), Bicep Femoris (BF), Gastrocnemius Lateralis (GL), Gastrocnemius Medialis (GM), Gluteus Maximus (GT) and Rectus Femoris (RF)) muscle contractile properties (n=193) were assessed using Tensiomyography (TMG); GK 40, Panoptik d.o.o., Ljubljana, Slovenia). Maximal muscle displacement (Dm) and contraction time (Tc) were estimated for all muscles. **RESULTS**: Soccer players were homogenous in whole body (76.7 ± 8.8) and lower limb (21.7 ± 2.5kg) LTM. Midfielders had lower RF-Tc than Goalkeepers (29.2 ms *vs* .32.8 ms; *P=0.034*). Forwards had lower GT-Dm than Defenders (9.1 mm *vs.* 10.7 mm; *P=0.042*). There was no difference in lower limb LTM or contractile properties between dominant and non-dominant limbs *(P>0.05)*. Increasing lower limb LTM was associated with a reduction in Dm (right= -.375, left= -.394*; P<0.05*). Lower limb muscle contractile properties normalised to lower limb LTM were higher in forwards compared to other outfield playing positions *(P<0.05)*. **CONCLUSIONS**: Our findings suggest players are homogenous in terms of the total amount of LTM and contractile function regardless of leg (dominant vs. non-dominant) studied. Differences in muscle contractile properties between playing positions may represent differences in positional demands. Increasing LTM might have been expected to produce increasing Dm; however, an increase in LTM is associated with an increase in non-contractile tissue that may lead to an overall reduction in contractile mass.

D-58 Free Communication/Poster - Musculoskeletal Mechanics and Modeling

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

1900 Board #56 May 30 2:00 PM - 3:30 PM

Electromyographic Evidence of Excessive Achilles Tendon Elongation During Isometric Contractions After Achilles Tendon Repair

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PURPOSE: Increased tendon elongation after Achilles repair is thought to contribute to selective weakness in end-range plantarflexion (PF). Excessive tendon elongation during maximum voluntary contraction (MVC) means greater muscle fiber shortening. Since mean frequency (MF) of the electromyogram (EMG) increases with decreasing fiber length, it was hypothesized that MF would be higher on the involved (Inv) versus non-involved (Non) side during isometric PF MVCs. The purpose of this study was to examine MF during isometric MVCs in patients with Achilles tendon repairs. **METHODS**: Isometric PF MVC was measured at 20°, 10°, 0° dorsiflexion (DF), and 10°, 20° PF, in 17 patients (age, 39±9 years; 15 men, 2 women) 43±24 months after surgery. Surface EMG signals were recorded during MVCs. MF was calculated from Fast Fourier Transforms of medial gastroc (MG) lateral gastroc (LG) and soleus (S) EMG signals. Effect of weakness on MF was assessed using analysis of variance. **RESULTS**: Patients had weakness in 20° PF (deficit 28±18%, P<0.01; 14 of 17 deficit >20%) but no weakness in 20° DF (deficit 8±15%, P=0.20; 4 of 17 deficit >20%). MF increased moving from DF to PF (P<0.001) but was not different between Inv and Non (P=0.22). At 10° PF 8 of 17 patients had weakness (>20% deficit). MF was significantly higher on Inv versus Non, across all angles, in patients with weakness versus no weakness at 10° PF (side by group P=0.014; Table 1). MF was 13% higher on Inv versus Non in patients with weakness (P=0.012) versus 3% lower in patients with no weakness (P=0.47).
CONCLUSIONS:Higher MF for Inv versus Non in patients with PF weakness is consistent with greater muscle fiber shortening. This indicates that weakness was primarily due to excessive lengthening of the repaired Achilles tendon. If weakness were simply due to atrophy, a lower MF would have been be expected.

Table 1	MG MF (Hz)			S MF (Hz)			LG MF (Hz)		
	Inv	Non	Inv/Non	Inv	Non	Inv/Non	Inv	Non	Inv/Non
Weak (n=8)	193±34	169±34	P=0.02	181±21	168±23	P=0.13	185±47	157±27	P=0.04
Strong (n=9)	165±31	170±23	P=0.63	165±20	168±24	P=0.70	154±26	162±38	P=0.54

1901 Board #57 May 30 2:00 PM - 3:30 PM

Spatial Resolution Of The Medial Gastrocnemius Mechanomyograph Resolved By Time-frequency And Principle Pattern Analysis

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(No relevant relationships reported)

PURPOSE: The purpose of the present study was to examine the mechanomyograph of the medial gastrocnemius spatially using a grid of nine accelerometers during electrically-invoked contractions. **METHODS:** 16 (8M, 8F) moderately-active volunteers (mean age = 21 ± 3 y) with measurable H-reflexes participated. The tibial nerve was stimulated in 2V increments with 10-second rest intervals, and data where the peak-to-peak M-wave amplitude exceeded the H-reflex were analyzed. Peak-to-peak MMG (MMG_{p-p}) data were subjected to the intensity analysis, and total intensity, the peak total intensities (Max), and time to Max (TTMax) were determined. Maps of the dependent variables were plotted across a 9-accelerometer grid for each stimulus for each participant to be analyzed. The MMG intensity analyses were subjected to a principle pattern analysis (p-space) and p-values (P, n = 5) were compared intra-subject. Pearson's *r* among the dependent variables and repeated measures ANOVA were calculated for P, MMG_{p-p}, Max, and TTMax, by stimulus (Stim) and accelerometer (ACC) using R open source software (www.r-project.org). Statistical significance was set at $\alpha = 0.05$. **RESULTS:** A significant correlation existed only for MMG_{p-p} and Max ($r = 0.9434$, $p < 0.0001$). RM-ANOVA demonstrated significant effects of Stim for MMG_{p-p} and Max; ACC for MMG_{p-p}, Max, and TTMax; and Stim by ACC for TTMax ($p < 0.001$). Progression of the MMG acceleration maps varied across individuals and ACCs. P-space analysis revealed significant differences between p-values for all participants ($p < 0.001$), significant effects for ACC ($p < 0.01$) in

eight participants, and Stim ($p < 0.05$) in five participants. In addition, there were significant interactions for Stim by P (n = 6, $p < 0.01$) and ACC by P (n = 1, $p < 0.01$). **CONCLUSIONS:** MMG varies spatially for the medial gastrocnemius and between individuals. Mapping the MMG acceleration may allow researchers to identify characteristic differences among individuals, as well as individual muscles (e.g., soleus). More research is suggested to identify such differences.

1902 Board #58 May 30 2:00 PM - 3:30 PM

Effect Of Ballet Dance On Knee Joints Muscle Strength Based On The Isokinetic Research

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(No relevant relationships reported)

PURPOSE: Several researches have revealed that dance training increases muscle strength. By comparing the muscle strength of knee joints of ordinary college students with ballet dance students', the differences between the two groups were analyzed and the influence of dance on muscle strength was explained.
METHODS: 48 healthy college students volunteered to participate in the study. Experimental group consisted of 24 Ballet students (12 male, 21.5±0.9years; 12 female, 20.9±1.8years); control group consisted of 24 non-dance students (12male, 20.7±0.9years, 12 female, 20.6±0.8years). German ISOMED2000 Isokinetic test device was used to test the knee joints strength of all participants, with the concentric contraction test going first and then following the eccentric contraction test , with the testing angular of 60°/s,180°/s .The test variables include peak torque,relative peak torque and the peak torque ratio of flexion and extension. **RESULTS**: The result showed that the female and male Ballet students have significantly higher peak torque (N·m)and relative peak torque (Nm/Kg) at all angular of knee flexion and extension than non-dance students (All peak torque flexion at 60°/s and 180°/s: 81.805±10.84 vs. 58.725±7.34 and 68.055±9.22 vs.46.875±8.78; both p<0.01. All peak torque extension at 60°/s and 180°/s: 178.335±25.88 vs. 124.2±19.54 and 128.465±14.96 vs. 92.505±16.41; both p<0.01. All relative peak torque flexion at 60°/s and 180°/s:1.29±0.14 vs. 1.02±0.14 and 1.08±0.14 vs.0.81±0.13;both p<0.01. All relative peak torque extension at 60°/s and 180°/s :2.84±0.43 vs.2.17±0.38 and 2.04 ±0.25 vs.1.61±0.28; both p<0.01.).However, there is no significant difference in peak torque ratio of flexion and extension between two groups (P>0.05).
CONCLUSIONS: The results indicated that long-term ballet training can obviously improve the control strength and outbreak power of knee flexion and extension. Ballet training leads to a balanced effect impact on hamstring and quadriceps, which helps to avoid knee injuries and improve the dance movements.**Acknowledgements:** This work was supported by Beijing philosophy and social science foundation research (Grants No.14JDWYB011).

1903 Board #59 May 30 2:00 PM - 3:30 PM

Ankle Related Musculotendinous Stiffness in Individuals With and Without Chronic Ankle Instability

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(No relevant relationships reported)

Chronic ankle instability (CAI) is a multifaceted condition linked to life-long residual symptoms and post-traumatic ankle osteoarthritis. Musculotendinous stiffness (MTS) is a vital component of joint stability but to date, only passive joint stiffness has been quantified in those with CAI. **PURPOSE:** To compare ankle related musculotendinous stiffness between CAI patients and uninjured controls. **METHODS:** 20 CAI (18F, 2M; 20±1 years,172±7cm, 68±13kg) and 20 uninjured healthy controls (18F, 2M; 20±1 years, 69±8cm, 60±8kg) volunteered to participate. CAI participants had experienced at least one lateral ankle sprain (3±1 sprains), at least two episodes of giving way within the past 6 months (6±4 episodes), ≥ 11 on the Identification of Functional Ankle Instability, ≤ 90% on the Foot & Ankle Ability Measure (FAAM) (87.3±8.9%), and ≤ 80% FAAM-Sport (73.3±14.9%). Active plantar flexor and peroneal muscle stiffness were estimated using the damped oscillation method. Participants were seated on a custom-made loading device with the hip, knee, and ankle joints at 90°. Participants were instructed to maintain the ankle in a neutral position by activating the plantar flexors or evertors isometrically to a level only strong enough to support the applied load which was adjusted to produce 30 ± 5% MVIC. A perturbation was then applied by dropping a ball onto the loading device from the height of 110cm in order to produce the series of oscillations of the shank about the ankle. Torsional stiffness (k) was calculated using the equation $k = 4\pi^2 r^2 m f^2$, where f is the damped frequency of oscillation, r is the system radius, and m is the total mass of the system. Independent t-tests assessed group differences with an alpha level of p<0.05. **RESULTS**: Plantar flexor stiffness was lower in CAI group (123.6 ± 20.5 N/m/kg) compared to healthy control (141.6 ± 28.0 N/m/kg) group (p=0.04). However, there was no difference in peroneal muscle stiffness between CAI (5.85 ± 1.2 N/m/kg) and control (5.84 ± 1.4 N/m/kg) groups (p=0.98). **CONCLUSION:** Those with CAI have reduced plantar flexor stiffness compared to the uninjured controls, which may be a potential underlying factor for CAI associated sensorimotor impairments. This lower plantar stiffness may influence ankle joint stiffness during activities, which may be a risk factor for recurrent ankle sprains.

1904 Board #60 May 30 2:00 PM - 3:30 PM

Influence Of Plyometric Training On Tendinous Tissue Elongation During Initial Phase Of Explosive Power Exertion

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(No relevant relationships reported)

PURPOSE: The sharp rise of the ground reaction force due to high pre-activation of muscles upon drop jump (DJ) contributes to increases in the reactive strength index (RSI). In our previous studies, in a comparison between athletic long jumpers and general men, the long jumper showed a significant increase in Achilles tendon tissue elongation immediately after DJ contact due to high pre-activation of the gastrocnemius muscle. In this study, we aimed to clarify the influence of plyometric training on Achilles tendon tissue elongation dynamics immediately after DJ contact.
METHODS: Five men (age, 21.0 ± 0.7 y; height, 172.2 ± 4.6 cm; weight, 67.6 ± 3.8 kg) volunteered to participate in this study. The subjects were asked to undergo plyometric training (maximum hopping 10 reps × 3 sets, 3 times a week, 12 weeks). Experiments were conducted before and after training and after 12 weeks of detraining. Changes in the Achilles tendon tissue length of the gastrocnemius medialis (the distance from the muscle tendon junction to the calcaneus along the line of action of the tendon) during DJs from a height of 0.3 m were measured using a high-speed camera and ultrasonography equipment. Electromyographic parameters and ground reaction force were measured in synchrony with the camera and ultrasonography equipment.
RESULTS: The RSI increased significantly after training (1.89 ± 0.35) and after detraining (1.78 ± 0.46) compared to that before training (1.49 ± 0.43). The elongation of Achilles tendon tissue immediately after the grounding of DJ was significantly increased by training (+ 2.99 ± 2.36 mm), and the training effect disappeared after detraining (- 0.23 ± 2.50 mm). On the other hand, there was no significant effect on the maximum elongation of tendon tissue in the push-off phase. In other words, the elongation of tendon tissue during the initial phase of explosive power exertion is more important than the maximum elongation of the tendon tissue.
CONCLUSIONS: Plyometric training increases tendon tissue elongation immediately after the DJ grounding and increases the RSI. These results suggest that the increase in tendon tissue elongation during the initial phase is one of the factors to increase explosive power exertion.

1905 Board #61 May 30 2:00 PM - 3:30 PM

Reliability Of Isokinetic Eccentric Hamstring To Concentric Quadriceps Torque Ratio Between Velocities, Sexes, And Limbs

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(No relevant relationships reported)

The ratio of eccentric hamstring strength to concentric quadriceps strength has recently been suggested to potentially have utility for prospectively identifying risk for injury. However, there has been little research on the reliability of these ratios and furthermore, the differences and reliability of this ratio between different velocities, sex, and limbs. **Purpose:** To establish the reliability of eccentric hamstring to concentric quadriceps ratios, and determine any differences between ratios at different angular velocities, sex, and limbs in healthy and physically active young adults. **Methods:** Following a standardized warmup, 20 women (23.3±3.5 years) and 20 men (25.3±3.0 years) performed concentric (c60 and c240 degrees·s-1) and eccentric (e30 and e120 degrees·s-1) knee flexion and extension protocols using both the dominant (D) and non-dominant (ND) limbs. Average peak torque from each set was used to create two ratios of eccentric hamstring to concentric quadriceps strength: e30/c240 and e120/c240. **Results:** For both sexes, the intraclass correlation coefficient (2,1) for the e30/c240 ratios (♂:.66 -.68, ♀:.62 -.71) were slightly higher than the e120/c240 ratios (♂:.45 - .59, ♀:.46 - .51). The Standard Error of Measurement (SEM) was similar across the two ratios within each sex; however, the SEM was smaller for men (4.5-5.0%) compared to women (5.2-7.3%). The D (P=.001, 95% CI_{diff}: .03 to .10) and ND (P=.035, 95% CI_{diff}: .003 to .09) e30/c240 ratios for the women demonstrated a significant systematic decrease across the two sessions. There were no limb differences for either of the ratios (P>.05); however, the e30/c240 ratio for the women was significantly higher (P=.046) than the men (95% CI_{diff}: .01 to .72). **Conclusion:** No potent reliability differences appeared between the two ratios, which may be attributable to using average peak torque across repetitions without considering

location of peak torque or sustained torque throughout range of motion (angular work). Partially explaining sex differences in absolute reliability and session changes could be experience with maximal effort muscular activation (e.g. resistance training).

1906 Board #62 May 30 2:00 PM - 3:30 PM

Regional Activation of Supraspinatus, Infraspinatus and Periscapular Musculature during Strengthening Exercises with Elastic Bands

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PURPOSE: Strengthening of the rotator cuff and periscapular muscles is crucial for appropriate neuromuscular control of the mobile glenohumeral and scapulothoracic joints. The aim of the current study was to quantify and compare the regional activation of supraspinatus (SUP), infraspinatus (INF) and some periscapular muscles during shoulder strengthening exercises with elastic bands.
METHODS:27 right handed healthy volunteers (22.5 ± 2.7 years old) were recruited. Four fine wire electrodes were inserted into the anterior and posterior regions of SUP and the superior and middle regions of INF under ultrasound guidance. Four paired surface electrodes collected data from the upper, middle and lower trapezius and serratus anterior (UT, MT, LL, SERR respectively). Participants performed four resistance exercises (in Y, T, W and L postures) with elastic bands while maintaining good form and cadence. Kinematics were recorded synchronously by Vicon motion tracking system. Electromyography values were presented as % of maximal voluntary isometric contraction (MVIC) and compared across exercises using ANOVA.
RESULTS: Rotator cuff and periscapular muscles showed similar activation profiles throughout the Y, W and T exercises. The peak activation of SUP anterior occurred in 20% of L exercise cycle while for other regions it occurred in 40-60% of time cycle. Mean activations of all rotator cuff partitions were over 40% MVIC during four exercises, except middle INF during T exercise (29.3% MVIC). LT was activated >80% MVIC during all four exercises, with no significant differences across exercises while MT was significantly more active in T exercise. The activations of SERR and UT were significantly higher during Y exercise. **CONCLUSIONS**: YTWL exercises induced moderate to high activation in supraspinatus and infraspinatus partitions, and very high activation in lower trapezius. These exercises are appropriate for strengthening of some rotator cuff and periscapular muscles and can potentially be useful for rehabilitation of scapular dyskinesia and shoulder impingement. However, caution should be taken while prescribing Y exercise for these pathologic conditions as this exercise may induce high activation in UT. Providing additional strengthening exercises for SERR to this exercise package is recommended.

1907 Board #63 May 30 2:00 PM - 3:30 PM

The Effect Of Knee Joint Angle Difference On The Compartment Neuromuscular Activation In Rectus Femoris

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(No relevant relationships reported)

Bi-articular muscles play an important role to smooth movement in human. However, the biomechanics and physiological function of those muscles is unclear. Thus, this study investigates the function of rectus femoris as a famous bi-articular muscle in lower limbs.
PURPOSE:The purpose of this study is to unravel the compartment neuromuscular activation of rectus femoris during isometric knee extension and hip flexion in different knee angles.
METHODS:Subjects were eight healthy men. Knee extension with hip flexion were performed in isometric contraction. Knee angle was set up at 90, 60, 30, and 0 degree. Also, there were three contractions as follow: Maximum voluntary contraction (MVC), 80%MVC and 60%MVC. Muscle activation of rectus femoris was measured by using multi-channel surface electromyography, and calculated the average rectified value (ARV). We evaluated the ARV of rectus femoris divided into proximal, medium and distal compartment. We evaluated the ARV of rectus femoris divided into proximal, medium and distal compartment.
RESULTS:In the proximal region at 30 degrees knee angle, averaged ARV value in the MVC (0.113 mV) was significantly higher than those of other two contraction groups (80%MVC: 0.071 mV, $p<0.05$ vs MVC; 60%MVC: 0.047 mV, $p<0.01$ vs MVC). There was no significant differences in ARVs both in medium and distal compartments.
CONCLUSIONS:Proximal region of rectus femoris has the role of knee extension and hip flexion in slightly flexed knee joint position. We conclude that the difference of knee angle affects the compartment neuromuscular activation in rectus femoris.

1908 Board #64 May 30 2:00 PM - 3:30 PM

Effect Of Neuromuscular Training On Rate Of Force Development And Joint Stability.

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Effect of neuromuscular training on rate of force development and joint stability.
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Abstract
Neuromuscular adaptations to training are primarily responsible for explosive movements through increases in neural drive and efficiency, which increases recruitment of fast twitch muscle fiber and rate of force development (RFD). Increases in RFD allow an individual to produce more force in shorter time durations, and are expected to increase joint stability. The purpose of this study was to determine the effects of neuromuscular training on RFD and joint stability. A training group and a control group were used. Using a multi-joint isokinetic dynamomter, a 4-week training program was developed. Ten participants performed squat, leg drive, lateral squat, and deadlift exercises twice a week, for three sets of ten seconds each, at 50% of maximal velocity. Pre and post-tests measured RFD using a squat exercise at 50% of maximal velocity, and measured joint stability using the Landing Error Scoring System in Real Time (LESS-RT). Results indicated no significant differences between pretest measures of RFD or LESS-RT between the training and the control groups; nor were differences found between pre and post test measures of RFD and LESS-RT for the control group. Results indicated a significant increase in RFD ($t_{(9)}$=-2.652, p=.026) and a significant decrease in scores ($t_{(9)}$=3.648, p=.005), indicating an increase in RFD and joint stability after training, and suggesting a decreased risk of injury.

1909 Board #65 May 30 2:00 PM - 3:30 PM

Shoulder Muscle Activity Changes in Patients After Injection and Physical Therapy

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INTRODUCTION
Shoulder pain is a common orthopedic ailment, with multiple potential sources of pain and dysfunction. A combination of treatments may be used. While treatment has generally shown to be effective, it does not resolve the syndrome for all patients.
PURPOSE To determine the effect of a standardized treatment protocol on the neuromechanics of the shoulder. It is hypothesized that rotator cuff activation will increase with both pain relief and physical therapy.
METHODS
Seven subjects, who were diagnosed with subacromial impingement, and seven healthy controls were recruited. At the first testing session, the subject was instrumented with six surface electromyography sensors and two fine-wire sensors.
Subjects elevated their arm in the scapular plane, while kinematics and EMG were recorded. EMG data were normalized to a reference contraction.
Following a subacromial injection, the subject repeated elevation motion. Following the testing session, the subjects completed six weeks of physical therapy. The subjects returned for additional testing following the same protocol. For patients, the three testing periods were designated T1 (before injection), T2 (after injection), and T3 (after physical therapy). For healthy controls,
only the original time point was analyzed.
RESULTS
Figure 1 shows the supraspinatus activity of seven patients during humeral elevation in the scapular plane. At baseline, it appears that muscle activation in the patients is lower than controls, but in most cases, increases over time. There also are potential differences in activity between patients and control subjects at the three time points, as well as changes associated with the subacromial injection or with physical therapy.
CONCLUSIONS
Immediately following the subacromial injection, activation levels appear to have remained relatively constant. However, after physical therapy, activation levels show a pattern of increase. Data collection and analysis are continuing.

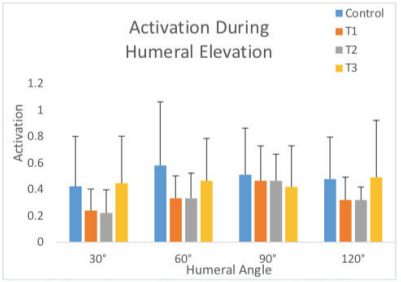

Figure 1: Supraspinatus activity at 30°, 60°, 90° and 120° of humeral elevation (n = 7, means +/- sd).

1910 Board #66 May 30 2:00 PM - 3:30 PM

Muscle Thickness And Strength Relationships In Patients With Patellofemoral Pain Before And After Rehabilitation

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The gluteus maximus (Gmax) and medius (Gmed) have shown altered strength and activation in patients with patellofemoral pain (PFP) and have been addressed commonly in rehabilitation programs. However, the relationship between strength and a visual method of quantifying muscle activation through ultrasound imaging has not been explored. **PURPOSE:** To determine relationships between muscle thickness (at rest and during contraction) and strength using hand-held dynamometry of the Gmax and Gmed in various positions (side-lying, bipedal stance, unipedal stance) before and after a 4-week impairment-based rehabilitation program. **METHODS:** 19 patients with PFP (23.7±4.8yrs, 168.7±6.8cm, 69.6±15.1kg, 14F) completed 12 sessions of supervised impairment-based rehabilitation focused on lower extremity range of motion, strength, functional movement, and core stability. Ultrasound imaging and strength of Gmax and Gmed was performed before and after rehabilitation. Ultrasound images were collected at rest while side-lying, during side-lying hip abduction, bipedal stance, and unipedal stance. Both strength and thickness measures were normalized to body mass (kg). **RESULTS:** There were no significant relationships found between strength and muscle thickness at the pre-rehabilitation session. Following rehabilitation, both Gmax and Gmed exhibited significant relationships between strength and muscle thickness during side-lying positions. For Gmax, side-lying at rest, there was a moderate relationship (r=0.50, p=.03) and during side-lying hip abduction (r=0.46, p=.05). Gmed revealed similar relationships following rehabilitation with side-lying at rest (r=0.65, p=.003) and during hip abduction (r=0.46, p=.046). **CONCLUSION:** Muscle thickness, as captured with ultrasound imaging, increases as strength increases for both the Gmax and Gmed in individuals with PFP, while side-lying, and only following rehabilitation. The strongest relationship was found in the Gmed, which is supported by the positioning being the same for both thickness and strength measures. The concentric nature of the Gmed contraction during side-lying hip abduction could also be a major contributor to this relationship.

D-59 Free Communication/Poster - **Upper Limb**

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

1911 Board #67 May 30 2:00 PM - 3:30 PM

Classifying Upper Extremity Exercises Using Biomechanics Captured with an Inertial Measurement Unit-based Device

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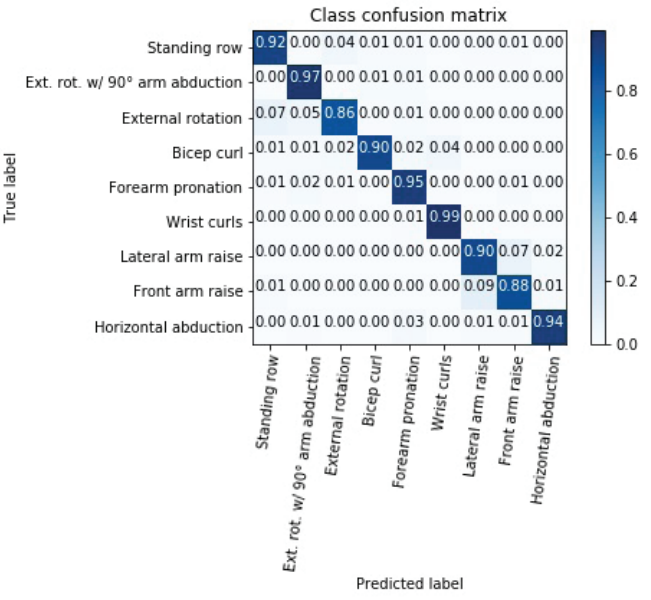
Exercise adherence and physical activity can be difficult to measure. Current methods often rely upon self-report surveys which are susceptible to error. Machine learning methods can be applied to biomechanical data to classify and identify activity. Each exercise has a unique "fingerprint" of biomechanical data in that there is a unique combination of motion in each joint. Inertial measurement units (IMU) can move biomechanical analysis from the lab to real world environments allowing for more ecologically valid measurements. **PURPOSE:** The purpose of this study is to develop a machine learning algorithm for classifying nine different upper extremity exercises, based upon biomechanics captured from an IMU-based device. **METHODS:** 50 participants (mean age = 21.9 years) were recruited. Participants performed one compound and eight isolation exercises with their right arm while wearing the device. Each exercise was performed ten times for a total of 4500 trials. The device consists of a small, self-contained computer and four 3-axis IMUs. IMUs were placed on the hand, forearm, upper arm, and torso. Joint angles were calculated using relative rotations between pairs of IMUs. A modified Hampel filter and Savitzky-Golay filter were applied to remove outliers and noise. Random Forests were trained on 50% of the data and tested on the remaining 50%. **RESULTS:** The model performed well with an overall classification accuracy of 92.4%. Figure 1 shows the class confusion matrix where the numbers represent the proportion of true cases that were predicted. **CONCLUSION:** The results suggest upper extremity exercises can be classified using biomechanics data captured with a novel IMU-based device. These findings set the basis for more objective activity logs which can be used for measuring exercise adherence, physical therapy, and physical activity levels. Ultimately, the device may be used to create activity profiles for health screening and health status.



1912 Board #68 May 30 2:00 PM - 3:30 PM

Effect of a Period of Cervical Flexion on Upper Extremity Muscle Strength

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As daily technology use increases, there is an increase in periodical cervical flexion, which can cause a strain on the neck and muscles of the upper extremity. It has been studied that on average people regularly experience cervical flexion of 45 degrees during handheld technology use. **Purpose**: Examine the effect that 30 minutes of cervical flexion has on upper extremity muscle strength, specifically the biceps brachii, triceps brachii, and middle deltoid. **Methods**: Twenty-four participants (12 male, 12 female) (n=24; height= 173.1±9.3 cm; weight=73.33±22.58 kg) were measured before and after 30 minutes of 45 degrees of cervical flexion in a seated position using a MicroFET2 Hand Held Digital Muscle Tester to isometrically test each muscle. Paired Samples T-test was used to determine overall strength changes and percent strength decreases. **Results**: Significant changes in muscle strength were evident in the left biceps brachii (254.1±101.5 vs 239.87±103 N, p<0.05), right biceps brachii (270.67±96.23 vs 254.53±102 N, p<0.05), left middle deltoid (140.82±54.27 vs 125.42±51.27 N, p<0.05), and right middle deltoid (129.2±46.1 vs 122.89±49.76 N, p<0.05). No significant strength changes were measured in either triceps muscle. Minimal changes were seen across contralateral arm muscles and across genders. When comparing dominant to non-dominant arms, significant changes in percent strength change were found in the dominant biceps brachii (272.8±100.77 vs

269.15±109 N, p<0.05), non dominant bicep brachii (251.94±96.59 vs 235.25±95.74 N, p<0.05), dominant triceps brachii (151.63±54.59 vs 141.34±51.32 N, p<0.05), dominant middle deltoid (132.6±47.92 vs 124±49.13 N, p<0.05), and non dominant middle deltoid (137.44±53.21 vs 124.27±51.92 N, p<0.05). **Conclusion**: A normal daily degree of cervical flexion will decrease some upper extremity strength over the course of 30 minutes.

1913 Board #69 May 30 2:00 PM - 3:30 PM

Effects Of An Exercise And Kinesiotape Intervention On Forward Head/Rounded Shoulder And Scapular Dyskinesis

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Improper posture including forward head, rounded shoulder and scapular dyskinesis have been linked to neck and shoulder pain. Treatment for forward head posture (FHP), rounded shoulder posture (RSP), and scapular dyskinesis has consisted of an exercise protocol. Kinesiotape (KT) has recently emerged as a treatment method but there is a lack of research on the effectiveness, or whether exercise or KT is better than the other. **PURPOSE**: To compare a KT intervention to a strengthening and stretching program for correction of FHP, RSP, and scapular dyskinesis in a healthy, non-athletic, college age population. **METHODS**: Twenty healthy college-aged subjects with forward head, rounded shoulder posture and scapular dyskinesis completed the study. There were 10 subjects (7 females, 3 males, 20.30±.82 yr, ht=171.07±11.82 cm, wt=79.47±13.79 kg) in the exercise group and 10 subjects (7 females, 3 males, 20.40±1.43 yr, ht=166.61±11.99 cm, wt=69.40±11.48 kg) in the KT group. Subjects were randomized into two intervention groups undergoing a four-week program. One group participated in a strengthening and stretching exercise protocol (EG) based on the current literature, while the other group had KT applied to the upper back and shoulders for a duration of five days with two days of no tape in a seven-day period. Pre-and post-test measurements included the craniovertebral angle (CVA) in degrees, forward shoulder angle (FSA) in degrees, and scapular dyskinesis as assessed using scapular dyskinesis scoring (0-3, maximum combined score = 6) for each scapula. **RESULTS**: There was a significant time main effect for the scapular dyskinesis score (SDS) as both groups improved pre-to-post intervention (F=12.5, P<.01; EG=4.8±1.14 vs 5.3±.949, KT=4.10±1.59 vs 4.9±1.01). Time effect sizes were small to moderate for CVA (KT=.13 to EG=.53), RSA (EG=.15 to KT= -.46) and SDS (EG=.44 to KT=.50) in both groups. Group effect sizes were small for CVA (0.24), RSA (0.25) and SDS (0.36). Minimal-detectable-change-scores were achieved for the CVA (EG=3.90, KT=.80) and SDS (EG=.50, KT=.80) for both groups, indicating clinical improvement. No other results were significant. **CONCLUSIONS**: Both groups improved pre-to-post intervention for the three measurements, even though only SDS was significant. Thus, either treatment could be used.

1914 Board #70 May 30 2:00 PM - 3:30 PM

Stimulation Techniques used to Assess Corticospinal Excitability Alters an Attentional Focus Maximal Voluntary Contraction of the Elbow Flexors.

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(No relevant relationships reported)

PURPOSE: To investigate the role of attentional focus on force output by assessing 1) force output during maximal voluntary elbow flexion contractions, 2) corticospinal excitability and 3) motor unit activation patterns
METHODS: 7 resistance-trained males completed two experimental sessions. Each session consisted of 12 maximum voluntary contractions (MVC) with 180s rest of recovery between MVC. Participants were given counter-balanced external and internal attentional focus conditions prior to each MVC to direct attention. Force output and electromyography (EMG) of the biceps brachii, triceps brachii, and brachioradialis were recorded for both sessions. Transcranial magnetic stimulation, transmastoid electrical stimulation, and brachial plexus electrical stimulation were used to produce motor evoked potentials (MEPs), cervicomedullary motor evoked potentials (CMEPs) and maximal M-waves (M_{max}) in the biceps brachii during each MVC in one of the two sessions. All MEPs and CMEPs were normalized to $M_{max.}$
RESULTS: Forces produced during the stimulation session were not significantly different between external and internal focus conditions (p = 0.20). However, forces produced during the non-stimulation session were 19.9% higher with an external cue compared to internal cues (p < 0.05). As well, forces produced with external cues were 13.2% greater during the non-stimulation session compared to the stimulation session. (p<0.05). EMG activity was not found to be significantly different between attention focus cues (p≥0.1).
CONCLUSIONS: The usage of stimulation techniques likely distracted participants from the attentional focus cues provided during the stimulation session. Therefore, we were unable to successfully assess changes in corticospinal excitability between focus cues. However, we were still able to show that external cues direct greater force production of the elbow flexors compared to internal cues.

D-60 Free Communication/Poster - New Insights in Children and Youth

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

1915 Board #71 May 30 3:30 PM - 5:00 PM

The Comparison of Children Active Travel Mode Time Under the Different Air Quality

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(No relevant relationships reported)

There are sufficient evidence to confirm the adverse effects of air pollution and the positive effects of active travel mode on the health. However, few studies have research on the impact of different air quality on children active travel mode time, especially in Asia country like China. **PURPOSE:** By comparing the active travel mode time of children under the different air quality areas to show the impact on air quality of children active travel mode time. **METHOD:** Through Beijing Municipal Environmental Protection Bureau to record the past year daily AQI(air quality index) data of different areas in Beijing, and according to the data to select two schools in good air quality (the AQI is 91 and 96) and two schools in poor air quality(the AQI is 102 and 120), all totals of 407 students (boys = 217, age = 10.78 ± 0.93 yrs). Using the questionnaire to record the children active travel mode time, including the time of children to go to school or other places on foot during the weekdays and weekend, and the time of children to go to school or other places by bike during the weekdays and weekend. The data were analyzed by using one-way ANOVA. **RESULT:** By comparing the active travel mode time of children in two schools with AQI of 91 and 96 (68.67±111.38 vs. 117.30±137.68mins, P<0.05);By comparing the active travel time of children in two schools with AQI of 91 and 102(68.67±111.38 vs. 154.66.30±249.61mins, P<0.05). **CONCLUSION:** Air quality may have an impact on children active travel mode time, the children in the best air quality areas have relatively less active travel mode time. Future studies should consider the more factors that may impact the children active travel mode time.

1916 Board #72 May 30 3:30 PM - 5:00 PM

Physical Activity, Sedentary Time, Body Composition and Cardiorespiratory Fitness In 4ThGrade Hispanic Children

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(No relevant relationships reported)

Physical activity (PA) positively influences health parameters such as cardiorespiratory fitness (CRF) and body composition in children and adolescents. However, evidence of these associations, including sedentary time (ST), among Hispanic children is insufficient. **PURPOSE:**To determine associations between PA, ST, body composition, and CRF in 4thgrade Hispanic children in Puerto Rico. **METHODS:**A group of 70 boys (n=33) and girls (n=37), 9.4±0.5 years of age completed a CRF test (PACER) and body composition evaluation (height, weight, calf and triceps skinfolds) using the FITNESSGRAM®protocol, and wore an accelerometer for 7-consecutive days. T-tests and Wilcoxon rank-sum tests were conducted to test for sex differences when appropriate, and correlation analyses by sex to test for associations between variables. **RESULTS:** Compared with boys, girls were less active (238.7±48.1 vs. 199.4±72.4 min/day of moderate to vigorous PA, P=0.01; 18528±4539 vs. 15003±5883 steps/day, P=0.01) and more sedentary (6.8±1.2 vs. 7.8±1.8 hrs/day, P=0.01). Boys and girls were not different in their mean BMI (18.0±5.0 vs. 18.5±3.6 kg/m^2, P=0.63), %fat (22.6±11.0 vs. 25.2±8.1 %, P=0.26), max steps/min (133±14.4 vs. 131±18 steps, P=0.57), and CRF test (34.2±21.2 vs. 26.5±17.1 laps, P=0.11). CRF in boys was inversely correlated with BMI and %fat (rho= -0.39 (P=0.04), -0.42 (P=0.02); respectively), and directly correlated with vigorous PA (rho=0.40, P=0.03); while in girls, CRF was directly correlated with maximal steps/min (rho=0.34, P=0.04). **CONCLUSION:**Although boys and girls appear sufficiently active, lower PA and higher ST among girls should be addressed to promote healthier lifestyles. Also, the

influence of PA intensity and body composition on CRF appear to differ by sex, a consideration for future PA interventions in this population. Supported in part by FIPI/DEGI/UPRRP.

1917 Board #73 May 30 3:30 PM - 5:00 PM

Effects of Exergaming on Motor Skill Competence, Perceived Competence, and Physical Activity in Preschool Children

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PURPOSE: Few school settings offer structured physical activity (PA) opportunities for preschool children, with little study conducted examining exergaming's effectiveness on health outcomes in this age group. This study's purpose, therefore, was to examine a school-based exergaming intervention's effect on preschool children's perceived competence, motor skill competence and PA versus usual care (recess), as well as examine gender differences for these outcomes.
METHODS: Sixty-five preschoolers (33 girls; M_{age} = 4.45 ± 0.46; $M_{BMIpercentile}$ = 59.05 ± 32.04) from 2 underserved urban elementary schools in a Midwestern U.S. state were enrolled and then assigned to 1 of 2 conditions, with school as experimental unit: (1) usual care recess group (8 weeks of 100 minutes [5 days x 20 minutes] recess/week); and (2) exergaming intervention group (8 weeks of 100 minutes [5 days x 20 minutes] school-based exergaming/week). All children underwent identical perceived competence, motor skill competence and moderate-to-vigorous PA (MVPA) assessments at baseline and at the end of the 8th week. A multivariate analysis of variance with repeated measures was employed to examine preschool children's changes in perceived competence, motor skill competence and MVPA over time.
RESULTS: A significant Group by Time effect was observed for MVPA ($F(1, 52) = 4.37$, $p = 0.04$, $\eta^2 = 0.04$), but not perceived competence ($F(1, 52) = 0.83$, $p = 0.37$, $\eta^2 = 0.02$) or motor skill competence ($F(1, 52) = 0.02$, $p = 0.88$, $\eta^2 = 0.00$). Specifically, intervention children displayed significantly greater increased MVPA at 8 weeks than the comparison children (4.05 vs. -1.99 minute). Additionally, there was a significant Time effect for motor skill competence ($F(1, 52) = 15.61$, $p < 0.01$, $\eta^2 = .23$) and Gender effect for MVPA ($F(1, 52) = 5.06$, $p = 0.02$, $\eta^2 = 0.09$). In detail, while all preschoolers' motor skill competence improved over time, boys demonstrated higher MVPA than girls at both time points.
DISCUSSION: Exergaming showed a positive effect in promoting preschool children's MVPA at school and has the potential to enhance perceived competence and motor skill competence. More research with larger sample sizes and longer study durations is warranted.

1918 Board #74 May 30 3:30 PM - 5:00 PM

The Effect of Extracurricular Coordinated Physical Education on the Development of Basic Motor Skills of Children aged 7-9 Years Old

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to analyze the effect of the extracurricular physical education program through a 12-week-coordination on the development of basic motor movements for children of 7-9 years.
METHODS: A sample of 120 children of the elementary school period, 58 of whom were in the experimental group and 62 of whom were in the control group, were incorporated into the study in line with their own consent after their guardian had also informed. The program lasted for 12 weeks in the form of 2 days and 2 hours a day. The control group was not involved in any extracurricular physical education program. A research model of "pretest-posttest" was used. The "independent t" and the "paired samples t" statistical package program were used to analyze the data.
RESULTS: The study results indicated that transfer coordination (t=2.89, $p<0.05$), click-to-click (t=2.76, $p<0.05$), climbing obstacles (t=4.47, $p<0.05$), and rolling skills (t=3.81, $p<0.05$) that four indicators were significantly higher in the experimental group. The rolling skill was a significant change pre-and post-experiment in the control group (t=2.13, $p<0.05$), no significant differences in other variables.
CONCLUSIONS: As the results of this study, it follows that apart from clearly mentioning the importance of physical pricing practices. The extracurricular physical education program through long-term proper practices will enable children to develop their basic motor skill. (This study was supported by NPOPSS Grant 15CTY011.)

1919 Board #75 May 30 3:30 PM - 5:00 PM

Comparisons Of In-school And Out-of-school Physical Activity Among Chinese Elementary School Children

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(No relevant relationships reported)

PURPOSE: Relatively little is known regarding children's physical activity (PA) during school and outside of school. Therefore, the objective of this study was to compare in-school and out-of-school PA among Chinese elementary school children.
METHODS: A cross-sectional study was conducted among 360 (4th grade) children recruited from 3 elementary schools in Shanghai, China. PA was measured in 5 consecutive school days by accelerometers. Minutes per hour (min/h) of moderate-to-vigorous PA (MVPA) and total PA (TPA) were calculated using established cut points. Children's in-school and out-of-school MVPA and TPA were compared using paired *t* test. Gender differences in MVPA and TPA across the two study settings were also examined using independent *t* test.
RESULTS: 242 participants (boys: 45.5%, mean age: 9.6±0.3 years, weight:35.0±7.6 kg, height:139.8±6.1 cm, body mass index: 17.8±2.9 kg/m^2) provided valid accelerometer data (defined as ≥ 2 days, ≥10 h/day) and were included in the study. Results showed a higher level of in-school MVPA compared to out-of-school MVPA (3.1 min/h vs 2.3 min/h, P<0.001) and of in-school TPA compared to out-of-school TPA (17.3 min/h vs 15.1 min/h, P<0.001). There were no difference in out-of-school MVPA and TPA across gender but boys showed a higher level of in-school MVPA (3.1 min/h vs 2.3 min/h, P<0.001) and TPA (18.3 min/h vs 16.6 min/h, P<0.001) compared to girls.
CONLUSION: Chinese elementary school children spent more time engaging in in-school PA compared to out-of-school PA with boys showing a higher level of in-school PA compared to their counterpart girls. Findings suggest that PA promotion strategies should focus on developing out of school, community-based programs and that maximizing in-school PA among girls.

1920 Board #76 May 30 3:30 PM - 5:00 PM

Predictors of Return to a Childhood Healthy Eating and Active Living Obesity Clinic

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(No relevant relationships reported)

PURPOSE: To identify predictors of program retention among children enrolled in a multifactorial obesity treatment clinic designed to support behavior change in physical activity and healthy eating to combat unhealthy weight levels. **METHODS**: Children age 2-18 years old (n = 285) attended a baseline visit at a childhood healthy eating and active living (CHEAL) clinic. Parents completed a behavioral survey and height, weight, blood cholesterol and blood glucose were objectively measured. Weight status was reflected as the Percent Over the 50th Percentile for age and sex based on CDC reference values (BMI50). Survey items included questions about prenatal and infancy history, family medical history, and eating and activity behaviors as well as desire to make changes and discuss nutrition behaviors with a dietician. All survey and objective measures were first evaluated with univariate analysis (Chi-Square and t-test) to identify differences between Returners and Non-Returners. Variables identified as having a significant relationship with returning for a second clinic visit were then entered into logistic regression models using forward selection. Four different models were constructed, with Model 4 containing all variables that were significant in univariate analyses.
RESULTS: Significant variables in univariate analyses included BMI50, sex, age, baseline cholesterol, sugar sweetened beverage (SSB) consumption, willingness to meet with a dietician, and the mother gaining more than 35 pounds during pregnancy. In logistic regression, children who consumed SSB once per week were more likely to return for a second clinic visit than those consuming SSB every day (OR 4.5 (95% CI: 1.9 - 10.5)) and older children were less likely to return than younger children (OR 0.9 (95% CI: 0.8 - 0.99)).
CONCLUSIONS: The predictors identified support theories associated with the importance of readiness for change (SSB consumption, willingness to meet with a dietician) and suggest that engaging families when children are young may improve retention rates for clinic-based interventions targeting healthy weight or energy-balance behaviors.

1921 Board #77 May 30 3:30 PM - 5:00 PM

Evidence for Compensation or Synergy of Children's Activity During Outdoor and Indoor Preschool Time

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(No relevant relationships reported)

INTRODUCTION: Evidence for physical activity (PA) compensation (e.g., high PA leads to low PA in another part of the day) and synergy (e.g., building on times of high PA with additional high PA) in school-aged youth has been reported, but has not been studied in preschoolers. **PURPOSE:** To determine if preschoolers exhibit evidence of compensation or synergy in indoor and outdoor PA during child care. **METHODS**: Children (N=44; 3-4 y) in three preschools wore an accelerometer on their right hip for two school days. PA intensity was determined using Pate cut-points (counts/15sec). A proximity tagging beacon was placed in each classroom, and children's accelerometers acted as receivers. Lack of communication between beacons and receivers indicated that children were outdoors. Outdoor and indoor time (min/hr) in light, moderate, vigorous, or total PA was determined. Paired t-tests were used to identify if time in each intensity (for indoor/outdoor time) significantly differed between days (p<0.05). Difference in time in each intensity between days was calculated and Pearson correlations were performed to compare between-day changes in outdoor and indoor light, moderate, vigorous, and total PA (e.g., correlation between change in outdoor total PA vs. change in indoor total PA). Positive associations support synergy, while inverse associations support compensation. **RESULTS:** No differences in time in each intensity between days were found. Change in outdoor light (r=0.02, p=0.883), moderate (r=-0.17, p=0.279), and total (r=-0.14, p=0.369) PA were not significantly related to change in indoor light, moderate, and total PA, respectively. Change in outdoor vigorous PA was positively related to change in indoor vigorous PA (r=0.40, p=0.007). For total PA, 59% of children exhibited evidence of compensation and 41% exhibited evidence of synergy. For vigorous PA, 45% of children exhibited evidence of compensation, and 55% exhibited evidence of synergy. **CONCLUSION:** Results suggest that vigorous intensity exercise may be more synergistic in nature. The weak-to-moderate, negative correlations among light, moderate and total PA warrant evidence for PA compensation at these intensities; however, results should be further examined in future studies using a larger sample size. **Funding:** ACSM Foundation, MWACSM, NASPEM, SHAPE

1922 Board #78 May 30 3:30 PM - 5:00 PM

The Effectiveness Of High-intensity Interval Training Versus Moderate-intensity Continuous Training On Cardiometabolic Risk Factors In Childhood Obesity: A Meta-analysis

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(No relevant relationships reported)

Exercise training is mainly prescribed for obese children to decreased cardiometabolic risks, however, studies examining the difference between high-intensity interval training (HIIT) and moderate-intensity continuous training (MICT) are limited. **PURPOSE**: The purpose of this study was to determine if HIIT differentially impacted on cardiovascular risk factors compared with MICT in obese children.**METHODS**: The relevant literature was searched from the databases of PubMed, Web of Science, Embase, the Cochrane library, and CNKI, which was completed in September 2018. Only randomized controlled trials involving both HIIT and MICT on obese children were included, and studies involving only one intervention would be excluded. Two researchers independently performed literature screening, literature quality evaluation, and data extraction according to inclusion and exclusion criteria.**RESULTS**: A total of 9 study with 309 obese children were included. Compared with baseline, both HIIT and MICT can significantly reduce body weight (BW), body mass index, systolic blood pressure, diastolic blood pressure, and increase VO2peak. Similar results were also found with respect to fasting glucose (FG) and fasting insulin in HIIT, while MICT is not significant. HIIT showed a small but significant effect on BW (mean difference (MD): -0.797 kg, 95%CI -1.018 to -0.575, p = 0.0001), total cholesterol (standardized mean difference (SMD) = -0.877, 95%CI -1.733 to -0.022, 0.044), HOMA-IR (MD = -0.620 mmol/L, 95%CI -1.234 to -0.006, 0.048), FG (MD = -0.391 mmol/L, 95%CI -0.608 to -0.173, 0.001) compared than MICT did. The main difference between HIIT and MICT is that HIIT is more effective for VO2peak (MD: 3.364 ml/kg/min, 95% CI 1.902 to 4.826, p = 0.0001).**CONCLUSIONS**: Our meta-analysis of randomized controlled trails indicates that both HIIT and MICT can significantly reduce cardiovascular risk factors in obese children, while HIIT with greater improvement observed in cardiorespiratory fitness.

1923 Board #79 May 30 3:30 PM - 5:00 PM

The Effects Of Active Video Games And SPARK PE On Children's In-school Physical Activity

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PURPOSE: Active video games (AVGs) is a technology tool that allows participants to engage in physical activity (PA) while playing video games. Research has shown that AVGs may serve as a "gateway" to increase individuals' PA. A physical education (PE) curriculum, Sport, Play, And Recreation for Kids (SPARK), is also designed to promote students' fitness and PA. The purpose of the study is to compare the effects of the two interventions (AVGs vs. SPARK PE) in increasing participants' in-school moderate to vigorous PA (MVPA).
METHODS: Both third (n=29, 34.5% for boys, 65.5% for girls, mean age = 9.1; SD = .6) and fourth grade (n=36, 41.7% for boys, 58.3% for girls, mean age = 10.2; SD = .5) students from a public school located in the South Georgia region participated in the study. Participants from third grade were enrolled in AVGs group while fourth graders were engaged in SPARK PE class. Both interventions lasted for six weeks with three 40-min sessions each week. A total of six Kinect AVG stations were set up with six participants practicing dance games at each station. Students in the SPARK PE group were taught by a student teacher who is familiar with SPARK K-5 curriculum. All participants were pre- and post-tested on their in-school PA for three days prior to and after the intervention using ActiGraph GT3X+. Everson's cut points were applied to generate the percentage of time engaged in MVPA. A two-way mixed ANOVA was conducted to examine the effects of interventions (between-subjects) and time (within-subjects) on participants' in-school MVPA percentage.
RESULTS: There was no significant main effect of time (F (1, 63) = .72, p >.05, partial η^2 = 01) on participants' in-school MVPA percentage. There was, however, significant main effect of interventions (F (1, 63) = 23.5, p <.001, partial η^2 = .27) on students' in-school MVPA percentage, with SPARK PE group (mean = 3.9) had higher percentage than did the Kinect AVG group (mean = 2.7). In addition, there was no significant interaction between time and intervention groups (F (1, 63) = 1.60, p >.05, partial η^2 = .03).
CONCLUSIONS: Neither Kinect AVG nor SPARK PE changed participants' in-school MVPA percentage. The effect of PA interventions on children's in-school MVPA need to be explored in future studies.

1924 Board #80 May 30 3:30 PM - 5:00 PM

Predictors and Acceptability of Shared Physical Activity in Parent-Child Dyads

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PURPOSE: To identify significant predictors and assess the acceptability of shared physical activity (PA) in young children and their parents.
METHODS: Twenty-eight parent-child dyads (mean±SD; age, parents: 38.0±6.6, children: 6.0±1.7) completed sessions in a fitness center that included five different shared PAs (brisk walking, dancing, tag games, body-weight exercises, and jumping games) and were instructed to try to complete at least one PA per day in the following week at home. One week later, parents reported their dyad's participation in the shared PAs. Parents reported demographic characteristics, family chaos, parent PA self-efficacy, parental PA self-efficacy for their child, and average min/week of shared PA. A forward stepwise regression was used to determine the optimal model to predict the total number of minutes parent-child dyads spent completing each PA together at home. McNemar's test was used to determine differences between perceived acceptability and completion of the five PAs as a dyad during shared time.
RESULTS: Lower family chaos (B=-19.41, p=0.034), higher parent body mass index (BMI) (B=7.65, p=0.003), and higher annual household income (B=11.85, p=0.023) significantly predicted minutes of shared PA at home. The proportion of parents who perceived brisk walking as an acceptable PA was not different (p=0.125) than those who briskly walked with their child. The proportion of parents who perceived jumping games, body-weight exercises, dancing, and tag games as acceptable PAs was greater than those who completed these PAs with their child (all, p<0.05).
CONCLUSIONS: Shared PA participation may be higher when participants have lower family chaos, higher parental BMI, and higher annual household income. Brisk walking could be considered in future family-based PA programs since it was perceived as acceptable and was completed in the home environment, whereas the other shared PAs were perceived as acceptable but not completed at home.

1925 Board #81 May 30 3:30 PM - 5:00 PM

The Effects of Playground Zoning on Physical Activity During Recess in Elementary-Aged Children.

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(No relevant relationships reported)

While many factors contribute to the development of obesity, a sedentary lifestyle plays a significant role in this epidemic. Epidemiological data indicates that 50% of children aged 6-11 years old and approximately 92% of adolescents aged 12-18 years old are not meeting the recommended health guideline of 60 minutes of moderate-to-vigorous physical activity (MVPA) per day. Therefore, the most effective interventions for combating inactivity and childhood obesity should target children before inactivity develops in their adolescent years. Due to the increasing youth obesity rates, schools have been identified as ideal environments to promote physical activity (PA). **PURPOSE:** The purpose of this study was to compare changes in physical activity in youth, measured by accelerometry, during recess with a playground zoning intervention. **METHODS:** The sample included 433 third-, fourth-, and fifth-grade boys and girls from two elementary institutions. PA was observed during recess using systematic observation of play and leisure activity in youth (SOPLAY) and measured using Actigraph-GT3X accelerometers on a subset of students (n = 78). Baseline data were collected for one week prior to playground zoning. Afterwards, the playgrounds were zoned into six various activities for two weeks and PA data was observed and measured. **RESULTS:** A repeated measures ANOVA detected a significant main effect with the zoning and decreased time spent in sedentary activity (p = .013) and moderate activity (p = .027). A significant cross-over interaction was detected with zoning and an increase in time spent in vigorous activity (p = .017) and MVPA (p = .006) for third graders, whereas fifth graders significantly decreased the time spent in MVPA (p < .001). Furthermore, third grade boys accumulated 204 more steps on the zoned playground compared to baseline measurements (p = .001). A McNemar test revealed a 5% increase in observational PA on zoned playgrounds (p < .001). **CONCLUSION:** Zoned playgrounds are an applicable, manageable, and effective program that can help improve PA during recess for young children. However, a different intervention may be needed to improve PA in older children.

1926 Board #82 May 30 3:30 PM - 5:00 PM

Influence of Parents' Physical Activity on Children's Physical Activity And Cardiopulmonary Endurance

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(No relevant relationships reported)

It is reported that parents have important influences on the children' physical activity(PA) and health fitness, but such research has hardly been found in China nowdays. **PURPOSE**: To investigate PA level, health fitness and economic status among the children of 7-9 yrs and their parents; to assess the influence of parents' PA level, economic, educational condition and so on.
METHODS: The subjects were selected from Huilongguan Centre Primary School in Beijing.The children are 7-9 yrs and their parent who brought up them with age of 30-39 yrs.Through self-designed questionnaire, the study made investigation of economics and educational status on the subject families,and the other main contents including medical history, family history, PA and sports.It was obtained the PA data of the children by the revised PAQ-A,and the parents'PA level were measured by accelerometer (ActiGraph GT3X+).Health fitness examination adopted the national standard for pupil's fitness measurements.
RESULTS: 36 families completed the examination totally. According to daily average time of MVPA, whether one person or two of the couple, less than 30 mins was regarded as PA insufficient family(iPAf), and more than 30 mins was PA sufficient family(sPAf). **(1)**The data proved 20 sPAf and 16 iPAf in the study. **(2)** There were different in the children's scores between sPAf(3.02±0.53)and insufficient ones(2.61±0.58)(P<0.05),and the BMI of the two groups (15.63±1.95 vs17.77±3.67) showed great difference(P<0.01).**(3)**The time of 50m*4 shuttle-run between the two children groups were different (119.35±29.42 vs 127.56±21.14s,P<0.05);**(4)** The sedentary time everyday of the husband and wife in a family were moderately correlated(r=0.516,P=0.023),and the light PA time displayed low positive correlation(r=0.362,P=0.046),while the correlation was not found between the time of their moderate and more intensity PA(r=0.145,P=0.093). **CONCLUSIONS**: **(1)** The findings indicated that the higher PA level the parent had, the higher PA level their children did;and the children's cardiopulmonary endurance are higher similarly, whereas with the lower obesity extent.**(2)**The PA level of the husband and wife were interdependent and interactive.Supported by Central Universities and Colleges Basic Scientific Research Funds Special Funding (2016ZX016).

1927 Board #83 May 30 3:30 PM - 5:00 PM

Preschool Children's Cognition is Associated With Motor Skill Competence and Cardiovascular Fitness

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(No relevant relationships reported)

PURPOSE: While the early years are a critical window for the development of a healthy lifestyle, it is the period of growth for which we know the least about evidence linking physical activity with health outcomes in this population. This cross-sectional study examined the associations among physical activity (PA), motor skill competence (MSC), perceived physical competence (PPC), cardiovascular fitness (CF), and cognition in preschool children.
METHODS: Sixty-five preschool children (33 girls; 27 White, 21 Black, 10 Hispanic, 7 other; $\bar{X}_{age}$ = 4.45 ± 0.46; $\bar{X}_{BMIpercentile}$ = 59.05 ± 32.04) were recruited from two local elementary schools in Minneapolis, Minnesota. Children's 3 days PA during school time included moderate-to-vigorous PA (MVPA) and steps were assessed via Actigraph Link; MSC was measured via the Test of Gross Motor Development-Second Edition; PPC was assessed via the Pictorial Scale of Perceived Competence and Social Acceptance; CF was assessed via a modified YMCA 3-Minute Step Test; and cognition was assessed via the computer-administered NIH Toolbox. Multiple linear regression was performed to determine the associations among outcome measures.
RESULTS: Preschool children's MVPA was not significantly related to MSC (r = 0.182, p > 0.05), PPC (r = 0.121, p > 0.05), CF (r = -0.141, p > 0.05), cognition (r = -0.095, p > 0.05), but step counts were significantly positively related to MSC (r = 0.282, p < 0.05), and preschool children's MSC was a significant predictor of step counts [F (4, 63) = 4.65, β = 0.12, p < 0.05, R^2 = 0.24] after age, gender, and BMI were adjusted. In addition, PPC was significantly positively correlated with MSC (r = 0.366, p < 0.01), and was a significant predictor of MSC [F (4, 63) = 2.66, β = 0.26, p = 0.04, R^2 = 0.15]. Preschool children's cognition was significantly positively correlated with MSC (r = 0.266, p < 0.01) and CF (r = 0.372, p < 0.01), respectively, but only CF seemed to be a significant predictor of cognition [F (2, 62) = 4.52, β = 0.35, t = 2.73, p = 0.01, R^2 = 0.14].
CONCLUSIONS: The findings support the need for effective strategies that simultaneously promote motor skill competence, cardiovascular fitness, cognition, and physical activity behaviors in early childhood. Future research with larger and more diverse samples is warranted.

1928 Board #84 May 30 3:30 PM - 5:00 PM

Physical Literacy Competency Among Elementary and Middle School Children

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Physical literacy addresses the ability, confidence and desire needed to optimize physical activity participation. Ability to perform, or competency in, fundamental movement skills, has not been recently evaluated among children in the United States, which is essential for identifying needs for intervention.
PURPOSE: To compare physical literacy competency between sexes and age groups in children. **METHODS:** 288 children (134 males, 153 females; age 9±2 years; height 132±36 cm; mass 41±14 kg) from 6 schools volunteered to participate. Participants completed tasks in a randomized order to assess five domains of physical literacy competency: locomotor, running, balance, upper extremity (UE) and lower extremity (LE) object control. Trained raters evaluated competency using a standardized, valid and reliable assessment (PLAYfun; Canadian Sport for Life). Participants were divided into age groups (Elementary: grades K-4; Middle: grades 5-8). Competency on all tasks was measured using a 0-100 continuous scale. Total average score and domain average scores were compared between sexes and age groups using a multivariate analysis of variance (α<.05). **RESULTS:** There were no significant interactions between sexes and age groups (p>.05). Regardless of age, males demonstrated greater competency than females for overall score (mean±SE points: males=71.5±1.0, females=63.7±1.0; p<.001), running (males=75.4±1.8, females=63.72±1.80; p<.001), UE object control (males=73.32±1.71, females=56.4±1.7; p<.001), and LE object control (males=66.9±2.0, females=52.3±2.0; p<.001). Regardless of sex, Middle had greater competency than Elementary for overall score (Middle=62.2±1.0, Elementary=73.0±0.9; p<.001), locomotor (Middle=75.3±1.17, Elementary=65.0±1.3; p<.001), balance (Middle=77.4±1.3, Elementary=62.1±1.3; p<.001), UE object control (Middle=70.0±1.6, Elementary=59.8±1.8; p<.001), and LE object control (Middle=67.9±1.9, Elementary=51.2±1.8; p<.001). **CONCLUSIONS:** Sex differences in physical literacy are present among children in the United States, especially in

tasks involving object control. Similarly, over 20% of children in middle school lack competency in object control tasks. These areas need to be addressed in order to optimize long-term physical activity.

1929 Board #85 May 30 3:30 PM - 5:00 PM

Classroom-based Strategies to Reduce Disparities in Physical Activity Among Children with Asthma

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(No relevant relationships reported)

PURPOSE: Children with asthma often experience physical activity (PA) induced symptoms 5-10 minutes following the start of exercise, with symptoms peaking 5-10 minutes post-activity. Classroom PA breaks provide shorter bouts of PA (4 minutes), and may represent a novel strategy to promote PA participation in this clinical population. Using a classroom-based PA intervention, we tested the feasibility of 5, 4-minute PA breaks to promote PA participation in children with asthma. **METHODS:** Nine, 3-6th grade classrooms at an elementary school in Detroit, MI (79% Hispanic; 80% on free/reduced lunch; 31% prevalence of asthma and asthma-like symptoms) participated in the 20-week intervention. Asthma status was self-reported via the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire in conjunction with nurse documentation. PA participation, exercise intensity [sedentary (SED), low-intensity physical activity (LPA), moderate-to-vigorous intensity physical activity (MVPA)], and asthmatic symptom occurrence were assessed via direct observation. **RESULTS:** All students accumulated approximately 19 total minutes (4.5±0.8 PA breaks x 246±8.0 seconds) of activity per day during PA breaks. Throughout the intervention, a greater percentage of children with asthma participated in MVPA during the PA breaks compared to children without asthma (asthma: 52.9±1.5% vs. non-asthma: 46.1±1.3%; p=0.001). In contrast, a greater percentage of students without asthma participated in LPA during PA breaks (non-asthma: 30.2±1.1% vs. asthma: 25.8±1.2%; p=0.006). There were no differences in the percentage of students who were SED during PA breaks (asthma: 21.3±1.7% vs. non-asthma: 23.7±1.8%; p=0.155). Out of 294 observations, six instances of asthmatic symptoms (coughing) were observed post PA break. **CONCLUSIONS**: Classroom-based interventions that incorporate short bouts of PA, represent safe exercises for children with asthma. Given the higher participation in MVPA among children with asthma, classroom interventions may be effective in reducing PA disparities in school settings.

1930 Board #86 May 30 3:30 PM - 5:00 PM

Wearable Activity Monitors as Part of a Childhood Obesity Treatment Program

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(No relevant relationships reported)

PURPOSE: It is well known that childhood obesity has become a common issue in the United States (1), and that obesity contributes to a multitude of chronic diseases and negative health conditions (2). One of the biggest challenges in the treatment and prevention of childhood obesity is that the goal of these programs is primarily to modify behaviors that occur outside of the program space. The purpose of this study was to summarize the findings from a 6-month program that used wearable activity monitors (WAM) as part of a clinical obesity treatment program for fifteen children in Arizona (USA) between December 2015 to November 2017. **METHODS:** Obese children were referred to participate in this program by their pediatrician. Participants were provided a WAM that was used to monitor their physical activity (PA) levels, heart rate, and sleep habits. For the first week, participants were instructed not to change their behaviors so that baseline PA data could be collected. Subsequently, appropriate step and heart rate zone goals were set and progressively increased each week that a participant met their previous goal. **RESULTS:** Adherence to wearing the WAM was high, with only about 1.3% of activity data and 3% of sleep data missing throughout the entire program. Three children dropped out of the study before the program was completed. For the children who completed the program, modest improvements were noted for step count, and healthy sleep habits were found to be positively correlated with PA. In baseline data collection, the children walked on average 8,900 steps per day. In the final week, the children recorded 9,784 daily steps on average, representing approximately a 10% increase in the average number of steps taken. **CONCLUSIONS:** Overall, childhood obesity treatment programs focus heavily on modifying behaviors that occur outside of the clinic setting. A WAM appears to be a feasible approach to continuously monitor and increase the PA of obese children. Including WAM and progressive goal setting in a clinical obesity treatment program for children may be an effective method to increase PA levels outside of the clinical setting. Further exploration of the link between healthy sleep habits and PA could yield additional findings useful to childhood obesity treatment and prevention.

1931 Board #87 May 30 3:30 PM - 5:00 PM

Association of Sports Participation with Intake of Fast Food for Family Meals Among Rural Children

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(No relevant relationships reported)

After-school sports participation is common among children, and the busy lives of families could lead to challenges to prepare healthful family meals. This often results in families seeking the convenience of fast food for their evening meal. However, there is a scarcity of research, particularly among families in rural areas, examining whether children's sports participation is associated with families' intake of fast food as their evening family meal. **PURPOSE**: To examine associations between sports participation and fast food intake of rural children. **METHODS**: Baseline data from the childhood obesity prevention, randomized controlled trial, NU-HOME, were analyzed. Children (n=60; age=8.95±0.89 years; 62% female; 60% normal weight) and their parents reported on sociodemographics, child's sports participation (activities in the last year and frequency after school and in evenings) and family's intake of fast food as the evening meal. Logistic regression analyses were performed. **RESULTS**: Mean sports participation in the past year was 2.36±1.27 activities, with children reporting engaging in after-school and evening activities on 2.19±1.66 and 2.61±2.21 days, respectively, over the past week. Of their evening family meals in the past week, parents reported that 1.2±1.01 meals were considered fast food. Although sports participation in the past year was correlated with socioeconomic status, there was no statistically significant association between sport participation and fast food as evening family meal (p>0.05). **CONCLUSIONS**: Although sports participation was not associated with fast food intake as evening family meal in this study, future research should explore this relationship in other populations, particularly in larger studies. Furthermore, the possibility of lower availability of fast food options in rural areas compared to more urban settings could be an important caveat.

1932 Board #88 May 30 3:30 PM - 5:00 PM

The Association Between Sex and Directly Observed Physical Activity in Preschool-Age Children

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Sex disparities in physical activity (PA) are evident in preschool-age children (2.9 – 5 years old). Preschool-age boys have been reported to participate in more PA during free play. However, it is unknown if this disparity is evident when participating in a structured PA intervention. **Purpose:** To examine the association between sex and directly observed PA levels in preschool-age children while participating in a PA intervention. **Methods:** This study utilized data from the Short bouTs of Exercise for Preschoolers (STEP) study. STEP was a 6-month cluster randomized controlled study that examined the effects of short bouts of structured PA implemented within the classroom setting as part of designated gross motor playtime in ten preschool centers. STEP consisted of structured PA during the first 10 minutes of gross motor playtime followed by 20 minutes of free playtime. PA levels during the 10-minute intervention session were measured using a modified Observational System for Recording Physical Activity in Children-Preschool Version. PA intensity was classified as sedentary, light, or moderate-to-vigorous (MVPA). This secondary analysis focused on the baseline and 3-month data of participants randomized to the intervention group (preschool centers, n = 5; participants, n = 75; age = 3.9 ± 0.67 years). Spearman correlations were used to examine the association between sex and PA intensity during the intervention. Repeated measures ANOVAs were used to examine the effect of sex on PA intensity. **Results**: Participants spent similar percent of intervals in MVPA at baseline (boys, 41.77±6.59; girls,38.27±5.16) and 3-months (boys, 46.61±7.59; girls, 43.89±7.55). There were no significant associations between sex and directly observed MVPA at baseline (r=-0.035, P=0.37) or 3-months (r=-0.039, P=0.81). Similarly, there were no significant effects of sex on any PA intensity (all P > 0.80) during the intervention. **Conclusion**: In this sample, sex was not associated with or impacted the number of intervals that preschool-age children spent in MVPA during the structured PA intervention. Future studies are needed to determine if these trends remain the same in a larger sample size.

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1933 Board #89 May 30 3:30 PM - 5:00 PM

Patterns of Physical Activity Change during Playground and Gardening Activities in Young Children

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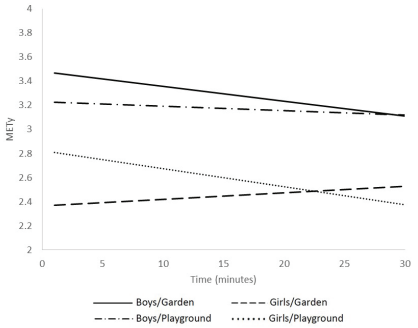
Previous research shows a decline in activity intensity during outdoor free play in young children, with the pattern of decline varying between boys and girls. However, this area has not been studied in other outdoor locations (i.e., garden) or during semi-structured play. **PURPOSE**: To determine if a time course change in intensity level, defined as a change in youth MET (MET_y), occurs during outdoor play on a natural playground and in a garden setting in preschool children. **METHODS**:Twenty-six children (4.5 ± 0.7 y; 13 boys) wore an ActiGraph GT3X+ accelerometer on the right hip during two 30 min free living conditions; free play on a natural playground and semi-structured play in a garden. The Pate et al. equation was used to calculate VO_2 from accelerometer data. MET_y values were calculated by dividing predicted VO_2 by predicted basal metabolic rate (Schofield equation). Hierarchical linear models were used to demonstrate the changes in MET_y over time (level one variable = time, level 2 variable = individual child, predictor variables = sex (boy or girl) and location (garden or playground)). There was a three-way interaction among time, location, and sex ($F(1, 725.984) = 7.858$, $p<0.001$), thus separate models were run for each sex. **RESULTS**:For boys, there was no time by location interaction ($F(1, 387.174) = 1.038$, $p=0.309$) and no main effects for time ($F(1, 177.036) = 3.115$, $p=0.268$) or location ($F(1, 384.913) = 1.234$, $p=0.078$). For girls, there was a significant time by location interaction ($F(1, 313.624)=9.925$, $p=0.002$), yielding the following equation: MET_y = 2.81 - 0.44 (location; playground = 0, garden = 1) - 0.02 (time) + 0.02 (location*time). The figure represents the average change in MET_y for each location and by sex.



CONCLUSIONS:Boys' MET_y level was consistent across time in both locations. Girls' MET_y level declined in the playground but increased in the garden. For girls, semi-structured activity in a garden may result in sustained higher MET_y activity during play.

1934 Board #90 May 30 3:30 PM - 5:00 PM

Recess And Overweight And Obesity In Children 5-11 Years Of Age: 2013-2016 Nhanes

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(Sponsor: James R. Churilla, FACSM)

(No relevant relationships reported)

There is limited evidence examining reported weekly volume of recess and odds of overweight and obesity using large nationally representative samples of U.S. children. **PURPOSE**: Examine the associations between reported weekly volume of recess, and overweight and obesity in a nationally representative sample of U.S. children. **METHODS**: The study sample included male (n=1,434) and female (n=1,409) children 5 to 11 years of age who participated in the 2013-2016 National Health and Nutrition Examination Survey. Overweight and obesity were defined using the 85th and 95th percentile of body mass index of the same age and sex. Proxy respondents answered interview questions regarding the number of days/week and minutes/day that the child participates in recess. **RESULTS**: Compared to a referent group participating in recess five days/week for > 30 minutes/day, analysis revealed significantly higher odds of obesity in females reporting no recess participation (Odds Ratio 1.81; 95% Confidence Interval, 1.03-3.16, P=0.0397). This relationship was independent of age and race/ethnicity. A similar relationship was not revealed for prediction of overweight in females or overweight and obesity in males. **CONCLUSION**: In a large nationally representative sample of U.S. children, reporting no recess was associated with significantly higher odds of obesity in females.

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Game-Play Characteristics by Field Size in Boys Youth Lacrosse

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(No relevant relationships reported)

US Lacrosse's Athlete Development Model (LADM) currently encourages small-sided game (SG) field dimensions to increase development and skill acquisition for youth athletes. No studies have evaluated changes in game-play subsequent to SG participation in boys' youth lacrosse (BYL). **PURPOSE:** To describe game-play characteristics during SG (35-45 yd) and full-field games (FG, 60-70 yd) in BYL. **METHODS:** Data was collected from 33 BYL players in Virginia (8.5±0.5 years, 138.3±5.7 cm, 35.9±6.5kg) on SG (n=15) and FG (n=18) teams. All games were filmed using a digital camera affixed to a camera lift system. Game-play characteristics were measured by reviewing the game video and coding for characteristics of unsuccessful passes, successful passes, shots on goal, goalie saves, changes of possession, loose balls, and intercepted passes. Descriptive statistics were reported (Frequency, Mean) for all observed game-play characteristics. **RESULTS:** Teams participated in 12 games total with 159 total athlete-exposures. Total gameplay characteristics were: unsuccessful passes (SG=587, FG=399), successful passes (SG=165, FG=347), shots on goal (SG=81, FG=143), goalie saves (SG=28, FG=79), changes of possession (SG=419, FG=335), loose balls (SG=799, FG=670), and intercepted passes (SG=31, FG=24). The average characteristic per game were: unsuccessful passes (SG=97.8, FG=66.5), successful passes (SG=27.5, FG=57.8), shots on goal (SG=13.5, FG=23.8), goalie saves (SG=4.7, FG=13.2), changes of possession (SG=69.8, FG=55.8), loose balls (SG=133.2, FG=111.7), and intercepted passes (SG=5.2, FG=4.0). Further characteristics included: percent successful passes (SG=22%, FG=47%) and percent of successful shots on goal (SG=60%, FG=41%). **CONCLUSION:** Generally, FG had a greater percentage of successful passes than SG with comparable attempts per game between the two groups. In addition, SG had a greater successful shot percentage on less shots but had fewer goalie saves per game. Lastly, the SG team had more unsuccessful passes, loose balls, and turnovers. Further research is required to understand the effects of all aspects of the LADM on player development in BYL.

1936 Board #92 May 30 3:30 PM - 5:00 PM

Increased Acute-chronic Training Load Ratio Is Associated With Time-loss Injury In Elite-youth Female Soccer Athletes

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(No relevant relationships reported)

Prior research demonstrates that elevated acute (1-week) relative to chronic (3-4 weeks) training load (TL) ratios are associated with increased injury risk. However, there is no existing research examining this relationship in youth female soccer athletes, who are at high risk for certain injuries during sport, such as anterior cruciate ligament injury. **PURPOSE**: To investigate the association between acute-to-chronic TL (A:C) ratio measures with time-loss injury in elite-youth female soccer athletes. **METHODS**: Forty-three elite-youth female soccer athletes participated in the study. Daily measures of training load, measured by self-reported (0-10 scale) rating of perceived exertion (RPE) multiplied by training duration (minutes), were recorded within 30-minutes of practices and games from pre-season (August 2017) until the end of the fall competitive season (December 2017) using a customized phone app. Following completion of the competitive season, the athletes completed a survey to determine their history of experiencing a time-loss injury during the season. A:C ratios were calculated at week-9 relative to weeks 5 through 8, as this was the most intensive TL period of the season. Binary logistic regression examined the association between A:C ratio and time-loss injury status. Receiver operator curve (ROC) analyses was performed to select a A:C TL cutpoint, followed by computation of sensitivity, specificity and area under the curve (AUC). Odds ratios (OR) were calculated and compared between those with and without time-loss injury. **RESULTS**: Nineteen athletes reported to miss ≥1 day of practice or game due to injury. Logistic regression demonstrated greater A:C ratio was associated with increased risk of time-loss injury (OR = 12.65 [95% CI=1.51, 105.27], Wald=5.49, P=0.019). ROC curve analysis identified an A:C ratio cutpoint of 1.62 to have optimal screening properties: sensitivity=73.3%, specificity=87.5%, AUC=0.76. The OR for an A:C ratio of 1.62 or higher compared to less than 1.62 was 19.25 (95% CI=3.64, 101.77). **CONCLUSIONS**: Elevated A:C ratios (>1.62) are associated with increased risk of suffering time-loss injury in elite-adolescent female soccer athletes. Monitoring and managing A:C TL may be an important injury prevention strategy in this population.

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Physical Education Enrollment Trends of Youth with Obesity in a Large Midwestern Metropolitan Area

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(No relevant relationships reported)

PURPOSE: To determine physical education (PE) enrollment trends of youth with obesity in primary and secondary schools in a large Midwestern metropolitan area.
METHODS: Data from 71 months of clinical visits to a pediatric weight management program were extracted from electronic medical records. Entries were refined to include only school-aged children, ages 6-18 years old. Multiple encounters per subject were included if the encounters occurred during separate school years. Information regarding frequency (days per week) and duration (length of school year) of PE class was used to determine what percent of total school days a subject was enrolled in PE. Data were analyzed to determine trends in PE enrollment by age, gender, race, ethnicity and socioeconomic status.
RESULTS: Data were obtained for 6221 patient encounters (3514 females, 2706 males). Of these, 31.4% of patients were not enrolled in PE during the school year of the encounter. The most common frequencies of PE enrollment overall were 20% (29.4%) and 40% (16.3%) of total school days. There was no significant difference in PE enrollment between the age groups of 6-11 years and 12-13 years (26.6% vs. 26.5%). Students ages 14-18 years old were enrolled in PE a lower percentage of school days (18.5%, p<0.0001). Of students ages 14-18 years, males were enrolled in PE significantly more than females (21.2% vs. 16.7%, p=0.002). Subjects with government-funded health insurance were enrolled in PE more than students with private health insurance (25.2% vs. 22.0%, p<0.0001). Differences between race and ethnicity were not significant.**CONCLUSION:** PE enrollment in this population falls below previously reported national averages for elementary and middle school students and slightly above average for high school students. The majority of school-aged youth with obesity in this metropolitan area do not acquire enough physical activity through PE to meet recommended daily physical activity guidelines.

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BMI, Body Composition and Race are Associated with Decreased Bicycling Ability in Youth with Obesity.

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(No relevant relationships reported)

PURPOSE: To evaluate which factors may decrease the ability to ride a bike in youth with obesity.
METHODS: Data from 71 months of clinical visits to a pediatric weight management program were extracted from electronic medical records. Demographics and anthropometric measures, along with patient response to the question, "Are you able to ride a bike?" were analyzed to determine which factors limit a patient's ability to ride a bike. Levels of continuous variables for riders vs non-riders were compared using Wilcoxon rank sums tests. Fisher's Exact tests were used to compare proportions. Stepwise logistic regression was used to determine independent predictors of ability to ride.
RESULTS: Data were obtained from 4276 patients (2409 females, 1876 males). Mean age was 12.2 ± 3.2 years. Mean BMI was 33.5 ± 9 kg/m^2. Overall, 78.9% of the subjects were able to ride a bike. Males were more able to ride than females (79.4% vs. 78.6%, p=0.54). Caucasians were more able to ride than African Americans (80.0% vs. 76.9%, p=0.0491). Older aged subjects were more able to ride than younger aged subjects (12.6 ± 3 vs. 11.9 ± 3.8 years, p<0001). Subjects with a higher BMI were less able to ride (34.8 ± 9.3 vs. 33 ± 8.8 kg/m^2, p<0.0001). Subjects with a higher percent body fat (PBF) were less able to ride (46.4 ± 6.1% vs. 43.4 ± 6.7%, p<0.0001). Body fat mass was also significantly higher in the group that was unable to ride (41.1 ± 25.5 kg vs. 37.3 ± 15.1 kg, p<0.0001).
CONCLUSIONS: Many different factors contribute to the ability to ride a bike in youth with obesity. Gender, race, age, BMI and body composition were all associated with the ability to ride a bike. Youth with greater amounts of obesity and body fat may struggle more to ride a bike. Being unable to ride a bike limits options for active transportation and moderate-to-vigorous play in youth with obesity.

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Game-Play Characteristics by Field Size in Girls' Youth Lacrosse

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(No relevant relationships reported)

To facilitate player development, the Lacrosse Athlete Development Model (LADM) recommends the use of small-sided games (SG) and fewer players on the field. Yet, no studies have evaluated if SG change game-play in girls' youth lacrosse (GYL).
PURPOSE: To describe game-play characteristics during SG and full-field games (FG) in GYL. **METHODS:** Female athletes (N=28, 8.5±0.5 years, 132.4±3.6 cm, 31.4±1.7 kg) participated on either a small-sided (SG, n=13) or a full-field (FG, n=15) 10U level team within a single GYL league in Virginia. Both SG and FG teams participated in 6 games during the season. All games were filmed using a digital camera affixed to a camera lift system. Game-play characteristics were measured by reviewing game video and coding the frequency of observed activities (e.g. successful passes, changes of possession, intercepted passes, shots on goal, and loose balls). Descriptive statistics (Frequency, Mean) for game-play characteristics were calculated.
RESULTS: A total of 137 athlete-exposures (AE) occurred across 12 games (SG=59AE, FG=78AE). Total characteristics for the season were: unsuccessful passes (SG=476, FG=378), successful passes (SG=59, FG=110), shots on goal (SG=183, FG=189), goalie saves (SG=58, FG=79), changes of possession (SG=333, FG=281), loose balls (SG=625, FG=575), and intercepted passes (SG=17, FG=10). Average characteristics per game were: unsuccessful passes (SG=79.3, FG=63.0), successful passes (SG=9.83, FG=18.3), shots on goal (SG=30.5, FG=31.5), goalie saves (SG=9.7, FG=13.2), changes of possession (SG=55.5, FG=46.8), loose balls (SG=104.2, FG=95.8), and intercepted passes (SG=2.8, FG=1.7). Further, the FG team had a larger proportion of successful passes (23%) than the SG team (11%). However, the SG team had a larger proportion of successful shots on goal (63%) than the FG team (54%).
CONCLUSION: A greater proportion of successful passes were observed in FG than SG with comparable attempts and slightly fewer intercepted passes per game. Further, SG was observed to have a greater proportion of successful shots on goal despite FG having slightly more attempted shots on goal and more goalie saves. Additional research is needed to better understand how all aspects of LADM guidelines affect player development and skill acquisition in GYL.

1940 Board #96 May 30 3:30 PM - 5:00 PM

Physical Activity Among Youth Lacrosse Players: Full vs. Modified Field Play

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(No relevant relationships reported)

PURPOSE: US Lacrosse developed the Lacrosse Athlete Development Model (LADM) to provide every athlete the opportunity to enter, enjoy and excel by learning and playing lacrosse in a way that's best for each stage of growth and development. Evaluation is essential to determine whether the LADM achieves the stated goals. The study aim was to assess whether players' physical activity (PA) was greater during games played on modified (Mod) fields than full-sized (Full) fields.
METHODS: This prospective cohort study involved two boys' and two girls' youth lacrosse teams who participated in six full or modified games. 61 youth players between the ages of 8-10 (U10) were selected via a convenience non-probability sample. Full field games were played on 60x110 yard fields; modified field games were played on 35x60 yard fields; games were 50-54 minutes long. Players wore the Actigraph Wgt3X-BT, a triaxial accelerometer that recorded PA over time in units of Metabolic Equivalents (1 MET = 3.5 ml $O_2 \cdot kg^{-1} \cdot min^{-1}$). Data were categorized by PA level and analyzed using Chi-square tests to assess differences in PA by play (Full vs. Mod).
RESULTS: Boys' median PA was 3.0 METs (Full) and 2.8 METs (Mod). Girls' median PA was 2.9 METs (Full) and 3.2 METs (Mod). Among boys, vigorous physical activity was higher in full field games (13.9%) compared to modified field games (9.4%). (p<0.001) Among girls, moderate physical activity was higher in full field games (12.6%) compared to modified field games (10.3%)(p<0.001).
CONCLUSIONS: There were modest differences in activity level by game type among youth (U10) boys and girls lacrosse players when playing on the modified (smaller) field compared to the full field games. Although statistically significant, differences may be attributable to the following factors:• Higher player-field density on the modified fields (i.e., less open space on the modified fields); • More experienced and talented players participating in full field play; • Relatively more players on the

bench for more of the game on the modified fields than full size fields; • Coaches stopping the game on multiple occasions to provide instructions to inexperienced players in the modified field game; • Local (rather than US Lacrosse) rules were used, allowing more players on the field and longer game times.

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Serum Vitamin D, and Metabolic Risks In Obese Youth Involved In a Physical Activity Program

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(No relevant relationships reported)

Purpose: to investigate whether a physical activity (PA) promotion program in overweight/obese (OW/OB) youngsters is favorable to changes in PA levels, vitamin-D (VIT-D) and metabolic profile and the correlations between those changes. **Methods:** This was an intervention study performed twice a week, over a period of six months with 57 OW/OB youngsters (31 girls). PA promotion program aimed to increase children and adolescent's moderate-vigorous PA levels. It was performed evaluation of body composition, physical activity, maturational stage and biochemical variables (HDL, LDL and VLDL cholesterol, glucose, insulin and VIT-D). For statistical analysis, Paired sample t-tests and partial correlations were used. **Results**: Significant differences between baseline and post intervention were observed for body composition, lipid profile and PA levels. Furthermore, ΔVIT-D was positively correlated with the ΔHDL (r=0.30), while negative correlations were found with metabolic risk factors. ΔVPA showed significant correlations with ΔVIT-D (r=0.37) and ΔHDL (r=0.34). **Conclusions:** After a PA program, OW/OB youth presented positive changes in body composition, vitamin D, metabolic profile and PA levels, indicating that interventions involving physical exercise should be promoted as an important component of a healthy lifestyle.This study was supportde by FCT :UID/DTP/00617/2013

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Investigating the Impact of Daily Physical Education on Fitness Levels of Underserved Minority Youth

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PURPOSE: To investigate the impact of a 45-minute daily physical education intervention on overall fitness among underserved, minority elementary school youth. **METHODS:** An analysis of variance (ANOVA) mixed effect linear model was used to evaluate the effectiveness of 45 minutes of daily physical education on the Progressive Aerobic Cardiovascular Endurance Run (PACER), push-ups, and curl-ups among elementary school youth attending Legacy Early College, a Title I school in the southeastern US. Gain scores (final post-test assessment in May 2018 - original pre-test assessment in September 2017) were calculated and analyzed for significance. The interaction between school and time was estimated for each outcome. Each analysis was stratified by gender and adjusted by age to control for baseline differences by school. A Title I control school that provided physical education only one day per week was used as a comparison. **Summary of RESULTS:** Legacy students had significantly greater increases in curl-ups (Gain Score=12.23, F=31.323, p=.000) and PACER laps (Gain Score=6.18, F=9.502, p=.002). Legacy males and females observed greater increases in their fitness levels than controls. Legacy male and female students performed significantly better than controls in curl-ups, push-ups and PACER laps (Gain Scores=11.46, 3.14, 5.22, F=71.695, 51.126, 9.51, p= .000,.000,.002 respectively). **CONCLUSION:** Implementing 45 minutes of daily physical education in underserved elementary schools could improve childrens' overall fitness levels. Supported by Campbell Young Leaders.

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Using Dance to Promote Physical Activity and Fitness Among Adolescent Girls with Intellectual Disabilities

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Girls with intellectual disabilities (ID) exhibit poor fitness and low physical activity (PA) levels, and are considered a vulnerable, at-risk population. Girls with ID have limited access to many PA opportunities, but dance is accessible, widely available, and perceived as enjoyable. **PURPOSE:** To evaluate the feasibility and preliminary efficacy of a 12-week dance intervention to promote engagement in moderate to vigorous PA (MVPA) and increase cardiorespiratory (CR) fitness among girls with ID ages 16-21. **METHODS:** The intervention was implemented in 3 urban communities and included two 75-minute weekly dance sessions. Dance styles included hip hop, jazz, and modern; the choreography and session structure were designed to promote MVPA. Continuous heart rate (HR) monitoring (Polar® E600) was used for motivation and to record time spent below/in/above each girl's target HR (THR) zone (60-80% HR_{max}). Pre- and post-test CR fitness was measured by the 6-minute walk test (6MWT). Survey items assessed enjoyment and satisfaction. **RESULTS**: 18 adolescent girls (17.3 ± 2.7 y) with ID completed the intervention. Attendance was high; girls attended an average of 87% of dance sessions (range 67% - 100%). Overall, girls spent 52% (± 23%) of each session engaged in MVPA; defined as in or above their individual THR zone. Engagement level was quite variable; one girl averaged 4% of the dance session in her THR zone and another averaged 94%. When queried weekly about their PA intensity during the sessions, 11 of 18 girls reported that they worked "really hard" at every session. We observed a mean increase of 74.6 feet in distance walked on the 6MWT baseline to post-test (n=14); however, this difference was not significant (p=0.17). Post-intervention surveys indicated that girls "liked" the dance program (14 of 17), perceived improved fitness (15 of 17), and wished to continue dancing (15 of 17). Most girls reported a preference for a girls-only dance program and a program exclusively for those with ID. **CONCLUSION:** Participants engaged in dance at an MVPA intensity level for over half of the 75-minute sessions, supporting that dance is viable for promoting PA for girls with ID. Girls expressed their enjoyment of the program and wanted to continue beyond the 12-week program. More frequent training is likely needed to increase CR fitness.

1944 Board #100 May 30 3:30 PM - 5:00 PM

Relationship Between Physical Activity, Sedentary Time, Cardiorespiratory Fitness And Academic Achievement In Norwegian Adolescents.

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(Sponsor: Ulf Ekelund, FACSM)
(No relevant relationships reported)

Background: There is increasing evidence of positive associations between physical activity (PA), cardiorespiratory fitness (CRF) and academic achievement. Some studies have found an inverse association between sedentary time and academic achievement, however, the findings are mixed and the literature is inconclusive. **Purpose:** To examine the associations between objectively assessed PA, sedentary time, CRF and academic achievement in a sample of Norwegian adolescents. **Methods:** This cross-sectional study included 1518 adolescents aged 13.9 years (53.8% girls) from 29 schools in Norway. We assessed PA and sedentary time by accelerometry (Actigraph GT3X+). Intensity thresholds for sedentary time and MVPA were <100 counts per minute (CPM) and >2000 CPM, respectively. CRF was measured with an intermittent shuttle run test. Academic achievement in reading and numeracy were assessed using standardized national academic tests. We used a multiple linear mixed model analysis including school as random effect to account for clustering, adjusted for covariates (age, sex, socio economic status (SES) and accelerometer wear time). Additionally, the analyses modelling sedentary time and MVPA as exposure variables were mutually adjusted.
Results: Mean achievement in reading and numeracy were 55.9 (Standard deviation (SD) 10.0) and 55.8 (SD 9.7) points, respectively. Achievement in reading was positively associated with sedentary time (B=0.044, 95% CI: 0.027; 0.062), time spent in MVPA (B=0.050, 95% CI: 0.018; 0.083) and CRF (B=0.014, 95% CI: 0.009; 0.019). Achievement in numeracy was positively associated with sedentary time (B=0.033, 95% CI: 0.016; 0.050), time spent in MVPA (B=0.033, 95% CI: 0.014; 0.065) and CRF (B=0.013, 95% CI: 0.009; 0.018). **Conclusion:** Achievement in reading and numeracy are positively and independently associated with sedentary time, time spent in

MVPA and CRF. The results suggest that accumulating 10 minutes more in MVPA or sedentary per day, is associated with improved achievement in reading and numeracy by approximately 0.5 and 0.3 points, respectively. However, due to the cross-sectional design and the small magnitude of the associations, the practical implications of these results should be interpreted with caution.

1945 Board #101 May 30 3:30 PM - 5:00 PM

Intervention With Exergames For Adolescents Promote Moderate To Vigorous Physical Activitiy

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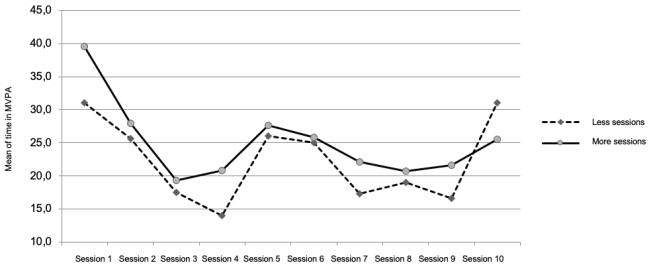
Both the decline in moderate to vigorous physical activity intensities (MVPA) and the increase in sedentary behavior (SB) have different deleterious effects on the health of adolescents. PURPOSE: Verify a 10-week intervention using exergames with adolescents was able to promote levels of physical activity from moderate to vigorous intensities (MVPA) and compare the time in MVPA between the group with more or less participation in sessions. METHODS: Twenty adolescents (11 boys and nine girls) with an average age of 11.7 ± 0.9 years participated in an intervention with 10 sessions of exergames on the school, twice a week for about 40 to 60 minutes. XBOX 360 equipment was used with Kinect and the pair of adolescents practiced the games using an ActiGraph accelerometer. The analyzes included the total time and time of involvement in MVPA at each session. Descriptive statistics analyzes and the independent student T test were used. The level of significance was 5%. RESULTS: Of the 20 adolescents, three participated in all the sessions (10), six participated in nine sessions and seven participated in eight sessions, representing 80% of effective participation in the intervention. Only 20% of the students participated in only four to six sessions per week. Approximately half the time of each session was spent with MVPA (20.7min vs. 24.4min), in favor of the group with the largest participation in sessions with active video games. This same group presented up to the ninth session with longer mean time in MVMA compared to the group that participated in fewer sessions. CONCLUSION: It was possible to observe that a 10-week intervention using exergames with adolescents was able to promote levels of physical activity of moderate to vigorous intensities (MVPA), mainly in the group that have more participation in sessions.



1946 Board #102 May 30 3:30 PM - 5:00 PM

Twelve Years Follow Up - Prevalence Trends Of Physical Inactivity And Overweight In Brazilian Adolescents

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(No relevant relationships reported)

PURPOSE: Determine the physical inactivity and overweight prevalence in adolescents living at São Paulo State (Brazil) from 2005 to 2017.
METHODS: We evaluated 3,845 adolescents as part of a cohort study that started in 2005 in São Paulo city. In this study we analyzed 2.012 both sex adolescents that were followed in 2005, 2009, 2013, 2015 and 2017. In 2005, adolescents were from 15 to 18 years of age. We assessed the habitual physical activity practice by International Physical Activity Questionnaire (IPAQ-short-8 version) considering active (AT) the adolescents that accumulated at least 300 minutes per week of moderate-vigorous PA and inactive (INA) if less than 300 min/week were reported. Body weight (kg) and height (m) were self-reported by questionnaire. BMI was calculated and the respective criteria for overweight classification were considered for Brazilian adolescents (CONDE and MONTEIRO, 2006). The anthropometry tendency changed overtime, and a linear regression model was designed to express the annual physical inactivity prevalence average and the excess of body weight. The significance was $p<.05$.
RESULTS: In general, the prevalence of physical inactivity in 2005 was 50.4%, with significant increase to 53.2% (2009); 56.7% (2013); 59.2% (2015) and 60.2% (2017), with 0.91% annual increase. Higher variation was observed in girls than boys (1.32% *x* 0.89% per year). The overweight prevalence followed similar trend: 2005 (16.7%); 21.2% (2009); 25.8%); 28.2% (2013), 28.7% (2015) and 29.3% (2017) with 1.29% increase per year ($p<.05$). Girls presented significantly and higher percentage change than boys (1.56 vs. 1.15% per year).
CONCLUSIONS: Data showed progressive trend of high physical inactivity and body fat increase, leading to an incidence of obesity in the next 10 years around 71.0% of all adolescents living in Sao Paulo State 37.2% of physically inactive behavior. These data suggests an early development of cardiovascular disease, with higher impact in girls than boys. Also data strongly suggest to effectiveness of public health policies towards the physical inactivity prevention and the excess of body mass among adolescents are related to unhealthy behaviors of eating, drinking and PA.

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Compliance With The 24-h Movement Guidelines In Hong Kong Adolescents: Associations With Body Mass Index

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(No relevant relationships reported)

The evidence-based 24-h Movement Guidelines (MG) for children and youth was launched in 2016, shifting the thinking from one single movement behavior to an integration of three behaviors under the 24-h circle: physical activity (PA), screen time (ST), and sleep. A low compliance rate of meeting these combined recommendations has been reported for children. However, few studies have focused on adolescents, and its association with health outcomes such as body weight status is largely unknown.
PURPOSE: To examine compliance with the 24-h MG among Hong Kong adolescents and their associations with body mass index (BMI).
METHODS: 1,039 adolescents (11-18 yrs) wore the waterproof activPAL™ for 24-h over 7 consecutive days to assess PA and sleep duration. ST was measured using items from the validated Chinese version of the Children's Leisure Activities Study Survey. Participants were classified into 8 categories depending on the adherence to the 3 recommendations: none, single recommendation (PA, ST or sleep), two recommendations (PA & ST, PA & sleep, or ST & sleep) and all three recommendations. BMI was calculated as weight (kg) / height (m^2). Linear mixed models were used to examine the associations of BMI with the 8 categories and the number of guidelines met (0~3), adjusted for age, sex and school clustering effects.
RESULTS: The analytic sample consisted of 656 adolescents (48% of girls) who provided valid activPAL™ data for at least 4 days and completed questionnaire. Only 1.1 % of the adolescents met the overall 24-h MG, while 38.7% met none of them. The proportion of meeting one single recommendation of PA, ST and sleep was 9.9%, 30.3% and 39.2%, respectively. Adolescents who did not meet the PA recommendation ($b = 1.34$; 95% CI, 0.32 to 2.36; $p = 0.007$) and those who did not met the combination of PA and sleep recommendations ($b = 2.15$; 95% CI, 0.49 to 3.82; $p = 0.011$) had higher BMI than those who met the respective recommendations. No significant association was found between number of recommendations met and BMI.
CONCLUSIONS: Compliance with the 24-h MG was alarmingly low among Hong Kong adolescents. Meeting PA recommendation and the combination of PA and sleep recommendations were more likely to have a healthier body weight.
Supported by the General Research Fund of the Research Grants Council, Hong Kong, China (#14501415).

1948 Board #104 May 30 3:30 PM - 5:00 PM

The Effects Of HIIT And LIT On Weight Loss In Obesity Children/adolescents: A Systematic Review And Meta-analysis

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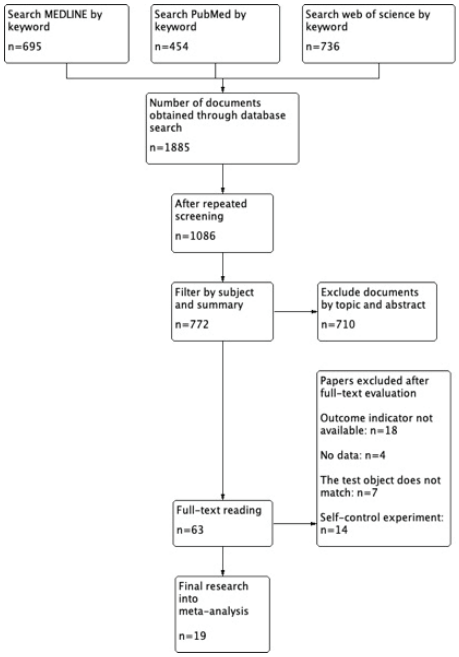
(No relevant relationships reported)

PURPOSE: To explore the effect of high-intensity interval training and low-intensity training on weight loss in obese children and adolescents.
METHODS: Search database (MEDLINE, PubMed, websites of science core database), the deadline is May 20, 2018. The screening conditions were as follows: Randomized controlled trials;Writing in English;Participants in the study were obese children/adolescents between the ages of 6 and 18 ;The intervention model is HIIT or

LIT, and the training time is at least four weeks;The final results of the study should include weight (body weight), BMI, body fat ratio (% body fat), and body fat (fat weight). The risk assessment was assessed using the Jadad scale (total score of 7).
RESULTS: Compared with LIT, HIIT can significantly reduce % body fat[-1.27(95%CI=-1.87,-0.67),Z=4.14(p<0.0001)] ,BMI[-0.42(95%CI=-0.83,-0.01),Z=2.00(p=0.05)] and body weight. [-0.40(95%CI=-0.73 ,-0.06),Z=2.33(p=0.02)];Comparing the EG and the CG of HIIT and LIT respectively which is found that for the body weight index, the combined statistical effect values of the two training methods were significantly different. However, LIT is better than HIIT[HIIT=-0.27(95%CI=-0.49,-0.04)][LIT=-0.94(95%CI=-1.12,-0.75)];%body fat, HIIT is better than LIT [HIIT=-0.56(95%CI=-0.84,-0.29)][LIT=-0.45(95%CI=-0.70,-0.21)]
CONCLUSIONS: HIIT is more effective for obese children/adolescents than LIT. LIT is better for whole body weight loss, but HIIT is better for body fat reduction. For aerobic training, the training period and the number of times are not proportional to the weight loss effect.



The subgroup analysis of low intensity training

Variables	Subgroup	Potential influencing factors	Number of study	Std. Mean Difference IV,Fixed,95% CI	I^2	P
Body weight	Age	< 14	4	-0.49 [-1.20, 0.23]	P = 68%	Z = 3.27 (P = 0.001)
		≥14≤18	6	-0.69 [-1.15, -0.22]	P = 76%	
	Training cycle	< 12 weeks	2	-0.87 [-2.76, 1.01]	P = 89%	Z = 2.32 (P = 0.02)
		≥12 weeks	6	-0.48 [-1.00, 0.04]	P = 72%	
	frequency	≤36	5	-0.65 [-1.00, -0.30]	P = 85%	Z = 6.76 (P < 0.00001)
		> 36	4	-0.80 [-1.07, -0.53]	P = 20%	
%body fat	Age	< 14	3	0.10 [-0.41, 0.61]	P = 0%	Z = 3.63 (P = 0.0003)
		≥14≤18	3	-0.64 [-0.92, -0.35]	P = 70%	
	Training cycle	< 12 weeks	2	-0.80 [-1.39, -0.22]	P = 87%	Z = 4.63 (P < 0.00001)
		≥12 weeks	5	-0.51 [-0.76, -0.25]	P = 67%	
	frequency	≤36	2	-0.44 [-1.07, 0.20]	P = 87%	Z = 3.01 (P = 0.003)
		> 36	4	-0.37 [-0.64, -0.10]	P = 75%	

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Comparing a Body Image Assessment Scale with Anthropometric Measures in Chilean Adolescents

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Body image is an important marker of health and well-being among young people. Instruments to assess body image use contour images that participants use to describe their body image self-perception. These images must be culturally sensitive and adequate for different age groups. Although the Contour Drawing Rating Scale (CDRS) has been validated among adolescents in Spain, no previous studies have compared the body image CDRS with anthropometric measures among Chilean adolescents.
PURPOSE: To assess body image using the CDRS among Chilean adolescents, and compare with anthropometric measures including body mass index (BMI) and waist circumference (WC).
METHODS: A group of 156 Chilean adolescents (87 males, 69 females) aged 13-14 years old participated in the study. They completed the body image CDRS consisting of 9 images from which they selected the one representing their body image self-perception. Values for selected images ranged from 1 (underweight) to 9 (obese). Subsequently, body weight was measured with a Tanita-HD313® scale, height with a SECA-206® stadiometer, and waist circumference with a Lufkin W606PM® tape, while participants were barefoot, and wore short-sleeve t-shirts and shorts. BMI was then calculated (kg/m^2). To determine sex differences, Chi-Square and t-test were used, and correlation analyses were performed to detect association between variables.
RESULTS: Body image CDRS values ranged from 2 to 8 in males, and 1 to 9 in females (Z=4.237, p<0.001). Mean (±standard deviation) BMI in males and females was 21.3±3.5, and 22.3±3.3 kg/m^2, respectively (Z=2.168, p<0.03). Mean (±standard deviation) waist circumference in males and females was 75.9±9.1, and 74.1±8.3 cm, respectively (Z=1.012, p>0.05). Spearman correlation coefficients showed a moderate but significant association between the CDRS score and BMI (males, *rho* = 0.68; females, *rho* = 0.49, p <0.01 for both) and waist circumference (males, *rho* = 0.66; females, *rho* = 0.52, p <0.01 for both).
CONCLUSIONS: The significant correlation between anthropometric measures and the CDRS in our group of Chilean adolescent males and females suggest that body image self-perception closely represent objective measures of body image assessment; thus, providing an adequate body image assessment tool in this population.

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Heavy TV Viewers Are The Heaviest Regardless Of Physical Activity: A Study Of 10,000 Preadolescents

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PURPOSE: To examine 1) whether recreational sedentary TV viewing and computer use are associated with body mass index (BMI), 2) whether the associations of TV viewing and computer use with BMI are modified by physical activity (PA), and 3) whether the associations of TV viewing and computer use are similar with BMI and waist-to-height ratio (WHtR).
METHODS: We assessed time spent on TV viewing, computer use and PA with an online questionnaire in 10,228 preadolescents with a mean age of 11.1 (SD 0.8) years from the Finnish Health in Teens (Fin-HIT) study. We categorized the preadolescents into Light, Medium and Heavy TV viewers and computer users, and into groups with Low, Medium or High PA levels. BMI categories and WHtR tertiles were established based on measured weight, height and waist circumference. We used multinomial logistic regression in order to calculate odds ratios (OR) with 95% confidence intervals (CI).
RESULTS: The percentages of Heavy TV viewers and Heavy computer users were higher in the overweight/obese group (46% and 43%, respectively) than in the normal weight (35% and 34%) or underweight groups (31% and 29%) (both p<0.001). Compared with Light TV viewers, Medium and Heavy TV viewers had a lower risk of being underweight (OR: 0.8, 95% CI: 0.7 - 1.0 and OR: 0.8, 95% CI: 0.6 - 0.9, respectively, when adjusted for age, sex, language, sleep duration and PA level) and a higher risk of being overweight/obese (adjusted OR: 1.3, 95% CI: 1.1 - 1.5 and OR: 1.6, 95% CI: 1.3 - 1.8, respectively). Compared with Light computer users, Heavy computer users had a higher risk of being overweight/obese (adjusted OR: 1.4, 95% CI: 1.2 - 1.7). We observed interactions between PA level and the amount of TV

viewed (p=0.012) or computer used (p=0.010). However, Heavy TV viewers had a higher risk of being overweight/obese regardless of PA level. The associations of TV viewing and computer use were similar with BMI categories and WHtR tertiles. **CONCLUSIONS**: Heavy TV viewing and computer use are associated with higher BMI and central adiposity in preadolescents. Heavy TV viewing seems to increase the risk for overweightness and central adiposity, regardless of PA level. Strategies to reduce high sedentary screen times could potentially help in preventing overweightness and adiposity among children and adolescents.

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Body Composition Changes Associated With A Structured Exercise Program Among Children And Adolescents

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Children and adolescents in the U.S. fail to meet physical activity guidelines and health consequences associated with inactivity, such as high body fat composition, continue to impact children. Targeting children for physical activity and fitness interventions have the potential to improve body composition; however, little is known on body composition changes during a fitness-based intervention.
PURPOSE: To determine changes in body composition for children participating in a fitness-based intervention.
METHODS: 21 children (age = 9.38 ± 3.82, BMI = 21.0, body fat percentage = 30.90) participated in an 8-week, structured fitness intervention consisting of 1-hour weekly sessions. Weekly sessions provided fitness opportunities in a fun, non-competitive environment with the purpose to elicit moderate-to-vigorous physical activity. Pre- and Post-testing using the iDXA was conducted to detail changes in body composition.
RESULTS: Results from a paired samples *t*-test showed significant increases in the following body composition measures: Left Leg Lean Mass (t = -2.366, p = .028), Right Leg Lean Mass (t = -3.914, p = .001), Lean Mass Truck (t = -2.766, p = .012), Lean Mass Total (t = -4.575, p <.001), Right Leg Bone Mass (t = -2.500, p = .021) and Bone Mass Total (t = -3.826, p = .004). **CONCLUSIONS:** Participation in an 8-week fitness intervention showed positive body composition changes for children. These changes occurred with minimal intervention (1 hour per week). Future studies should determine the duration of the effect.

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Multi-Component School-Based Weight-Management Program Improve Physical Fitness and Vascular Reactivity in Obese Adolescent

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The prevalence of childhood obesity has increased markedly in both eastern and western countries. Development of obesity in early life could lead to serious health problems including a premature cardiovascular disease. Therefore, a primary prevention such as an effective weight management program would be needed in order to minimize the adverse effects of childhood obesity. **PURPOSE:** This study aimed to determine the effects of multi-component school-based weight-management program on body composition, physical fitness and vascular function and structure in obese adolescents. **METHODS**: Twenty-eight obese adolescents (21 males, 75%) between the ages of 13 and 15 (14.1±0.8) at or above the sex-specific 90th percentile on BMI-for-age growth charts were recruited. Participants were randomly assigned into control (CON; n=12) and intervention (INT, n=16) groups. The INT group participated in a multi-component school-based intervention for 10 weeks which included supervised after-school physical activities, dietary and daily physical activities related advices. Moreover, school-health promotion environment and health education lectures for school staffs, students and parents were included in the program. Non-curricular physical activities (i.e., running, playing games and resistance training) were performed moderate to vigorous aerobic activities for 50 minutes/day, three days a week on alternate days. Body composition, physical fitness, vascular function (brachial-FMD) and structure (IMT and baPWV) were measured before and after intervention. **RESULTS:** After 10-week of multi-component school-based weight-management program, body mass (89.7±8.6 vs. 88.0±10.5, p<0.05) and body fat percentage (44.13±5.27 vs. 41.22±6.74, p<0.05) significantly decreased only in an INT group. Peak oxygen consumption (29.25±2.41 vs. 31.56±3.05, p<0.05) and health related physical fitness increased only in an INT group (p<0.05). Moreover, vascular reactivity of an INT group was improved after 10-week program compared with a CON group (6.81±2.25 vs. 3.62±1.48, p<0.05). There was no change in artery wall thickness and stiffness in any group. **CONCLUSIONS:** Multi-component school-based weight-management program may be an effective primary prevention for reducing cardiovascular disease risk factors.

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Weekly Frequency Of Meeting The Physical Activity Guidelines And Cardiometabolic Risk In Youth: Nhanes 2003-2006

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The current physical activity (PA) guidelines for children and adolescents recommend accumulating 60 minutes of moderate-to-vigorous intensity physical activity (MVPA), 7 days per week. Although the time and intensity components of the PA guidelines have been rigorously studied, the days per week (frequency) component is less researched. **PURPOSE:** To examine the influence of frequency of meeting the MVPA guidelines on cardiometabolic risk in children and adolescents. **METHODS:** Accelerometer data from children and adolescents (age 6-18 years; n=673) with at least 4 valid days, 10 hours of wear time, and an average of ≥60 minutes per day of MVPA participating in the National Health and Nutrition Examination Survey 2003-2006 were used. The Evenson cut points for MVPA were applied. The proportion of valid days meeting the ≥60 minutes of MVPA guidelines (DMG) were calculated and used to assign subjects to quartiles. General linear modeling was used to compare associations of quartiles to individual cardiometabolic risk factors. Covariates included age, sedentary time, MVPA, sex, race/ethnicity, asthma, physical disability, assessment period, quartiles of the Healthy Eating Index, and poverty-income ratio. **RESULTS:** DMG by quartile are as follows: Quartile 1 (n=158; DMG=43.6%; 95% CI 41.8-45.5); Quartile 2 (n=171; DMG 62.3%; 95% CI 61.4-63.2); Quartile 3 (n=154; DMG=75.3%; 95% CI 74.6-76.0); Quartile 4 (n=194; DMG=91.6%; 95% CI 89.2-94.1). Diastolic blood pressure was higher in Quartile 1 and Quartile 2 compared to Quartile 3 (Q1=56.8mmHg, 95% CI 51.2-62.3; Q2=56.9mmHg; 95% CI 50.4-63.4, Q3=50.2mmHg; 95% CI 43.2-57.1; p<0.01 and p<0.05 respectfully). There were no other differences between quartiles for BMI percentile, waist circumference, waist-to-height ratio, systolic blood pressure, cholesterol, triglycerides, glucose, or insulin. **CONCLUSION:** This cross-sectional analysis found no association between proportion of DMG and cardiometabolic risk factors in children and adolescents. Achieving an overall weekly average of 60 minutes per day of MVPA appears to be sufficient for cardiometabolic health regardless of meeting the frequency component of the PA guidelines. Future studies are needed to understand optimal weekly patterns and volume of PA as well as their associations with health outcomes in youth.

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Fitness In Pediatrics: Is It Adequately Carried Out?

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(No relevant relationships reported)

INTRODUCTION: The physical fitness in the pediatric area is mandatory, prior to the realization of physical activity, whether recreational, school or competition. Regarding the increasing demand we find that each pediatrician performs them by requesting complementary studies according to their own criteria and in a routine manner. **OBJECTIVE**: Show the lack of consensus when requesting studies to perform the physical aptitude in the area of pediatrics. M**ATERIAL AND METHODS:** A personalized type survey was conducted; to specialists of the pediatric area in the city of Buenos Aires during the month of May of the year 2018, in which they questioned about physical fit in pediatric age in healthy children and for all kind of physical activity. The data obtained was analyzed to know what evaluations and complementary studies request to give the physical aptitude. **RESULTS:** A total of 105 pediatricians were interviewed, of which 99 of them made physical aptitudes in their daily practice, this being the total number of surveys selected, 94% were clinical pediatricians and 6% had another subspecialty (cardiology, infectology, other ones). 68% had more than 10 years in the profession, only 12% had less than 5 years of activity in the specialty: this data did not make a significant difference when deciding on the request for studies. The 60% of professionals performed daily physical fitness, being 96% for school physical activity and of these only 45% were competitive schools and sport, none of them was for high performance. In relation to studies requested, 73% asked for an electrocardiogram, 25% Rx. of chest, 21% blood count, 10% echocardiogram and 3% ergometry annually, considering for this the type of physical activity to be carried out, as well as the weekly work load of the activity. The request for studies was not greater in the cases of competitive sports nor was it influenced by the number of weekly hours of sports practice. In relation to the age to request different studies, the majority

of doctors performed it after 5 years old and it was striking that in 72% of them do it annually, despite being the whole population healthy children. **CONCLUSIONS:** Facing this result, we believe it is necessary to unify the medical criteria to request studies in relation to the needs of patients

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Contribution Of In-school And Out-of-school Physical Activity Towards Meeting The Daily Recommendations.

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PURPOSE: The purpose of the study was to examine in-school and out-of-school activity in children as related to achieving daily activity recommendations for moderate-to-vigorous physical activity (MVPA) and steps. **METHODS**: Activity patterns of 346, 10-12 year old fifth-grade students in three Midwestern elementary schools were assessed during a two week period, one week during school hours only and the other week for continuous 24 hour periods. Data were collected using wrist worn activity trackers (Polar Active). Teachers distributed the devices at the start of each school day and collected at the end of each school day for the first week and provided to the students for the next week for continuous monitoring. Monitors measured MVPA, steps, and calories expended per day. Demographic and anthropometric data were also recorded (age, height, weight). All data were uploaded to the monitor's manufacturer website and then collected by the researchers. A prior study was used to determine that four days of monitoring could accurately estimate physical activity. A final sample of 186 (N=186) students who attained a 500 step minimum for the same four consecutive school days between both weeks (M-R or T-F), were identified. These data were used to determine averages for steps, minutes of daily activity, and calories expended. **RESULTS**: Results indicate students attained an average of 15319.38 steps/day. In-school activity and out-of-school activity accounted for an average of 6362.79 steps/day (41.53% of total), 8956.59 (58.47% of total) respectively. Activity minutes averaged 77.43 minutes/day. In-school and out-of-school activity accounted for an average of 33.58 minutes (43.37% of total), and 43.85 minutes (56.63% of total) respectively. Calories expended averaged 2044.66 Kcal/day. In-school and out-of-school activity accounted for an average of 1560.56 Kcal (76.32% of total), and 484.10 Kcal (23.68% of total) respectively. **CONCLUSIONS**: These results indicate that out of school activities account for most of daily steps taken and activity minutes in the fifth grades students studied during an average school day. A similar distribution of caloric expenditure was not observed between in school and out of school monitoring.

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The Effect of Increased Extracurricular Physical Activity on the Mathematics Achievements of Children aged 7-9 Years Old

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PURPOSE: The purpose of this study was to assess the impact of an increased extracurricular physical activity on mathematics academic performance for children aged 7-9 years.
METHODS: A sample of 120 children aged 7-9 participated in the MQ101 Program. The experimental samples were randomly divided into the experimental group (58 children) and the control group (62 children). The experimental group involved in the extracurricular exercise with games as the main activity content, intervention. The activity lasted for 12 weeks, twice a week for 60 minutes each time, exercise intensity: MVPA = (220-age) × (60-69%); the control group did not participate in any intervention project. The body shape, physical fitness, and mathematics testing scores of the subjects were tested before and after the experiment. The main finding is the change in numerical scores, measured by a standardized mathematical test of 10 minutes. The secondary outcome is a change in body shape and physical fitness.
RESULTS: The results showed that the experimental group was better than the control group in the problem solving ($t=2.87$, $p<0.01$), calculation speed ($t=-3.39$, $p<0.01$) and accuracy rate ($t=2.21$, $p<0.05$). The math scores of the experimental group were significantly higher than the control group ($t=4.14$, $p<0.01$). In addition, the changes in physical fitness of the experimental group were significantly better than the control group ($t=2.34$, $p<0.01$), however, the difference in body shape index was not statistically significant ($t=1.91$, $p>0.05$).

CONCLUSIONS: The results of this randomized trial are expected to provide schools and policy-makers with significant new insights into the potential of extracurricular PA to improve physical fitness and academic achievement in children. (This study was supported by NPOPSS Grant 15CTY011.)

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Influence Of Menarche On Perception, Dimension And Body Image Of Active And Insufficiently Active Girls

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Menarche causes body changes such as increased body fat and classic changes occur in secondary sexual characteristics. In this way due to body changes, the body perception also needs to be adjusted. The regular practice of physical activity has been considered a key element to improve the perception of size and body image in different populations, however, to our knowledge, the association between menarche and the level of physical activity in perception of the dimension and of the body image still unexplored. **PURPOSE:** Verify the influence of menarche in the perception of the dimension and the body image of active and inactive girls. **METHODS:** After the approval of the São Judas Tadeu University Research Ethics Committee, thirty-eight girls were distributed into two groups active and insufficiently active subjects and analyzed semiannually by 2,5 years by identification before and after menarche. Anthropometric parameters (height, body weight and body mass index), perceptions of body size (using the Image Marking Procedure) and body image (silhouettes scale) were used as evaluation parameters. **RESULTS:** After menarche, all the girls in both groups presented alteration ($p<0.05$) only in the anthropometric parameters and in the body perception index of the hip after the menarche. No significant changes were identified ($p> 0.05$) between groups. **CONCLUSION:** menarche induced anthropometric alterations and perception of the hip dimension, but without promoting changes in the general perception of the body, as well as in the indication of the silhouettes and in the corporal satisfaction regardless of the level of activity physical.

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Habitual Physical Activity And Academic Achievements Among Undergraduate Adult Students

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(No relevant relationships reported)

Physical activity is associated with many physical and mental health benefits. The activity improves mood, reduces stress and anxiety and as shown previously increases academic performance with higher grades among youth and young undergraduate students. **PURPOSE:** To examine the relationship between physical activity habits and academic achievement among undergraduate adult male and female students. **METHODS:** Two hundred and thirty two male students (34.5 ± 10.2 yrs) and seventy two female students (36.5 ± 7.6 yrs) from the Faculty of Health Sciences at Ariel University volunteered to participate in this study. The cross-sectional study was conducted using a quantitative method and data was collected by a closed questionnaire, which included questions about physical activity in view of intensity, type of activity, time duration and frequency per week and was analyzed vis-à-vis academic achievements. **RESULTS:** A significant positive correlation ($p<0.03$) was found between physical activity habits and higher grades only among the male students. For the younger male students and the adult male students - the higher the physical activity time duration and frequency the higher the grades were. No correlation between adult female students' physical activity and academic grades were found ($p>0.05$). **CONCLUSIONS:** Older male students' academic grades were correlated to their physical activity habits. The awareness of the importance of physical activity habits among undergraduate male students is not limited to the younger age students but is also true for all age groups.

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Assessing Hispanic College Students Knowledge Related to Metabolic Syndrome Conditions

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PURPOSE: To investigate Hispanic college students' awareness and knowledge related to metabolic syndrome (MetS) conditions.
METHODS: Hundred and thirty-nine Hispanic college students (age= 22.43 ± 4.07) volunteered to participate in the study. Each participant read and signed the consent form prior to any data collection to take place. Demographic data including age,

race, gender, and major were collected. Participants then answered 89 questions and completed MetS knowledge questionnaire (Yahia et al., 2014; Becker et al., 2008). The questionnaire was designed to assess MetS related knowledge and awareness and has seven categories: diabetes, adiposity, hypertension, high serum cholesterol, arteriosclerosis, stroke, and myocardial infarction. Students' responses were scored and interpreted as poor knowledge (≤50% correct), fair knowledge (51-80% correct), and good knowledge (81-100%).
RESULTS: The results showed that majority of the students had fair level of knowledge (71.80% correct) related to MetS conditions. The participants were more knowledgeable on stroke and adiposity, and least knowledgeable on cholesterol, myocardial infraction, and diabetes components. There was no significant difference between genders for the level of knowledge for adiposity, cholesterol, myocardial infarction, and diabetes component of the questionnaire. However, there was a significant difference in knowledge level for stroke component between genders ($p<0.01$). Males had more knowledge on stroke component than females.
CONCLUSIONS: Majority of Hispanic college students have fair level of knowledge about MetS and MetS related conditions. Findings suggest that students MetS related knowledge and awareness can be improved. MetS is highly prevalent among Hispanic population. Therefore, increasing Hispanic students' awareness and knowledge related to MetS is essential to improve students' overall health. Previous studies identified colleges and universities as potential settings for health prevention and early intervention. Future studies should investigate the effects of various intervention methods on Hispanic students' MetS related knowledge and long-term health conditions.

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Comparison of School Meal Patterns in High School Athletes and Non-Athletes

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PURPOSE: To compare differences in school meal patterns and total (both interscholastic organized sports and leisure-time) physical activity among high school athletes and non-athletes. **METHODS**: A total of 308 high school students (16.04 ± 1.35 years old, 56.5% female, 59.4% Caucasian) completed a series of questionnaires regarding their consumption of meals provided at school (both breakfast and lunch), participation in their school's free/reduced price meal program, and reasons for not consuming school meals. Additionally, questions regarding weekly duration and frequency of organized interscholastic sports practices and leisure-time physical activity were included. Due to skewed distributions, both non-parametric and parametric analyses were conducted to compare differences among male and female athletes and non-athletes. All analyses were conducted in SAS software version 9.4 with a significance level set at $\alpha < 0.05$ software.
RESULTS: Out of the 308 participants, 56% of the sample (n=168, 51% female) participated in interscholastic sports, and 44% (n=136; 65 % female) were classified as non-athletes. Student athletes participated in more overall weekly physical activity (p=0.00) compared to non-athletes. No differences existed between athletes and non-athletes regarding their consumption of either school breakfast (24.4% athletes vs. 18.4% non-athletes, p=0.2) or lunch (52.3% athletes vs 45.6% non-athletes, p=0.24). Additionally, there were no differences between athletes (29%) and non-athletes (34.5%) regarding participation in the school free/reduced meal program (p=.023). Qualitative feedback provided for avoiding consumption of school meals included students arriving to school without enough time to purchase breakfast before class, eating breakfast or lunch from home, and that school meals are not appetizing or healthy. **CONCLUSIONS**: School meals are consumed by student athletes; therefore the nutritional value of school meals should provide for the energy needs of student athletes as well as the general student population of non-athletes.

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Effects of Peer-Led Aerobic Training on the Physical and Psychological Health of Urban College Students

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PURPOSE: Mental health concerns, like anxiety and depression, are prevalent among college students (Blanco et al., 2008). Chronic moderate-intensity exercise has been shown to improve these difficulties (Morres et al., 2018). This study evaluated changes in physical and psychological health in ethnically-diverse urban undergraduate students after a 10-week peer-led aerobic training intervention. **METHODS:** Twenty-three sedentary undergraduate students (mean age = 21 ± 2.24 yrs) participated in a 10-week training program composed of one weekly peer-led aerobic exercise session and completed 2 additional sessions per week independently. One week prior to and following the training program, assessments of cardiovascular fitness, using the Rockport 1-mile walk test, anthropometric measures, and psychological health, using self-report measures from the NIH Toolbox and the Patient-Reported Outcomes Measurement Information System scales, were conducted. Paired-samples t tests were used to assess pre-post program changes in these measures. **RESULTS:** Participants attended 8.3 ± 1.26 moderate-vigorous exercise sessions under the supervision of their peer-trainer and exercised independently 2.39 ± 1.95 $d \cdot wk^{-1}$ for an average of 34.85 ± 19.62 $min \cdot session^{-1}$. Despite a significant progressive increase in intensity from the first 3 to the last 3 sessions (mean HR = 135.98 ± 16.98 and 150.15 ± 15.16, respectively; $p < .001$), no effect of aerobic training on cardiovascular fitness or other anthropometric measures were detected (all $p > .10$). Nevertheless, there were significant pre-post-program improvements on multiple measures of psychological functioning including perceived stress, positive affect, sadness, and emotional support (all $p < .05$). There were marginally significant trends towards improvement in measures of perceived rejection ($p = 0.055$), general life satisfaction ($p = 0.062$), and perceived hostility ($p = 0.069$).
CONCLUSIONS: These preliminary findings are consistent with the literature indicating that moderate-intensity aerobic exercise improves psychological functioning. They support the further assessment of peer-mediated aerobic exercise to alleviate stress and improve quality of life in undergraduate students representing a diverse inner-city demographic.

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Relationship Between Duration and Quality of Sleep on College Student Health Behaviors and Outcomes

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Lack of sleep among college students is currently a massive epidemic affecting millions. Sleep duration and quality is an important determinant of overall health, and is related to health behaviors (physical activity (PA) & diet) and outcomes (mental health). But little is known about these relationships among college students. **Purpose:** Examine how PA, depression, body mass index (BMI), fruit and vegetable consumption (FVC), and academic performance differed based on sleep quality and duration. **Methods:** Students completed an online survey, self-reporting their sex, height, weight, grade-point average (GPA), PA levels, FVC, and also responded to questions regarding mental health and sleep. Participants were grouped into those who reported less <4 or ≥4 nights of restful sleep/week. Paired samples t-tests examined differences in the aforementioned PA, FVC, BMI, and GPA between groups. Chi-square tests for independence examined differences in mental health (depression and stress) based between groups. **Results:** 4380 participants responded to the sleep question, the majority of whom were women (59.2%) and non-Hispanic white (76.1%). For all participants, those who reported better sleep reported significantly higher moderate PA ($p = .045$), vigorous PA ($p < .001$), weekly MET-min ($p < .001$), and GPA ($p < .001$), whereas BMI ($p = .627$) and FVC ($p = .107$) did not differ between groups. When split by sex, the same results were revealed for women, but among men the only significant differences were in GPA ($p = .042$) and vigorous PA ($p = .019$). Those who reported better sleep also reported significantly less symptoms of depression regardless of sex ($p < .001$). **Conclusion:** A positive relationship between sleep and PA was found for women. In men, only vigorous PA was found to have a positive relationship with sleep. Though, a positive relationship between sleep and academic performance was evident for both sexes. In addition, better sleep was associated with better mental health regardless of sex. In summary, findings highlight the importance of more education on the importance in the relationship of sleep and better academic performance and mental health. Further research is required to examine the relationship, in particular directionality, between the amount PA and the duration of sleep in college students.

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Student Experiences in a Mandatory Health and Wellness Course, A Qualitative Investigation

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Research suggests that many undergraduates do not achieve the minimum recommended amounts of physical activity (PA). Furthermore, the link between college students' attitudes toward PA and participation are unclear. **PURPOSE:** The purpose of this investigation was to qualitatively examine student experiences and attitudes about PA while enrolled in a conceptually-based, mandatory, health and fitness course. **METHODS:** Semi-structured interviews were performed individually

with a subset of 10 (6 female, age 18-21years, 70% Caucasian) students who were enrolled in a larger study (n=135) investigating learning and behavioral outcomes from participation in a health and fitness course. Interviews were audio recorded and transcribed verbatim. Thematic analysis was used to identify predominant themes. **RESULTS:** Interviewees described their experiences and learning outcomes from the course. In regards to PA attitudes and practices, three themes emerged: (1) Self-Consciousness. Participants reported feeling embarrassed and awkward in the fitness center when using equipment that was unfamiliar to them. (2) Friend/Family Influences. The majority of interviewees reported exercising with friends as a strategy to improve motivation. Additionally, many identified family members as either having a positive or negative influence on PA behaviors. (3) Motivational Factors. The primary factors participants cited as influencing PA motivation were health, and maintenance of body weight. **CONCLUSIONS:** Results show that several factors influence college students' motivations, attitudes, and adherence to PA participation. It is recommended that health educators consider implementing practices to ensure that physical activity courses meet the specific needs of college students. This study was funded by a Fitchburg State University Special Projects Grant.

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Effects Of A 13-week Yoga Class On College Aged Student's Flexibility, Body Image, And Mood

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PURPOSE: Yoga has been practiced as a low to moderate intensity physical activity in recent years and evidence suggests that yoga practices can bring beneficial effects on physical and mental health. The present study examined whether a 13-week yoga practice of postures, breathing, and relaxation techniques can improve the flexibility, body image and mood of college aged students. METHODS: A sample of 60 students was recruited from university to participate in a 13-week yoga class. A pre-post test design was used for this study. Measurement on the physical aspects included the flexibility test and whereas the mental aspects included body image questionnaire (Body Appreciation Scale-2) and mood questionnaire (The Positive and Negative Affect Scale). Data were analyzed at the significance level of p<.05 for one group pre- and post-test of two data sets. RESULTS: The Mann-Whitney showed significance at the p<.01 for the sit and reach flexibility test and significance at the p<.05 for the body image and mood questionnaire. Sixty students (19 ± 2.1years; 1.60 ± 0.15 m; 52 ± 8.4kg;) reported improved flexibility (ranged from 3% to 9%) , increased body appreciation (mean value from 3.8 to 4.2) and positive mood (mean value from 3.9 to 4.3) after the 13-weeks class. The majority students desired to participate in more yoga classes in the future. CONCLUSIONS: This study suggests that a 13-week yoga class showed improvements of flexibility, increasing positive body image and enhancing mood who are novice yoga practitioners. Since the participants in this study were all girls and future study can examine the gender difference on the topic.

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Associations between Parents' Physical Activity and Young Children's Health Outcomes

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(No relevant relationships reported)

PURPOSE: While parents play an important role in child development, little is known about the influence of parents' physical activity (PA) on young children. This study examined the associations between parents' PA and their preschoolers' body mass index (BMI), PA, and fundamental movement skills (FMS). **METHODS**: Of 257 parent-child dyads recruited across 3 cohorts from 4 Colorado Head Start/preschool centers from 2010-2012, 109 children (57 girls, 36 Hispanic, $\overline{X}_{age}$ = 4.69±0.34, $\overline{X}_{BMIz}$ = 0.49±1.14) and parents had complete data were included in the analysis. Parents' and children's PA on 4 weekdays and 2 weekends were assessed by pedometers and calculated as steps per hour. Children's BMI and sex- and age-adjusted BMIz scores were calculated using 2000 CDC Growth Charts for the United States. Children's FMS was assessed via the Bruininks-Oseretsky Test of Motor Proficiency—2nd Edition (BOT-2), including 1) Balance, 2) Running Speed and Agility (locomotor skills), 3) Upper-Limb Coordination (object control skills), and 4) Strength. Bivariate correlation and linear regression were used to examine the associations between parents' PA and children's BMI, PA, and FMS.
RESULTS: Bivariate correlation indicated that parents' PA was positively associated with children's locomotor skills (r = 0.19, p < 0.05), strength (r = 0.21, p < 0.05), PA (r = 0.34, p < 0.01), and inversely related to children's BMI (r = - 0.23, p < 0.05). Linear regression further suggested that parents' PA was a significant predictor of children's locomotor skills [F (5, 108) = 2.45, β = 0.13, p < 0.05, R^2 = 0.11], PA [F (5, 108) = 2.95, β = 0.32, p < 0.05, R^2 = 0.13], and BMI [F (5, 108) = 2.97, β = -0.16, p < 0.05, R^2 = 0.13], but not a significant predictor of strength [F (5, 108) = 1.35, β = 0.18, p = 0.25, R^2 = 0.06], after children's age, sex, ethnicity, and school site were adjusted. **CONCLUSIONS**: The findings suggest that parents' physical activity behavior is directly associated with their children's BMI, PA, and FMS—setting the stage for the development of experimental trials seeking to promote improvements in preschool children's FMS and overall health. Future research with larger and more diverse samples investigating the influence of parents' PA intensity (i.e., light, moderate, and vigorous) on preschool children's other health outcomes is warranted.

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Effects Of A Peer-led Aerobic Training Program On Physical Activity Behavior Of Urban College Students

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PURPOSE: Peer-based education is commonly used on college campuses to provide health information. Using it to introduce physical activity to ethnically-diverse sedentary students attending an urban commuter college has not been explored. We examined the impact of a 10-week peer-based aerobic-exercise (AE) training program on urban college students' leisure physical activity behavior. **METHODS:** Inactive students (N = 23, mean age: 21 ± 2.24 yrs) participated in a 10-week training program consisting of approximately 3 weekly AE sessions. Once-per-week sessions led by a peer-student trainer included a short lecture on exercise's health benefits followed by 30 mins of AE (55%-65% HRR); participants were instructed to complete 2 other AE sessions independently per week and completed weekly online journals to assess adherence. Pre- and post-training evaluations of AE behavior patterns [International Physical Activity Questionnaire (IPAQ)] were conducted in the weeks prior to and following the exercise program and one month (30-IPAQ) and 90 days (90-IPAQ) after the conclusion of training. Descriptive statistics describing program participation and adherence are presented. Paired-samples t-tests were conducted comparing pre- and post-training cardiovascular fitness. **RESULTS:** Each week 19.1 ± 1.66 participants attended a peer-led session, training at THR of 142.61 ± 22.88. Participants completed a mean of 8.3 ± 1.26 sessions out of the expected 10. They completed a mean of 2.39 ± 1.95 d·wk^{-1}; 34.85 ± 19.62 min·session^{-1} independently. Twenty (86.96%) participants completed the 90-IPAQ thus, students' leisure physical activity analysis included only these 20 participants. Pre-IPAQ data demonstrated that 25% of participants engaged in leisure physical activity at a mean of 164 ± 120 MET-min·wk^{-1}. One month following the training period 60% of participants exercised at a mean of 434.38 ±395.76 MET-min·wk^{-1}; 90-IPAQ data demonstrated 55% of participants continued to engage in leisure physical activity at 488.73 ± 381.33 MET-min·wk^{-1} on average. There was no significant effect of aerobic training on participants' cardiovascular fitness level. **CONCLUSION:** Participation in a peer-led aerobic training program may serve as a gateway to adopting a low level of leisure physical activity by urban college students.

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Association of Sleep Quality and Physical Activity among Chinese College Students

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Sleep plays a critical role in the growth of youth. However, increasing studies suggest that the sleep quality (SQ) in Chinese youth is in a worrying situation. Meanwhile, SQ is associated with lifestyle factors, such as physical activity (PA). Therefore, this study will particularly focus on the association between PA level and SQ in Chinese college students, a special youth group who are under academic pressure.
PURPOSE: The present study is aimed to determine the correlation between SQ and PA level in Chinese college students.
METHODS: In 2017, 4330 college students (male: 60.1%; female:39.9%) aged 17-24 years were randomly sampled from Shanghai Jiao Tong University, China. SQ, PA level, academic pressure and lifestyles of students were collected via a questionnaire. SQ and PA level were evaluated by Pittsburgh Sleep Quality Index (PSQI) and International Physical Activity questionnaire, respectively. SQ dichotomizes two levels: good SQ (PSQI score ≤5) and poor SQ (PSQI score>5). PA was also divided into two levels: sufficient PA and insufficient PA according to World Health Organization moderate-to-vigorous physical activity (MVPA) recommendations.
RESULTS: Average MVPA time was 43.5±37.5 min/day (males: 47.0±39.6 min/day; females: 38.1±33.2 min/day). About 25.5% of participants met MVPA recommendations (males: 29.0%; females: 20.1%). Average SQ score was 7.81±1.89 (males: 7.67±1.86; females: 8.06±1.91). About 89.5% of participants had poor SQ (males: 87.9%; females: 91.8%). Males with sufficient PA had better SQ (7.42 ±1.87) than those with insufficient PA (7.74±1.85, P<0.05). But no significant correlation was found in females. The linear regression results showed that insufficient PA was

associated with higher SQ score (B=0.24,P<0.01) among males. Other health-related factors such as dietary habits and academic pressure also showed significant correlation with SQ. However, regarding the females, no significant correlation between PA and SQ was observed. Furthermore, after adjustment for the demographic variables and health-related factors, the results of binary logistic regression showed that males with insufficient PA had higher odds of poor SQ (aOR=1.44, 95%CI=1.12-1.86, P<0.01) compared with the others.
CONCLUSION: Better SQ was related to higher PA level in male college students.

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Associations Between Physical Activity, Diet, And Substance Use With Academic Performance

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Physical inactivity, poor diet, and alcohol/substance abuse are common health behaviors among college students. However, little is known about the relationship between these health behaviors and academic performance. **Purpose:** To examine differences in grade point average (GPA) based on physical activity (PA) levels, fruit and vegetable consumption (FVC), and use of alcohol and substances. **Methods:** Students completed an online survey self-reporting demographics (age, sex, race/ethnicity), PA (min/week of moderate and vigorous PA), FVC (servings/day), use of alcohol and substances (yes/no), as well as GPA. Independent samples t-tests were used to examine differences in GPA between those who did/not meet PA and FVC recommendations, and those who did/not use alcohol and substances. **Results:** Data was collected from 3738 participants (women, 57.8%, non-Hispanic white, 77.2%). For all participants, GPA differed significantly between those who did (3.40±.40) and did not (3.36±.48) accumulate 500 weekly MET-min (p=.034), and those who did (3.42±.40) and did not (3.34±.46) meet FVC recommendations (p<.001). GPA also differed significantly between tobacco users (3.26±.41) and non-users (3.40±.42, p<.001), as well as cigarette users (3.30±.40) and non-users (3.41±.42, p<.001), but not based on alcohol use, for all participants. **Conclusion**: Findings indicate that those who utilize substances, are less physically active and display unhealthy eating habits, tend to have poor academic performance. This provides insight to students and campus health professionals regarding how their health behaviors may be affecting their GPA.

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Pilates Connect: A Program To Support The Transition Of Student-athletes To Lifetime Activity

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Student-athletes face challenges maintaining physical activity when they transition beyond college athletics, including loss of team support, few specific goals and strong athletic identities with weaker exercise identities (Fuller, 2014; Reifsteck, Gill, & Labban, 2016). Resources that prepare final-year student-athletes for meaningful lifetime physical activity support physical and psychological wellness. **PURPOSE:** To implement the *PILATES Connect* program for final-year student-athletes and evaluate their experiences and program support in the transition to lifetime physical activity. **METHODS:** Twelve final-year student-athletes participated in *PILATES Connect*, once each week for six weeks. The sessions included 35 minutes of Pilates training, 15 minutes of reflection and discussion, and 10 minutes of evaluation. Measures included attendance, session and program evaluations, and focus groups. **RESULTS:** Final-year student-athletes strongly adhered to the program, with an overall attendance rate of 94.4%. In session evaluations (1=not at all true, 7=very true), participants agreed that they were pretty good at Pilates (M=4.8), did the activity because they wanted to (M=6.6), and felt like they could trust the other participants (M=6.4). Participants agreed that *PILATES Connect* supported their confidence in the transition to lifetime activity (M=5.5), greater control over activity choices (M=5.9), and connection to other participants (M=6). They would recommend *PILATES Connect* to other student-athletes (M=6.8) and consider participating in Pilates or other group exercise in the future (M=6.8). Focus group responses highlighted increased confidence through progression in a new form of activity and recognition of different options for activity after graduation. Student-athletes enjoyed discussing the transition with peers and felt less alone. They recommended more sessions and promoting the program through word of mouth and feedback from past participants. **CONCLUSION:** The six-week *PILATES Connect* program was feasible, as evidenced by strong adherence rates and positive feedback from participants. Final-year student-athletes agreed that the program supported their competence, autonomy, and relatedness in physical activity as they approached the transition to alumni.

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Gunter Submission

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PURPOSE: To learn if different physical activity (PA) promotion approaches for boys compared to girls are needed in rural elementary school settings, we evaluated sex differences in total physical activity (TPA) and moderate-to-vigorous physical activity (MVPA) among 1st - 5th graders attending six rural schools in Oregon.
METHODS: We assessed the PA levels of 1739 students (835 girls and 901 boys) over four consecutive school days using Walk4Life MVP pedometers in fall 2015. Devices were worn above the right hip for the duration of the school day (6.5 hours/day) and programmed to measure PA time at any intensity (i.e. no minimum requirement for step rates/min). Time spent in MVPA was evaluated using a pre-specified step rate (≥ 120 steps/min). Teachers distributed and collected devices daily, recorded wear time, and reported daily classroom schedules (e.g. time for recess, lunch, etc.). At the end of day 4, data were downloaded, screened for outliers (daily step counts <500 or >15000, incorrect MVPA settings) and adjusted for transport time. Linear mixed effects models were used to assess relationships between TPA and MVPA, and child sex and grade level. To examine the school and teacher influence, we utilized teachers nested within schools as a random effect in the model. All analyses were run in R.
RESULTS: Analyses were done on data from 577 boys and 552 girls. There were significant sex and grade-level differences in the volume of TPA and MVPA accrued throughout the school day (p <0.001). Boys accrued more TPA and MVPA than girls, and younger children accrued more TPA and MVPA than older children (p<0.001). There was a significant grade by sex interaction. Specifically, for both MVPA and TPA, girls in 2nd through 4th grades accumulated fewer minutes than similarly aged boys, and this difference was attenuated as children got older. By grade 5, boys and girls were accruing similar levels of TPA and MVPA during school hours.
CONCLUSIONS:Physical activity levels at school declined for all students from 1st through 5th grade. Girls in 2nd through 4th grades exhibited lower TPA and MVPA levels than boys. Preliminary findings suggest different approaches to increase PA among elementary school girls may be warranted. More data are needed to learn where to target those approaches.
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Effect Of 10-week Flag Football Intervention On Physical Activity Of Overweight And Obesity Children

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PURPOSE: To investigate the effect of 10-week flag football exercise and regular physical education class on daily physical activity (PA) levels in elementary school students.
METHODS: A total of 48 9-10yr students (mean age in yr: 9.73±0.55; 24 males, 24 female) was divided into either a flag football intervention group or a conventional physical education group. The intervention group received a 35-minute flag football exercise session, twice a week, for 10 weeks. The physical education group received a 35-minute/day routine session, including gymnastics and sports games. Daily PA was measured before and after 10 weeks for both groups using ActiGraph GT3X + (wore on right hip) for seven consecutive days. The cut-points established by Evenson et al. were used to convert Actigraph counts data into PA in minutes in different intensity levels (sedentary: 0-25 counts/15 seconds, light: 26-573 counts/15 seconds, moderate-to-vigorous: ≥574 counts/15 seconds). Differences in PA between intervention and control groups before and after the 10-week intervention period were compared by a series of mixed model repeated measures ANOVAs . Data were expressed as mean ± standard deviation; Significant level was set at 0.05.**RESULTS**: The intervention group spent less sedentary time than the control group after the 10-week intervention (Table 1). **CONCLUSIONS**:
Flag football exercise could help reduce overweight and obesity elementary school students' daily sedentary time. Meanwhile, it was noticed that daily MVPA levels of most of these students were significantly below 60 min/d. This study was supported by National Social Science Fund of China (No. 18BTY095)

Table 1 Group differences in weekday PA levels (min/d)						
PA		Intervention (n=24)	Control (n=24)	F	p	η_p^2
ST	Pre	565.47±79.85	556.49±68.70	1.80	0.04	0.19
	Post	497.05±59.81*	529.21±104.51			
LPA	Pre	199.51±28.91	181.58±48.38	0.82	0.07	0.37
	Post	182.22±36.35	177.15±44.34			
MPA	Pre	30.48±9.57	26.98±9.19	0.85	0.07	0.36
	Post	27.65±8.79	27.12±9.84			
VPA	Pre	16.23±5.10	15.56±6.74	1.353	0.07	0.251
	Post	14.74±7.85	15.66±7.30			
MVPA	Pre	46.72±11.84	42.54±13.73	1.419	0.07	0.239
	Post	42.39±14.69	42.78±15.35			

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The Effect Of Extracurricular Physical Activities In The Development Of Coordination Ofchildren Aged 7 To 9 Yearsold

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PURPOSE: The purpose of this study was to assess the effects of extracurricular physical activities on the physical coordination in children aged 7-9 years.
METHODS: A sample of 120 children aged 7-9 years (52% boys) was enrolled for a 12-week experimental intervention study. The sample was divided into an experimental group (58 children) and control group (62 children) by random number method. The experimental group participated in extracurricular intervention courses twice a week for 1 hour. The content of the course was mainly game, medium exercise intensity. The control group did not participate in the extracurricular exercise. The "Chinese Children Coordination Test "(CCCT) developed by the project team was used to conduct the coordination test before and after the experiment. The raw data was standardized and compared according to age and gender.
RESULTS: After 12 weeks of extracurricular intervention, the results showed that the scores of the experimental group in the transfer coordination (t=2.89, p<0.05), click-to-click (t=2.76, p<0.05), climbing obstacles (t=4.47, p<0.05), and rolling skills (t=3.81, p<0.05) were significantly higher than the control group. The experimental group was significantly higher than the control group (t=2.90, p<0.05) in the standardized comprehensive score. **CONCLUSION**: Extracurricular physical activity intervention could significantly improve the coordination ability of children, and the density of extracurricular physical activities should be strengthened in this age group.
ACKNOWLEDGEMENT: Supported by NPOPSS Grant 15CTY011, Humanities and Social Sciences by Ministry of Education Grant 17YJC890020.

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Effects of Eight-week Fundamental Motor Skills Intervention on Children's Physical and Cognitive Health Outcomes

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Globally, 80.3% of school-aged children do not engage in the recommended 60 minutes of daily moderate-to-vigorous physical activity (MVPA; Hallal et al., 2012). Motor skill competence is fundamental to a child's physical activity and cognitive development (Stodden et al., 2008), and thus may explain the lack of MVPA engagement among children.
Purpose: This study aimed to examine the effects of a fundamental motor skills (FMS) intervention program on physical and cognitive health outcomes among elementary children.
Methods: Participants were 31 K-2 students (19 girls, 12 boys; M_{age} = 6.65) from three public elementary schools in the southwestern U.S. They were randomly assigned to either the intervention (1 school, n = 20) or the control group (2 schools, n = 11). During two separate 8-week periods in 2017 and 2018, children in the intervention group (13 girls, 7 boys) joined the FMS intervention for three times per week (60 minutes each time), while children in the control group (6 girls, 5 boys) followed a traditional afterschool program (e.g., free play). Children's pre- and post-intervention data were collected using the Test of Gross Motor Development - 2nd edition (TGMD-2; Ulrich et al., 2000), accelerometers (Actical), and a cognitive function questionnaire (PedsQL™; Varni et al., 2011). To examine the intervention effect, a 2 × 2 repeated measures MANOVA was used, with group as the between-subjects variable and time as the within-subjects variable.
Results: The MANOVA showed significant differences between the intervention and the control group over time, $F(4,26) = 16.83$, $p < .001$, partial $\eta^2 = .72$. Follow-up univariate tests for the group × time effect indicated significant differences ($p < .05$) in locomotor skills (intervention: $M_{T1} = 25.4$ vs. $M_{T2} = 37.98$, d =8.31; control: $M_{T1} = 29.73$ vs. $M_{T2} = 30.32$, $d = 0.25$), object-control skills (intervention: $M_{T1} = 24.68$ vs. $M_{T2} = 39.78$, $d = 7.07$; control: $M_{T1} = 27.05$ vs. $M_{T2} = 27.59$, d =0.19), and MVPA (intervention: $M_{T1} = 143.62$ vs. $M_{T2} = 170.06$, $d = 2.54$; control: $M_{T1} = 166.24$ vs. $M_{T2} = 155.17$, $d = 0.79$), but not in cognitive function ($p > .05$).
Conclusion: The FMS intervention showed significant improvements in FMS and MVPA, compared to a traditional afterschool program. Findings highlight the importance of FMS for motor skill competence and MVPA promotion among school-aged children.

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Evaluation Of A Physical Activity Level And And Physical Fitness In Obese Children: Health Educational Program For Children (hepchild)

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PURPOSE: This study aimed to investigate the impact of a Health Educational Program for Children (HEPchild) being 5 days of Camp and 12weeks follow-up on the physical activity level (PAL) and physical fitness (PF) in obesity children.
METHODS: The HEPchild was designed for obese children and developed in two phases: The Phase 1 consisted of Pre assessments and five-day camp (CAMP); and Phase 2 corresponded to the 3 months follow-up. Twelve children attended to CAMP as well as PAL and PF tests
RESULTS: After 12 weeks, 25% of children became more active (> 1500 and <3000METs per week). In contrast the amount of sedentary children (<600METs week) decreased by 15% and the insufficiently active (> 600 and < 1500METs per week) increased by 15%. No child was classified as very active (> 3000METs per week) in any time. The PAL leisure time during the week and during the weekend increased 26.06% and 14.1%, respectively, when comparing pre CAMP to the end of 12 weeks follow-up. SB during the week and the weekend showed a significant mean reduction of 177.14 and 41.43 minutes respectively. A significant improvement was observed in the subjects' sit and reach flexibility, upper limb strength, and lower limb strength.
CONCLUSIONS: The HEPchild contributed to increase PAL and reduction of sedentary behavior and improve physical fitness in obesity children.

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Introducing Physically Active Lessons in a UK Secondary School: A Pilot Cluster-Randomised Controlled Trial

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PURPOSE Assess the feasibility, acceptability & costs of delivering a physically active lessons (PAL) training program to secondary school teachers & explore preliminary effectiveness for reducing pupils' sedentary time. **METHODS** Two mixed-sex, non fee-paying schools were randomised as intervention (n=1; received PAL training) & control (n=1; no training) schools. Training was delivered to all subject teachers in two after school sessions & focused on integrating movement into lessons. Feasibility & acceptability of PAL training were assessed with quantitative & qualitative measures. Student outcomes (including accelerometer assessed activity) were assessed at baseline & 8 weeks post training for 107 & 98, 11-14 year olds at intervention & control schools, respectively. The study received ethical approval. **RESULTS** 29 of 33 teachers attended both training sessions. Teachers' feedback indicated low acceptability of PAL training & a need to revise certain training components, e.g., outdoor PAL training & increasing the learning challenge of the PAL strategies. The assistant head teacher echoed teacher's concerns about the training but suggested the concept was acceptable for secondary schools. At follow up, teachers had increased PAL delivery & students received an average of 6.9 PAL/

week. Of the pupils who recalled being in a PAL (58%), >90% wanted teachers to continue teaching PAL. Delivering the training cost £901 (£451 staff time, £450 equipment). Change in student's sedentary time (95%CI) was +5.1(-1.3,11.5) & +1.3(-6.2,8.7) minutes at control & intervention schools, respectively. **CONCLUSION** As most PAL evaluations focus on primary schools, this study makes a valuable contribution to the literature. Delivering PAL training to teachers was feasible, and delivering & participating in PAL was acceptable for teachers & students. However, low acceptability of PAL training & no evidence of effectiveness on student outcomes indicate the need to review the training. Receiving 6-7, 60 minute PAL/week has the potential to reduce adolescent's sedentary time, although the amount of activity introduced by PAL requires review. Results do not support PAL implementation or progression to a full trial with the current program. Further research could explore if different PAL training elicits more promising results.

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SOFIT Studies of Physical Education in U. S. and International Schools

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There is growing interest in assessing physical education programs worldwide in order to improve program quality. To this end, SOFIT (System for Observing Fitness Instruction Time) is a valid and reliable tool for assessing physical education, and it has been used to evaluate physical education programs worldwide since 1991.**PURPOSE:** To compare and contrast the characteristics of SOFIT studies of PE conducted in U.S. schools and in other countries. **METHODS:** Following guidelines outlined by PRISMA, we searched 10 library databases for SOFIT studies conducted worldwide. We located a total of 800 distinct records (233 U.S.; 567 non-U.S.) and evaluated a total of 305 full-texts (137 U.S; 168 non-U.S.) for eligibility. Studies were selected if they (a) were published in English in peer review journals; (b) used the standard SOFIT protocol; and (c) assessed physical education in preK-12 schools. **RESULTS:** Fifty-eight studies met the inclusion criterion, including 29 in the U.S. and 29 in other countries. U.S. studies included nearly five times more lessons as non-U.S studies (12,256 vs 2,703 lessons). All 58 studies described physical activity, 83% described physical activity andlesson context, and 53% included physical activity, lesson context, and teacher behavior. Interobserver reliabilities consistently exceeded 85% agreement for all main variables. The most common analyses in U.S. studies were for teacher preparation (48%), lesson location (38%), and student gender (31%). In contrast, in non-U.S. studies the most common analyses were for student gender (59%), teacher preparation (34%), and lesson location (21%). Mean lesson MVPA% was below the 50% public health objective in most studies worldwide. There was substantial diversity both within and among studies in the allocation of time to different contexts. Less than 30% of studies assessed MVPA% within lesson contexts. **CONCLUSIONS:** SOFIT has been reliably used to assess physical education internationally since 1991. There was substantial diversity in study characteristics and how data were analyzed and reported. Increased consistency in implementing the SOFIT protocol and the reporting of data could improve the generalizability of results and provide a clearer worldwide picture of the conduct of physical education.

D-61 Free Communication/Poster - **Physical Activity and Health II**

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

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Accumulating 10,000 Steps/Day Using a Wristband Activity Monitor May Not Meet Step Guidelines.

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Physical activity (PA) guidelines aimed at accumulating 10,000 steps/day through exercise (EX) and activities of daily living (ADL) has become increasingly common with the advent of wristband PA monitors. Yet, accumulated "steps" with wristband PA monitors may not equal validated pedometers. Consequently, there is a need for evaluating and developing guidelines for step counts using wristband PA monitors for the general population. **PURPOSE:** To compare pedometer and wristband PA monitor steps accumulated through EX and ADL designed to mimic real-world behavior using a diverse participant population. **METHODS:** 24 males and 35 females, age: 18-65 yrs., BMI: 19-45 kg/m^2, including exercisers and non-exercisers, were recruited for this two-day study. On Day 1 participants completed 30 minutes of EX on a treadmill at 64-74% of their age-predicted HRmax wearing a pedometer and wristband PA monitor. Pedometer and wristband PA monitor steps were recorded after EX and pedometer steps were subtracted from 10,000 to determine the remainder of steps participants needed to accumulate 10,000 steps through ADL on Day 2 (ADL pedometer steps = 10,000 steps – exercise pedometer steps). Next, participants were sent home with a pedometer and wristband PA monitor. On Day 2, participants were instructed to accumulate the remainder of steps needed to reach 10,000 steps through ADL. Once participants accumulated their ADL pedometer steps, step counts on both devices (i.e., wristband PA monitor and pedometer) were recorded. Total step counts were calculated as: EX steps on Day 1 plus ADL steps on Day 2 for devices. **RESULTS:** Significantly fewer wristband PA monitor steps were accumulated than pedometer steps during treadmill EX (3864±68 vs. 3573±81 steps; P<0.01) on Day 1 by 7.5%. Conversely, on Day 2, accumulated wristband PA monitor steps were significantly greater than pedometer steps during ADL (7973±275 vs. 6255±72 steps; P<0.01) by 27.5%. Consequently, total steps were significantly higher for wristband PA monitor steps than pedometer steps (11546±281 vs. 10119±57 steps; P<0.01). **CONCLUSION:** In order to achieve to the equivalent of 10,000 pedometer steps using a wristband activity monitor through treadmill exercise and activities of daily living, wristband activity monitor users should strive for closer to ~11,500 "steps" per day.

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Effects of Three Regular Activity Breaks on Postprandial Triglyceride Response in Healthy Young Adults

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PURPOSE: To determine whether interrupting prolonged sitting with three kinds of regular walking activity breaks has an immediate or delayed effect on postprandial triglyceride response.
METHODS: In a randomized crossover trial, 16 inactive healthy adults (7 men, aged 21-30 years) completed four 26-h (from 8:00 AM on day 1 to 10:00 AM on day 2) laboratory conditions. Except for the 9-h intervention phase, the same procedure was used in the following four trials: (1) 9-h prolonged sitting **(SIT)**; (2), (3), and (4) sitting with 3, 5, and 8 minutes of brisk walking (60% VO_2max) every 35, 50, and 70 minutes, respectively **(WALK3, WALK5, and WALK8)**. Postprandial serum triglyceride (TG) and nonesterified fatty acid (NEFA) were measured for 2-h dinner immediately on day 1 and for 2-h breakfast on day 2. Meals and meal times were standardized across the conditions for all the participants.
RESULTS: Compared with SIT, only WALK8 significantly attenuated 2-h breakfast postprandial triglyceride total area under the curve (tAUC; SIT: median [Q1, Q2], 2.12 mmol·h·L^{-1} [1.46, 3.67] vs WALK8: 2.01 [1.25, 3.34], p = 0.041). The tAUC for 2-h dinner postprandial triglyceride and for both 2-h dinner and breakfast postprandial NEFA were not significantly changed in the three-activity break conditions. However, compared with SIT, the three-activity break conditions significantly increased the pre-dinner NEFA concentrations on day 1 (WALK3 52%, WALK5 36%, and WALK8 75%; all p < 0.05), but only WALK8 increased the fasting NEFA concentration on day 2 (25%; p < 0.05). No significant differences in all the above-mentioned indicators were found among the three-activity break conditions.
CONCLUSIONS: The 8-min brief bouts every 70 min attenuated the postprandial triglyceride response measured about 24 h after, not immediately after, the intervention phase. *Supported by the Shanghai Science and Technology Committee (No. 16080503300).*

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Physical Activity Level And Prescription Pattern Of Physical Activity Among Physicians In Santiago De Chile.

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PURPOSE: The aim of this research was to determine the level of physical activity (PA) and prescription pattern (PP) of physical activity among physicians in their private practices. **METHODS:** An analytical cross-sectional study analyzed 341 physicians (182 males, 159 females; mean age 39.7 years) of 13 different private health care centers in Santiago de Chile, South America. Data of PA was collected using the short form of the International Physical Activity Questionnaire (IPAQ-SV) and the data of the PP was collected using the Exercise Is Medicine (EIM) questionnaire developed in Latin America. **RESULTS:** 30% of the participants reported low level of physical activity (≤600-MET min/week). Higher physical activity levels were found among male physicians compared to female physicians (9% versus 6%). 80% of the physicians reported prescribing PA to their patients (always 37%; almost always

43%), but only 8% fully knew the international PA recommendations for health. When asked why they do not prescribe PA, among those who do not do it regularly, the main cause was because they do not know the PA current guidelines (12%), and among those who knew the guidelines, the "lack of time within the consultation" was the most common cause (39%), followed by the doctor's preconceived notion that "the patient will not comply with the prescription given" (19%). Although both national and international guidelines establish PA as the first line of treatment of chronic non-communicable diseases, 92% of physicians do not prescribe PA in accordance with these recommendations. Among these, 46% of them refer not to know these recommendations and something that in our opinion is even more worrisome is that 21% of the doctors surveyed, had knowledge of the guidelines, but do not apply them. **CONCLUSION:** data suggested a relationship between the level of knowledge of PA recommendation, the prescription pattern in clinical practice, and the practice of PA itself among doctors.

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Large vs Small Skeletal Muscle Mass Training: a Pilot Study on Solid Organ Transplanted Recipients

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Kidney (KTR) and liver (LTR) transplanted recipients suffer from a reduced exercise capacity ($V'O_{2peak}$) and performance. Several studies pointed out the skeletal muscle as the main responsible for the low peak work rate (WR_{peak}) and reduced $V'O_{2peak}$ in KTR and LTR, rather than the central factors (e.g. maximal O_2 delivery) (Williams & McKenna, 2012). Indeed, skeletal muscle dysfunctions and atrophy seem to be a common scenario in the post-transplant period (Kempeneers et al., 1990; Kallwitz, 2015).
PURPOSE: The aim of the present study is to determine if endurance training (ET) involving a small muscle mass, e.g. single leg cycling (SLC), might induce the development of higher $V'O_{2peak}$ and WR_{peak} than ET with large muscle masses, e.g. double leg cycling (DLC), in KTR and LTR.
METHODS: 9 sedentary patients were enrolled (KTR=6; LTR=3) and divided into SLC (n=5; age 50±10.3 yrs; time post transplant 11±14.8 yrs; BMI 25±3.0) and DLC (n=4; age 58.5±0.7 yrs; time post transplant 4.3±1.5 yrs; BMI 26.3±2.9) groups. Subjects completed DLC incremental test to determine $V'O_{2peak}$ and WR_{peak} on an electronically braked ergometer. Pulmonary gas exchange was measured using breath-by-breath analyses. All subjects were asked to attend 24 ET sessions: the DLC group trained both leg at the same time and the SLC group performed the first half of the session with one leg and the second half with the other limb.
RESULTS: 2 subject in the DLC group did not complete the ET regimen due to health-related issues, thus were excluded from the analysis. SLC (n=5) and DLC (n=2) groups completed 20±2.5 and 23±1.4 ET sessions, respectively. SLC and DLC groups increased significantly (p: 0.025) the $V'O_{2peak}$ of 2.5±2.0 and 3.0±2.3 $mL \times min^{-1} \times kg^{-1}$, respectively. SLC and DLC groups improved (p: 0.053) the WR_{peak} of 18.0±14.4 and 10.0±7.1 W, respectively.
CONCLUSION: These preliminary results suggest that SLC training elicited a similar change in $V'O_{2peak}$, but slightly higher improvement in WR_{peak} with respect to the DLC training. This might suggest the key role of skeletal muscles in limiting peak exercise performance. The results are promising, but the low sample sizes prevent us from drawing firm conclusions.

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Recalled Age at Menarche from The Michigan State University Motor Performance Study

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Background: Many growth studies have assessed age at menarche to quantify biological maturation, as it is related to several physiological and performance variables. Begun in 1967, the Michigan State University Motor Performance Study (MPS) tested youth on a battery of physical growth, maturation, and motor performance tasks twice yearly for 32 years. One maturation marker, age at menarche, was collected for female participants and their mothers. In a follow-up study to investigate participants' adult health outcomes, females again reported age at menarche. **Purposes:** 1- Determine whether recalled age at menarche (up to 20 years after the fact) was related to a more timely assessment of age at menarche, and 2-Determine whether daughters' and mothers' ages at menarche were related to each other. **Methods:** During the MPS, a letter was sent to participants' mothers asking for age at menarche for themselves (n = 118) and their daughters (n = 99). At the follow-up, 127 females provided their recalled age at menarche; 25 of these respondents were matched with their earlier recall data. Descriptive statistics and correlations were calculated. **Results:** Age at menarche assessed during the MPS for the daughters was (mean ± sd) 13.13 ± 1.1 years (minimum-maximum = 11.2-16.7 years). At the follow-up, the recalled age at menarche was 13.11 ± 1.4 years (minimum-maximum = 10.2-18.0 years). For the 25 participants who had both MPS and follow-up data for age at menarche, the correlation was positive and strong: $r = 0.75$, $p < 0.001$. A moderate positive relationship between mothers' and daughters' ages at menarche was also found, $r = 0.39$, $p < 0.001$. Mothers of the MPS participants reported a slightly younger mean age at menarche than their daughters (12.83 ± 1.4 years). **Discussion:** Many studies have examined the accuracy of recalled age at menarche, with the relationship between actual and recalled age at menarche ranging from $r = 0.70$-0.81. Results from this small sample showed that MPS participants remembered their ages at menarche with similar reliability. Given that the original results were based on the recall from their mothers, the agreement between the two recalls is particularly noteworthy. The current sample is consistent with previous work which found a significant correlation of $r = 0.25$ between mothers' and daughters' ages at menarche.

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Time Spent In Moderate- to Vigorous-intensity Physical Activity Is Associated With Intramuscular Adipose Tissue Content In Young Men

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Physical inactivity induces decreases of skeletal muscle mass and increases content of the adipose tissue in humans. However, it is not well known that the relationships between daily physical activity and various types of adipose tissues such as intramuscular adipose tissue (IntraMAT), intermuscular adipose tissue (InterMAT) or subcutaneous adipose tissue (SAT). **PURPOSE**: To investigate relationship between daily physical activity and contents of IntraMAT, InterMAT and SAT in the thigh for young men.
METHODS: Twenty healthy young men (24.5±4.8 years) participated in this study. Axial images of the mid-thigh were taken using magnetic resonance imaging. The cross-sectional area (CSA) of IntraMAT, InterMAT, SAT and skeletal muscle were measured. Daytime physical activity time was measured using an accelerometer on 14 consecutive days and summarized the activity time of two intensities; light-intensity (1.1-2.9 METs), and moderate- to vigorous-intensity (3.0-7.0 METs).
RESULTS: In the accelerometer data, time spent in light-intensity physical activity was 672.4±74.6 min/day, and time spent in moderate-to vigorous-intensity physical activity was 96.6±30.5 min/day. Light-intensity physical activity time was not significantly correlated with contents of all adipose tissues in the thigh. The moderate-to vigorous-intensity physical activity time was correlated with IntraMAT content ($r = -0.739$, $P < 0.01$). On the other hand, moderate- to vigorous-intensity physical activity time was not significantly correlated with contents of InterMAT and SAT. Stepwise regression analysis was performed, with IntraMAT content as a dependent variable and age, body mass index, SAT CSA/body weight, skeletal muscle CSA/body weight, light-intensity physical activity time, moderate- to vigorous-intensity physical activity time as independent variables. As a result, skeletal muscle CSA/body weight and moderate- to vigorous-intensity physical activity time were independent variables ($R^2 = 0.655$).
CONCLUSIONS: These results suggest that moderate- to vigorous-intensity physical activity time was related to IntraMAT content only, skeletal muscle size and moderate-to vigorous-intensity physical activity time could be a major determinant of IntraMAT content in young men.

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Association Between BMI And Health Perceptions In Preservice Teachers

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Schools play an important role in shaping the dietary and physical activity behaviors of children, and teachers are increasingly called to deliver health-related information in the school setting. No study has examined the association between body mass index (BMI) and health perceptions in preservice teachers in elementary education programs. PURPOSE: To determine the association between perceptions of physical activity, healthy weight, and healthy eating in a sample of preservice teachers in elementary

education programs.METHODS: Participants included 341 preservice teachers enrolled in elementary education programs in the state of Florida. Individuals ranged in age from 18 to over 50, with 93% of the participants in the age range of 18 to 29. Females accounted for 91% of the participants. All participants provided self-report height and weight information and responded to statements regarding perceptions of physical activity, healthy weight, and healthy eating. Participants also provided the number of days per week they engaged in at least 30 minutes of moderate to vigorous physical activity.RESULTS: Bivariate correlations showed lower BMI was associated with the perceptions of a more physically active lifestyle (r = -0.25, p<.01), healthier weight (r = -0.66, p<.01), and healthier eating choices (r = -0.26, p<.01). In terms of exercise, higher BMI was associated with fewer days per week of at least 30 minutes of moderate to vigorous physical activity (r = 0.16, p<.01). CONCLUSION: The current findings indicate that BMI is associated with perceptions of health in preservice teachers in elementary education programs. Should they be replicated, such findings encourage researchers to examine the ways in which health promotion programs should be delivered to preservice teachers to improve their health and enhance their ability to promote healthy eating and physical activity to their future students.

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Physical Activity and Body Composition in Adults

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(No relevant relationships reported)

Rates of overweight and obesity have risen significantly since the 1980's, while levels of physical activity have declined. Reductions in physical activity may explain much of the increased body fatness realized over the past several decades, and increases in physical activity may contribute to improved body composition and weight management.
PURPOSE: To examine the relationships among markers of energy expenditure and body composition in adults. **METHODS:** Participants arrived at the laboratory between 6:00 and 9:00 a.m., having fasted for at least 10 hours. Height and body mass (BM) were measured, and 4-compartment body composition (percent body fat [%BF], fat mass [FM] and fat-free mass [FFM]) was determined using data derived from bioelectric impedance analysis and dual energy x-ray absorptiometry. Resting metabolic rate (RMR) was determined via indirect calorimetry. Participants were then provided with accelerometers to allow for measurement of various markers of physical activity (PA), including physical activity energy expenditure (PAEE), sedentary time (SED), time spent in moderate- to vigorous-physical activity (MVPA), and step counts (STEPS). Accelerometers were worn for 21-28 days, and associations between markers of PA and body composition were analyzed. **RESULTS:** Absolute expressions of PA (e.g., PAEE, STEPS) were not associated with body composition. However, expressions of PA relative to various fractions of BM were significantly correlated with %BF in both men and women. The strongest predictor of %BF was STEPS·kgFM^{-1}·day^{-1}. Power regression analysis yielded the model, 2907.1(STEPS·kgFM^{-1}·day^{-1})$^{-0.778}$ in men (R^2 = 0.91), and 820.25(STEPS·kgFM^{-1}·day^{-1})$^{-0.546}$ in women (R^2 = 0.82). **CONCLUSIONS:** Physical activity expressed per unit of FM strongly predicted %BF. These findings suggest relative expressions of PA (e.g., STEPS·kgBM^{-1}·day^{-1} or STEPS·kgFM^{-1}·day^{-1}) may be more efficacious than absolute expressions of PA in developing PA prescriptions for weight management.

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What is the Effectiveness of HIIT Body Work on Energy Expenditure in Active Male Adults

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INTRODUCTION: The High Intensity Interval Training (HIIT) has been identified as an important strategy in fitness by improving the cardiometabolic function in adults. However, different models of HIIT performed with body weight, known as HIIT body work (HBW) in blocks with maximum intensity, still lack information namely the energy demand imposed in training. **PURPOSE:** Assessment the energy expenditure in a single session of HBW in healthy male adults. **METHODS:** 12 male adults (33,3 ± 12 years old) performed an all-out protocol with 30 seconds effort x 30 seconds recovery, amounting 20 minutes in the total session. The session exercises were Jumping Jack (JJ), Burpee (BP), Montain climber (MC) and Squat Jump (SJ), performing 5 sets for each set. The energy expenditure was determined by indirect calorimetry with K5, gas analyser throughout the entire session. Heart rate was also measured as well as the rating of perceived exertion (0-10 Borg scale). Repeated measures ANOVA, followed by Tukey (0.05) post hoc test, were performed to compare the differences between exercises. All analysis were performed using SPSS software. **RESULTS:** The session mean VO_2 was 35.31 ± 5.21 ml.kg.min^{-1}, total energy expenditure was 250.78±27.41 kcal; mean heart rate was 164±8bpm and mean RPE was 8.92±0.68. The mean and standard deviation for the blocks of the different exercises are described in the table below, values followed by the same letter do not differ significantly from each other. Table – Mean VO_2 and energy expenditure per exercise and per minute of exercise.

	JJ	BP	MC	SJ
EE (kcal)	50.27 + 8.23 [a]	73,66 + 8,84 [b]	62,60 + 8,2 [c]	64,24 + 6,55
EE (kcal.min^{-1})	10.5 + 1.65 [a]	14,73 + 1,77 [b]	12,52 + 1,64[c]	12,85 + 1,31

Note: a and b = significantly different from every other exercise (p<0.05); c = significantly different from JJ and BP (p<0.05). **CONCLUSION:** The burpee exercise is the most demanding exercise in terms of aerobic energy expenditure. Contrarily, the jumping jack exercise was the least demanding. Aerobic energy expenditure seems consistent with the use of this type of workout to promote weight loss and / or fat loss.

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Mechanical Efficiency After High Intensity Interval Training In Hiv+ Hispanic Women

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(No relevant relationships reported)

High intensity interval training (HIIT) is known to improve cardiorespiratory fitness (VO_2peak) and exercise capacity in healthy and living with chronic disease adults. Mechanical efficiency (energy demand at a given workload) also helps improve exercise capacity; however, few studies have evaluated mechanical efficiency resulting from HIIT; and none with HIV+ adults. **PURPOSE**: To compare mechanical efficiency in HIV+ and HIV- women after a low volume HIIT intervention. **METHODS**: A group of 20 HIV+ and 11 HIV- Hispanic women completed a graded exercise test (GXT) on a bicycle ergometer with increments of 25W until volitional fatigue, during which measures of VO_2 and HR were obtained. GXT were conducted before and after a low volume-HIIT intervention (1:1 intervals) 3 days/wk. for 6 weeks (2 wks. (16 min total) at 80%, and 4 wks. (20 min total) at 90% of HR reserve). Percent VO_2peak and %HRpeak were determined at 25, 50, 75, and 100W. T-tests and Wilcoxon Ran Sum tests were used to detect pre to post-test differences within each group. **RESULTS**: Compared with HIV-, HIV+ had lower VO_2 at 100W workload during pre-test (20.4±1.9 vs. 17.5±1.9 ml·kg^{-1}·min^{-1}, P=0.01), and also at 75W and 100W during post-test (16.9±1.7 vs. 14.8±2.4, P=0.02; 21.0±2.8 vs. 17.3±3.4 ml·kg^{-1}·min^{-1}, P=0.01; respectively). Reduced metabolic demand (%VO_2peak) was observed at 25W in HIV- (46.4±15.4 vs. 37.9±10.5 %, P=0.01), at 50W in both HIV- and HIV+ groups (60.8±16.5 vs. 53.6±13.4, P=0.02; 62.8±13.3 vs. 59.5±11.2 %, P=0.04; respectively), and at 75W in HIV+ (81.3±13.8 vs. 75.9±13.7%, P=0.04). **CONCLUSION**: Although VO_2 was lower at near maximal workloads in HIV+ compared with HIV-, both groups increased their mechanical efficiency at various submaximal workloads; thus, improving exercise capacity with HIIT. Supported by NIMHD S21MD001830, R21MH095524, U54MD007587-04, and R25MD007607.

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Weight Loss Decreases Dyspnea on Exertion and Unpleasantness in Obese Adults

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PURPOSE: We have previously shown that weight loss improved dyspnea on exertion in obese, otherwise healthy, women. Dyspnea is a multidimensional symptom comprised of at least two distinct domains: sensory-perceptual (i.e., dyspnea intensity) and affective distress (i.e., unpleasantness and emotional response). Both domains may lead individuals to avoid exercise. In this retrospective study, we investigated the effects of weight loss in obese women and men on these dyspnea domains. **METHODS:** Twenty-one participants (12 M/9 F, 33 ± 7 yrs, 169 ± 12 cm, 102 ± 18 kg, 35 ± 4 kg/m^2, 41 ± 7% body fat) underwent a 12-week weight loss program. Pre-

and post-intervention measurements included a submaximal cycling test at 60W for women and 105W for men. Participants rated their perceived breathlessness (RPB, 0-10 Borg scale) as well as unpleasantness, depression, anxiety, frustration, anger, and fear associated with their breathlessness (visual analog scales, 0-10 cm) at the end of the test. Paired t-tests were used to analyze difference between pre- and post-intervention. **RESULTS:** Significant decreases were achieved in body weight by 9 ± 4 kg (9 ± 4%), BMI by 3 ± 1 kg/m^2, and body fat by 5 ± 10% ($p < 0.05$). RPB dropped by 1.5 ± 1.8 ($p < 0.05$). Significant decreases in ratings of unpleasantness (-2.3 ± 2.2), anxiety (-1.2 ± 1.8), frustration (-0.8 ± 1.9), and fear (-0.4 ± 1.0) were observed, while ratings of depression and anger were unchanged. **CONCLUSIONS:** Moderate weight loss alleviated not only dyspnea on exertion, but also the unpleasantness and negative emotional response related to the dyspnea. Supported by NIH Grant R01 HL096782 and King Charitable Foundation Trust.

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Prior Baby Jumper Use Is Correlated With Children's Parent-Reported Physical Activity Level

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PURPOSE: Baby jumpers are ubiquitous in the infant equipment selection. Anecdotally, while some parents link them to enhanced motor development, others link them with delayed walking onset. Baby jumper use involves successive vertical push-offs (rebounds) against the floor with the feet. The resulting raising and lowering of the body's center of mass is consistent with movements that require leg stiffness regulation. Leg stiffness has been shown to be positively related to maximum sprint velocity in adults and adolescents. Yet, no studies (to our knowledge) have investigated relationships between prior baby jumper use and current locomotor and physical activity (PA) behaviours in young typically developing children. This pilot study investigated these relationships.
METHODS: Parents of 45 children (age: 4 ± 2.3 years; height: 97.5 ± 25.6 cm; mass: 17.2 ± 9.4 kg) completed a 24-item survey administered through Qualtrics software. Questions included prior use of a baby jumper, age at walking onset, current fundamental locomotor behavior and PA level. Questions on the degree of a behavior level were on a 5-point Likert scale. Surveys were excluded, if a parent indicated that the child was born preterm or diagnosed with an intellectual or developmental disability. Bivariate correlations were used to evaluate the directionality of relationships between previous baby jumper use and locomotor and PA behaviors. A Mann-Whitney U test was used to compare age at walking onset between children who used and did not use a baby jumper.
RESULTS: Of the sample, 64% previously used a baby jumper. The proportions of the sample that were underweight, healthy weight, overweight, and obese, were 14%, 51%, 17%, and 17% respectively. Prior use of a baby jumper was moderately positively correlated with children's parent-reported PA level ($\rho = .545$, $p = .013$) and running pace (compared to peers their age and sex) ($\rho = .348$, $p = .019$). There was no significant difference in age at walking onset between the groups ($U = 231.0$, $p = .981$).
CONCLUSIONS: Prior baby jumper use may be linked with running performance and PA level and may promote physical actvity in young children. These relationships should be further investigated and modeled using objective measures of locomotor and PA behaviors. Prior baby jumper use did not delay walking onset in the sample.

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Overall Mortality, Survival, And Causes Of Death In Former US Olympians

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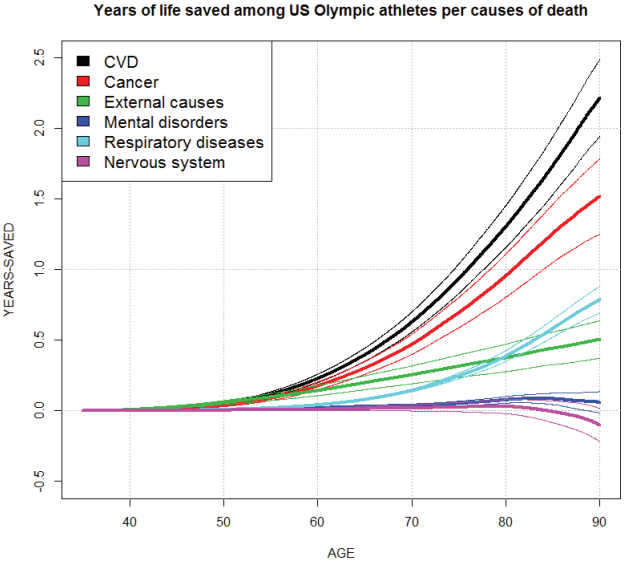
United States (US) send a greatest number of athletes to Olympic Games but their longevity and specific causes of deaths have not been examined.
PURPOSE: To quantify US Olympic athletes' longevity and to determine the impact of specific causes of deaths (CoD) on Olympians life duration in relation to the general population.
METHODS: Female (n = 2,301) and male (n = 5,823) US athletes who have participated at least once in the summer or winter Olympic Games between 1912 and 2012 were followed up to 2016. Their life status and CoD were certified by the National Death Index. The years-saved method was applied to quantify longevity gains/losses in former US Olympians in comparison to the general population.
RESULTS: Former US Olympians lived on average ~5 years longer (95% CI 4.3 to 6) than their referents in the general population, based on the 2,309 deaths observed out of 8,124 former athletes. The burden of each CoD was distributed according to its impact on the total number of years of life saved: cardiovascular diseases (CVD), 2.2 years (1.9 to 2.5); cancer, 1.5 years (1.3 to 1.8); respiratory diseases, 0.8 years (0.7 to 0.9); and external causes, 0.5 (0.4 to 0.6). Nervous system diseases and mental disorders mortality rates were not significantly different from their peers in the general population.
CONCLUSION: US Olympians live ~5 years longer than their referents in the general population, advantage mainly driven by lower risks of CVD and cancer. Nervous system diseases and mental disorders do not appear to contribute to the extended longevity that Olympians display.



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Elevated Serum Uric Acid And Heart Failure In U.S. Adults: 2007-2016 NHANES

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(No relevant relationships reported)

There is limited evidence examining the relationship between elevated serum uric acid (UA) concentration and heart failure (HF) in U.S. adults. **Purpose**: Examine the associations between elevated UA and HF using a nationally representative sample of U.S. adults. **Methods**: The final sample with complete data for this analysis (N=17,412) included men and women aged ≥40 years who participated in the 2007-2016 National Health and Nutrition Examination Survey. Self-reported diagnosis of HF was assessed via interview. Elevated UA was defined as values >6.0 mg/dL for women and >7.2 mg/dL for men. Multivariable gender-stratified logistic regression was utilized to examine the odds of HF. **Results**: The estimated prevalence of HF was 3.85% and 3.39% among men and women, respectively. Age adjusted analysis revealed significantly increased odds of HF in men (odds ratio [OR], 2.78; 95% confidence interval [CI] 2.09-3.71, $P<0.01$) and women (OR, 3.25; 95% CI 2.37-4.45, $P<0.01$) with elevated UA. Significance remained following adjustment for education, income, race, body mass index, alcohol consumption, hypertension, diabetes, physical activity, and creatinine in men (OR, 1.59; 95% CI 1.04-2.43 $P=0.03$) and women (OR, 2.03; 95% CI 1.33-3.08, $P<0.01$). **Conclusions**: In a representative sample of U.S. adults, having an elevated UA concentration was associated with significantly increased odds of HF when compared to adults with normal UA.

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Modernization of a Developing Country: Effect on Body Mass Index

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Modernization provides technology and resources that commonly displace physical activity (PA) from the daily routine; in time, body mass index (BMI) trends upward.

Given the host of deleterious consequences precipitated by poor body composition, it may be helpful to isolate specific factors that predict the largest elevations in BMI. Uganda is an appropriate location to evaluate this. Over 5 years, the percentage of women classified as overweight or obese increased from 19% to 24%; men increased from 4% to 9%. During this time, PA underwent considerable change while nutrition was relatively stable. **PURPOSE**: To evaluate the impact of modernization on BMI in Uganda. **METHODS**: We analyzed the 2016 Demographic and Health Surveys of Uganda, Household Members database. 11,577 subjects met inclusionary criteria. We conducted descriptive statistics to characterize this population, linear regression to examine the effect of modernization on BMI, and logistic regression to test these factors on the odds of overweight (BMI ≥ 25) or obesity (BMI ≥ 30). **RESULTS**: Mean age was 28.7 ± 10.2 yr; BMI was 22.0 ± 3.7; 16.0% of subjects were either overweight (n=1,405) or obese (n=440). More subjects owned a bicycle (40.6%) than a motorcycle (12.6%) or car (4.3%); more subjects owned mobile phones (79.7%) than computers (4.3%); 28.8% of households had electricity and 16.2% had television. Linear regression (R^2=0.160; p<0.001) found BMI to be increased when a household had a refrigerator (β=0.483; p <0.004), electricity (β=0.409; p<0.001) and television (β=0.961; p<0.001). Additionally, ownership of a car (β=0.421; p<0.016) and a mobile phone (β=0.625; p<0.001) predicted increases in BMI, while ownership of a bicycle (β=-0.330; p<0.001) and a land-line phone (β=-0.657; p<0.034) predicted decreases in BMI. Logistic regression (pseudo R^2=0.21; p<0.001) found the odds of being overweight or obese increased when a household had electricity (79%; p<0.001) and television (107%; p<0.001). Additionally, ownership of an automobile (41%; p=0.002) and a mobile phone (147%; p<0.001) increased the odds of being overweight or obese. **CONCLUSIONS**: Specific features of modernization associate with increases in BMI. As developing countries continue their development, public health interventions are warranted to promote the maintenance of PA.

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Effects of Division I Cross-Country Training on Iron Markers and Systemic Inflammation

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(No relevant relationships reported)

Inflammatory cytokine and immune cell production is modulated by iron status including storage measured by ferritin levels. Cross-country athletes have an elevated risk of iron depletion; the effects of long term cross country training on inflammatory cytokine profile and its relationship with iron storage markers have yet to be elucidated.
PURPOSE: To determine the influence of cross-country training on markers of inflammation and iron storage and to interpret potential mechanisms underlying these relationships.
METHODS: Twelve NCAA division 1 cross-country athletes, ages 18 to 25 years old, were followed for two years. Blood was collected at the beginning of the season and analyzed by complete blood count (CBC) and ferritin levels were assessed by enzymatic spectrophotometry. Cytokines IL-1β, IL-2, IL-4 IL-5, IL-6, IL10, TNF-α and IFN-γ were measured with the Luminex® MAGPIX® system. Dependent samples t-test was used to compare ferritin cytokines and CBC mean difference between first and second year measurements. Pearson correlations were conducted to assess associations between ferritin and immune cells/inflammatory cytokines. IBM® SPSS Statistics 22 software was used to analyze the data.
RESULTS: TNF-α levels increased from the 1st to the 2nd year (98.60 ± 11.17 vs. 121.41 ± 11.93 pg/dL, p=0.006). Platelets (253.63 ± 12.28 vs 267 ± 13.43 K/μL, p=0.041), Neutrophils (44.46 ± 1.26 vs 50.46 ± 2.70) K/μL, p=0.045) and Monocytes (8.58 ± 1.90 vs 10.61 ± 2.70 K/μL, p=0.003) also significantly increased from the 1st to the 2nd year. Ferritin levels were positively correlated with TNF-α both years (r=0.716 p=0.009, r=0.595 p=0.04).
CONCLUSIONS: One year of cross-country training seems to influence increases in pro-inflammatory cytokines and immune cell concentrations in NCAA Division 1 Athletes. Although there were no significant changes on ferritin levels over the years of study, ferritin increases were linked to increases in pro-inflammatory cytokine TNF-α.

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Relationship Between Weight History and Depression in U.S. Adults

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(No relevant relationships reported)

PURPOSE: Explore the relationship between changes in weight over time and subsequent depression status using a nationally representative sample of U.S. adults. **METHODS**: The study sample (n=20,505) included male and female adults (≥36 years of age) who participated in the 2007-2016 National Health and Nutrition Examination Survey. Weight history examined fluctuations of weight, mainly gain in weight, from self-reported current weight and self-reported weight 10 years ago. Depression status was assessed using the PHQ-9 utilizing a cut point of ≥10 to assign a depression score. Logistic regression analysis was utilized to examine odds of depression across ranges of weight gain. **RESULTS**: Overall prevalence of depression among U.S. adults aged 36 years and older was found to be at 7.5% (95% Confidence Interval [CI] 6.9-8.2). Following adjustment for gender, race, education, smoking, and physical activity, those who gained 20 or more lbs. had significantly greater odds of having depression (OR 1.45; 95% CI, 1.26-1.67) compared to those gaining <5 lbs. (referent). A similar relationship was not revealed for other weight gain ranges: 5-9lbs. (OR 0.84; 95% CI, 0.62-1.14), 10-14lbs. (OR 0.90; 95% CI, 0.70-1.15), 15-19lbs. (OR 0.93; 95% CI, 0.66-1.31). **CONCLUSION**: Findings revealed that weight gain of 20lbs. or more resulted in significantly greater odds of a PHQ-9 score indicative of depression.

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Cardiorespiratory Fitness, Serum 25-hydroxyvitamin D, and Risk of Metabolic Syndrome Among Men: The Cooper Center Longitudinal Study

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(No relevant relationships reported)

PURPOSE: We examined the individual and joint associations among cardiorespiratory fitness (CRF), serum vitamin D [25(OH)D], and metabolic syndrome (MetSyn). **METHODS:** Between 2006 and 2018, 14349 apparently healthy men completed a comprehensive health examination. Measures included CRF based on a maximal treadmill exercise test, components of MetSyn, and 25(OH)D. Participants were classified into categories of low (quintile 1), moderate (quintiles 2-3), and high (quintiles 4-5) CRF by age group, as well as by clinical cut points for MetSyn and 25(OH)D. We examined mean 25(OH)D levels in men with and without MetSyn. We calculated odds ratios (OR) of MetSyn across levels of CRF and 25(OH)D, and also examined joint associations among these three variables. **RESULTS:** The prevalence of 25(OH)D deficiency and MetSyn was 16.9% and 22.2%, respectively. Mean 25(OH)D levels were 30.9 ± 11.6 and 26.3 ± 10.7 ng/mL in men without and with MetSyn, respectively (p<.001). Prevalence of MetSyn was inversely associated with ordered categories of CRF and 25(OH)D (p for trend <0.001 for both). Men with normal 25(OH)D had lower odds of MetSyn than men who were vitamin D deficient (OR=0.29, 95% CI=0.26-0.33). Men with moderate (OR=0.31, 0.27-0.35) or high CRF (OR=0.08, 0.07-0.09) had lower odds of MetSyn than men with low CRF. Joint associations between CRF, 25(OH)D, and MetSyn revealed significantly greater prevalence of MetSyn in unfit men when compared to fit men within each category of 25(OH)D (p<0.001). Each 5 ng/mL increment of 25(OH)D, and 1 MET increment of CRF was associated with a 16.0% and 31.3% lower prevalence of MetSyn, respectively. **CONCLUSION:** There are strong individual and joint associations between CRF, 25(OH)D, and MetSyn. Although these observed associations are cross-sectional, it seems prudent to recommend increased levels of physical activity and vitamin D intake in men with low CRF, vitamin D deficiency, and/or MetSyn.

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Effect Of Fitbit Alone Compare To Fitbit And Kinesiology-Dietitian Counseling In Sedentary Men: Preliminary Report

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(No relevant relationships reported)

The scientific literature has shown increased data on the FitBit ambulatory self-monitoring device but little is known about its effects on sedentary adult men. **PURPOSE:** The purpose of this pilot study was to evaluate the impact of FitBit-HR2 (G1) and FitBit-HR2 with kinesiology - Dietitian counseling (G2) on the number of steps taken per day. **METHODS:** 12 sedentary men aged between 18-35 yld were asked to wear a Fitbit watch for 60 days. Six men using FitBit (mean=25.7±3.2 years old, BMI 21.8±3.7 kg/m^2) were compared to 6 men using FitBit while also receiving kinesiology - Dietitian counseling (mean=27.3±5.0 years old, BMI 25.2±8.3 kg/m^2) in their respective ecological environments. The participants in G2 received four 60-minute individual counseling sessions. **RESULTS:** Both groups appear to have significantly increased the number of steps they take per day during the study. Participants in G1 took 5838.9±1035.0 steps on average at week 1 and 9029.0 ± 2529.4 steps at week 7 (Cohen's d = 1.65; p<0.001). Participants in G2 took 3708.2±1340.2 steps on average at week 1 and 8942.9±4456.6 steps at week 7 (Cohen's d = 1.59; p<0.01). While G2 mean Steps difference (week 7-week 1) is bigger than that of G1, it is too early to suggest that counseling sessions combine with FitBit had an increased value. **CONCLUSION:** It appears that using a self-monitoring ambulatory device

by itself is likely to help sedentary men to increase the step per day number. Future research should involve more sedentary men and women of all ages to help conclude the impact of either FitBit alone and FitBit and counseling.

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Heart Rate Characteristics for Male Chinese College Students of Different PA-Level during 3000 Meters Running

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PUPPOSE: To explore the Heart Rate load variation for male Chinese college students of different physical activity level during 3000 meters running, providing a reference for training load monitoring and security.
METHODS: Real-time heart rate of 475 Chinese undergraduate students in Tsinghua University were test with Team 2 Polar tester during 3000-meter-run test. The physical activity was investigated by an international questionnaire. All subjects were grouped three by PA levels. Data calculated by SPSS 20.0.
RESULTS: 1. There were significant difference in heart rate among students with different levels of physical activity during 3000-meter-run. The mean of maximum heart rate in group with lower PA level was the highest 202.4±8.9, while that of the group with good PA level was the lowest 198.7±6.4($P<0.05$). 2. The heart rate has relation to the time during 3000-meter-run. The average speed of first three laps has a significant linear relationship to the average heart rate($R=0.875$). The heart rate reached a plateau in the last four laps. The heart rate of all reached the maximum in the end of test. 3. The maximum heart rate of 20% individual students reached or exceeded the summit value of maximum heart rate (220-age), and continued for a several minutes within a relatively dangerous range.
CONCLUSIONS: Mean of maximum and average heart rate of Chinese male college students with good PA level group was lower than that of poor PA level group in 3000-meter-run test. There is a high risk factor for poor PA level Chinese male students when running continuously in the maximum heart rate level. Study was supported by The Chinese General Administration of sports (2015B075)

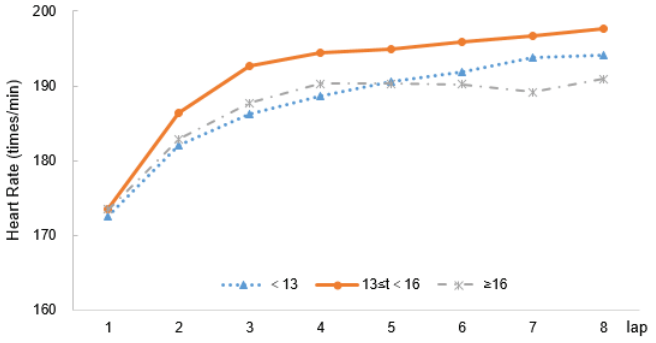

Fig. 1 Mean of heart rate for different PA levels during 3000 meter running

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Monitor Type: Participant Evaluations of Two Types of Activity Tracking Devices during a Walking Intervention

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Commercial physical activity tracking devices have gained popularity both in the lay population and in research settings, however; research examining the effectiveness of commercial physical activity monitors has been mixed. One potential factor to the mixed results may be participants' perceptions and preferences of the type of activity monitor. **PURPOSE:** The purpose of the study is to investigate usage and adoption issues as well as the perceived impact for two types of activity trackers. **METHODS:** A 2-arm randomized trial was used to compare the influence of type of data engagement on activity with two types of activity monitors: 1) a hip accelerometer (New Lifestyles 1000) (n = 19) requiring manual logging (MANUAL) and 2) a wrist accelerometer (Fitbit Charge 2) (n = 19) with digital logging (DIGITAL). Participants wore the activity trackers for four weeks with instructions to attempt to meet daily step goals. At the end of the study they completed an online questionnaire evaluating their experiences with the activity trackers. The open-ended question responses for each participant were analyzed qualitatively by a content analysis. Meaning units (n = 166) from responses were coded and organized into categories and sub-categories. **RESULTS:** For both MANUAL and DIGTIAL groups, the top identified categories regarding the perceived impact of the devices were 1) awareness of daily activity patterns (n = 28), 2) influenced motivation (n = 15), and 3) enhanced intuitive understanding of activity (n = 14). Differences between groups were found in prominent themes related to usage and adoption. The MANUAL users identified three themes equally: 1) concern about security of device while wearing (n = 8), 2) issues with ease of wearability (n = 8), and 3) positive experiences (n = 8). The DIGITAL users identified top themes: 1) no issues (n = 8) and usability problems (n = 8) equally, and 3) questioning accuracy (n = 6). **CONCLUSION:** Participants in both groups identified similar themes related to the impact of the devices indicating the both types of trackers were found to be perceived similarly impactful. Differences emerged in usage and adoption. Users of both types of trackers identified negatives and positives to tracker type indicating the importance of matching tracker type with personal preferences to maximize usage.

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The Downfall of Sitting: The Relationship between Sedentary Time and Blood Pressure

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(No relevant relationships reported)

One third of the population is affected by hypertension, and previous research has shown that sitting for extended amounts of time can be detrimental to a person's health. **PURPOSE:** The purpose of this study was to evaluate the correlation between self-reported sitting time and blood pressure. It was hypothesized that sedentary time was significantly related to blood pressure. **METHODS:** The study included faculty or staff that were ambulatory and full-time equivalent. The participants were given a self-reported physical activity questionnaire (The International Physical Activity Questionnaire [IPAQ]) to determine sedentary time. Resting blood pressure (systolic and diastolic) was assessed using a stethoscope and sphygmomanometer, after sitting quietly in a chair for 5 minutes. Data was analyzed with a bivariate correlation test. **RESULTS:** There was a significant, positive, moderate relationship between sedentary time and systolic blood pressure (n = 10, r = .705, p = .01) and a significant, positive, strong relationship between sedentary time and diastolic blood pressure (n = 12, r = .810, p = .001). **CONCLUSION:** Self-reported sedentary time was positively related to blood pressure. In other words, the greater the individual's sitting time, the higher the systolic and diastolic blood pressure was found to be. Engaging in physical activity and reducing sedentary time may decrease the likelihood of developing hypertension. Future research should focus on the effects of programming to decrease sedentary time on measures of health.

1999 Board #155 May 30 3:30 PM - 5:00 PM

Self-Reported Sedentary Behavior Is Associated With Total, Visceral, And Segmental Body Fat In Adults

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Regional body fat deposition, particularly visceral fat, may be an important mechanistic link between sedentary behavior and cardiometabolic disease risk with advancing age. **PURPOSE**: To examine the associations of sedentary behavior and screen time with total, visceral, and segmental body fat in middle to older aged adults. **METHODS**: 47 adults (mean±SD: age 53.5±11.2 y; body fat 30.5±10.6%; men 38.3%) self-reported sedentary behavior and moderate-to-vigorous physical activity (MVPA) using the Sedentary Behavior Questionnaire and International Physical Activity Questionnaire, respectively. Leisure screen time was defined as television viewing, video games and computer games. Total, visceral, and segmental body fat were estimated with the InBody770 bioelectrical impedance analyzer. Waist circumference was measured at the top of the iliac crest. Multiple regression assessed the associations of sedentary behavior and screen time with total and regional fat distribution, controlling for age, sex and MVPA. **RESULTS**: Average sedentary time was 7.5±2.3 $h \cdot d^{-1}$ with 1.3±0.9 $h \cdot d^{-1}$ reported as screen time. Sedentary time was associated with total fat mass (R^2=0.19, β=0.33, p=0.02), visceral fat (R^2=0.20, β=0.31, p=0.03), trunk fat (R^2=0.17, β=0.36, p=0.01), waist circumference (R2=0.23, β=0.39, $p<0.01$) and leg fat (R^2=0.24, β=0.30, p=0.03) independent of age and sex. When MVPA was added to the model total fat mass (R^2=0.20, β=0.30, p=0.04), trunk fat (R^2=0.17, β=0.34, p=0.03) and waist circumference (R^2=0.25, β=0.36, p=0.01) remained significant. Screen time was associated with trunk fat (R^2=0.13, β=0.30, p=0.04) and waist circumference (R^2=0.23, β=0.38, $p<0.01$) independent

of age and sex, with the association of trunk fat attenuated after accounting for MVPA. **CONCLUSIONS**: Our findings suggest self-reported sedentary behavior is independently associated with the accumulation of excess total body fat, visceral fat, and fat within the trunk and legs in middle to older-aged adults. However, the association between sedentary behavior and visceral fat is attenuated by MVPA, indicating MVPA may be important for preventing the accumulation of visceral fat. Our findings also suggest total sedentary behavior is more strongly associated with regional fat deposition than screen time in this sample.

2000 Board #156 May 30 3:30 PM - 5:00 PM

Knowledge of Heart Disease and Indices of Physical Activity in Health and Non-Health Based Majors

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(No relevant relationships reported)

Cardiovascular disease (CVD) is the leading cause of mortality and is associated with modifiable lifestyle factors, such as physical activity (PA). Research has examined CVD knowledge (CVDK) and PA level in undergraduate students; however, no research has examined the relationship between CVDK and PA in this group. **PURPOSE**: To examine differences in CVDK and indices of PA between sex and major (health (HB) or non-health (NHB) based) and potential associations between CVDK and PA. **METHODS:** Students (N=241) completed an online survey including the 30-item Heart Disease Knowledge Questionnaire and 7-item International Physical Activity Questionnaire. Twenty-four outliers were removed prior to statistical analyses (n=217; 21.1±2.7 yrs; 145 females, 141 HB majors). Independent samples t-tests were conducted to test for differences in total (TK), dietary (DK), epidemiological (EK), medical (MK), risk factor (RFK), and symptom (SK) knowledge, as well as weekly frequency and duration of moderate PA (MPA), vigorous PA (VPA), and total MET-min/week of MVPA between sex and major. Alpha was adjusted for multiple comparisons. Pearson's r was used to test for linear associations between TK and PA indices. **RESULTS**: Sixty-seven percent of students met recommended PA guidelines with a minimum of 500 MET-min/week of MVPA. Females had greater RFK than males (4.6±1.6 vs. 4.0±1.6, p=0.006). HB majors had significantly higher TK (18.4±5.0 vs. 15.3±5.3, p<0.001), DK (3.7±1.7 vs. 3.1±1.9, p=0.007), EK (2.8±1.1 vs. 2.4±1.2, p=0.006), MK (4.4±1.5 vs. 3.3±1.4, p<0.001), and RFK (4.6±1.6 vs. 3.9±1.5, p=0.002) than NHB majors. There were no significant differences in SK between majors (p>0.05). Males reported significantly higher levels of MVPA than females (2300.7±2377.7 vs. 1441.9±1348.6 MET-min/week, p<0.01). There were no associations between TK and any PA index (p>0.05). **CONCLUSION**: HB majors had greater knowledge than NHB majors in all areas except SK; however, there were no differences in PA levels between majors. This suggests that CVDK may not translate to increased PA levels in undergraduates. Future research should investigate relationships between CVDK and risk reduction behaviors in this population.

2001 Board #157 May 30 3:30 PM - 5:00 PM

Association Between Objectively Measured Body Fat Percentage And Two Indirect Measures Of Adiposity

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(No relevant relationships reported)

Body mass index (BMI), calculated using height and weight, is used clinically to diagnose obesity. The ability of BMI to estimate adiposity is limited in the general population and unknown in college aged individuals. Relative fat mass (RFM) has been proposed as an alternative technique to BMI for diagnosis of obesity. RFM accounts for mass stored in the lower portion of the torso by incorporating height and waist circumference into the equation. **PURPOSE:** The purpose of this study was to compare rates of obesity determined by BMI, RFM and objectively measured percent body fat (BF%) via bioelectrical impedance analysis (BIA) in a large cohort of college aged men and women. **METHODS:** 3804 college students completed an objective fitness assessment, where they self-reported their age and sex, and height, weight, waist circumference, and BF%, were assessed. Correlation and chi-square tests for independence analyses examined the relationships and differences in rates of obesity between each method. **RESULTS:** The mean age of the sample was 21.2±1.1, and the majority (n = 2406, 63%) identified as male. Significant correlations were found between BMI and BF% for men (r=0.79, p<0.001) and women (r=0.84,p<0.001); BMI and RFM for men (r= 0.85, p<0.001) and women (r=0.83,p<0.001); and, BF% and RFM for men (r= 0.74, p<0.001) and women (r= 0.76,p<0.001). Differences were found between the observed and expected classification of normal adiposity or obesity by BMI, RFM and BF% for men and women (for all p<0.001). Among men, comparing BF% vs. BMI and RFM vs. BMI, more obese men via BF% or RFM were classified as normal via BMI (BF%; χ^2=665, p<0.001; RFM; χ^2=1189, p<0.001). For women, comparing BF% vs. BMI and RFM vs. BMI, more women who were obese via %BF and RFM were classified as normal via BMI (%BF χ^2=576,p<0.001; RFM χ^2=108, p<0.001). Comparing RFM and BF%, more men and women classified as obese by RFM were considered normal by %BF (χ^2=626, p<0.001; χ^2=246.5, p<0.001). **CONCLUSION**: Strong associations are observed among BMI, RFM and objectively measured %BF in college students. Despite these strong relationships, discrepancies were observed between obesity classifications between BF%, BMI and RFM.

2002 Board #158 May 30 3:30 PM - 5:00 PM

Physical Activity and Health Habits Among Emergency Medical Technician Students

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Of the recognized emergency medical service professionals, the least is known about EMTs and EMT students. One known study suggests that EMT-B students have some level of predisposition to conditions such as high blood pressure, low exercise tolerance, obesity, and poor health-habit decision-making with regard to tobacco and alcohol use. **PURPOSE:** To determine the prevalence of health risk, physical activity and sedentary behaviors among students enrolled in an Emergency Medical Technician Certification Program. **METHODS:** Sixty EMT students (mean age 24.9 ± 8.3 years, 46.7% female, 98.4% Caucasian) completed risk behavior surveys including physical activity, health status, smoking, and alcohol use modeled after the Centers for Disease Control and Prevention (CDC) Behavioral Risk Factor Surveillance System (BRFSS) and a Modifiable Activity Questionnaire (MAQ) to assess leisure-time physical activity and sedentary behavior. **RESULTS:** The median (25^{th}, 75^{th} percentile) METmin/week of self-reported physical activity from the MAQ for all participants was 558 (228, 1074) and by gender 660 (246, 1074) males and 480 (375, 1098) females. When categorized as meeting or not meeting the current US Physical Activity Guidelines, 56.7% met or exceeded the ≥ 500 METmin/week guideline. Median BMI for all participants was 25.6 (22.9, 30.1) kg/m^2 with approximately 28.3% of the population considered overweight and 25% obese. Among reported health conditions, 41.7% rated their general health as very good or excellent; 20.0% percent reported being diagnosed with asthma and 16.7% reported being diagnosed with a depressive disorder. With regard to smoking and alcohol, 11.7% reported currently smoking, 15.0% reported current use of chewing tobacco or snuff and 43.3% reported ever vaping or using an e-cigarette. Additionally, participants reported a mean (standard deviation) of 4.4 (4.6) days per month of drinking at least one drink of alcohol and drinking 2.5 (2.4) drinks when they drank. **CONCLUSION:** Among EMT students, over half are meeting the current US Physical Activity Guidelines. Prevalence of overweight/obesity, smokeless tobacco use, and reported depression may put this population at risk for comorbid conditions as they transition from student to professional EMT.

2003 Board #159 May 30 3:30 PM - 5:00 PM

Accelerometer-determined Sedentary Time And Physical Activity Across Standard Occupational Categories In CARDIA

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PURPOSE High accumulated sedentary time with inadequate physical activity is a common behavioral profile in the United States. Examining differences in activity patterns across occupational categories can distinguish target populations for intervention.
METHODS This cross-sectional analysis of Year 20 CARDIA data (2005-6) included participants who had valid accelerometry data (≥4 days with ≥10 hours), reported job and job duties, and were not currently a student (n=2,050). Uniaxial accelerometry data (ActiGraph 7164), including leisure and occupational time, were expressed in 60 second epochs and summarized as: average counts per minute (CPM) and time spent (hours/day) in total sedentary behavior (SED), light physical activity (LPA), and moderate-to-vigorous physical activity (MVPA) using Freedson cutpoints. Self-reported job and job duties were categorized into the 23 major groups of 2010 Standard Occupational Classification (SOC) using Occucoder v2.7 followed by adjudication by a trained researcher. Military and forestry categories were excluded because <5 participants reported jobs in those categories. Omnibus group differences were analyzed using ANCOVA adjusted for sex, race, age, education, wear time, center, and BMI.
RESULTS Table 1 shows the least and most favorable three SOC groups in each activity category with mean (standard error) reported. P-values represent overall group

difference across occupational categories. Building/grounds maintenance had the highest CPM while office and admin support had the lowest. Architecture/engineering had the highest SED while food preparation had the lowest. Food preparation had the most LPA and legal had the least. Construction had the highest MVPA while healthcare support had the lowest.
CONCLUSION Activity patterns have large variation across occupational categories, justifying occupation as an important determinant of activity and the workplace as a potential intervention setting.

Table 1 – Occupational Categories with the Least and Most Favorable CPM, SED, LPA, and MVPA

	Least favorable 3 categories	mean (SE)	Most favorable 3 categories	mean (SE)	p-value
CPM	Office and Administrative Support	338.2 (7.6)	Food Preparation and Serving	416.6 (19.9)	
	Healthcare Support	341.7 (27.3)	Construction and Extraction	425.3 (17.7)	≤0.001
	Architecture/Engineering	351.0 (20.9)	Building/Grounds Maintenance	428.4 (22.3)	
SED (hrs/d)	Architecture/Engineering	9.18 (0.22)	Personal Care and Service	7.58 (0.16)	
	Legal	9.07 (0.21)	Building/Grounds Maintenance	6.88 (0.24)	≤0.001
	Computer/Mathematical	9.03 (0.15)	Food Preparation and Serving	6.64 (0.21)	
LPA (hrs/d)	Legal	3.83 (0.14)	Personal Care and Service	4.79 (0.11)	
	Computer/Mathematical	3.86 (0.10)	Healthcare Support	4.87 (0.19)	≤0.001
	Arts/Entertainment/Sports/Media	4.00 (0.10)	Food Preparation and Serving	5.25 (0.14)	
MVPA (hrs/d)	Healthcare Support	0.45 (0.08)	Life/Physical/Social Sciences	0.71 (0.05)	
	Office and Administrative Support	0.50 (0.02)	Building/Grounds Maintenance	0.72 (0.06)	0.0479
	Community and Social Service	0.52 (0.05)	Construction and Extraction	0.73 (0.05)	

CPM=counts per minute; SED=total sedentary behavior; LPA=light physical activity; MVPA=moderate-to-vigorous physical activity

2004 Board #160 May 30 3:30 PM - 5:00 PM

Association Between Cardiorespiratory Fitness And Continuous Cardiometabolic Syndrome Risk Score In Korean Men

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PURPOSE: We examined the hypothesis that cardiorespiratory fitness (CRF), defined as maximal oxygen uptake, predicts the risk of incident cardiometabolic syndrome (CMS) defined as having ≥3 relevant risk factors and is prospectively associated with continuous CMS risk score in healthy men. **METHODS:** Participants were 2,742 Korean men who underwent general health examinations and had no evidence of CMS, cardiovascular diseases, diabetes, and hypertension at baseline. Baseline CRF was directly measured by peak oxygen uptake (VO_{2peak}) and divided into quartiles. Incident CMS was defined as participants having ≥3 CMS components, and continuous CMS risk score was computed as the sum of z-score of five risk factors at follow-up. **RESULTS:** During a median follow-up of 5 years, 946 (34.5%) men developed CMS. The relative risks (RR) and 95% confidence interval (CI) of incident CMS in the highest quartile (>38.1 ml.kg.min) vs. the lowest quartiles of peak oxygen uptake (<31.8 ml.kg.min) was 0.62 (95% CI: 0.52-0.75) after adjusting for age, body mass index, smoking and alcohol intake. Baseline peak oxygen uptake was independently associated with continuous CMS risk score at follow up after adjusting for covariates (ß=-0.092, p<0.001). **CONCLUSION:** The independent association between CRF and incident CMS and continuous CMS risk score, suggesting that improving CRF should be considered as an additional risk factor to predict the future likelihood of CMS in Korean men.

2005 Board #161 May 30 3:30 PM - 5:00 PM

Differential Impacts Of Exercise Systolic Blood Pressure Response On The Risk Of Sudden Cardiac Death In Men With And Without A History Of Cardiovascular Disease

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PURPOSE: Although exercise systolic blood pressure (ESBP) response has been associated with different prognosis in men with and without known or suspected coronary artery disease, it remains unclear whether ESBP is associated with an increase or a decrease in the risk of sudden cardiac death (SCD) in both groups. We tested the hypothesis that ESBP would be associated with differential outcomes of SCD in men with and without a history of cardiovascular disease. **METHODS**: This prospective study was based on a population sample of 2,410 men, aged 42-61 years, who were followed up in the Kuopio Ischemic Heart Disease cohort study. Excessive ESBP was defined by a maximal SBP ≥210mmHg during progressive bike exercise testing to volitional fatigue. Participants were stratified by men with (n=884) and without (n=1,526) a history of cardiovascular disease at baseline. **RESULTS**: During a median follow-up of 25 years, 226 SCDs occurred. After adjusting for age, each 10 mmHg increase in ESBP was associated with an increased or decreased risk for SCD in men without (HR=1.14, 95% CI 1.06-1.24) and with (HR=0.94, 95% CI 0.89-0.99) a history of cardiovascular disease, respectively. After adjusting for age, BMI, resting SBP, smoking, alcohol intake, LDL-C, HDL-C, family history of heart disease, diabetes, and maximal oxygen uptake, an increased risk of SCD was observed with excessive ESBP response in men without a history of cardiovascular disease (HR 1.73, 95% CI 1.07-2.82). A trend for a reduction in the SCD risk was observed with excessive ESBP response in
men with history of cardiovascular disease (HR 0.92, 95% CI 0.60-1.41).
CONCLUSION: Our findings indicate that ESBP response was associated with the risk of SCD in both groups. However, the heightened risk of SCD associated with excessive ESBP response appeared in men without a history of cardiovascular disease, whereas excessive ESBP response may have opposite results in men with a history of cardiovascular disease.

2006 Board #162 May 30 3:30 PM - 5:00 PM

Moderators Of The Relationship Between Worksite Walkability And Physical Activity

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Purpose: This study examined traditional and novel moderators (i.e., age, sex, race, income, # of children <18 yrs, ratio of cars to drivers, home walkability) of the relationship between worksite neighborhood walkability (WNW) and physical activity (PA).
Methods: Participants (n = 512, mean 44 yrs, 59% female, 70% White) were employed (not at home) during the baseline phase of a larger trial. Measures included self-reported PA (total min/week, min/week of transport-PA inside (TPAin) and outside (TPAout) the home neighborhood; NPAQ) and Actigraph-measured PA (min/week moderate-to-vigorous PA in bouts [MVPA] and sedentary-light PA [SLPA]). GIS-assessed WNW (500m network buffer of residential, intersection, and transit densities; land use mix). Negative binomial regression estimated associations of WNW with PA, each moderator, and WNW x moderator (i.e., age, sex, race, income, # of children <18, car:driver ratio, home walkability) interactions. Alpha level set at 0.10 to probe conditional effects. Main effects of covariates (residence tenure, distance to work, reason moved to residence, total household members; and in accelerometer models, wear time) were included.
Results: Sex and # of children <18 yrs moderated relationships of WNW with MVPA and SLPA. Race moderated the relationship of WNW with TPAout. For women, the conditional effect of WNW on MVPA was positive (p = .04) while the conditional effect of WNW on SLPA was negative (p = .04); effects not different from zero for men. For adults with no children <18, the conditional effect of WNW on MVPA was positive (p = .01) while the conditional effect of WNW on SLPA was negative (p = .01); not different from zero for those with at least 1 child. For White participants, the conditional effect of WNW on TPAout was negative (p = .07); not different from zero for non-Whites. No other moderators (age, income, car:driver ratio, or home walkability) interacted with WNW.
Conclusions: For women, adults without young children, and Whites (but not men, those with young children, and non-Whites), PA is influenced by walkability of worksite environments in mostly expected directions. An underexplored aspect of behavioral ecological models is identifying who is sensitive to the environmental conditions that can bolster health promotion efforts.

2007 Board #163 May 30 3:30 PM - 5:00 PM

Association of Leisure Time Physical Activity and Back Pain in Brazilian adults

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Leisure time physical activity (PA) may reduce the risk of back pain. A recent meta-analysis found that moderate to high PA during leisure time protects against low back pain by up to 16%. However, there is no study investigating this association in a developing country like Brazil (the biggest nation in Latin America).
PURPOSE: To investigate the association of leisure time PA and back pain in adults from the Brazilian National Health System (NHS).
METHODS: Data were obtained from 557 adults (410 women) enrolled in the Brazilian NHS in 2016. Participants were 50 years or older, registered for at least

one year in the NHS, and received at least one medical visit in the past six months. Leisure time PA was estimated using the Baecke questionnaire. Participants were classified according to tertiles of PA score: active, moderately active and insufficiently active. Presence of back pain was assessed through standardized questionnaire about health condition. Binary logistic regression was used to estimate values of odds ratios (ORs) and 95% confidence intervals (95% CIs). Reference group was the bottom tertile. Health status, sociodemographic and behavioural covariates were potential confounders.
RESULTS: In overall sample, mean age was 69.0 ± 8.40 years, 214 (38.4%) were physically active, 189 (33.9%) were moderately active and 154 (27.6%) were insufficiently active. Back pain was present in 344 (61.8%) adults. In the adjusted model, physically active participants were less likely to have back pain when compared to insufficiently active group (OR: 0.59; 95%CI = 0.36 to 0.95).
CONCLUSION: In this sample, leisure time PA was inversely associated with the presence of back pain.
Supported by São Paulo Research Foundation (FAPESP) Grant 2015/17777-3 and 2016/11140-6.

2008 Board #164 May 30 3:30 PM - 5:00 PM

Agreement Between Measured BMI and Reported BMI Obesity Definitions in a Brazilian Civil Servants

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Body mass index (BMI) is a worldwide used method for obesity identification. It is an easy and low-cost method recommended for large samples assessment. Concerns exit regarding the risk of misclassification when BMI is calculated based on reported height and weight as compared to the measured height and weight for BMI calculation. **PURPOSE:** We compared the prevalence of obesity categorized by measured BMI (m-BMI) and reported BMI (r-BMI) among Brazilian civil servant. **METHODS**: We evaluated 398 randomly selected volunteers (42.2% men), aged 44.8±8.7 yrs, m-BMI: 25.6±4.7 kg/m^2, from a federal labor court. Volunteers reported weight and height in a health questionnaire without knowing that they would be subsequently measured in an anthropometric scale (Welmy-RI W200). Both m-BMI and r-BMI were calculated using the Quetelet formula: BMI = (weight in kg)/(height in m^2). Obesity was defined as BMI ≥30.0 kg/m^2. Due to lower sensitivity among women, a BMI ≥29.0 kg/m^2 alternative cut-off point was also tested. Agreement analyses was done considering m-BMI as reference, using following indices: 1) total agreement (TA) as the sum of the percentage of true positive and true negative values (TA=TP+TN); 2) sensitivity = [TP / (TP+FN)] X 100, were FN is false negative; 3) specificity = [TN /(TN+FP)] X 100. All indices were calculated as their point value and 95% interval of confidence (95%IC). **RESULTS:** Agreement indices are shown on Figure 1. When the 29.0 kg/m^2 cut-off point was used in the r-BMI, we found a much higher sensitivity (88.2%) with small reductions on TA (-1.4%) and specificity (-3.1%). **CONCLUSION**: We observed very high agreement between r-BMI as compared to m-BMI in the total sample and among men. The accuracy of r-BMI to identify obesity among women was lower than among men, probably affected by its lower prevalence. Using the 29.0 kg/m^2 alternative cut-off point for women resulted on a sensitivity as good as in men. r-BMI also showed to be a highly specific method to exclude obesity.

Figure 1. Agreement between measurement BMI (kg/m^2) and reported BMI in Brazil civil servant (n= 398)

			Measurement BMI ≥30 kg/m^2 Yes	No	Total
			N (%)	N (%)	N
Reported BMI ≥30 kg/m^2	Yes	N (%)	55 (94.8%)	3 (5.2%)	58
	No	N (%)	10 (2.9%)	330 (97.1%)	340
	Total	N	65	333	398

MEN AND WOMEN
Agreement: 96.7% (95%CI 94.5–98.1)
Sensitivity: 84.6% (95%CI 73.9–91.4)
Specificity: 99.1% (95%CI 97.4–99.7)

MEN (n= 168)
Agreement: 98.2% (95%CI 94.9–99.4)
Sensitivity: 90.3% (95%CI 75.1–96.6)
Specificity: 100.0% (95%CI 97.3–100.0)

WOMEN (n= 230)
Agreement: 95.7% (95%CI 92.2–97.6)
Sensitivity: 79.4% (95%CI 63.2–89.6)
Specificity: 98.5% (95%CI 95.6–99.5)

2009 Board #165 May 30 3:30 PM - 5:00 PM

The Overwatch League: A Pilot Study of Professional Video Gamers

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A pilot study of professional video gamers reveals the presence of subclinical cardiovascular disease
PURPOSE:
Sedentary behavior in contemporary society is typically coupled with extended screen time (i.e. hours spent in front of a television / computer screen). In November 2016, the commercial video game developer, Blizzard Inc.™, announced the creation of the Overwatch League (OWL), an international e-gaming association built on the model of a traditional professional sports league.
The purpose of this pilot study was to establish the feasibility of a larger project and to evaluate for the presence of subclinical pathology in members of the OWL team representing Boston.
METHODS:
The members of the Boston Uprising (n=10, age=20±2) were tested using electrocardiography, cardiac imaging (echocardiography), vascular function testing (applanation based tonometry) and multiple neurocognitive tests (testmybrain.org). Additionally, a questionnaire was administered that obtained information on health history as well as gaming history of the young subjects.
RESULTS:
All participants were in their first season of professional e-gaming and reported e-game screen time exposure of 54±14 hours/week over the last 12 months with <1 day/month with complete freedom from screen time. Cardiovascular health metrics derived from the study document evidence of subclinical cardiovascular disease. Specifically, 50% of the subjects had either pre-hypertension (n=4, SBP >120 mmHg) or hypertension (n=1, SBP>140 mmHg) Additionally, 40% of the subjects measured in the 80th percentile for age and height in measured vascular stiffness (assessed by pulse wave velocity).
CONCLUSION:
This study demonstrates the feasibility of onsite data collection in an OWL team and suggests the presence of subclinical cardiovascular disease in these young individuals. Larger scale study is planned, and confirmation of the findings would indicate that this group of young individuals requires attention to cardiac risk factor modification and may benefit from a regular exercise routine being incorporated into their 'training.' These findings may have a public health impact given the large number of sedentary Americans with high amounts of screen time.

2010 Board #166 May 30 3:30 PM - 5:00 PM

Age-related Health State Over European Countries: The Context May Be The Difference

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The age-related life quality in aged population has been widely reported in literature including muscular functioning and self-reported health state. The EQ-5D-5L questionnaire is widely used at population level and comprises five dimensions including mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Grip strength and walking ability are known to be associated with muscular functioning and activities of daily living. Little research has exanimated the differences throughout European countries. **Purpose**: this study aimed to investigate the relationship between the health state and health predictors, among elderly from 4 different European countries [Portugal (PT), Italy (IT), Bulgaria (BL) and Hungary (HU)]. **Methods**: 324 (81 PT, 119 IT, 76 BL and 48 HU) older adults (68,9±6,3 yrs, 73,6±12,7 Kg, 1,61±0,08 m), male (24%) and female (76%), were recruited from local population. The subjects completed the EQ-5D-5L and were assessed as handgrip test (HandT), 6 minutes walking test (6MW). EQ-5D-5L index (EQ_index) was calculated to assess the quality-adjusted life years (QALYs). ANOVA was performed to detect country group differences. Pairwise comparisons was executed with Tukey post hoc test and Cohen D. Pearson coefficient of correlation was used to assess relationship between determinants. Significance was set at p<0.05. **Results**: Pairwise comparisons showed that BL has lower scores than HU, IT and PT in EQ_index (differences ranged between -17% to -28%, p<0.05, d=0.80 to 1.30), HandT (differences ranged between -29% to -69%, p=0.000; d=2.60 to 3.98); and 6MW (differences ranged between -72.33% to -82%, p=0.000; d=4.58 to 12.03), for both sexes. In all counties the EQ_ index was moderately and positively correlated with HandT (r=0.453; p=0.000) and 6MW (r=0.533; p=0.000). However the pattern was not cross-country homogeneous, as HU showed lowest correlations (r=0.124; p=0.400; 6MW, r=-0.016; p=0.913).

Conclusions: Different environments promote different life quality in aged population. BL evidences poorer quality of life and fitness status than other European countries. HU seems to well promote healthy life style. Further investigation is need to better understand the present findings.

2011 Board #167 May 30 3:30 PM - 5:00 PM

Impact Of Physical Activity On N-glycan Profile In Older Adults

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The biological mechanisms underlying the beneficial effects of regular physical activity (PA) on prevention of chronic diseases are not fully understood. It is currently suggested that N-linked enzymatic glycosylation, a post-translational modification modulating the biological function of several proteins, may contribute to disease development. Nevertheless, the influence of PA on N-glycans in humans has never been explored. **PURPOSE:** To explore serum N-glycan profile in a sample of community-dwelling older women with different objectively assessed PA levels and metabolic risk status. **METHODS**: Components of the metabolic syndrome (MetS) and serum N-glycans analyzed using DSA-FACE technology were assessed in 109 older community-dwelling women (65-70 yrs). Ten peaks, each representing a unique N-glycan structure were detected. Adherence to PA guidelines was determined using accelerometry. Participants daily engaged in 30 minutes of MVPA were classified as meeting PA guidelines.
RESULTS: Significant differences in N-glycan peaks were indicated when comparing women adhering to the PA guideline to those less active: when adjusted by MetS, a 12% ($p = 0.006$) and a 13% ($p = 0.004$) lower level of NA3 (peak 8) and NA4 (peak 10), respectively, were evident among the physically active women compared to those less active. In contrast to findings based on the MVPA threshold, no differences in N-glycan peaks were observed between PA groups when based on the lower intensity threshold, which may indicate that the influence on N-glycan levels by PA is intensity-sensitive.
CONCLUSIONS: Adherence to PA guidelines is related to a favorable N-glycan profile, regardless of metabolic risk status. This proposed effect on N-glycans only occurs above the moderate PA-intensity threshold. Our findings support the promotion of a physically active lifestyle as a supporting non-pharmacological public health approach.

D-62 Free Communication/Poster - **Protein Metabolism**

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

2012 Board #168 May 30 2:00 PM - 3:30 PM

Post-exercise Cooling Impairs Muscle Protein Synthesis Rates In Healthy Young Males

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Protein ingestion and cooling are strategies employed by athletes to improve post-exercise recovery and, as such, to facilitate muscle reconditioning following exercise. However, whether post-exercise cooling affects postprandial protein handling and subsequent muscle protein synthesis rates during recovery from exercise has not been studied.
Purpose: This study assessed the impact of post-exercise cooling on acute postprandial (hourly) and prolonged (daily) myofibrillar protein synthesis rates during recovery from resistance-type exercise over a 2-week period.
Methods: Twelve healthy, male adults (age: 21±1 y) performed a single session of resistance-type exercise followed by water immersion of both legs for 20 min. One leg was immersed in cold water (8°C: CWI) while the other leg was immersed in thermoneutral water (30°C: CON). After water immersion, a beverage was ingested containing 20 g intrinsically L-[1-^{13}C]-phenylalanine and L-[1-^{13}C]-leucine labelled milk protein with 45 g of carbohydrates. In addition, primed continuous L-[*ring*-$^{2}H_5$]-phenylalanine and L-[1-^{13}C]-leucine infusions were applied, with frequent collection of blood samples and muscle biopsies to assess myofibrillar protein synthesis rates *in vivo* over a 5-h recovery period. In addition, deuterated water ($^{2}H_2O$) was ingested with the collection of saliva, blood and muscle biopsies over 2 weeks to assess the effects of post-exercise cooling with protein intake on myofibrillar protein synthesis rates during more prolonged resistance-type exercise training.
Results: Incorporation of dietary protein-derived L-[1-^{13}C]-phenylalanine into myofibrillar protein was significantly lower in CWI compared to CON (0.016±0.002 vs 0.021±0.002 MPE; P=0.016). Post-exercise myofibrillar protein synthesis rates were lower in CWI compared to CON based upon L-[1-^{13}C]-leucine (0.058±0.003 vs 0.072±0.005%·h^{-1}, respectively; P=0.024) and L-[*ring*-$^{2}H_5$]-phenylalanine (0.042±0.003 vs 0.053±0.004%·h^{-1}, respectively; P=0.025). Daily myofibrillar protein synthesis rates assessed over 2 weeks were significantly lower in CWI when compared to CON (1.48±0.05 vs 1.67±0.11%·d^{-1}, respectively; P=0.042).
Conclusion: Cold-water immersion during recovery from resistance-type exercise impairs myofibrillar protein synthesis rates.

2013 Board #169 May 30 2:00 PM - 3:30 PM

High-Protein Diet in Combination with Resistance Training Improves Performance without Changing Blood Parameters in Rats

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PURPOSE: The effects of consuming a normal or high-protein diet containing isolated whey protein (IWP) in conjunction with resistance training (RT) is little known. This study aimed to determine the effects of IWP on *performance*, biochemical, hormonal and tissue parameters in rats completing a vertical ladder training protocol.
METHODS: Thirty-two 45-day-old male Wistar rats were divided into four groups (n=8/group): normal protein diet (14% IWP) sedentary (NS) and trained (NT); high-protein diet (35% IWP) sedentary (HS) and trained (HT). RT consisted of 8 vertical ladder climbs/3x a week, over 6 weeks. In weeks 1-2, rats carried a load equivalent to 70% of the maximal load, determined by a maximal load test (MLT), performed on the first and last days of training. The load was adjusted to 80% and 85% of the MLT, respectively, every 2 weeks. At the conclusion of the study, the animals were anesthetized and euthanized after 12h of fasting. Quadriceps (Q), anterior tibial, gastrocnemius (G), soleus and long finger extensor, kidneys, liver and heart tissues were excised and weighed (g).
RESULTS: Perfor*mance* values (g) on the last MLT improved in HT (964.8±117.6) compared to HS (730.6±89.7), NT (472.6±72.7) and NS (323.0±63.7). There was no difference in plasma levels of testosterone, IGF-1, hepatic enzymes, creatinine, and β-hydroxybutyrate, as well as hematological parameters. Levels of HDL-c ($p<0.001$) were higher in HT (104.4±26.0) and HS (100.7±21.2) compared to NS (73.9±15.7) and NT (60.8±12.0). There was an observed difference in the relative weights of the kidneys (HS=0.72±0.05, HT=0.70±0.04, > NS=0.58±0.04, NT=0.59±0.02, $p<0.0001$), liver (HT=2.93±0.21 > NS=2.62±0.19, NT=0.59 ± 0.02, $p=0.004$) and heart (HS=0.32±0.02 > NS=0.28±0.02, NT=0.27±0.01, $p=0.003$). In relation to the relative muscle weight of G ($p=0.05$) and Q ($p=0,02$), HT (1.16±0.09; 1.67±0.09) showed higher values in comparison to NT (1.04±0.08; 1.53±0.09).
CONCLUSIONS: A high-protein diet of 35% IWP in combination with RT improved performance as well as increased muscle and organ weight without damaging tissues related to protein metabolism (confirmed by unchanged hematological parameters). This finding may help to minimize the risk of developing cardiometabolic disorders in certain populations.

2014 Board #170 May 30 2:00 PM - 3:30 PM

Satiating Effect Of High Protein Diets On Resistance-trained Individuals In Energy Deficit.

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Short-term energy deficit strategies are employed by weight class and physique athletes to enhance strength:body-mass and body composition during training or prior to competition. During such phases, athletes may consume very high protein intakes to maximise satiety, maintain caloric deficit and minimise lean muscle losses despite

a paucity of research supporting any benefits. **PURPOSE:** To compare the satiating effect of two protein diets on resistance-trained individuals in short-term energy deficit. **METHODS:** Following University ethical approval, 16 resistance-trained participants (age: 28±2years; height: 1.72±0.03m; body-mass: 88.83±5.54kg; body-fat: 21.85±1.82%) were randomly assigned to a moderate (PRO_{MOD}: 1.8 $g \cdot kg^{-1} \cdot d^{-1}$) or high protein ($PRO_{HIGH}$: 2.9 $g \cdot kg^{-1} \cdot d^{-1}$) matched calorie-deficit diet for 7 days in a cross-over manner, including 4-week wash-out. Venous samples were collected (time-points T0, 60, 120mins) for assessment of plasma grehlin and protein YY concentrations to a fixed-protein ($0.7g.kg^{-1}$) meal, along with perceived satiety ratings, following each diet. **RESULTS:** Following PRO_{MOD}, mean grehlin concentration ($pg \cdot ml^{-1}$) significantly reduced post-meal (T0: 972.8±130.4, T60: 659.7±86.4, T120: 613.6±114.3; $p \leq 0.003$ compared to T0). Similar observations were reported for PRO_{HIGH} (T0:1088.2±158.8, T60: 786.6±117.3, T120: 850.6±147.7; $p \leq 0.015$). However, T120 responses differed between conditions, and further confirmed when data were normalised for relative change (PRO_{MOD}: -0.40±0.06, PRO_{HIGH}: -0.26±0.06; p=0.015). PYY concentrations ($pg \cdot ml^{-1}$) increased post-meal across time-points (PRO_{MOD}: 84.9±8.9 to 147.1±11.9 and PRO_{HIGH}: 100.6±9.5 to 143.3±12.0; $p<0.001$), with no differences reported between diets. Perceived 'hunger', 'fullness' and 'satisfaction' were comparable between diets ($p>0.05$). However, 'desire to eat' remained significantly blunted at T120 post-meal for PRO_{MOD} only (p=0.048). **CONCLUSIONS:** PRO_{HIGH} does not confer additional satiating benefits in resistance-trained individuals during short-term energy deficit. Grehlin response to a test-meal support the contention that satiety was sustained with PRO_{MOD}, with implication that high protein meals may be adequate to increase acute satiety when following a PRO_{MOD} energy-restricted diet.

2015 Board #171 May 30 2:00 PM - 3:30 PM

Effect Of Branched-chain Amino Acid Plus Glucose Supplement Timing On DOMS And Related Indicators After Eccentric Exercise

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PURPOSE: Nutrient timing is a strategic approach to maximize training effects, reduce risk of injury, and help with recovery. The present study examined the effect of BCAA plus Glucose on markers of muscle damage and Inflammation after eccentric exercise in male college students.
METHODS: 18 healthy college students were divided into control group (PLA) group and supplement (BCAA+G) group randomly. Each group was randomly assigned 4 people for pre-exercise supplementation and 4 people after exercise for the first time, and changed for the second time. Before or after supplementation, volunteers performed an eccentric exercise protocol. Muscle soreness(VAS), creatine kinase (CK), C-reactive protein (CRP) and interleukin-6 (IL-6) and 3-methylhistamine (3MH) assessments were performed before exercise and after 30min, 24, 48 hours.
RESULTS: The VAS score of the subjects increased significantly 24 hours after high-intensity eccentric exercise(2.86 vs 1.66, p<.05), and the increase of serum CK level(364.45 vs. 151.02U/L), CRP(4.77 vs. 3.28mg/L) and IL-6(279.00 vs. 110.63pg/ml) increased significantly(p<.05); BCAA plus G supplement significantly reduced the VAS score(1.27 vs 2.86, p<.05) and CK(258.74 vs. 364.45U/L), CRP(3.75 vs. 4.77mg/L), IL-6(164.09 vs.279.00pg/ml) levels(p<.05), compared with pre-supplementation group, post-supplementation had lower VAS score(1.27 vs. 2.63), CRP(3.75 vs. 4.26mg/L) and IL-6(164.09 vs. 226.66pg/ml) and 3MH(105.07 vs. 131.67umol/L) response at 24 h after eccentric exercise(p<.05). **CONCLUSIONS**: High-intensity eccentric exercise caused DOMS with the elevation of damage and inflammatory markers as CK, CRP and IL-6. BCAA plus G supplementation can effectively reduce the level of DOMS, decrease muscle damage and inflammatory factors and protein breakdown. Compared with pre-exercise supplementation, post-exercise supplementation has a better effect on reducing inflammatory factors and protein breakdown caused by DOMS.

2016 Board #172 May 30 2:00 PM - 3:30 PM

Acute Effect Of The Order Of Resistance Exercise And Nutrient Intake On Muscle Breakdown

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Combined resistance exercise (RE) and nutrient intake synergistically interacts with muscle hypertrophic effect (MHE) (Phillips et al.,2006). Indeed, muscle breakdown (MB) is suppressed with acute RE and proper nutrient (amino acid + carbohydrate), reflected by decreases in 3-methylhistidine (3-MH), a MB marker in 24h urine collection. The study also suggested that the response of MB marker upon acute RE may reflect MHE in chronic RE training (Bird et al., 2006). However, the effect of the order of nutrient intake and RE on acute MB response remains unclear. Given that MB acutely responds to RE (Louis et al., 2007), it is important to assess acute changes in MB markers upon nutrient intake and RE.**PURPOSE**:The aim of this study was to investigate the effect of the order of nutrient intake and RE on acute changes in urinary MB marker and thus MHE.
METHODS: Twelve healthy men were divided into three conditions: 1) nutrient intake before RE condition (Pre), 2) nutrient intake after RE condition (Post), and 3) RE without nutrient intake condition (No). They performed 5 types of multiple RE at 70%RM intensity. In all conditions, RE was performed from 8:30 to 9:30. The time of nutrient intake in the Pre was at 7:00, while in the Post was at 9:30. The standard Japanese lunch menu with 21 g of whey protein and 200 ml of milk (total energy, 1019 kcal; Protein, 53.4 g; fat, 25.1 g; carbohydrate, 139.5 g) was provided. Urinary samples were collected at 7:00, 10:00, 12:00, 15:00, and 18:00, and urea nitrogen (UN), creatinine (Cre), and 3-MH concentrations were measured, and 3-MH and UN, were normalized by Cre.**RESULT**: The acute responses of MB markers were validated by the result that the time-course change in the total amount of UN and UN normalized by Cre were consistent at any given time point. The area under the curve (AUC) of 3-MH was significantly higher in Pre than that in No ($P < 0.01$). There was no significant difference between Post and No in the AUC of 3-MH. The AUC of UN was significantly higher in Pre than that in Post ($P < 0.05$) and No ($P < 0.01$).
CONCLUSION: These results suggest that nutrient intake before RE may have no substantial MHE.Supported by Grant-in-Aid for Scientific Research from the Japanese Ministry of Education, culture, Sports Scientific, and Technology (Grants 26702029 and 15KK0358).

2017 Board #173 May 30 2:00 PM - 3:30 PM

Different Amounts Of Protein Intake Influence Body Composition And Performance In Elite Cyclists

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PURPOSE: The ideal amount of protein intake for endurance athletes has been poorly investigated. The aim of our study was to evaluated the physiological impact of different dietary protein intakes on body composition and performance outcomes in a group of elite cyclists. **METHODS**: Thirty-four elite cyclists (1600-1800 km/month) participated to the study. Subjects were divided in 4 groups with different levels of protein intake: normal (NP, 1.2 g/kg), moderate (MP, 1.6 g/kg), high (HP, 2.0 g/kg) or very high (VHP 2.4 g/kg)protein for 8 wk. In the diets fats were maintained constant whilst energy from carbohydrate and protein was modified to maintain an isocaloric diet. Body composition was assessed via Dual X Ray Absorptiometry (DXA) and via ultrasound to calculate cross sectional area (CSA) of the anterior thigh. VO_2max, peak power output and 1 RM half squat test were also performed.
RESULTS: After two months both HP and VHP showed a significant improvement of 1 RM (HP pre 133±14 Kg vs post 141±12 Kg, p<0.001; VHP pre 137±12 Kg vs post 144±11 Kg, p<0.001), PPO (HP pre 505±78 W vs post 534±67 W, p<0.001; VHP pre 512±55 W vs post 541±76 W, p<0.001), and VO_2max (HP pre 62.1±5.8 mlO_2/Kg vs post 64.5±5.9 mlO_2/Kg, p<0.001; VHP pre 61.2±5,5 mlO_2/Kg vs post 64.1±7,6 mlO_2/Kg, p<0.001), without differences between groups. There were no significant changes of 1 RM and VO_2max for both NP and MP whilst NP showed a significant decrease of PPO. Both HP and VHP showed a significant increase of lean body mass (LBM) (HP pre 64.72±1.9 Kg vs post 65.99±2.2 Kg, p<0.001; VHP pre 65.52±2.0 Kg vs post 67.61±1.7 Kg) whilst both NP and MP showed a significant decrease (NP pre 63.31±2.1 Kg vs post 62.4±2.3, p<0.05; MP pre 66.88±1.8 Kg vs post 65.80±2.9). HP and VHP showed a significant increase of anterior thigh CSA (HP pre 50.5±7.8 cm^2 vs post 53.4±6.7 cm^2, p<0.001; VHP pre 51.2±5.5 cm2 vs post 54.1±7.6 cm2). No chnages of blood values are detected.
CONCLUSIONS: Our data suggest that an higher protein intake (2.0 and 2.4 g/Kg) may help elite cyclists to improve performance and to increase muscle mass without differences between the two levels of protein intake. Instead 1.2 and 1.6 g/Kg of protein seemed to be not sufficient and could impair performance and muscle mass.

2018 Board #174 May 30 2:00 PM - 3:30 PM

The Association Between The Number Of Meals With Adequate Protein Intake And Maximal Deadlift Strength

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PURPOSE: To analyze the association between the number of meals with adequate protein intake and maximal deadlift strength in college athletes.
METHODS: We evaluated 250 (107 women) college athletes previous to a national contest. Maximal strength was assessed with one repetition maximum (1RM) on deadlift and was adjusted for body mass (kg lifted weight/kg body mass). The protein intake per meal was assessed with 24-h dietary recalls. The reported protein intake was expressed as absolute (g) and relative (g/kg body mass). Adequate protein intake per meal was deemed as ≥20 g and ≥0.3 g/kg. Next, we calculated the number of meals that achieved these thresholds and were grouped as ≤1, 2, 3, ≥4 meals for each criterion. Then, 1RM was compared between groups with and without adjustment for covariables (age [years], lean body mass [kg, bioelectrical impedance], height [cm], sex, relative protein intake [g/kg/d]) for each criterion.
RESULTS: For ≥20 g criterion, the ≥4 meals group showed significantly higher 1RM than ≤1 group for the unadjusted model. When it was corrected for age, lean body mass, height, and sex, it remained significant. However, the differences were no longer significant when the model was also adjusted for relative protein intake. As the model was adjusted, the number of meals decreased their contribution to the model. The same pattern was observed with the ≥0.3 g/kg criterion (Table).
CONCLUSIONS: The number of meals with adequate protein intake is associated with higher deadlift 1RM. However, its importance decreased when were adjusted for relative protein intake. Therefore, the association between protein intake and deadlift 1RM could be mediated by total relative protein intake, and the number of meals with adequate protein intake could serve as a strategy to eat more protein rather than playing a "timing" role.

Table. Comparison of maximal deadlift strength by number of meals with adequate protein intake.

≤1		Number of meals with adequate protein intake				p	$R^{2§}$	R^{2}#
		2	3	≥4				
20 g/meal	n	52	73	91	34			
	1 RM (kg/kg)*	1.35 ±0.055 a	1.52 ±0.047 ab	1.57 ±0.042 b	1.60 ±0.069 b	0.008	0.047	0.047
	1 RM (kg/kg) †	1.36 ±0.055 a	1.49 ±0.044 ab	1.56 ±0.041 b	1.62 ±0.099	0.020	0.04	0.204
	1RM (kg/kg) ‡	1.43 ±0.063	1.51 ±0.046	1.54 ±0.043	1.52 ±0.108	0.586	0.008	0.218
0.3 g/kg/meal	n	56	78	86	30			
	1 RM (kg/kg)*	1.34 ±0.053 a	1.53 ±0.045 b	1.55 ±0.043 b	1.69 ±0.072 b	0.001	0.067	0.067
	1 RM (kg/kg) †	1.40 ±0.051 a	1.49 ±0.043 ab	1.49 ±0.043 ab	1.71 ±0.092 b	0.032	0.036	0.188
	1RM (kg/kg) ‡	1.49 ±0.061	1.52 ±0.044	1.46 ±0.044	1.57 ±0.106	0.621	0.007	0.211

Data expressed as mean ±standard error. Different letters denote significant differences between groups (p<0.05). 1RM: One repetition maximum (kg of weight lifted/kg body mass). * Unadjusted model. † Adjusted for age, lean body mass, height, and sex. ‡ Adjusted for age, lean body mass, height, sex, and relative protein intake. § R^2 for number of meals within the model. # R^2 for the model.

2019 Board #175 May 30 2:00 PM - 3:30 PM

Correlation Between Dietary Protein Intake And Grip Strength In Inactive Vegetarian And Vegan Females

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(No relevant relationships reported)

More than 5% of U.S. adults 18-35 y self-identify as vegetarian or vegan. While health benefits, including reduced risk for cardiometabolic diseases are promoted, concern remains over the potential of lower protein intake, which can lead to reduced muscle mass and strength.
PURPOSE To examine the relationship between dietary protein and grip strength in inactive vegetarian and vegan female adults.
METHODS Thirty-three self-reported inactive (<150min exercise/wk) female vegetarians and vegans (31y±9.6; n=23 vegan) of at least 1 year were recruited for this study. A 24hr dietary recall was administered by a trained researcher and protein intake calculated using Food Processor software. Dominant handgrip strength was measured 3 times using a handheld dynamometer, and greatest score recorded. An *a priori* α of 0.05 was used and partial Pearson Product Moment correlation was determined between protein intake and grip strength when controlling for diet type (vegetarian vs. vegan). Independent samples t-tests were conducted to compare protein intake and grip strength in vegetarians vs. vegans.
RESULTS Results showed significantly greater grip strength in vegans (26.7±4.7 kg) as compared to vegetarians (23.5±2.9 kg), t(2.046) $p<.050$, and no difference in protein intake between groups t(-.368) $p=.716$. Results show no correlation between protein intake (43.7±15.2 g PRO/d) and grip strength (25.7±4.4 kg) while controlling for diet type ($r(30)=.118$, $n=33$, $p=.520$). It is noteworthy that mean grip strength in the sample was significantly below the reference value for North American females (31 kg).
CONCLUSION This study provides evidence that there was no significant association between protein intake and grip strength in inactive female vegetarians; yet, the grip strength for this population fell significantly below region/gender-specific reference ranges.

2020 Board #176 May 30 2:00 PM - 3:30 PM

Combining Whey Protein Isolate with Eccentric Training Improved Quadriceps Strength in Patients with ACL Rupture

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Anterior cruciate ligament (ACL) rupture results in significant quadriceps weakness, which will then cause abnormal gait and knee instability. Eccentric training (ET) can produce larger effects on muscle strength than concentric training[1], which may be further augmented by protein supplement[2]. **Purpose** To examine the effects of combining whey protein supplement with preoperative isokinetic ET on quadriceps strength and function after ACL rupture. **Methods** Thirty-seven male subjects aged 18-40 years with ACL rupture were randomly assigned to isokinetic ET (IET, N=19) group or isokinetic ET with whey protein isolate (IET+WP, N=18) group. Both groups received preoperative isokinetic ET for six weeks, containing 3-4 sets per day with 8-10 repetitions for each set, twice a week. Subjects in IET+WP consumed whey protein isolate 22 g per day. Cross-Sectional Area (CSA) of quadriceps was scanned by MRI, and strength and knee function were measured before and after the trials. **Results** After intervention, CSA of the involved quadriceps increased by 3.7% (NS) in IET and 7.6% (P=0.012) in IET+WP. The ratio of side-to-side increased by 3.9% (NS) in IET and 4.8% (P=0.002) in IET+WP. The peak torque of quadriceps during eccentric contraction at 60 degree/s, concentric contraction at 60, 180 and 300 degree/s increased by 27.9% (P<0.001), 35.9% (P<0.001), 34.3% (P=0.002) and 27.3% (P=0.003) in IET, and increased by 44.2% (P<0.001), 42.3% (P<0.001), 37.4% (P=0.002) and 36.7% (P<0.001) in IET+WP, respectively, with no differences between the two groups. Lysholm and IKDC2000 knee function score in IET+WP increased by 24.7% (P=0.001) and 12.9% (P=0.001). **Conclusions** Combining whey protein supplement with ET tends to be more effective on improving CSA of quadriceps, knee function and quadriceps strength when compared to ET alone after ACL rupture, even though the results did not reach statistical differences. **References** [1]. Douglas, J., et al., 2017. [2]. Cermak, N.M., et al., 2012. Supported by The National Key Research and Development Program (No.2016YFD0400603)

2021 Board #177 May 30 2:00 PM - 3:30 PM

The Effect of Protein Supplementation on Recovery From Exercise-Induced Muscle Damage

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The Effect of Protein Supplementation on Recovery From Exercise-Induced Muscle Damage

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Macronutrient consumption is a crucial component to recovery from vigorous physical activity. Specifically, carbohydrates and protein play a substantial role in recovery from strenuous physical activity. **PURPOSE:** To determine whether or not a carbohydrate plus protein (CHO-P) supplement (containing branched chain amino acids) invoked improved recovery from exercise-induced muscle damage (EIMD) when compared to an isocaloric carbohydrate (CHO) only control supplement, while simultaneously controlling for diet. **METHODS:** Twenty resistance-trained college males (22.1±3.9 yrs, 176.0±6.9 cm, 84.2±17.6 kg) participated in a ten-day, double-blind, randomized trial. Subjects consumed a provided diet (60±5% carbohydrate, 25±4% fat, 15±3% protein) and a daily supplement of 60 g carbohydrates or 40 g carbohydrates plus 20 g protein for eight days. On the fifth day, subjects completed a 100-box jump EIMD protocol. Measures of creatine kinase and myoglobin were obtained prior to EIMD and at 12, 24, 48, and 72 hours post exercise. Muscle soreness and lower body muscle force production were measured pre-EIMD and at 24, 48, and 72 hours post-EIMD. **RESULTS:** Creatine kinase levels (U/L) were elevated at 12 (227.1±18.5), 24 (216.1±17.0), 48 (189.6±18.3), and 72 (168.1±18.0) hours post-EIMD when compared to baseline (121.4±15.2). Myoglobin levels (ng/mL) were elevated at 12 (60.4±56.6) hours post-EIMD when compared to baseline (8.745±6.3). Although the elevations in creatine kinase and myoglobin indicate that EIMD was produced, there were no significant differences in creatine kinase or myoglobin between CHO and CHO-P groups at any time points measured. Although muscle soreness was increased at all time points post-EIMD, there were no significant differences between the CHO and CHO-P conditions. In addition, there were no significant differences in lower body muscle force production between the CHO and CHO-P conditions. **CONCLUSION:** These data suggest that a CHO-P supplement does not elicit greater recovery from EIMD when compared to a CHO supplement alone.

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Associations Among Dietary Protein Intake, Physical Activity, and Muscle Quality in Young Adults

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It is well established that moderate-vigorous intensity physical activity (MVPA) and resistance training (RT) positively influence muscle capacity and quality and health across the lifespan. Dietary protein intake is also known to influence muscle health. Data suggest that MVPA, RT, and dietary protein intake differ in young men and women, which may impact muscle capacity and quality; however, research in recreationally active young adult cohorts is lacking. **PURPOSE**: The aim of this study was to determine the associations between dietary protein intake quantity and source and muscle capacity (MC) and quality (MQ), controlling for MVPA and RT, in young men and women. **METHODS**: Young adults (n=122; 18-22 yr; 54% female) were assessed for a) total, animal and plant protein intakes via 3-day diet recall with analysis by Nutrition Data Systems for Research software; b) body composition via DXA scans, and c) knee extensor muscle strength (MC-S) and power (MC-P) via isokinetic dynamometry and Nottingham leg extensor power rig, respectively. Muscle quality was calculated as strength (MQ-S) and power (MQ-P) relative to leg lean mass. MVPA was determined using accelerometry and RT was determined from questionnaire. **RESULTS**: Compared to females, males ingested more animal protein when normalized per body weight, as a percentage of total kcal, and as a percentage of total protein intake (all $p<.05$). Males also had more lean mass and greater MC-S, MC-P, and MQ-S than females (all $p<.05$); however, there was no sex difference in MVPA, RT, or MQ-P (all $p>.05$). Additionally, males had a significant relationship between total protein, total animal protein, and total plant protein intake and MC-S whereas females did not. Controlling for sex, MVPA, and RT, higher total dietary protein and total animal protein intake were associated with greater MC-S ($r = .29$ and .25, respectively, both $p<.05$). Higher relative animal protein intake was positively related, whereas higher relative plant protein intake was inversely related to MQ-P (both $p<.05$). **CONCLUSIONS**: This data suggests that young adult males and females differ in their dietary protein intake patterns. Moreover, dietary protein intake is modestly related to muscle capacity and quality with effects being stronger in males compared to their female counterparts.

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Association of Protein Intake at Three Meals With Muscle Mass in Healthy Young Subjects

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(No relevant relationships reported)

PURPOSE: In addition to importance of total daily protein intake for regulation of muscle mass, protein intake over 0.24 g/body weight (BW) from each meal may be necessary to maximize postprandial muscle protein synthesis in young population. Therefore, we hypothesized that if individuals do not achieve protein intake over 0.24 g/BW at least one of three meals (breakfast, lunch, and dinner), muscle mass can be decreased. This cross-sectional study examined the association of protein intake at three meals with muscle mass among healthy young subjects. METHODS: We collected 3-day dietary records to evaluate dietary intake. We calculated total fat free mass (FFM) and appendicular (AppFFM) with dual-energy X-ray absorptiometry, and TotalFFM% and AppFFM% were also calculated as FFM relative to BW. The 266 subjects were categorized into two groups: AP group, achieving over 0.24 g/BW of protein intake at all three meals; or NP group, not achieving 0.24 g/BW of protein intake at least one meal. RESULTS: There was no linear association between total protein intake above the recommended dietary allowance (RDA) and both TotalFFM% and AppFFM%. Consequently, we examined the association of protein intake at three main meals with muscle mass in subjects consuming total daily protein intake above the RDA. Regardless of potential confounders (e.g. sex, physical activity, and energy intake), we demonstrated that TotalFFM% (77.0 ± 0.5 vs $75.2 \pm 0.4\%$, $P = 0.008$) and AppFFM% (34.7 ± 0.3 vs $34.1 \pm 0.2\%$, $P = 0.058$) in AP group was greater than in NP group consuming total protein intake above the RDA.CONCLUSION: This finding suggests that even if individuals achieve total protein intake above the RDA, not achieving protein intake over 0.24 g/BW at least one meal may lead to decreased muscle mass in young population. This work was supported by the Japanese Council for Science, Technology and Innovation (SIP, Project ID 14533567), and the grant "Technologies for creating next-generation agriculture, forestry and fisheries" (funding agency: Bio-oriented Technology Research Advancement Institution, NARO).

2024 Board #180 May 30 2:00 PM - 3:30 PM

Effects Of Soy Milk Ingestion On Running Anaerobic Sprint Test (RAST) Performance

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PURPOSE: Pre-exercise feeding is crucial in ensuring individuals are well-fuelled and able to perform at high intensities. Soy protein supplementation have shown to improve performance and recovery, in endurance or resistance exercises. However, there is sparse research on its effects in the repeated anaerobic sprint test (RAST) which is a valid and reliable method in measuring anaerobic capacity. The purpose was to investigate the effects of soy milk ingestion on anaerobic performance using the RAST. **METHODS**:10 males (age: 23.2 ± 1.23 years, height:174.3 ± 5.84 cm, weight: 65.39 ± 6.44 kg) participated in the study. They performed two RAST with a soy milk intervention (SOY: 500mL soy milk + 4g stevia sweetener) and a placebo control (CON: 500 mL water + 4g stevia sweetener) over a 7-day period. The RAST consisted of six 35 m sprints with 10 seconds recovery between each sprint; sprint times, heart rate (HR), rating of perceived exertion (RPE), hunger and fullness, blood glucose and lactate levels, mean power output (MP) and fatigue index (FI) were measured. **RESULTS**: The total effort time(seconds) was not significant between SOY (32.77 ± 1.23) and CON (33.28 ± 1.71), $p = 0.179$. FI in SOY (31.64 ± 5.20) was significantly lower than CON (37.30 ± 5.70), $p = 0.023$. MP (Watts) (Soy: 499.27 ± 62.72; Con: 486.39 ± 86.13, $p = 0.410$) and relative power output (Watts)(Soy: 9.34 ± 1.02; Con: 9.55 ± 1.51, $p = 0.461$) were not significant. No significance were found between trials for the peak blood lactate (PBL) ($mmol.L^{-1}$) (Soy: 9.75 ± 1.61; Con: 10.24 ± 1.90, $p = 0.488$) and peak blood glucose (PBG) ($mmol.L^{-1}$) (Soy: 23.94 ± 3.90; Con: 25.09 ± 4.61, $p = 0.497$) levels. PBL ($r = - 0.654$) and PBG ($r = - 0.662$) concentrations were inversely associated with MP in the SOY trial. No significance were found in mean HR (SOY: 111 ± 40.43; CON: 112 ± 38.69, $p = 0.448$) and median RPE ($p = 0.391$) between both trials. There were no significant differences in the ratings for hunger ($p = 0.844$) and fullness ($p = 0.853$) between both trials. **CONCLUSIONS**: The soy milk intervention in RAST significantly lowered the FI, but had no significance in any of the variables investigated. The significant decrease in FI and earlier peak lactate levels post-exercise may indicate the possibility of soy milk reducing fatigue. Future studies are required to examine the ergogenic effects of soy milk.

2025 Board #181 May 30 2:00 PM - 3:30 PM

Effects Of Menstrual Cycle On Branched-chain And Aromatic Amino Acids During Endurance Exercise In Female Athletes

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Cyclic fluctuations in ovarian hormone (estrogen and progesterone) levels that play an important role in reproductive function are a unique characteristic of adult women. However, these changes in ovarian hormone levels affect physical and mental condition. Previous studies have reported that levels of branched-chain amino acids (BCAA) and aromatic amino acids (AAA) in the blood are related to fatigue. **PURPOSE**: This study investigated the effects of the menstrual cycle on the concentration of BCAA and AAA during endurance exercise and the recovery period in female athletes. **METHODS**: Seven eumenorrheic female athletes (lacrosse players; age, 21.7 ± 0.5 years; height, 157.4 ± 5.1 cm; weight, 52.7 ± 4.6 kg), who usually exercised 4 h/day, 5 days/week, were recruited. Subjects performed endurance exercise on a cycle ergometer for 60 min at 65% of their VO_2peak, measured in a preliminary trial, during the follicular phase (FP) and luteal phase (LP) of their menstrual cycles. After exercising, subjects rested in a chair for 60 min and their post-exercise recovery was observed. Blood samples were taken: pre-exercise (0 min); 30 min after the start of exercise (30 min); 45 min after the start of exercise (45 min); immediately post-exercise (60 min); 30 min post-exercise (90 min); and 60 min post-exercise (120 min). Levels of estradiol, progesterone, BCAA (valine, leucine, isoleucine), and AAA (tyrosine, phenylalanine) in the blood were assessed. The Fischer ratio(BCAA/AAA) was calculated using the following formula: BCAA/AAA = (valine + leucine + isoleucine)/(tyrosine + phenylalanine). **RESULTS**: Estradiol and progesterone levels were significantly lower in the FP than in the LP (estradiol: 40.2 ± 15.4 pg/mL vs. 170.8 ± 75.2 pg/mL, $p<0.01$; progesterone: 0.5 ± 0.1 ng/mL vs. 11.3 ± 6.5 ng/mL, $p<0.05$). The Fischer ratio significantly decreased from exercise initiation to exercise conclusion during both phases (FP: 3.6 ± 0.4 (0 min), 3.2 ± 0.3 (60 min), $p<0.05$; LP: 3.6 ± 0.4 (0 min), 3.3 ± 0.6 (60 min), $p=0.05$); however, no significant differences were observed between the FP and LP. **CONCLUSION**: No differences in the levels of BCAA and AAA in the blood were observed between the FP and LP of the menstrual cycle pre-, during, or post-exercise.

D-63 Free Communication/Poster - Cognition and Emotion

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

2026 Board #182 May 30 2:00 PM - 3:30 PM

Semantic Memory fMRI in Healthy Older Adults After Acute Exercise and Rest

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An extent literature suggests that regular participation in long-term exercise enhances cognitive function. However, less is known about the beneficial effects of acute exercise on semantic memory.
PURPOSE: This study investigated brain activation during a semantic memory task after a single session of exercise in healthy older adults (ages 55-85) using functional magnetic resonance imaging (fMRI). **METHODS**: We used a within-subjects counterbalanced design where 26 participants (ages 55-85) underwent two experimental visits on separate days. During each visit, participants engaged in 30 minutes of rest or stationary cycling exercise immediately prior to performing recognition of Famous names and Non-Famous names during fMRI scanning. **RESULTS**: There were no significant differences in the Famous Name Task (FNT) response time (RT) or accuracy after exercise and rest. Acute exercise was associated with significantly greater semantic memory activation (Famous > Non-Famous) in bilateral middle temporal gyrus, right cerebellum, and left fusiform gyrus. A post-hoc analysis showed significantly greater activation in the bilateral hippocampus after exercise compared to rest. **CONCLUSIONS**: Greater brain activation following a single session of exercise suggests that exercise may increase neural processes underlying semantic memory activation in healthy older adults. These effects were localized to the known semantic memory network, and thus do not appear to reflect a general or widespread increase in brain blood flow. Coupled with our prior exercise training effects on semantic memory-related activation, these data suggest the acute increase in neural activation after exercise may provide a stimulus for adaptation over repeated exercise sessions.

2027 Board #183 May 30 2:00 PM - 3:30 PM

The Effects of Continuous and Interval Exercise on Cognitive Performance in Young Adults

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(No relevant relationships reported)

Exercise has been shown to increase cognitive performance. However, there are few studies that have compared exercise types to determine different effects. **PURPOSE:** The purpose of the present investigation was to compare changes in cognitive function after two different forms of work matched exercise. **METHODS:** The participants were 22 healthy college age males. Participants were randomly assigned an order of treatment consisting of work matched continuous (CONT) and interval exercise (INT) protocols. The continuous exercise treatment consisted of 20:24 min of 50% VO_2max on the cycle ergometer. The interval exercise treatment consisted of 6 cycles of 2:00 min 40% VO_2max and 1:00 min 90% VO_2max on the cycle ergometer for a total of 18 minutes. Pre and post exercise blood samples were collected to quantify brain-derived neurotrophic factor (BDNF) and participants completed a battery of assessments on the CogState software platform. The cognitive function battery exam included tests of reaction skills, memory skills, psychomotor skills, visual attention, working memory, and spatial working memory. Additionally, blood pressure was continuous measured during the 2 hours post exercise using a non-invasive finger cuff system. **RESULTS:** Repeated measures ANOVA analysis did not reveal any difference in serum BDNF levels by time ($F=0.237$, $p=0.629$; pre: 388.9±196.4, post: 464.3±222.4) or treatment by time ($F=0.896$, $p=0.349$). Non-parametric analysis of cognitive data revealed significant ($p<0.02$) changes in attention (identification speed test) in both CONT and INT (baseline: 460.6±69.3 sec, post CONT: 513.8±99.2 sec, post INT: 504.5±85.6 sec). For the executive function (Groton's maze) only the INT resulted in a significant increase ($p<0.01$) from baseline (baseline: 48.2±11.7, post INT: 38.4±13.8). There were significant correlations between systolic blood pressure during recovery for both INT and CONT and improvements in executive function (CONT $r=0.567$, $p<0.01$; INT $r= 0.570$, $p<0.01$). **CONCLUSION:** It appears that both CONT and INT exercise promote some increases in cognitive function related to elevated recovery systolic blood pressure and independent of serum BDNF. Moreover, INT exercise may increase executive function more that aerobic exercise, though more investigation into this effect is warranted.

2028 Board #184 May 30 2:00 PM - 3:30 PM

The Effects Of A 30-min Moderate Aerobic Exercise On Autonomic And Inhibitory Control - ERP Study

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(No relevant relationships reported)

PURPOSE: The current study aimed at exploring whether inhibitory control would be changed after a 20-min bout of moderate cycling exercise plus 5-min warm-up and 5-min cool-down. The study hypothesized that subjects who demonstrated greater high frequency heart rate variability (HF-HRV) reactivity (i.e. larger HF-HRV decrease) under a mental stress evoked by a Stroop color-word test, would perform better on the Stroop tasks after acute aerobic exercise. **METHODS**: 40 young male adults (age=21.3 +/- 2.1 yrs. old) were randomly assigned to either an exercise intervention or no exercise (control) condition. Participants of intervention were asked to engage in a 20 min cycling exercise at 60%VO_{2max}, while computerized Stroop color-word test was conducted before and after the cycling to examine the acute effects of aerobic exercise on inhibitory control. HRV was measured during the Stroop tasks by using the Electrocardiogram (ECG), which was recorded via two bipolar electrodes that were placed on the left and right chest of the participants. The electroencephalogram (EEG) signal was recorded continuously from a 32 scalp electrodes arranged according to the International 10-20 system. The EEG data was re-referenced offline to average of mastoid electrodes, and bandpass filtered at 0.1 to 20 Hz. Target-locked ERP analysis was restricted to the frontocentral midline electrodes (Fz, Cz, Pz) as Stroop interference effect were known to be maximum at the midline.
RESULTS: Two-way repeated measures MANOVA showed significant Intervention X Time interaction on Stroop interference at Pz location ($p < 0.03$). Meanwhile, significant Intervention X Time interaction on HF-HRV differences was revealed between the exercise intervention and control groups on the Stroop tasks ($p < 0.01$). Exercise group performed significantly lower score on Stroop interference and lower HRV reactivity at post-test than the control group ($p < 0.05$). Lower scores reflecting more adaptive response and enhanced cognitive performance.

CONCLUSIONS: A 30-min acute moderate aerobic exercise could elicit inhibitory control for young adults. The studies manifested the potential physiological mechanism between central nervous system and autonomous nervous system which were reflected by HRV index.

2029 Board #185 May 30 2:00 PM - 3:30 PM

Aerobic and Muscular Fitness Associations with Adolescent Cognitive Control

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Purpose: Physical activity supports greater cardiorespiratory fitness (CRF); a correlate of cognitive control. The relation of muscular fitness (MF) and cognitive control are less clear. The present study investigated the differential relationship of CRF and MF with cognitive control in older adolescents; a population subjected to social and academic stressors.
Methods: Students (15-17 years, N = 289, 122 females) from ten secondary schools completed tests of inhibition, working memory (WM), CRF (PACER), and MF (standing long jump, push-ups).
Results: Stepwise regression analyses accounted for demographic factors in step 1, and either CRF or MF in step 2. CRF predicted flanker response accuracy (RA) and reaction time (RT) across congruency conditions (β's $\geq$ 0.14, p's $<$ 0.05). In the 1-back WM task, CRF predicted greater RA, greater d', and shorter non-target RT (β's $\geq$ 0.15, p's $<$ 0.05). In the 2-back WM task, CRF predicted greater non-target RA and d' (β's $\geq$ 0.14, p's $\leq$ 0.05). Comparatively, MF only predicted 2-back target accuracy (β = 0.14, p = 0.02). Follow-up 3-step regressions assessed significant outcomes from the 2-step models to account for the contrasted fitness variable in step 2, and the fitness variable of interest in step 3. CRF remained a significant predictor for most cognitive outcomes (β's $\geq$ 0.17, p's $\leq$ 0.05). However, with MF entered in step 2, CRF marginally predicted incongruent flanker RA and 1-back non-target accuracy (β's $\leq$ 0.16, p's $\geq$ 0.06), and no longer predicted greater 2-back d' (β = 0.11, p = 0.20). Comparatively, MF marginally predicted 2-back target accuracy with CRF accounted for (β = 0.12, p = 0.09).
Conclusion: MF was unrelated to cognitive performance, especially with CRF included in the model. CRF's predictability of WM decreased with MF accounted for, particularly during conditions requiring greater WM demands. CRF was generally related to faster processing speed and greater RA during a task modulating inhibitory demands, suggesting that increased CRF may improve cognition via modulation of older adolescents' inhibitory control. Such findings highlight physical activity's value in aiding cognition underlying older adolescents' academic performance.
Project funded by the National Health and Medical Research Council (APP1120518).

2030 Board #186 May 30 2:00 PM - 3:30 PM

Cortical Activation during Walking While Smartphone Texting: a Dual Task Based fNRIS Study

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BACKGROUND: Previous studies demonstrated that gait performance was decreased when walking while performing a cognitive task such as texting on a smartphone, which reflects a cognitive-motor dual-task interference. The neural bases of the interference are not well studied.**PURPOSE**: To investigate the cortical activation during a dual task of walking while smartphone texting in young healthy adults using the functional near-infrared spectroscopy (fNIRS). **METHODS**: In a crossover study design, 39 right-handed college students (21.3 ± 2.5 years, 46.1% females) randomly undertook the following three task conditions separated by a minimum of 48 hours: smartphone texting only (T task), walking only (W task), and dual task of smartphone texting while walking (TW task). Cortical oxygenation during the three tasks was monitored using a 38-channel fNIRS (NIRx Medical Technologies LLC, USA). Walking was conducted on a treadmill with a speed of 2.0 km/hour. Texting task was performed with a typing APP on a smartphone. **RESULTS**: There was no significant difference in texting speed between T task and TW task (71.7 ± 10.4 vs. 71.0 ± 12.9 chars/min, P > 0.05). Texting enhanced hemodynamic response in frontopolar area (eg, $Ch1_{T\ task\ vs.\ W\ task}$, 1.10±1.93 vs. -0.12±0.14 a.u, P < 0.01; $Ch1_{TW\ task\ vs.\ W\ task}$ 0.89±1.05 vs. -0.12±0.14 a.u, P < 0.01) dorsolateral prefrontal cortex (e.g., $Ch6_{T\ task\ vs.\ W\ task}$,0.24±0.43 vs. -0.15±0.42 a.u, P < 0.01; $Ch6_{TW\ task\ vs.\ W\ task}$ 0.21±0.33 vs. -0.15±0.42 a.u, P<0.01) and Broca's area (e.g., $Ch35_{TW\ task\ vs.\ W\ task}$ 0.99±0.81 vs. 0.47±0.75 a.u, P < 0.01). In addition, W task evoked an increased activation in temporopolar area (e.g., $Ch8_{T\ task\ vs.\ W\ task}$ 0.04±0.12 vs. 0.75±1.30 a.u, P < 0.01) and superior temporal gyrus (e.g., $Ch15_{T\ task\ vs.\ W\ task}$ 0.22±0.64 vs. 0.76±0.84 a.u, P < 0.01) than T task. There were no significant differences in those regions between T task and TW task. **CONCLUSIONS**: The findings indicated that walking on a low speed requires less cognitive resources from the prefrontal cortex, while the temporal lobe is involved. When walking while texting on a smartphone, the brain areas (temporopolar area and superior temporal gyrus) involved in gait were activated, and areas in prefrontal cortex were also activated. Thus, more cognitive resources were allocated to smartphone texting during the dual task.

2031 Board #187 May 30 2:00 PM - 3:30 PM

Can Repeated Bouts Of Exercise Improve Equally Post-exercise Inhibitory Control As Single Bout Of Exercise?

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PURPOSE: We previously demonstrated that post-exercise improvements of inhibitory control (IC) are associated with increase in exercise volume (Tsukamoto et al. Med Sci Sports Exerc. 2017). Previous studies reported that repeated bouts of moderate-intensity exercise (Repeated), which is performed with a short rest interval during exercise program, may be a useful strategy in improving metabolic function, potentially by enhancing lipid metabolism compared with volume-matched single bout of moderate-intensity exercise (Single) (Goto et al. J Appl Physiol. 2007). However, it remains unknown whether Repeated would be effective in improving post-exercise IC. In this study, we compared the effect of Repeated and Single on post-exercise IC. **METHODS**: Fifteen healthy men (age: 20.6 ± 0.4 years) performed Repeated and Single in randomized order. The Repeated was consisted of twice moderate-intensity cycling exercise (60% $VO_{2\ peak}$) for 20 min which was separated by a 20-min sitting rest, while the Single was performed for 40 min without rest. To evaluate IC, the Stroop task was administered before exercise, immediately after exercise, and every 10 min during the 30-min post-exercise recovery period. At the same time points, blood was collected for glucose and lactate measurement, and psychological arousal level was assessed by the felt arousal scale. **RESULTS**: The exercise-induced increase in mean arterial pressure was significantly lower in Repeated than in Single ($P < 0.05$), but not heart rate and ratings of perceived exertion. Psychological arousal level in post-exercise recovery did not differ significantly between the two conditions. Similarly, there were no significant differences for blood glucose and lactate immediately after exercise and post-exercise recovery between conditions. IC was significantly improved immediately after both Repeated and Single ($P < 0.05$), but it did not differ significantly between two conditions. **CONCLUSION**: The present findings suggest that Repeated can similarly elicit IC improvements as Single.

2032 Board #188 May 30 2:00 PM - 3:30 PM

The Differential Relationships Between Physical Activity and Adiposity with Cognitive Function in Preadolescent Children.

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PURPOSE: To identify the effects of adiposity and a physical activity (PA) intervention on cognitive and neuroelectric indices of inhibitory control in preadolescent children. **METHODS:** Children were randomly assigned to either a 9-month afterschool physical activity (PA) or a wait-list control (CON) group. Children completed a task that manipulated inhibitory control at pre- and post-test while measures of task performance and the P3-event related potential (ERP) were assessed. Children were further grouped according to weight category. 76 children with obesity (39 PA; 37 CON) completed testing. A sample of normal weight children (NW) (n=76) were matched to the sample of children with obesity based on treatment allocation and demographic variables of age, sex, IQ, SES, and fat-free VO_2max. Changes in adiposity measures included whole body percent fat (%Fat), subcutaneous abdominal adipose tissue (SAAT), and visceral adipose tissue (VAT). The influence of physical activity and adiposity on task performance and brain function was examined. **RESULTS:** Children in the PA group decreased %Fat from pre- to post-test (p=.011); an effect not observed in the CON group. Children in the CON group gained SAAT and VAT from pre- to post-test (p's≤0.001), whereas children in the PA group did not. The PA group showed larger P3 amplitude from pre- to post-test (p=.026); an effect not seen in the CON group. P3 amplitude did not differ between groups at pre-test for children with obesity; however, the PA group demonstrated larger P3 amplitude compared to the CON group at post-test (p=.006). Children with obesity in the CON group had smaller P3 amplitude at post-test compared to pre-test (p=.003), an effect not seen in NW children. Results suggest that physically inactive children with obesity

have increased adiposity and smaller P3 amplitude over 9 months. Furthermore, results suggest that a PA intervention may be particularly beneficial for children with obesity, as they showed increased P3 amplitude from pre- to post-test. **CONCLUSION:** PA is beneficial for brain function in pre-adolescent children, especially in those with obesity. Given that childhood obesity is a public health concern with an array of health complications, these results have important implications for the physical and cognitive health of children.

2033 Board #189 May 30 2:00 PM - 3:30 PM

Association of School Day Segmented Physical Activity with Children's Physical and Cognitive Health

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Purpose: Around 32% of children are overweight or obese and do not meet the 60-minute moderate-to-vigorous physical activity recommendation (MVPA; SHAPE America, 2016). Given that physical activity is highly variable between children across the school day and during specific segments (CDC, 2013), it is unclear which segmented MVPA during school contributes the most physical and cognitive health benefits. This study aimed (1) to investigate associations between time spent in MVPA during recess, lunch, physical education (PE), and physical fitness components (BMI, cardiorespiratory and muscular fitness), as well as cognitive health, respectively; and (2) to test the indirect effect of segmented MVPA on cognitive health through physical fitness among 8-9 years old children.
Methods: Participants were 340 8-9 years old children (M_{age} = 8.40, SD = 0.49) recruited in the southwest region of the U.S. Time spent in MVPA during recess (RE_MVPA), lunch (LU_MVPA) and PE (PE_MVPA) segments were measured by accelerometers across five school days. The FITNESSGRAM® test battery was used to assess physical fitness components including PACER, curl-up, push up, and BMI. Children's cognitive health was measured by also the 6-item PedsQL™ Cognitive Functioning Scale (Varni et al., 2011).
Results: The time spent in MVPA during recess was positively associated with physical fitness (cardiorespiratory and muscular fitness; r = .27, r = .40, p < .01) and had low, but positive correlation with cognitive function (p < .05). Both cardiorespiratory (r = .26, p < .01) and muscular fitness (r = .12, p < .05) were significantly related to cognitive health. The structural equation modeling analyses suggested a significant indirect effect of time spent in MVPA during recess and PE on children's cognitive function through physical fitness with sound goodness-of-fit indices: χ^2/df = 109.46/58, CFI= .93, RMSEA=.051; (90% CI [0.04, 0.07]).
Conclusion: The results suggest that school segmented MVPA in PE and recess provide children with opportunities to maintain appropriate levels of physical fitness and cognitive health. This study fills the research gap by identifying unstructured physical activity periods such as recess that can provide greater room to implement physical activity and health promotion strategies in school-age children.

2034 Board #190 May 30 2:00 PM - 3:30 PM

Relationship Between Fitness and Active-Sedentary Behavior with Cognitive and Emotional Recognition in Elderly: Core Study

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The decline in cognitive function and emotional regulation in aging have broad negative implications for independence, social competence and behavior that affect health. These impaired conditions can be exacerbated by increased sedentary behavior (SB) and lower levels of physical activity (PA) and fitness. However, it is not clear which of these have a higher relationship with cognitive function and emotional regulation in elderly.
PURPOSE: To investigate the relationship between cognitive function and emotional regulation with physical fitness, PA and SB in the elderly.
METHODS: This preliminary analysis of the Cardiovascular, Cognitive and Exercise Study in the Elderly (CORE) included 60 volunteers (64±3.47 years; female n: 39), who performed a cognitive task (Wisconsin cards sorting test) and an emotional facial recognition task, physical fitness test (senior fitness test and handgrip strength), PA level (Minnesota Leisure-time Physical Activity Questionnaire) and sedentary behavior questionnaire (Longitudinal Aging Study Amsterdam). Bivariate correlations using Spearman's rho (ρ) were used with statistical significance set at 5%.
RESULTS: Significant relationship between cognitive performance with, leg strength (total correct response, ρ=0.28; total errors, ρ=-0.28; and non-perseverative errors, ρ=-0.28), 6-min walking test (total correct response, ρ=0.31; total errors, ρ=-0.31; and non-perseverative errors, ρ=-0.30) and SB (perseverative errors ρ{\displaystyle \ rho }=-0.27). Also, the reaction time (RT) during the emotional facial recognition had a significant relationship with upper body strength (RT positive ρ=-0.26; RT negative ρ=-0.33) and PA level (MET, hr/w) (RT negative ρ=-0.31). Also, a significant relationship between worse cognitive performance with handgrip strength (non-perseverative errors, ρ=0.26) and SB (perseverative errors, ρ=-0.27).
CONCLUSIONS: These preliminary results suggest that physical fitness and SB are associated with cognitive performance. Also, PA level and upper body strength are associated with emotional performance. These findings suggest the importance between the balance of maintaining an active behavior and the inclusion of aerobic and resistance exercises to improve cognition and emotional regulation in the elderly.

2035 Board #191 May 30 2:00 PM - 3:30 PM

Cardiovascular Risk Moderates Aerobic Training Efficacy on Executive Function in Older Adults

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PURPOSE: To examine whether the Framingham Cardiovascular Risk Profile Score (FCRP) moderates the effect of a 6-month progressive aerobic training program (AT) on executive function in older adults with mild subcortical ischemic vascular cognitive impairment.
METHODS: This is a secondary analysis of a proof-of-concept randomized controlled trial in 71 older adults, who were randomized to either a 6-month, thrice-weekly, progressive AT program (AT), or usual care plus an education program (CON). At baseline and trial completion, three executive processes were measured: 1) response inhibition by Stroop Colour Word Test; 2) working memory by digits backward test, and 3) set shifting by the Trail Making Test (B-A). Baseline cardiovascular risk was calculated using the FCRP, and participants were classified as either low risk (<20% FCRP score; LCVR) or high risk (>20% FCRP score; HCVR). A complete case analysis (n=57) was conducted using an analysis of covariance (ANCOVA) to evaluate between-group differences in the three executive processes. Age, baseline Montreal Cognitive Assessment score, education, and baseline score for the outcome variable were entered as covariates in all models.
RESULTS: A significant interaction was found between FCRP and group (AT or CON) for the digit span backward (F(1,49)=4.67, p=0.03) and the Trail Making Test (F(1,50)=4.09, p=0.04). There was no significant interaction for the Stroop Colour Word Test (F(1,48)=.802 p=.38). On the digit span backward test, AT improved performance compared to CON (3.74±.33 vs. 2.75±.46) in those with LCVR, while in those with HCVR, AT did not improve performance compared to CON (2.97±.45 vs. 3.76±.41). Similarly, for the Trail Making Test (B-A), AT improved performance compared to CON (52.66±13.27 vs. 80.12±17.82) in those with LCVR, while AT was not beneficial compared to CON in those with HCVR (98.80±18.06 vs. 59.92±17.09).
CONCLUSION: We found that cardiovascular risk significantly moderates the efficacy of aerobic exercise on working memory and set shifting in older adults with vascular cognitive impairment. Our findings highlight the importance of intervening early in the disease course of vascular cognitive impairment, when cardiovascular risk may be lower, to reap maximum benefits of aerobic exercise.

2036 Board #192 May 30 2:00 PM - 3:30 PM

A Single Bout of Exercise Improves Accuracy in Video Gaming: a Pilot Study

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There are 2.3 billion of video gamers worldwide and this number is expected to grow to more than 2.7 billion by 2021. Research has demonstrated negative associations between the number of hours spent in front of a screen and physical inactivity. Video gamers are thus at a great risk of experiencing long-term health issues associated to excessive sedentarism. Cardiovascular exercise has been proven to be an effective intervention in reducing the risk of cardiometabolic clinical conditions as well as enhancing brain health and function. However, whether exercise has positive effects on video game performance is not known.
PURPOSE: To investigate the effects of a single bout of cardiovascular exercise on the performance of "League of Legends" (LoL), a video game played daily by more than 30 million players. **METHODS:** 14 healthy young (18-28 yo) LoL gamers played an individual LoL task of 20 min preceded by either 15 min of a high-intensity interval exercise or rest. The two conditions were administered on two separate days in a counterbalanced fashion. Video game performance was assessed as the number of targets destroyed, as well as accuracy, defined as the ability to destroy a target with only one attack. Attacks that required more than one attempt to destroy a target

were counted as accuracy errors. **RESULTS:** Exercise improved the capacity of participants to successfully destroy targets, but differences between exercise (119.43 [4.23]) and rest (111.50 [3.98]) did not reach statistical significance (paired t-test; t=1.81; p=0.094). Exercise enhanced accuracy, with fewer errors after exercise than after rest (paired t-test; t=-2.38; p=0.033). Self-reported sitting time was negatively associated with total score after the rest condition (r=-0.55; p=0.040). Neither other variable (cardio-respiratory fitness, BMI, cognitive level) was associated with game performance. **CONCLUSION:** Exercise performed before playing LoL improves video game performance increasing accuracy. The fact that players with less sitting time showed better performance reinforces the importance of reducing sedentary behaviors in this group. The implementation of exercise routines in video gamers may improve their general health and their gaming performance.
Supported by FRQS Junior I Salary Award (MR) and by the McGill Faculty of Medicine (OL).

2037 Board #193 May 30 2:00 PM - 3:30 PM

ASsociation Between Cognitive Funtion And Handgrip Strength In Physical Education College Students

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PURPOSE: To analyze the association between cognitive function and handgrip strength in a sample of university students of Physical Culture in Bogotá, Colombia. **METHODS:** the cross-sectional study included a total sample of 104 voluntary university students of Physical Culture, 18 - 25 years old, from Bogotá, Colombia. The handgrip strength was determined by the digital dynamometer and the cognitive function was evaluated individually by trained personnel through the Paced Auditory Serial Addition Test (PASAT), to evaluate the speed and flexibility of the processing of auditory information, the sustained and divided attention, as well as the calculation capacity, a standardized audio was used in the speed of the stimulus, presenting the individual digits every 3 seconds (PASAT-3), adding each new digit to the previous one immediately. The shorter stimulus intervals were used in 2 seconds (PASAT-2), increasing the difficulty. The association between cognitive function and handgrip strength adjusted for weight, was performed using the linear logistic regression model in the statistical package SPSS v25. **RESULTS:** The sample was middle-aged (Age=19.8±2.4yrs; N=87 men). The logistic regression model showed a strong association between hand grip strength adjusted to weight and cognitive function, through the stimulation of PASAT-2 (p = 0.026, Beta = 0.219), compared with PASAT-3 (p = 0.062; Beta = 0.184) where no significant difference was found, however a low tendency is identified. **CONCLUSION:** the results of this study show that hand grip strength is associated with a better cognitive response in speed and flexibility of processing in college students of Physical Culture of Bogotá, Colombia, for which it is suggested to promote the regular practice of exercise physical that stimulates muscle strength, in order to improve cognitive performance in college students.

2038 Board #194 May 30 2:00 PM - 3:30 PM

Exercise Intensity Influences Prefrontal Cortex Oxygenation During Cognitive Testing

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Various types of exercise therapies, including high and low intensity aerobic exercise, along with mind-body exercise (e.g., yoga) have been implemented into treatment for those suffering from psychological disorders and traumatic brain injury. The prefrontal cortex (PFC), which houses key cognitive constructs is responsive to exercise, and is commonly measured using functional near infrared spectroscopy (fNIRS). Evidence suggests that exercise mediates neural adaptation through increased blood flow and neurogenesis, which enhances neural activation leading to improved cognitive performance. However, the type and intensity of exercise that has the most robust impact on brain blood flow is currently unknown. **PURPOSE**: Therefore, the primary aim of the study is to compare PFC activation during cognitive tasks performed after low-intensity, high intensity, and yoga exercises. We also aim to determine if markers of cardiovascular and metabolic stress influence brain activity after each exercise bout. **METHODS**: Eight subjects (4 male, 4 female), aged 35 ± 5 years completed a control, high intensity, low intensity, and yoga exercise trial followed by administration of a cognitive task (NIH Toolbox Fluid Cognition). Left and right PFC oxygenation were measured during the post-exercise cognitive assessment using fNIRS technology. **RESULTS**: Oxygenation during the cognitive task was higher in the left PFC region after low intensity exercise compared to all other trials (control, high intensity, yoga). Regression model analysis showed that a 10% increase in %HRmax up to 70% intensity predicts an increase in left PFC oxygenation by 2.11 umol. No relationship was detected between PFC oxygenation and cognitive performance or the lactate response among participants in the current study, however a relationship between control levels of brain derived neurotrophic factor (BDNF) and processing speed was detected. **CONCLUSIONS**: Acute exercise below 70% aerobic intensity increased brain blood flow during a post-exercise cognitive task. Therefore, it may be beneficial for those who engage in any cognitive related activity to perform a brief bout of low intensity exercise prior to the task. This may include people who participate in academic-based testing, cognitive behavioral therapy, or motor training.

2039 Board #195 May 30 2:00 PM - 3:30 PM

Exploring The Relationships Between Personality And High-intensity Exercise-affect In Men And Women

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In general, men are more likely to meet physical activity guidelines in comparison to women, and tend to report exercising at higher-intensities. However, less is understood in regards to how men and women differ in feeling states (e.g., core affect) during a high-intensity exercise bout. **PURPOSE**: Determine whether sex differences exist in personality traits and high-intensity exercise-affect. **METHODS**: Male (M; n=63) and female (F; n=101) undergraduates (*n*=164, 20±2yrs, 24±4 body mass index (BMI), 62% female, 82% regular exercisers) completed several personality surveys along with a 15-minute high-intensity circuit (HIC). Core affect (via Feeling Scale & Felt Arousal Scale) was assessed prior to, every 3-minutes during, and 20-minutes post (P20) condition. **RESULTS**: Multivariate ANOVAs revealed significant differences (P_s<0.05) in the personality traits extraversion (F= 46.2, M= 42.2, *d*= .894), neuroticism (F= 47.4, M= 45.1, *d*= .644), openness (F= 14.5, M= 15.6, *d*= -.496), intensity-preference (F= 26.4, M= 29.0, *d*= -.535) and intensity-tolerance (F= 25.2, M= 28.4, *d*= -.651). No sex differences (P_s>0.05) were observed for exercise-affect prior to, during, and following the HIC. **CONCLUSIONS**: Although sex differences exist in various personality traits, these differences did not influence how one felt prior to, during, and following a HIC. These findings support the notion that men and women respond similarly to exercise stimuli. More research is needed to understand why women exercise less and at lower-intensities in comparison to men.

2040 Board #196 May 30 2:00 PM - 3:30 PM

Acute After-School Screen Time in Children Decreases Impulse Control: A Randomized Crossover Trial

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PURPOSE: This study examined the effect of three hours of after school active play vs. sedentary screen time on executive function in children.
METHODS: This study used a crossover design with treatment conditions that were randomized and counter-balanced. There were two experimental conditions: three hours of active play compared to three hours of sedentary screen time. Participants included 32 boys and girls age 8-9 yrs. Physical activity patterns were measured using an actigraph accelerometer. Exectuve control was measured using the Stroop color and word test. **RESULTS**: The mean age and BMI were 8.7 ± 0.4 years and 16.9 ± 2.2. On the active day, children spent 95 ± 28 minutes in MVPA after school compared to 3 ± 3 minutes on the sedentary day (F = 252.1, P < 0.0001). There was no difference between days in the Stroop Task performance for word reading or color naming. However, there was a significant difference between conditions for the incongruent task, with children performing better on the active day (F = 6.79, P = 0.0150). **CONCLUSIONS**: The results of this study demonstrate that active play after school improves executive function in children by increasing their ability to inhibit cognitive interference.

2041 Board #197 May 30 2:00 PM - 3:30 PM

Acute Exercise Alters Functional Connectivity During Cognitive Task

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PURPOSE: There is a growing body of evidence to show that acute aerobic exercise improves cognitive performance. Nevertheless, it remains largely unknown how acute

exercise improves cognitive performance. The purpose of this study was to test if alteration in functional connectivity is involved in improving cognitive performance induced by acute exercise.
METHODS: Participants were 10 healthy right-handed young men (age: 21.6 ± 1.4 yr., peak oxygen uptake = 46.5 ± 8.7 ml/kg/min). Experiments were conducted in a randomized crossover design. In the Exercise condition, subjects cycled at 40% peak oxygen uptake for 30 minutes. In the Control condition, subjects rested for 30 minutes without exercise. In both conditions, participants performed cognitive task (Go/No-Go task) before and after exercise (rest). We first analyzed regions specifically activated by exercise as region of interest. Then, we identified regions where functional connectivity was altered before and after exercise. We also identified regions where amount of alteration in functional connectivity was correlated with that of reaction time (RT).
RESULTS: RT was reduced in the Exercise condition (Pre: 420 ± 77 ms, Post: 388 ± 65 ms, $p = 0.02$), while it did not change in the Control condition (Pre: 416 ± 79 ms, Post: 417 ± 78 ms, $p = 0.82$). We observed significant increases in activation in the opercular and triangular parts of the left inferior frontal gyrus (IFG) and anterior cingulate cortex ($p < 0.01$, *uncorrected*). We observed an increase in functional connectivity between the opercular part of the left IFG and the left putamen (Pre: 0.02 ± 0.11, Post: 0.12 ± 0.13, $p = 0.08$). Alteration in the functional connectivity between these regions was negatively correlated with the alteration in RT ($r = -0.44$, $p = 0.06$).
CONCLUSIONS: Alteration in functional connectivity may be associated with improvement of cognitive performance after acute exercise.

2042 Board #198 May 30 2:00 PM - 3:30 PM

The Effects Of Exercise Intensity On Auditory Processing Speed And Flexibility: A Randomized Crossover Study.

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PURPOSE: The purpose of this study was to determine how exercise, at a moderate and vigorous intensity, alters auditory processing speed and flexibility, and calculation ability. **METHODS**: One hundred and thirty-six men and women between the ages of 18-45 were recruited for this randomized crossover study. Participants were randomly assigned to each of the following exercise conditions: moderate (35% VO2 max), vigorous (70% VO2 max), and sedentary (no exercise). Each condition lasted 40 minutes and was separated by 7 days. After the exercise condition, a battery of cognitive tests were administered. The Paced Auditory Serial Addition Test (PASAT) was one of these tests and was used to measure the relationship between exercise intensity and auditory processing speed and flexibility. **RESULTS**: Eighty-one men (age=23.2, BMI=23.9 ± 3.2) and fifty-five women (age=20.9, BMI=22.4 ± 2.8) completed the study. There was no main effect of condition for the number of problems answered correctly ($F = 1.24$, $P=0.2900$), the number of problems attempted ($F = 1.48$, $P=0.2291$) and the percent of problems correctly answered ($F = 1.69$, $P = 0.1865$). There was a main effect for gender for the number of problems answered correctly ($F = 21.7$, $P < 0.0001$), the number of problems attempted ($F = 19.5$, $P < 0.0001$) and the percent of problems answered correctly ($F = 7.06$, $P = 0.0084$). However, there was no significant gender by condition interaction for any variable of interest ($Ps > 0.05$).
CONCLUSIONS: The results of this study show that there is no significant relationship between exercise and auditory processing speed and flexibility, and calculation ability post exercise. These results suggest that exercise at a moderate or vigorous intensity does no hinder a person's ability to perform complex cognitive processing tasks.

2043 Board #199 May 30 2:00 PM - 3:30 PM

The Effects Of Acute Aerobic Exercise On BDNF Levels And Cognition In Postmenopausal Women

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PURPOSE: The purpose of this study was to examine how menopausal status affects choice reaction time and peripheral BDNF levels after aerobic exercise. It was hypothesized that exercise would affect peripheral BDNF levels and choice reaction time similarly among pre and postmenopausal women. **METHODS:** The subjects consisted of 14 active females (7 premenopausal and 7 postmenopausal). Subjects went through two different trials: an exercise trial and a controlled reading trials. The exercise trial consisted of running on a treadmill at 75% of VO_2max for 30 minutes. The control trial consisted of a reading session. A computerized Stroop test was given to assess choice reaction time, and blood samples were obtained before, immediately after, and 30 minutes after the exercise and control trials. **RESULTS:** Exercise did not lead to a significant change in BDNF in either group. However, there was a statistical interaction ($P=0.041$) between pre and postmenopausal women over time between pre and post timepoints, with premenopausal women trending towards an increase in BDNF, and postmenopausal women trending towards a decrease in BDNF. There was a large effect size within this interaction represented with a partial eta squared value of .265. A Post Hoc test was done to further investigate the interaction. There was not enough statistical power ($P = .164$) to state that there was a difference in BDNF levels (pre to post) but that there appears to be a trend. Both age and FSH had indirect relationships with BDNF ($p<0.05$); the greater the age or FSH, the lower the peripheral BDNF levels. There was a positive correlation between age and Stroop Test time over all time points ($P = .039$, .089, and .027; pre, post, and post30 exercise respectively). This indicated an age-related decline in choice reaction time capabilities.
CONCLUSION: Within the study, there was not statistical evidence that acute exercise affects BDNF levels nor choice reaction time for the Stroop incongruent test, regardless of menopausal status. However, a clear decline in choice reaction time was noted with increase age. Additionally, there appears to be a blunting of exercise-induced increases in BDNF in postmenopausal women. Further investigation is required to clarify this relationship.

2044 Board #200 May 30 2:00 PM - 3:30 PM

Chronic Effect of Exercise on Working Memory in Children And Adolescents: A Meta-Analysis of Randomized Controlled Trials

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INTRODUCTION: Working memory (WM), generally considered executive function, is gaining attention due to its role in contributing to children and adolescents' academic achievement, especially verbal and quantitative reasoning, and sports-related tactical memory. Quantitative reviews regarding the effect of exercise interventions (EX) on this higher-level cognitive skill in these important cohorts are lacking.
PURPOSE: The aim of the study was to assess the chronic effect of EX on WM in children and adolescents and to evaluate potential moderators of this effect using a meta-analytic approach.
METHODS: A computerized literature search was conducted based on seven databases: SPORTDiscus, Google Scholar, PubMed, ScienceDirect, Dialnet Plus, SciElo, and MEDLINE. Studies needed to meet the following inclusion criteria: 1) a RCT design in children or adolescents, 2) EX with mode description, 3) published in English, Spanish, or Korean 4) WM as dependent variable, and 5) reported descriptives that permitted effect size (ES) calculation. The quality score was defined using a scale from 1 to 5. A random-effects model with a within-group design was used to calculate the ES. One-way analysis of variance of independent groups or Pearson's correlation coefficients were used to examine moderators.
RESULTS: 6207 articles published before Nov. 2016 were found, of which 10 studies representing 60 ES's and totaling 806 participants (males and females, 9.93 ± 8 yo) were included in the analysis. The mean quality for the studies was 4.4±.7. An overall ES of .85 was found ($p\leq.001$; $CI_{95\%}=.47$ to 1.24; $z=4.35$; $Q=419.50$; $I^2=94.28\%$) suggesting a positive high effect of the EX to enhance WM. Age ($r=-.34$; $p=.048$), number of sessions ($r=.42$; $p=.03$), and sex ($F_{statistic}=3.6$; $p=.04$), significantly moderated the effect. Neither a) quality of the studies ($r=-.24$; $p=.17$), b) min/session ($r=-.28$; $p=.15$), c) weeks of intervention ($r=.24$; $p=.17$), nor d) type of exercise (i.e., aerobic, anaerobic, neuromotor; $r=.41$; $p=.53$) were significant moderators. No bias was found according to Egger's regression analysis ($p=.39$).
CONCLUSIONS: EX has a positive significant effect on children and adolescents' WM compared with their control peers. Different types of exercise appeared to be equally effective strategies for improving WM in these cohorts.

2045 Board #201 May 30 2:00 PM - 3:30 PM

Motivational Differences Between Crossfit And Traditional Resistance Training Participants

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PURPOSE: To investigate the motivational factors, behavioral regulations based on self-determination theory framework, and the relationships between basic psychological need satisfaction and actual exercise behaviors of CrossFit and resistance training (RT) participants.

METHODS: Have been evaluated 493 subjects (males = 351, females = 148), RT (n = 365, 279 males, 86 females) and CrossFit (n = 128, 69 males, 59 females) completed the follow online questionnaires: Behavioural Regulation in Exercise Questionnaire, Exercise Motivations Inventory-2, The Basic Psychological Needs in Exercise Scale. **RESULTS**: The CrossFit participants presented higher levels of enjoyment, stress management, social recognition, affiliation, competition, and weight management. Conversely, RT participants reported higher motives for appearance. Intrinsic regulation to exercise was significantly higher in CrossFit, whereas RT clients scored higher controlled motivation. The CrossFit group reported higher levels of relatedness, while RT group presented more perception of autonomy. There was no significant difference between weekly exercise volume between groups; therefore, correlation and mediation analysis were conducted with pooled data. Autonomy and competence were significantly associated with more autonomous forms of motivation. Exercise frequency and weekly exercise volume were positively related to intrinsic motivation. When mediating model was evaluated, the social motives to exercise and intrinsic motivation were found to mediate the relationship between competence and weekly exercise volume (95% BCa CI of 2.47 to 11.91).
CONCLUSIONS: These findings suggested that CrossFit members attend the gym/CrossFit box predominantly for intrinsic reasons and social motives as compared to RT participants. Exercise professionals may consider the development of programs to increase social motives and exercise-related identity (e.g., interest, affiliation, and enjoyment) to promote intrinsic regulation in individuals from fitness centers.

2046 Board #202 May 30 2:00 PM - 3:30 PM

Neuroelectric Indices of Attentional Processing are Reduced During Low-Intensity Cycling

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Acute aerobic exercise exerts a small beneficial effect on cognition. A majority of studies have examined cognitive function following acute bouts of exercise, while very few have evaluated changes that may occur during exercise. The limited research that has been conducted in this area is mixed, demonstrating differential effects on cognitive performance depending on methodological decisions including exercise intensity and duration. **PURPOSE**: The primary purpose of this study was to examine the effects of low-intensity cycling on cognitive function, measured by behavioral performance (response accuracy and reaction time) and neuroelectric indices of attentional processing (P3 amplitude and latency). **METHODS**: Twenty-seven (Mage = 22.9 ± 3.0 years old) college-aged individuals were counterbalanced into low-intensity exercise (EX) and seated control (SC) conditions. During each condition, participants completed a 10-minute resting baseline period, 20 minutes of either sustained cycling or seated rest, and a 20-minute recovery period. Electroencephalography (EEG) data were recorded during a modified oddball paradigm in order to assess primary cognitive outcome measures at 10-minute intervals (5 blocks total) throughout each condition. **RESULTS**: Individuals in EX and SC conditions displayed lower accuracy to rare trials across time, $F(4,23) = 4.54$, $p = .008$, $\eta^2_p = .44$, suggesting reductions in performance to more difficult trials as testing sessions progressed. There were no significant differences in reaction time between EX and SC conditions. Significant reductions in P3 amplitude were observed only during the 20-minute cycling period compared to seated rest, $F(4,23) = 3.50$, $p = .023$, $\eta^2_p = .38$, while no differences in P3 latency were observed between EX or SC conditions. **CONCLUSIONS**: Taken together, results indicate that exercise at lower doses may have small but significant effects on behavioral and neuroelectric outcomes of cognitive performance. These changes may be due in part to the shifting of attentional resources from the cognitive task to the maintenance of exercise. Information gathered from this study may aid in the development of appropriate exercise prescription for populations looking to specifically target cognitive function deficits through acute aerobic exercise.

2047 Board #203 May 30 2:00 PM - 3:30 PM

Impact of Stress on Resting Skeletal Muscle Oxygen Consumption with and without Prior Exercise

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The effects of acute exercise on muscle metabolism are well established, however the impact of mental stress (MS) on muscle metabolism is not well understood. PURPOSE: To assess muscle oxygen consumption (mVO2) after acute MS and evaluate the effect of acute exercise prior to MS on mVO2. METHODS: Participants (N=15 males, 22± 2 yr, VO2peak 40.8 ± 5.7 ml/kg/min) served as their own control in a randomized counter balanced design. Participants completed a total of three visits over 3-5 weeks. On the initial visit, a maximal oxygen uptake test on a cycle ergometer was performed. Near-infrared spectroscopy (NIRS) was used during a five-minute cuff occlusion and the initial slope during the occlusion was used to assess mVO2 in the gastrocnemius muscle. mVO2 was assessed at baseline (BL), after rest (CON) or exercise (EX), and after mental stress (MS). On two separate days, participants either rested for 25 minutes (CON) or completed 25 minutes of exercise (EX) at 90% ventilatory threshold on cycle ergometer. MS was evoked by a serial subtraction test administered by two research assistants dressed in white lab coats. Data were analyzed using a 2x3 repeated measures ANOVA with Fishers LSD post hoc tests, and are presented as mean percent change +/- SD. RESULTS: A significant interaction effect of Condition x Time on mVO2 was observed($F=6.3$ $p<0.05$,$\eta2=0.326$). Post hoc comparisons indicated mVO2 was significantly increased after EX compared to CON by 21.8+/- 26.0% ($p<0.05$). Within CON, MS increased mVO2 by 12.6 +/- 10.2% ($p<0.001$). In EX, there was an increase in mVO2 from BL to after EX by 12.6 +/- 16.0% ($p<0.05$) and from BL to after MS by 18.2 +/- 64.1% ($p=0.053$). CONCLUSION: To our knowledge, these data are the first to suggest that acute MS increases the metabolic rate of resting skeletal muscle. Interestingly, the combination of prior EX and MS does not further augment metabolic activity beyond MS alone.

2048 Board #204 May 30 2:00 PM - 3:30 PM

Affective and Perceptual Responses to High-Intensity Interval Training: Comparing Graded Walking to Ungraded Jogging

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Benefits associated with high-intensity interval training (HIIT) are well-established. Research has also demonstrated that HIIT can be well-tolerated in a variety of populations, protocols, and modalities. Treadmill-based HIIT has almost exclusively included running interspersed with walking. Research to date has not investigated the delivery of HIIT by way of graded walking interspersed with ungraded walking. **PURPOSE:** Compare the effects of ungraded jogging to graded walking as a modality of HIIT on perceived exertion, affect, and enjoyment. **METHODS:** Nine healthy participants (5 males, 4 females; mean BMI = 25; mean age = 26) completed two 20-minute counterbalanced HIIT trials after completion of maximal testing. Both trials alternated between workloads associated with 85% of VO2max and a brisk and comfortable walking speed (mean = 3.2 mph). The interval portions of the trials were performed at elevated grade (mean = 17%) for the WALK-HIIT trial and elevated speed (mean = 6.7 mph) for the RUN-HIIT trial. Affect, enjoyment, and perceived exertion, both overall (RPE-O) and legs only (RPE-L), were measured throughout each trial. Enjoyment was measured upon completion of each trial. **RESULTS:** Data was analyzed using dependent t-tests. RPE-O, RPE-L, affect, enjoyment, and HR (all p-values > 0.05; all ES values < 0.50) were not significantly different for the WALK-HIIT and RUN-HIIT trials**. CONCLUSIONS:** Findings indicate that WALK-HIIT and RUN-HIIT trials produce similar perceptual and affective responses, with each providing a significant exercise stimulus sufficient to improve cardiometabolic health. The production of relatively similar responses suggests that graded walking is a viable alternative to running for the delivery of the many benefits associated with interval-based exercise without negative impacts on the exercise experience.

2049 Board #205 May 30 2:00 PM - 3:30 PM

The Impact of Qigong Baduanjin on Cognitive Function & Mental State in Patients with type 2 Diabetes

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(No relevant relationships reported)

PURPOSE: This study aims to assess the clinic efficacy of Qigong Baduanjin (QBDJ) on cognition and mental status in patients with type 2 diabetes. **METHODS**: sixty-seven type 2 diabetic patients with mild cognitive impairment (MCI) (31 males and 36 females; aged 47-68 years; the educational background of all participants were above middle school) were screened and randomly divided into two groups: the QBDJ group (n=34), and the control group (n=33). Both groups were based on the routine treatment of diabetes. The QBDJ group received Baduanjin excise forty minutes a time and five times per week for three months, whereas the control group without special exercise intervention. Montreal Cognitive Assessment (MoCA) and Hamilton Anxiety Scale (HAMA) were used to evaluate the change of cognitive function and mental status in all patients. All data were analyzed using SPSS Statistics for Windows v 17.0. Group differences in baseline characteristics were tested using the χ;2 test and the T test. For the outcome measures, independent-sample T test was performed to compare the changes between the QBDJ and control groups. The paired T test was used to compare the effects before and after treatment. The level of significance was established at p;=0.05. **RESULTS**: There was no significant difference in the scores of MoCA and HAMA between two groups before the intervention. After 3 months of Baduanjin practice, the total score of MoCA, the score of visuospatial/executive, and the score of delayed recall were significantly higher in the QBDJ group than in the

control group (P<0.05). QBDJ training also contributed to improving the ability of emotion regulation. Compared with the control group, participants in the QBDJ group had significantly lower total HAMA score (P<0.05). **CONCLUSIONS**: These results indicate that regular QBDJ exercise can effectively improve cognitive function and produce positive effects on mental state in type 2 diabetic patients with MCI.

TABLE 1. COMPARISION OF SCORES FOR ALL MoCA SUBTESTS IN TWO GROUPS

	Control group(n=33)		QBDJ group(n=34)	
	Before intervention	After intervention	Before intervention	After intervention
Visuospatial/executive	3.01±0.74	3.06±0.82	3.04±0.57	3.98±1.04*※
Naming	2.51±0.63	2.53±0.71	2.48±0.59	2.55±0.91
Attention	4.43±0.75	4.46±1.01	4.44±0.63	4.62±0.88
Language	2.02±0.46	2.04±0.53	2.03±0.57	2.11±0.70
Abstraction	0.98±0.27	1.01±0.36	1.02±0.33	1.15±0.54
Delayed recall	1.94±0.66	2.02±0.71	1.91±0.58	3.37±0.89*※
Orientation	5.78±0.53	5.81±0.42	5.73±0.64	5.89±0.76
Total score	20.83±1.34	21.14±1.52	20.59±1.21	23.63±1.63*※

When the difference is significant (p<0.05), the P value is marked with *(QBDJ group vs. Control group) and※(compared with before intervention in QBDJ group)

TABLE 2. COMPARISION OF HAMA SCORE IN TWO GROUPS

	Control group(n=33)		QBDJ group(n=34)	
	Before intervention	After intervention	Before intervention	After intervention
HAMA	15.44±3.58	16.25±4.03	15.83±3.32	10.63±3.71*※

When the difference is significant (p<0.05), the P value is marked with *(QBDJ group vs. Control group) and※(compared with before intervention in QBDJ group)

2050 Board #206 May 30 2:00 PM - 3:30 PM

Self-Reported Physical Activity and Memory Performance among Adolescent Cannabis Users

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(No relevant relationships reported)

Prior work has found that heavy cannabis use (CU) is associated with learning and memory impairments, whereas physical activity (PA) has been linked to enhanced memory and cognition.
PURPOSE: To determine whether PA moderates the link between CU and memory among adolescents, such that CU leads to greater memory deficits in those who report less PA.
METHODS: Participants were 387 adolescents (ages 15-19) from a larger study, 198 of whom completed the Sports & Activity Involvement Questionnaire added after study onset. We used minutes reported in the past 6 months as our measure of PA. Frequency of CU (in days) was assessed over the last 6 months; 70% endorsed some CU. Participants completed the California Verbal Learning Test-II and Wechsler Memory Scales-IV Logical Memory and Designs subtests. We used composite scores from these tests' immediate and delayed free recall trials to derive latent constructs of immediate and delayed memory, respectively.
We examined the independent influence of CU and PA on our latent constructs of immediate and delayed memory in separate regression models. To assess whether PA moderates the association between CU and memory performance, we ran separate models for each memory construct with both predictors and their interaction term. We repeated these analyses controlling for lifetime alcohol, nicotine, and CU frequency to isolate the effects of recent CU.
RESULTS: Greater past 6-month CU frequency was associated with poorer immediate, $\beta = -.22$, $p < .001$, and delayed memory, $\beta = -.23$, $p < .001$. However, past 6-month PA was not associated with immediate, $\beta = -.01$, $p = .90$, or delayed memory, $\beta = .07$, $p = .19$. The PA X CU interaction effect was not significant for either immediate, $\beta = .03$, $p = .88$, or delayed memory, $\beta = .03$, $p = .85$. Results were unchanged after controlling for other substance use and lifetime CU frequency, which accounted for significant variance on immediate, $\beta = -.27$, $p = .03$, but not delayed memory, $\beta = -.11$, $p = .39$.
CONCLUSION: Our findings replicate the well-established link between CU and memory. However, self-reported PA did not influence this association in our adolescent sample. Future work should employ objective measures of PA to account for factors like activity intensity, aerobic fitness, and social biases inherent in self-report.
Supported by NIH Grants R01 DA031176 & U01 DA041156.

2051 Board #207 May 30 2:00 PM - 3:30 PM

Action Boundary Perception Across 30 Days in an Isolated and Confined Environment

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Successful execution of operational tasks requires accurate and efficient action boundary perception. An action boundary is the task- and individual-specific threshold where an action is possible. The inability to accurately perceive changes in action possibilities due to changing action boundaries may increase the risk adopted during a task, possibly compromising mission success. Astronauts must maintain effective operational performance in isolated, confined and extreme (ICE) environments for extended timeperiods, similar to those expected on the proposed mission to Mars. It is unknown how these environments affect action boundary perception. **PURPOSE:** Investigate changes in action boundary perception behavior during a 30-day Human Exploration Research Analog (HERA) mission. **METHODS:** Sixteen subjects completed six trials of the perception-action coupling task (PACT), a novel tablet-based action boundary perception task, in the afternoon of days 3, 10, 17, 24 and 5 days post-mission. The 15-minute PACT presents a series of virtual balls and apertures varying in ball to aperture size ratio (B-AR) from 0.2 to 1.8 with a ratio of 1.0 representing the action boundary. Subjects determined whether the ball could fit through the aperture, then responded based on their perception of this action possibility. 8 (ratio) x 5 (time) repeated measures ANOVAs were performed to assess changes in response time (RT), accuracy (ACC) and lapses. **RESULTS:** No significant ratio x time interactions were observed. RT ($F_{4, 60} = 3.631$, $p = 0.010$, $n^2_p = 0.195$) was faster on day 24 (0.738 ± 0.088s) than day 17 (0.768 ± 0.092s). No differences were observed between other timepoints. ACC and lapses did not vary during the mission ($p > 0.05$). RT ($F_{2.583, 38.742} = 42.815$, $p < 0.001$, $n^2_p = 0.741$) and ACC ($F_{1.423, 21.341} = 42.815$, $p = 0.002$, $n^2_p = 0.407$) were sensitive to changes in B-AR; responses were slower and less accurate near the action boundary. **CONCLUSION:** Minimal change in action boundary perception performance was observed in HERA ICE analog, with improvements in RT detected. Faster RT may reflect more efficient responses or behavioral changes due to ICE environments, suggesting action boundary perception is not compromised by a 30 day ICE analog assessment. This material was based on work supported by NASA (NNX15AC13G) PIs: Alfano and Simpson

2052 Board #208 May 30 2:00 PM - 3:30 PM

Associations Of Cognition With Physical And Vascular Function In Patients With Chronic Kidney Disease.

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(No relevant relationships reported)

Cognitive impairment is prevalent in patients with chronic kidney disease (CKD), but little is known about its relationship with physical and vascular function.
Purpose: To investigate the relationship between cognitive function, and physical and vascular function in older adults with stage 3-4 CKD and preclinical cognitive impairment. We hypothesized that physical and vascular function would be related to cognitive function. **Methods:** Participants (n=28) with CKD and preclinical cognitive impairment (57% female, 68% black, eGFR 43.7, age 68) completed the Trail Making Test (TMT-A: psychomotor speed, and TMT-B executive control), and digit symbol coding (DSC) (visuomotor speed/complex attention). These are standard measures that are sensitive to cognitive decline. Physical function was determined via the short physical performance battery test (SPPB) and the 6-minute walk test (6MWT). Vascular function was determined via brachial artery flow mediated vasodilation (FMD) following 5-minutes of forearm occlusion. Correlations were assessed via Pearson's bivariate correlation. **Results**: All participants scored below the fiftieth percentile of age and sex specific normative values on the TMT; 32% scored below the tenth percentile on the TMT-A and 50% scored below the tenth percentile for TMT-B. Age, years of education, sex, or race did not correlate with TMT-A, TMT-B, or DSC. TMT-A were inversely correlated with 6MWD (r=-.5, p=.007), SPPB score (r=-.65, p<.001), and FMD (r=-.4, p=.04). TMT-B was inversely correlated with 6MWD (r=-.39, p=.04), but not with SPPB, or FMD. DSC was correlated with 6MWD (r=.47, p=.01), but not with SPBB, or FMD. **Conclusion:** In patients with CKD, psychomotor speed is associated with indicators of physical function and fitness levels, and with vascular function. Executive control, visuomotor speed, and complex attention was associated with physical fitness levels. These results indicate a concomitance between higher levels of fitness, physical, and vascular function, and higher scores in psychomotor speed and executive control in patients with CKD. The clinical

implications of our work remains to be further explored, but interventions to improve fitness levels, and physical and vascular function may contribute to lessening the impact of CKD-associated cognitive alterations.

2053 Board #209 May 30 2:00 PM - 3:30 PM

Effects Of Three Months Of A "Playing Actively And Learning" Program On Selective Attention Performance In Boys And Girls

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(No relevant relationships reported)

Physical education classes provide an opportunity for students to be physically active and also to help in school learning. **PURPOSE:** To compare the effects of physical education program combined with scholar contents named "Playing actively and Learning (PAL)" on selective attention in boys and girls. **METHODS:** 39 children with low academic achievement (9.5±0.9yr) from an elementary public school of vulnerability area at Brasilia - Brazil, undertook Stroop test before and after intervention. The anthropometric data (weight and stature) were assessed for characterization of the sample. The stimuli at Stroop test GO/No-go was a colored bar and a colored word in congruent (e.g., RED in red ink) or incongruent (e.g., RED in blue ink) color ink. The participants had to match the color of the bar to the meaning of the word and press the correct key as soon as the stimuli appeared at computer screen. Nineteen boys (BG; n=19; 32.1±4.5 kg; 138±0.4 cm; 16.7±1.7 kg.m$^{2(-1)}$) and twenty one girls (GG; n=21; 31.1±7.3; 137±0.4 cm; 16.4±3.5 kg.m$^{2(-1)}$) participated on the study. Both BG and GG attended to 24 classes (60 min, twice a week for three months) during school journey. At those classes they learned the content of Portuguese and Mathematics while doing active plays (running, jumping and aerobic dance) (PAL) at moderate intensity (154.6±17.2 bpm). ANOVA mixed was used to compare data before and after intervention. **RESULTS:** No differences were observed in congruent or incongruent conditions between groups. The reaction time decreased in incongruent Go condition in both groups after intervention for boys (958.3±113.3ms to 877.9±105.6ms; P=0.004) and girls (976.6±91.5ms to 904.6±86.7ms; P=0.005) (Figure 1). **CONCLUSION:** Three months of PAL resulted in improvement in a similar way in boys and girls at the most difficult part of Stroop test. To support these results studies with a neuroeletric analysis (i.e. event related potential component) can be recommended.

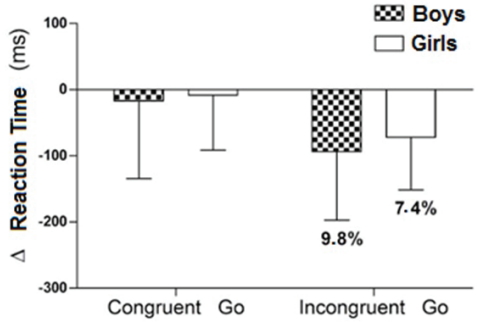

Figure 1. Improvement of Reaction Time in the congruent and incongruent Go condition of the Stroop test after PAL program in boys and girls.

2054 Board #210 May 30 2:00 PM - 3:30 PM

Physical Activity from Childhood to Adulthood and Cognitive Performance in Midlife

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The prevalence of cognitive deficits is increasing worldwide, making risk factor reduction a crucial target on the global public health agenda. Adulthood physical activity (PA) is suggested to protect against old-age cognitive deficits, but the independent role of childhood / youth PA for adulthood cognitive performance is unknown.
PURPOSE: We investigated the association between PA from childhood to adulthood and midlife cognitive performance.
METHODS: This study is a part of the Cardiovascular Risk in Young Finns Study. From 1980, a population-based cohort of 3,596 children (baseline age 3-18 years) have been followed-up for 31 years in 3-9-year intervals. PA was queried in all study phases. Cumulative PA was determined in childhood (age 6-12 years), adolescence (age 12-18 years), young adulthood (age 18-24 years) and adulthood (age 24-37 years). Cognitive performance was assessed using computerized neuropsychological test in 2011 among 2,026 participants aged 34-49 years.
RESULTS: High PA level in childhood (β 0.119, 95% confidence interval (CI) 0.055-0.182, p=0.0002), adolescence (β=0.125 SD, 95% CI 0.063-0.188, p<0.0001), young adulthood (β=0.135 SD, 95% CI 0.063-0.207, p=0.0002) and adulthood (β=0.045 SD, 95% CI 0.013-0.077, p=0.006) was independently associated with better reaction time in midlife. Additionally, an independent association between high PA level in young adulthood (β 0.101, 95% CI 0.001-0.200, p=0.048) and adulthood (β=0.064 SD, 95% CI 0.018-0.110, p=0.006) and better visual processing and sustained attention in midlife was found among men. Associations for other cognitive domains were not found.
CONCLUSIONS: Cumulative exposure to PA from childhood to adulthood was found to be associated with better midlife reaction time both in men and women. Furthermore, cumulative PA exposure in young adulthood and adulthood was associated with better visual processing and sustained attention in men. These associations were independent of PA levels in other measured age frames. Therefore, physically active lifestyle should be adopted already in early childhood, and continued into midlife to ensure the plausible benefits of PA on midlife cognitive performance. Concluding, this study provides novel insight into cost-effective and well-timed promotion of cognitive health.

2055 Board #211 May 30 2:00 PM - 3:30 PM

Patient Perceptions of a Cancer Rehabilitation Program Which Provides 12 Weeks Of Individualized Exercise Prescription

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(No relevant relationships reported)

Purpose: The purpose of this study was to determine why cancer patients choose to participate and remain in an exercise rehabilitation program. **Methods**: 79 participants in a cancer rehabilitation program were asked to complete a questionnaire consisting of 6 open ended questions asking 1. Who referred them, 2. What did they follow through with the referral, 3. Why they have chosen to remain in the program, 4. What their initial thoughts of the program were, 5. What their current thoughts about the program are, and 6. Are they satisfied with the program. This study was approved by the Saint Francis University IRB. **Results**: 38% of clients were referred by either an oncologist or family doctor, 25% by hospital staff, 24% by friend or support group and 13% by media outlets. 59% of clients followed though for their health, and 15% for supervision of their exercise sessions. 51% of clients continued in the program because of the results they obtained and 25% because they had not yet met their goals, while 24% continued because of their cancer exercise trainer. 73% of clients had positive thoughts about the program, and 99% had the same or improved thoughts. Finally 94% of clients were satisfied with the program. **Conclusion:** The majority of clients were referred by their oncologist, or hospital staff indicating the power that physicians and hospital staff have in providing guidance for their clients. Further, once clients join a cancer rehabilitation program the benefits motivate them to continue in the program.

Clearly they are satisfied with the program which is a program which provides individualized personalized exercise prescription and a cancer trainer for support and motivation.

D-64 Free Communication/Poster - **Hydration/Fluid Balance**

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

2056 Board #212 May 30 2:00 PM - 3:30 PM

Impact of Nutrient Intake During Exercise on Hydration Markers Following Exercise and Rehydration

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(Sponsor: Lawrence Armstrong, FACSM)
(No relevant relationships reported)

Endurance athletes commonly strive for optimal hydration status during and after events, and have vast nutrition options available to support performance and well-being. **PURPOSE:** We aimed to evaluate relationships among nutrients consumed during exercise and markers of hydration status. **METHODS:** Fifty-one cyclists (age mean=51y and range=21-72y; 49 males, 2 females) completing a 161km event (mean=26°C, 76%RH; maximum=30°C, 93%RH) recorded all dietary intake during the ride. Five hydration markers (urine color and specific gravity, plasma osmolality (P_{osm}), plasma copeptin (P_{cop}), and body mass change (BM) were collected before and after (POST) the ride, and one hour after a 650mL water bolus ($POST_{1h}$). Linear regressions tested associations between hydration markers and eight predictor terms derived from nineteen nutrients merged into a reduced-dimensionality dataset through serial k-means clustering. As an indicator of water retention signaling, P_{cop} tertiles were analyzed via two-way ANOVA to evaluate nutrient intake influence. **RESULTS:** Five predictor clusters were significantly associated to hydration markers (number of associated hydration markers in parenthesis): 1) glycemic load + carbohydrates + sodium (one), 2) protein + fat + zinc (one), 3) magnesium + calcium (two), 4) pinitol (three), and 5) water (four); caffeine, potassium, fiber, betaine, and three sugar-alcohols did not associate with hydration markers. All hydration markers (except P_{osm}) associated to at least one nutrient predictor. P_{cop}POST tertiles (13.5±5.9, 34.4±7.4, and 76.8±40.0 pmol/L, respectively) differed by sodium (1st vs. 3rd tertile p=0.0047; 2217±1295 and 1747±1214 mg, respectively) and water intake (1st vs. 3rd and 2nd vs. 3rd, all p<0.0001; 1st=4910±1722, 2nd=4887±1011, 3rd=3837±1097 g). $P_{cop}POST_{1h}$ tertiles (7.4±3.0, 22.0±5.4, and 54.2±36.7 pmol/L, respectively) differed by water intake (1st vs. 3rd and 2nd vs. 3rd, all p<0.0001; 1st=4921±1652, 2nd=4953±1063, and 3rd=3759±1072 g). **CONCLUSION:** These data suggest that some nutrients impact fluid-electrolyte balance and hydration markers. Nutrient intake appears to mediate urinary markers more than P_{cop}, and P_{cop} more than BM. Further, sodium and water appear to best mitigate water retention signaling following exercise and rehydration.

2057 Board #213 May 30 2:00 PM - 3:30 PM

Effects of Caffeine Dose Timing on Total Urine Excretion during Sodium-Aided Hyperhydration Protocols.

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When used alone, both caffeine and sodium-aided hyperhydration (SAH) can be ergogenic. Although caffeine use in conjunction with SAH promotes diuresis, hyperhydration can be achieved, albeit at lower levels compared to SAH alone. Previous caffeine and SAH work has suggested most of the caffeine induced diuresis occurs within 15 min of consumption of a bolus of caffeine, sodium and water. This response suggests that caffeine-induces diuresis for only 15 min following its consumption, and/or that the diuretic effects of caffeine are dependent on hydration levels. **PURPOSE:** to determine the effects of caffeine, consumed at different time-points, on diuresis during SAH protocols. **METHODS:** Subjects were 17 healthy males (23 ± 5 yr, 177 ± 8 cm, 83.4 ± 15.3 kg). Each performed 4, 90 min hyperhydration trials in a randomized, double-blind fashion. Protocols began with a bladder void and measurement of urine specific gravity (USG) followed by ingestion of 15 mL H_2O · kg bm^{-1} with one of four treatments: Placebo (PL), 70.5 mg NaCl · kg bm^{-1} (Na), or a combination of NaCl and caffeine consumed in two different strategies: 70.5 mg NaCl + 5 mg caffeine · kg bm^{-1} taken at the start of the trial (NaCaf0), or 70.5 mg NaCl · kg bm^{-1} taken at the start and 5 mg caffeine · kg bm^{-1} taken at 75 min of the trial (NaCaf75). After consuming the water, subjects rested for 90 min performing a measured bladder void every 15 min. Total urine excreted (TUE) was expressed as a percentage of the total fluid consumed during the hyperhydration protocols. USG and TUE were compared using one-way repeated measures ANOVA with Sidak post hoc analyses. Levels of significance were set *a priori* at $P < 0.05$. **RESULTS:** USGs were 1.007 ± 0.003 (PL), 1.008 ± 0.003 (Na), 1.007 ± 0.004 (NaCaf0), and 1.009 ± 0.004 (NaCaf75) ($P > 0.05$). TUE for PL (87 ± 30%) was significantly higher than all other protocols ($P < 0.05$). TUE for NaCaf0 (73 ± 16%) was significantly higher than Na (56 ± 18%, $P = 0.02$) and NaCaf75 (52 ± 13% $P < 0.01$). NSD in TUE was observed between Na and NaCaf75. **CONCLUSION:** The results reaffirm that, when caffeine is consumed at the beginning of a SAH strategy, hyperhydration can be achieved, but at a lower level compared to SAH without caffeine. The results also suggest that waiting to consume caffeine until 75 min after water is consumed does not result in caffeine induced diuresis during a SAH protocol.

2058 Board #214 May 30 2:00 PM - 3:30 PM

Dehydration Impairs Accuracy and Increases Brain Activity During a Rhythmic Bimanual Choice Reaction Time Task

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(No relevant relationships reported)

Dehydration impairs motor coordination but the influence on other fundamental cognitive-motor functions is unclear. **PURPOSE**: To determine the impact of dehydration on rhythmic bimanual choice performance (accuracy & reaction time) and brain function (electroencephalography). **METHODS**: Ten aerobically fit men (22.4 ± 2.5 y) completed three experimental sessions: control (seated rest; CON), dehydration (EHS-DEH) induced by 2.5 h intermittent walking in the heat (45ºC, 15% RH), and euhydration (EHS; 2.5 h intermittent walking in the heat but matching sweat loss with water ingestion). Performance during a bimanual probabilistic choice reaction time task (PCRT; 32 min) consisting of randomly presented dominant (~67%) and non-dominant (~33%) stimuli was examined concurrently with visual evoked potentials. Perceived PCRT mental workload (NASA-TLX, 21-point scale) was assessed following task completion. **RESULTS**: PCRT reaction time was not different ($p = 0.40$) averaged across trials (CON: 538.3 ± 37.7, EHS: 542.6 ± 39.2, DEH: 532.6 ± 39.2 ms). EHS-DEH (67.3 ± 14.1%) reduced PCRT accuracy during non-dominant (less frequent) responses vs. CON (83.7 ± 5.8 %; $p = 0.04$) but not compared with EHS (74.6 ± 11.0 %; $p = 0.18$). Accuracy during dominant stimuli were not different across trials ($p > 0.05$). N1 amplitude in the occipital electrodes (perceptual processing) was higher following EHS-DEH (385.2 ± 141.3 uV*ms) compared to CON (241.8 ± 168.6 uV*ms; $p = 0.001$) but not vs. EHS (300.3 ± 171.1 uV*ms; $p = 0.60$). EHS and CON were not different from each other ($p = 0.60$). No differences ($p > 0.05$) were observed among trials for the contingent negative variation (movement anticipation) or N2 (stimulus categorization). EHS-DEH (6.4 ± 5.0) elicited greater levels of perceived effort vs. CON (3.7 ± 2.4; $p = 0.03$) and frustration vs. EHS (11.8 ± 5.0, 7.5 ± 5.1; $p = 0.0004$). **CONCLUSIONS**: Dehydration increased perceived effort, frustration, and perceptual processing demands, resulting in impaired accuracy for this cognitive-motor task requiring vigilance during prolonged fine motor movements. Prevention of dehydration during exercise-heat stress preserved cognitive-motor performance, brain activity, and mental workload similar to control conditions.
Supported by Carl V. Gisolfi Memorial Fund ACSM Foundation Grant

2059 Board #215 May 30 2:00 PM - 3:30 PM

Dehydration Has No Influence on Simulated Motor-race Performance Despite Greater Cardiovascular and Thermoregulatory Demand

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Purpose: Motor-racing drivers compete in hot compensable environments imposing high physiological strain. Dehydration may impact a driver's health, safety and race performance. This study examined the effect of heat-induced dehydration on performance and physiological outcomes during a simulated motor-race.
Methods: Fifteen healthy men [age: 25.2±5.4 y, body mass: 84.8±10.7 kg, $\dot{V}O_{2peak}$: 43.7±7.8 mL.kg^{-1}.min^{-1} (mean±SD)] participated in this controlled crossover study. Participants were randomised (counter-balanced) to a no fluid trial [1.9±0.1% body mass loss (BML) via sauna exposure (wet bulb globe temperature (WBGT): 43.6±2.8°C)] and fluid trial [1.0±0.5% body mass gain via room temperature water consumption every 10 min during sauna exposure]. All participants completed ~60 min of Australian simulated motor-racing in a heated (WBGT: 33.7±0.7°C) laboratory with no fluid provided to both trials which resulted in a 1.3±0.4 and 0.9±0.2% BML for the fluid and no fluid trials respectively. Lap time, physiological strain, heart rate and core/skin temperature were measured throughout the task. Urine [specific gravity (USG) and osmolality (Uosm)], body mass, and serum [sodium (Na), osmolality (Sosm), and plasma volume (PV)] samples were collected pre- and post- sauna and race.
Results: Mean lap time was not different between trials (fluid=134.981±2.402 s, no fluid=134.718±2.147 s; p=0.293). The no fluid trial resulted in significantly higher (p<0.05) peak heart rate (129±16 vs. 121±16 beats.min^{-1}), core temperature (38.0±0.2 vs. 37.7±0.3°C), physiological strain (4.1±1.1 vs. 3.5±1.1), Sosm (310±4 vs. 300±4 mOsm.kg^{-1}), Na (138.7±2.1 vs. 135.8±4.5 mmol.L^{-1}), USG [median(interquartile range): 1.025(1.024-1.027) vs. 1.006(1.004-1.013)], U_{osm} [942(879-1010) vs. 221(186-497) mOsm.kg^{-1}], total body mass loss (2.7±0.3 vs. 0.9±0.4%) and change in PV (-7.9±4.2 vs. -3.3±4.2 %) than the fluid trial.
Conclusion: Dehydration of ~2.7% BML without fluid replacement had no influence on simulated race performance measured by mean lap time, despite significantly greater cardiovascular and thermoregulatory demand. Further research is warranted to assess the impact of greater cardiovascular and thermoregulatory demand from dehydration on the safety, health and well-being of drivers.

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Self-Reported Changes in Thirst and Alertness during Variable Prescribed Fluid Intake

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PURPOSE: To evaluate the relationship between self-reported thirst and alertness in people drinking variable amounts of prescribed water. **METHODS:** Subjects (n = 115, 59 males, 32 ± 10 y; 24.6 ± 4.4 kg·m^{-2}) visited the lab 3 times over 10 days: V1, a baseline visit that prior to participants were drinking *ad libitum*; V2, following 3 days of fluid restriction (1 L·d^{-1}, of which 250 mL was consumed in the morning prior to the visit); and V3, the morning following a prescribed increase in water intake. The increase in water intake at V3 varied by group assignment: a control group (CON) maintained 250 mL of morning water consumption, while LOW and HIGH intake groups (n = 45 each) consumed 496 ± 82 mL and 878 ± 125 mL, respectively. At each visit, which occurred after the morning water consumption period, subjects indicated on an open-ended visual analog scale (VAS) how thirsty and alert they felt. Two-way ANOVA for thirst and alertness between groups from V1 to V2 and V2 to V3 were completed. Repeated measures correlation procedure was completed for change in alertness and thirst from V1 to V2 and V2 to V3. **RESULTS:** Groups were similar at baseline (V1) for fluid intake, thirst and alertness (all $p \geq 0.17$). Fluid restriction (V2) resulted in a main effect of time for both thirst and alertness (both $p < 0.01$), with no main effect of group. On average, thirst increased (35 ± 35 mm) and alertness decreased (-19 ± 31 mm) from V1 to V2. The prescribed increase in water intake (V3) revealed a significant interaction of time and group for both thirst and alertness (both $p < 0.01$). Independent-samples t-tests revealed that HIGH reduced thirst (-38 ± 37 mm) and increased alertness (18 ± 25 mm) significantly more than both LOW (thirst, -7 ± 37 mm; alertness -1 ± 24 mm) and CON (thirst, -6 ± 23 mm; alertness 0 ± 23 mm; all $p < .01$). There was no difference between LOW and CON (both $p > 0.92$). Repeated measures correlation analysis showed a negative relationship between change in alertness and thirst ($R^2 = 0.29$, $p < 0.01$). **CONCLUSION:** An inverse relationship was observed between self-reported alertness and thirst. Following fluid restriction, drinking a larger volume of water (750-1000 mL) in the morning decreased thirst and increased alertness.
Investigation funded by Danone Research

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Exercise Induced Hypohydration Reduces Subsequent Ad-libitum Food Intake

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Reported Relationships: **L.J. James:** *Industry contracted research; Funding from PepsiCo and LucozadeRibenaSuntory, with funds paid to the institution.*

The relationship between hydration status and appetite regulation/energy intake is unclear. Animal models suggest hypohydration/reduced water availability suppresses food intake, but the effects in humans are less clear, with a paucity of research examining exercise-induced hypohydration. **PURPOSE:** To investigate the effects of exercise-induced hypohydration with or without post-exercise rehydration on *ad-libitum* energy intake, as well as selected appetite regulatory gut peptides. **METHODS:** Twelve recreationally active, non-obese males (mean (SD) age 22±3 y; height 1.77 (0.06) m; body mass 77.7 (9.8) kg; VO_2peak 47 (9) mL/kg/min) completed a 75 min treadmill run at 65% VO_2peak in 24.5 (0.8) °C and 82 (4) % relative humidity without fluid intake, inducing body mass loss of 1.7 (0.4) %. Over the subsequent hour, subjects either rehydrated with water equivalent to 100% of body mass loss (REHY) or consumed no water so they remained hypohydrated (HYPO). A multi-item *ad-libitum* buffet lunch was then served, with subjects instructed to eat until 'comfortably full and satisfied'. Venous blood samples were taken before and after exercise and before lunch. **RESULTS:** Serum osmolality was higher, whilst plasma volume was lower pre-lunch during HYPO vs REHY (P<0.05). *Ad-libitum* energy intake at lunch was lower in HYPO (1149 (638) kcal vs 1399 (712) kcal; P=0.024), whilst *ad-libitum* water intake from drinks (733 (243) mL vs 344 (288) mL; P=0.008) and from food and drinks combined (1113 (330) mL vs 737 (366) mL P=0.011) were higher in HYPO. Additionally, fat (P=0.042) and salt (P=0.046) intake were lower in HYPO, whilst carbohydrate (P=0.064) and protein (P=0.099) intake tended to be lower in HYPO. Pre-lunch, acylated ghrelin concentration was lower in HYPO (48.7 (35.3) pg/mL vs 62.7 (33.5) pg/mL; P=0.038), but there was no difference between trials for PYY (P=0.157) or GLP-1 (P=0.379) concentrations. **CONCLUSION:** These data suggest that in healthy, non-obese males, exercise induced hypohydration without subsequent rehydration reduces acylated ghrelin concentration, as well *ad-libitum* energy intake. Exercise-induced changes in hydration should be carefully considered in situations where adequate post-exercise energy and nutrient replenishment are important. This project received no funding.

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Influence Of Different Hydration Levels On Artistic Gymnastics Performance In Preadolescent And Adolescent Gymnasts

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The effect of different hydration levels in artistic gymnastics performance has not been studied. **PURPOSE**: To examine the possible influence of different hydration levels in artistic gymnastics performance in preadolescent and adolescent gymnasts. **METHODS:** Eleven male preadolescent and adolescent artistic gymnasts [12.1 ± 0.8 (range 10-15) years old, 2.8 ± 0.2 (range 2-3.5) Tanner Stage; mean ± SE] performed two 3-hour identical training sessions separated by one week, while they ingested artificially sweetened water equivalent to either 50% (Low Volume; LV) or 150% (High Volume; HV) of the fluid lost in training. After training, in both trials participants performed the same programs in 3 apparatuses and were evaluated by an international level judge via the assistance of video. The fluid lost in training was identified during three similar preliminary training sessions, where gymnasts drunk water *ad libitum,* and was observed that they replaced about 50% of their fluid lost. Hydration, dietary and training status were controlled before LV and HV trials which were performed in a random order and under similar environmental conditions (23.4 ± 0.3 °C and relative humidity 53-54 ± 2% in both LV and HV). Pre and post exercise differences between trials were analyzed using two-tailed t-tests, whereas responses over time were examined by 2-way ANOVA. **RESULTS:** The different volumes of

fluid provided established different hydration levels as indicated by the different urine specific gravity (USG) levels post-exercise (LV: 1.017 ± 0.002 vs. HV: 1.002 ± 0.001; *p<0.001*), while pre-exercise USG were similar between conditions (LV: 1.018 ± 0.002 vs. HV: 1.015 ± 0.001; *p=0.09*). The percentage of fluid lost was higher in LV (1.2 ± 0.2 %) compared to HV (0.4 ± 0.1 %) (*p=0.02),* however, mean performance evaluation in the 3 apparatuses was not different between conditions (LV: 8.72 ± 0.21 vs. HV: 8.68 ± 0.20; *p=0.57*). **CONCLUSIONS:** By ingesting fluid equivalent to about 50% of the fluid lost during a 3-hour training session, artistic gymnasts of about 12 years old maintain short-term hydration levels and avoid excessive dehydration (> 2 %). Ingesting a higher amount of fluid equivalent to about 1.5 times the fluid lost does not provide an additional benefit in terms of performance evaluation.

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The Effects of Mode of Rehydration on Subsequent Exercise-heat Challenge Performance

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PURPOSE: Athletes and soldiers routinely exercise in the heat for extended periods of time without matching fluid intake to sweat rate, risking impaired physiologic function and performance decrements. Intravenous and oral rehydration are both used to overcome performance decrements associated with dehydration. The purpose of this study was to examine the efficacy of mode of rehydration using athletically relevant dehydration- rehydration-exercise scenarios.
METHODS: Ten healthy, active men (age 23.3 ± 1.1 yr; height, 177.8 ± 2.8 cm; body mass, 81.4 ± 1.3 kg; body fat, 11.0 ± 1.0%, VO_{2max}, 58.8 ± 1.3 ml·kg^{-1}·min^{-1}) completed four trials consisting of overnight dehydration, exercise dehydration, rehydration, observation and an exercise-heat challenge (EHC) in a hot environment (35.6 ± 0.2 °C, 35.0 ± 1.8 % relative humidity) differing only in rehydration mode. Participants were rehydrated to -2% of baseline weight over 30 minutes with intravenous (IV), oral (ORAL), ½ IV + ½ ORAL (I+O), or *ad libitum* (ADL) half-normal saline. For the EHC subjects completed a 25 min submaximal run followed immediately by an all-out maximal 0.5 mile run, five minutes rest, and five minutes of repetitive box lifting (RBL). Run time and number of boxes lifted per minute were recorded. Performance data was analyzed with a two- way repeated measures ANOVA.
RESULTS: Total number of boxes lifted was significantly lower in the ADL and ORAL trials (47.1 ± 9.5, 46.3 ± 11.8, respectively) compared to I+O (52.3 ± 11.1), but not IV (49.9 ± 12.2). Boxes lifted during minutes 1 and 5 were significantly higher than minutes 2, 3, and 4 for all trials. Performance times for the 0.5 mile run were not different among trials.
CONCLUSIONS: Partial rehydration via IV and oral fluids appears to have an ergogenic effect on high-intensity, total-body exercise in the heat possibly due to a combination of more rapid plasma volume restoration, oropharyngeal and gastric cues, as well as reduced gastric distention discomfort due to a lesser amount of oral fluids. These findings suggest a synergistic benefit to total-body performance with I+O between exercise bouts in the heat.

2064 Board #220 May 30 2:00 PM - 3:30 PM

Hydration And Gender Differences In Terms Of Non-oxidative Performance

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Nonoxidative performance is vital to the performance of many high level athletes (Armstrong, Johnson, McKenzie, Ellis, & Williamson, 2015; Chamari, Chaouachi, & Racinais, 2015). Many athletes are voluntarily hypohydrated through training as they do not properly rehydrate after a training session (Cengiz, 2015). The decrease in performance that accompanies changes in hydration can negatively impact athletes (Cengiz, 2015). **PURPOSE:** The present study examined the effect of hydration status on nonoxidative performance and to examine differences between the genders in terms of nonoxidative performance. **METHODS:** Twelve subjects, 6 males and 6 females, completed three sessions where a Wingate test was performed and lactate was measured. All subjects were NCAA Division III club or varsity athletes. The subjects completed a familiarization trial, a trial in the hypohydrated state and a trial in the hydrated state. The hypohydrated trial was completed after a 12 hr water restriction in order to induce a 2-4% decrease in body weight. No weight was lost prior to the hydrated trial and urine specific gravity was below 1.010. **RESULTS:** No significant difference was found in terms of hydration and nonoxidative performance (p = .082, η^2 = .27). A significant difference was found in terms of gender and nonoxidative performance. Males had a higher nonoxidative capacity (9.01 W/kg ± 0.37 vs. 6.58 W/kg ± 0.37, p = .001), nonoxidative power (13.51 W/kg ± 1.12 vs. 9.18 W/kg ± 1.12, p = .021) and fatigue index compared to females (24.84 W/s ± 3.86 vs. 10.28 W/s ± 3.86, p = .024). **CONCLUSION:** The results from this study indicate that hydration does not influence non-oxidative performance in NCAA Division III club or varsity athletes. Female
athletes within this study had a decreased nonoxidative performance compared to the male athletes. These results contradict previous findings that indicated that relative measures of nonoxidative performance did not vary between the genders when represented in relative terms (Maud & Shultz, 1986; Van Praagh, Fellman, Bedu, Falgairette & Coudert, 1990). Future research can be performed to look at differences in fat mass between the genders and the impacting collegiate athletes in terms of non-oxidative performance.

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Effects Of Caffeine Dose Timing On The Time-course Of Diuresis During Sodium-aided Hyperhydration.

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When used alone, both caffeine and sodium-aided hyperhydration (SAH) can be ergogenic. Caffeine, when used with SAH, promotes diuresis, but hyperhydration can be achieved, albeit at lower levels than with SAH alone. In previous caffeine and SAH work, caffeine induced diuresis occurred only within 15 min of consumption of a bolus of caffeine, NaCl, and H_2O. This suggests that caffeine-induced diuresis may occur for only 15 min after its consumption, and/or that the diuretic effect of caffeine is dependent on hydration levels. Caffeine has been shown to be ergogenic when taken as little as 5 min before exercise; thus, determining the temporal aspects of caffeine induced diuresis in conjunction with SAH may lead to better pre-exercise nutritional strategies. **PURPOSE**: To determine the effect of caffeine, consumed at different time-points, on diuresis over a 90 min SAH protocol. **METHODS**: Subjects were 17 males (23 ± 5 yr, 177 ± 8 cm, 83.4 ± 15.3 kg). Each performed 2, 90 min SAH trials beginning with a bladder void and measurement of urine specific gravity (USG) followed by ingestion of 15 mL H_2O · kg bm^{-1} with one of two treatments: 70.5 mg NaCl + 5 mg caffeine · kg bm^{-1} taken at the start of the trial (NaCaf0), or 70.5 mg NaCl · kg bm^{-1} taken at the start and 5 mg caffeine · kg bm^{-1} taken at 75 min of the trial (NaCaf75). After consuming the H_2O, subjects performed a measured bladder void every 15 min for 90 min. USGs were compared using a paired t-test. Urine excretions (UE) for each bladder void of the trials were expressed as a percentage of the total H_2O consumed and compared with a two-way repeated measures ANOVA and Sidak post hoc analyses. **RESULTS**: USGs were 1.007 ± 0.004 (NaCaf0), and 1.009 ± 0.004 (NaCaf75) (P = 0.30). UE for NaCaf0, and NaCaf75, respectively at the urine collection points were 15 ± 9%, 7 ± 6% (15 min, P < 0.01), 15 ± 5%, 9 ± 2% (30 min, P < 0.01), 18 ± 5%, 14 ± 4% (45 min, P = 0.05), 15 ± 5%, 11 ± 6% (60 min, P = 0.05), 10 ± 5%, 8 ± 6% (75 min, P = 0.25), and 7 ± 5%, 6 ± 3% (90 min, P = 0.88). **CONCLUSIONS**: Although consuming caffeine at the start of the trial resulted in significantly greater diuresis for the first 30 min of the trial, waiting to consume caffeine until 75 minutes after the consumption of the water and NaCl did not result in caffeine induced diuresis 15 min after consumption of the caffeine.

2066 Board #222 May 30 2:00 PM - 3:30 PM

Racial Differences in 24 Hour Urinary Hydration Markers

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Prior literature has investigated racial/ethnic differences in hydration status based on spot urine samples, however, no literature has examined these differences using 24 h urinary hydration measures.
PURPOSE: To examine 24 h urinary hydration markers in college-aged non-Hispanic White (WH) and non-Hispanic Black (BL) men and women.
METHODS: Thirteen men (BL, n=6; WH, n=7) and nineteen women (BL, n=16, WH, n=3) (mean±SD; age, 20±4y; height, 169.2±12.2cm; body mass, 71.3±12.2kg; body fat, 20.8±9.7%), combined from two separate research projects were included.

Participants provided a 24 h urine sample across 7 (n=13) or 3 (n=19) consecutive days (148 d total) for assessment of urine volume (U_{VOL}), urine osmolality (U_{OSM}), urine specific gravity (U_{SG}), and urine color (U_{COL}). Differences in 24 h hydration status between sex and ethnicity were assessed using linear mixed effects models with associated Bonferroni post hoc analyses. Significance was set a-priori at $p<0.05$.
RESULTS: U_{VOL} was significantly lower in BL (0.85±0.43 L) compared to WH college students (2.03±0.70 L) ($p<0.001$). Conversely measures of U_{OSM}, U_{SG}, and U_{COL}, were significantly greater in BL (716±263 mOsm•kg^{-1}, 1.020±0.007, and 4.2±1.4, respectively) compared to WH college students (473±194 mOsm•kg^{-1}, 1.013±0.006, 3.0±1.2, and respectively) ($p<0.05$). Independent of race, women were significantly less hydrated than men by measures of U_{VOL}(MD [95% CI];-0.56 L [-0.823, -0.308], $p<0.001$), U_{OSM}(107 mOsm•kg^{-1} [24, 190], $p=0.012$), U_{SG}(0.003 [0.001, 0.005], $p=0.017$), and U_{COL}(-0.6 [-1.2, -0.1], $p=0.012$).
CONCLUSIONS: Based on 24 h urinary hydration markers, college-aged non-Hispanic Black men and women were inadequately hydrated compared to their non-Hispanic White counterparts when assessed over consecutive days. Furthermore, women were significantly less hydrated than men, independent of racial background. Given the importance of hydration on acute and long-term health, identifying populations that are inadequately hydrated may allow for the development of targeted strategies to improve habitual fluid intake. Future research examining 24 h hydration status coupled with fluid intake behaviors across a broader sample of races or ethnicities is warranted to further understand the determinants that guide drinking behaviors.

2067 Board #223 May 30 2:00 PM - 3:30 PM

Hydration Knowledge and Behavior in Youth Mountain Bike Teams

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Many youth sports organizations recognize the importance of educating on hydration practices and awareness, however, according to recent research current hydration education is not translating to effective practices. **PURPOSE**: The purpose of this study was to assess and describe the hydration knowledge and behavior of student-athletes participating in competitive youth mountain bike teams. **METHODS**: One hundred thirty-three student-athletes, 11-18 years were surveyed on hydration knowledge and behavior. Participants were apparently healthy and active members of a National Interscholastic Cycling Association Mountain Bike Team. **RESULTS**: The mean score for knowledge was 9.3±1.5 (out of 15). Less than 30% of participants scored higher than 70% (≥10.5 out of 15). Adequate knowledge was described as ≥ 70% of a maximal score of 15. Over 98% of participants understood the importance of fluids on performance, however, only 65% of participants received hydration education. Knowledge scores were significantly higher ($P < 0.05$) in those receiving hydration education; however mean knowledge scores were still low (9.5±1.5). Mean knowledge scores increased by year in school but were still low. Post-exercise weight loss knowledge was varied between answers. Of those who felt their fluid intake during training or races was adequate, 70% had low knowledge scores. Girls reported they were less certain about being adequately hydrated than boys (Girls: 63%, Boys: 37%). Stopping in a race due to an excessive feeling of heat was significantly higher in boys (60%) than in girls (40%). **CONCLUSION**: Despite understanding the importance of keeping hydrated, mean knowledge scores indicated inadequate knowledge, while hydration behavior indicated inconsistency in translation of knowledge.

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Afternoon Urine Osmolality Is Equivalent To 24-h In Healthy 3-13 y Children

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While daily hydration is best assessed in a 24-h urine sample, using a urine spot sample can be more practical for healthcare professionals, researchers, and individuals. Although urine product is subject to circadian variation, 24-h urine concentration reported to be approximated from a mid- to late-afternoon spot urine sample in adults. However, no data exists in children. **PURPOSE**: To identify time windows during which spot values of urine osmolality (UOsm) is representative of 24-h values in healthy children.
METHODS: Among 541 healthy children (age: 3-13 y, female: 45%, BMI: 17.7±4.0 kg·m^{-2}), equivalent test was performed by comparing UOsm from specific time windows [morning (0600-1159), early afternoon (1200-1559), late afternoon (1600-1959), evening (2000-2359), overnight (2400-0559), and first morning (0600-0959)] to 24-h urine sample. The equivalency was determined when the mean difference and the confident interval between the spot and 24-h urine sample fell below the bound of 80 mmol·kg^{-1}. The analysis was performed by using the first spot urine sample from each time window. Other spot urine samples after the first spot urine within each time window were not used to avoid unequally weighting data.
RESULTS: Equivalence test showed that the late afternoon (1600-1959) spot urine sample UOsm value was equivalent to the 24-h UOsm value in children ($P<0.05$; mean difference: 62; CI: 45-78). The overall diagnostic ability of urine osmolality assessed at late afternoon (1600-1959) to diagnose elevated urine osmolality (>800 mmol·kg^{-1}) on the 24-h sample was "good" (area under the curve: 87.4%; sensitivity: 72.6%; specificity: 90.5%; threshold: 814 mmol·kg^{-1}).
CONCLUSIONS: These data suggest that in free-living healthy children, 24-h urine concentration can be approximated from a late afternoon spot urine sample.

D-65 Free Communication/Poster - Thermoregulation/Hyperthermia

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

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Comparison of Skin Cleaning Methods for Measurement of Regional Sweat Electrolyte Concentrations

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Reported Relationships: **S.D. Brown:** *Salary; Gatorade Sports Science Institute, PepsiCo Inc. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc..*

Various skin preparation methods, ranging from MINIMAL (alcohol wipes) to more THOROUGH (e.g., shaving and cleaning), have been used to remove surface contamination prior to patch application for sweat electrolyte measurements. Using MINIMAL cleaning methods could improve athlete participation and the efficiency of sweat testing in the field, but it is unknown if this would result in higher sweat [Na^+], [Cl^-], and [K^+] due to insufficient removal of surface contamination.**PURPOSE**: To compare the effect of MINIMAL vs. THOROUGH skin cleaning methods on regional sweat [Na^+], [Cl^-], and [K^+].
METHODS: Thirteen subjects (7 male, 6 female; 23-45 y; 74.6±15.8 kg) cycled at ~80% HR_{max} in a warm laboratory (30°C, 50% rh) while sweat was collected from right (RDF) and left (LDF) dorsal forearms with absorbent patches (3M™ Tegaderm+Pad). Prior to patch application (20 min before exercise), the RDF was shaved, cleaned with alcohol, wiped with deionized water, and dried with gauze (THOROUGH). The LDF was cleaned with alcohol wipes only (MINIMAL). Patches were removed upon adequate sweat absorption (0.60±0.15 g, 57±15 min). Sweat from absorbent patches was extracted via centrifuge and subsequently analyzed for [Na^+], [Cl^-], and [K^+] by ion chromatography. Regional sweating rate (RSR) was determined via gravimetry.
RESULTS: There were no differences between MINIMAL and THOROUGH for sweat [Na^+] (54.4±24.7 vs. 53.4±23.8 mM, $p=0.06$) or sweat [Cl^-] (45.2±23.2 vs. 44.4±22.2 mM, $p=0.13$). Bland Altman 95% limits of agreement (LOA) were 4.0 to -2.2 mM and 4.8 to -3.0 mM for sweat [Na^+] and [Cl^-], respectively. Sweat [K^+] was higher with MINIMAL vs. THOROUGH cleaning (5.0±0.8 vs. 4.5±0.6 mM, $p=0.001$; LOA: 1.3 to -0.3 mM). RSR was not different between cleaning methods (0.973±0.411 vs. 0.954±0.406 mg/cm^2/min, $p=0.75$; LOA: 0.435 to -0.397 mg/cm^2/min).
CONCLUSIONS: MINIMAL cleaning of the skin with alcohol results in similar regional sweat [Na^+] and [Cl^-] compared with more THOROUGH preparation that includes shaving of hair and cleaning with alcohol and deionized water. Sweat [K^+] is statistically (but not practically) higher when MINIMAL cleaning is conducted. THOROUGH skin preparation prior to sweat testing may not be warranted; although future research in field conditions is needed to confirm that MINIMAL cleaning is adequate.

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Epifluidic Colorimetric Patch for On-Skin Analysis of Regional Sweat Chloride Concentration during Laboratory-based Exercise

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Assessing regional sweat electrolyte concentrations using standard patch techniques requires post-collection benchtop harvesting and analysis of sweat, which precludes real-time feedback to athletes. A technique enabling on-skin analysis is needed to advance the practicality of sweat testing. **PURPOSE**: To determine the accuracy and reliability of a novel epidermal microfluidic patch with built-in colorimetric assay (Epifluidic patch) to measure regional sweat [Cl^-].
METHODS: Twenty-three subjects (15 male, 8 female; 18-42 y; 72.3±11.2 kg) cycled at 85% HR_{max} in a warm laboratory (30°C, 50% rh) while sweat was collected from the right and left ventral forearms with an Absorbent patch (3M Tegaderm+Pad) and Epifluidic patch (Epicore Biosystems, Inc.), respectively. A subset of subjects (n=9) completed two identical trials 2-4 days apart to determine test-retest reliability. Immediately after removal of the Absorbent patch, an image was taken of the Epifluidic patch on-skin with a digital single-lens reflex camera for analysis of [Cl^-] via colorimetry. Sweat from the Absorbent patch was extracted via centrifuge and subsequently analyzed for [Cl^-] by ion chromatography. Data are shown as mean±SD.
RESULTS: There was no difference in sweat [Cl^-] between Absorbent and Epifluidic patches (32.9±16.8 vs. 34.5±19.6 mmol/L, p=0.21). Bland-Altman Limits of Agreement between methods was -10.1 to 13.3 mmol/L. There was a significant correlation between patches (r=0.96, p<0.0001) and the coefficient of determination (r^2) for predicting Absorbent from Epifluidic patch [Cl^-] was 0.92. Based on Deming regression analysis, the slope and intercept of the regression line describing Absorbent vs. Epifluidic patch sweat [Cl^-] were not different than 1 and 0, respectively. Sweat [Cl^-] was not different between repeat trials for the Absorbent (1.4±4.4 mmol/L, p=0.36) or Epifluidic patch (-0.4±1.6 mmol/L, p=0.51) and test-retest CVs were 12% and 4%, respectively.
CONCLUSIONS: The Epifluidic patch provides accurate and reliable data for forearm sweat [Cl^-] estimation during exercise in controlled laboratory conditions. Future research is needed to evaluate the Epifluidic Colorimetric Patch for on-skin analysis of sweat [Cl^-] at other regional sites as well as during live practices and games.

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Skin Tattoos Do Not Affect Exercise-induced Sweat Rate Or Sodium Concentration.

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(No relevant relationships reported)

PURPOSE: Skin tattoos have been shown to reduce sweat rate and increase sweat sodium concentration when sweating is artificially stimulated. This study investigated whether similar responses are observed with exercise-induced sweating.
METHODS: Twenty-two healthy individuals (25.1±4.8 y (Mean±SD), 14 males) with a unilateral tattoo ≥11.4 cm^2 in size, >2 months in age, and shaded ≥50% participated in this investigation. Participants undertook 20 min of intermittent cycling (4 x 5 min intervals) on a stationary ergometer in a controlled environment (24.6±1.1°C, RH 64±6%). Resultant sweat was collected into absorbent patches applied at two pairs of contralateral skin sites (pair 1: Tattoo vs. Non-Tattoo; pair 2: Control 1 vs. Control 2 (both non-tattooed)), for determination of sweat rate and sweat [Na+]. Paired samples t tests were employed to determine differences between contralateral sites.
RESULTS:Tattoo vs. Non-Tattoo: Neither sweat rate (Mean±SD: 0.92±0.37 vs. 0.94±0.43 $mg \cdot cm^{-2} \cdot min^{-1}$, respectively; p=1.000) nor sweat [Na+] (Median(IQR): 36(32-53) vs. 37(31-45) $mM \cdot L^{-1}$, respectively; p=0.827) differed. Control 1 vs. Control 2: Neither sweat rate (Mean±SD: 1.19±0.53 vs. 1.19±0.53 $mg \cdot cm^{-2} \cdot min^{-1}$, respectively; p=0.917) nor sweat [Na+] (Median(IQR): 29(26-41) vs. 31(25-43) $mM \cdot L^{-1}$, respectively; p=0.147) differed. The non-significant differences for Tattoo vs. Non-Tattoo were within the range of normal variability (sweat rate CV=5.4%; sweat [Na+] CV=4.4%).
CONCLUSIONS: Skin tattoos do not appear to alter rate or [Na+] of exercise-induced sweat. The influence of skin tattoos on thermoregulatory responses to exercise may have been over-estimated.

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Comparison of Sports-Oriented Sweat Prediction Equation Performances During Running

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Reported Relationships: **K.J. Sollanek:** *Other (please describe); Travel support for Dr. Sollanek provided by Sports Science Synergy, LLC.*

PURPOSE: This study compared the performance of three sports-oriented sweat prediction equations against measurements made during outdoor running or indoor treadmill running with adequate airflow.
METHODS: Eleven open literature studies were identified where runner sweating rates (L/h) were carefully measured and reported from changes in body mass (n = 109). For studies that did not correct for non-sweat losses of body mass, a standardized correction of 0.20 g/kcal was subtracted from the reported sweating rates. Body mass, air temperature, relative humidity, running speed and distance or duration was provided in the published reports. A prospective field study of n = 37 volunteers was completed with n = 40 separate sweating rate observations made. Outdoor track testing was completed through a range of environmental conditions (temperature range: 10-31.3°C). The performance of three sports-oriented sweat prediction equations (H2Q™, Putnam, and Barr & Costill) was compared to measured sweating rates.
RESULTS: Measured sweating rates from the literature ranged from 0.417 to 2.129 L/h; track sweating rates ranged from 0.293 to 1.739 L/h. Agreement between measured (x-axis) and predicted (y-axis) sweating rates were assessed using the concordance correlation coefficient (CCC; ≥ 0.800). The relative error (RE; < 1.000) and accuracy (percent agreement; ≥ 70%) were also assessed using 0.250 L/h as an error acceptance threshold. For retrospective data (n = 109), the CCC ranged from 0.377 to 0.809; RE from 0.732 to 1.208; accuracy from 43 to 70%. For prospective data, the CCC ranged from 0.455 to 0.882; RE from 0.564 to 1.105; accuracy from 58 to 88%. In all instances the three equations performed better on the more highly controlled prospective data set. One equation (H2Q™) performed best on all three agreement parameters and on both data sets.
CONCLUSIONS: These results illustrate the difficulty of accurately predicting sweating rates in runners, but also the possibility of achieving good accuracy with the right equation.

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Validity And Reliability Of The Cortemp™Telemetric Pill During 50 H Of Reuse.

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(No relevant relationships reported)

Continuous measurement of rectal temperature using a telemetric pill (TP) inserted as a suppository has been validated. However, the use of TP may remain limited because of its high cost and single use. We have determined in our laboratory that the CorTemp™ TP can be used repeatedly over time; in fact, it has a large battery autonomy, can be turned on and off at will and easily survives high-level disinfection. Reuse of the TP is made possible using a technique involving inserting the TP inside a condom, attaching it to a dental floss and introducing the TP inside the rectum with an over-the-counter suppository applicator. **PURPOSE:** The aim of the study was to examine the validity and reliability of CorTemp™ TPs during repeated use in a water bath for a duration of 50 h. **METHODS:** Three TPs already used for less than 5 h each in a previous human study were tested in a water bath during 20 trials ranging from 1 to 5 h each, for a total of 50 h and with temperature variations ranging from 37 to 40°C. Trials were conducted in a randomized manner and temperatures of the TPs were compared to those of a wired rectal probe (YSI 401, WRP). After each trial, TPs were placed in a 2.5% glutaraldehyde solution for 20 min to achieve high-level disinfection, as recommended when a probe is used with a condom. The WRP and each TP were calibrated before the start of the experiment. Acceptable agreement between sensors was taken as a bias ≤ 0.2°C (sum of both instrument measurement errors). **RESULTS:** 50 h mean biases and random errors between TP 1, 2 and 3 and the WRP were of -0.09°C/±0.12°C, -0.10°C/±0.14°C and -0.12°C/±0.15°C, respectively. Mean biases and random errors at 17 h, 34 h and 50 h of reuse were of respectively -0.10°C/±0.11°C, -0.06°C/±0.11°C and -0.11°C/±0.11°C for TP 1 vs. WRP, -0.09°C/±0.13°C, -0.08°C/±0.12°C and -0.13°C/±0.16°C for TP 2 vs. WRP and -0.14°C/±0.17°C, -0.10°C/±0.13°C and -0.11°C/±0.12°C for TP 3 vs. WRP. **CONCLUSION:** Our results indicate that the CorTemp™ TP can be reused up to at least 50 h while still providing valid and reliable temperature readings. Furthermore, the CorTemp™ TP can undergo high-level disinfection repeatedly while maintaining full structural and functional integrity.

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Validity of Calculated Core Temperature From Heart Rate Measured by an Electronic Vest

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(No relevant relationships reported)

Recent technology has included development of ingestible pills and vests designed to monitor core and skin body temperatures. If accurate, they can be ideal in many field settings. However, little research has been performed to demonstrate the accuracy (validity) of this new technology. **PURPOSE:** We compared these new technologies with traditional modalities during 60 min of continuous cycle ergometer exercise at room (20º C) temperature. **METHODS:** Study participants included a convenience sample (N=18, 14 female, age:23.8±3.4 yr, wt: 70.4±11.6 kg, ht: 175.5±9.3 cm). Intensity for the first 30 min was set at a Power (watts, W) corresponding to individual participant RPE values of 12-13. Intensity increased to an RPE of 15-16 for the final 30 min of cycling, and W were adjusted accordingly. Heart rate (HR) was measured continuously (Polar). Core temperature was measured via a rectal (PROBE-C) thermistor and an ingestible pill (PILL). Skin temperature (PROBE-S) was measured at the arm, chest, thigh, and calf, and a mean value was calculated (Ramanathan, 1964). Core and skin temps were also estimated from a sensor electronics module located in a vest (VEST, Equivital) worn by each participant. Vest temperatures were calculated according to equations developed previously (Buller et al., 2013). Repeated measures ANOVA, Pearson correlations, and dependent t-tests were used to examine relationships among the various temperature measurement modalities (Alpha = $p<0.05$). **RESULTS:** HR averaged 125±25 and 151±18 b/min for the first and second 30 min of exercise, respectively. Likewise, Power averaged 81±22 and 97±22 W. While core temperatures were nearly identical at onset of exercise (~37.3º C), the three modalities differed after 60 min of cycling (PROBE-C; 37.9±0.8, PILL; 38.3±0.3, VEST; 38.6±0.4º C ($p<0.05$). Skin temperatures differed between PROBE-S and VEST at both beginning (31.2± 1.1 vs 33.8±1.2º C) and end (32.9± 1.5 vs 37.0±0.6º C) of exercise ($p<0.01$). Correlations among the various modalities were significant ($p<0.05$) and ranged from R=0.51 - 0.77, but did not differ from each other. **CONCLUSION:** The major study finding was that the vest estimated higher core and skin temperatures during exercise compared to traditional temperature measuring devices, overestimating work intensity at study ambient conditions.

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Physiological Strain Index Of Female Wheelchair Basketball Players During Competition

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(No relevant relationships reported)

Purpose: The purpose of this study was to assess the thermoregulatory responses and physiological strain of elite wheelchair (WC) basketball players during international competitions. Methods: Eleven female (n=11; 7 SCI and 4 Non-SCI) national team WC basketball players volunteered for the study. Testing occurred during a four-game series against the same international competitor (temp 22.1±1.2°C, RH 55±2%). Hydration habits were monitored and gastrointestinal temperature (Tc), heart rate, and skin temperature (SkT) were recorded in real-time. Results (mean±SD): Athletes arrived hydrated for all games (urine specific gravity, 1.014±0.002). Players lost a mean of 0.5±0.1% body mass due to sweat loss and replaced ~69% of fluid losses. SCI athletes played 21±4 min and Non-SCI athletes played 14±6 min. SCI athletes had a mean SkT throughout the game of 35.2±0.2°C and Non-SCI of 36.2±0.2°C. SCI SkT rose a mean of 6.3±1.1°C and Non-SCI 6.8± 0.9°C. SCI Tc rose a mean of 1.0±0.2°C and Non-SCI a mean of 0.9±0.4°C. 2/10 players reached a Tc>39°C (SCI athlete class 1, 39.4°C; Non-SCI class 4.5 athlete, 39.5°C). Mean physiological strain index (PSI) was 5.1±0.7 (range, 2.6-7.9). Athletes who played >50% of the game (n=4) had a mean PSI of 6.7±0.8 compared to athletes who played <50% of the game (n=6) who had a PSI of 3.9±0.7, with the greatest contribution to PSI from core temperature. Conclusions: Monitoring Tc and PSI during competition is encouraged to understand competition specific responses and identify athletes more at risk of heat-related fatigue due to injury level and high playing time.

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Effects of Passive Heating on Perfusive and Diffusive Microvascular Oxygen Delivery

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(No relevant relationships reported)

Previous studies have demonstrated that passive heating has led to increases in endothelial function and vasodilation of the brachial artery. The increase in vasodilation is thought to originate from increased nitric oxide bioavailability, thus increasing blood flow into the limb. However, the different aspects of the downstream microvascular oxygen delivery (i.e. perfusive and diffusive) to the exercising muscle have yet to be described. **PURPOSE:** The purpose of this study was to determine the effect of seven days of passive heating on oxygen delivery during handgrip exercise. We tested the hypothesis that, 7 days of passive heating would result in a decrease in the diffusive oxygen delivery (total-[heme]) and an increase in the perfusive oxygen delivery (deoxy-[heme]) in the exercising muscle. **METHODS:** Three participants (2 women, 23.0 ± 1.0 yrs, 70.9 ± 15.7 kg, 171 ± 10.1 cm) participated in this study. Peak power was determined by an incremental two-hand handgrip exercise test. Subjects performed 10 minutes of dynamic handgrip exercise at 40% peak power pre and post 7 days of passive heating. Absolute concentrations of deoxy-[heme] and total-[heme] of the flexor digitorum superficialis muscle were measured continuously via frequency-domain multi-distance near-infrared spectroscopy (OxiplexTS, ISS). The passive heating protocol consisted of immersion up to the shoulder in a 40°C hot tub until rectal temperature reached 38.5°C or increased by 1°C for 60 minutes. Data reported as mean ± SE. **RESULTS:** From baseline to the last 30 seconds of exercise there was no significant difference in the Δ deoxy-[heme] (perfusive oxygen delivery) for pre (52.3 ± 2.2 μM) and post passive heating (47.6 ± 16.4 μM; p=0.822). However, the Δ total-[heme] (diffusive oxygen delivery) was significantly lower following passive heating ($p<0.001$). Pre and post passive heating Δ total-[heme] was 75.1 ± 13.8 μM and 30.7 ± 13.3 μM, respectively. **CONCLUSION:** The significant decrease inΔ total-[heme] after passive heating suggests that the diffusion of oxygen into the exercising muscle was reduced. This finding, along with no change in the perfusive oxygen delivery as represented by the Δ deoxy-[heme], suggests that the oxygen uptake of the exercising muscle was decreased.

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Effect of Heat and Humidity on the Inflammatory Response During Aerobic Exercise

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to examine the inflammatory responses via classical and trans signaling in response to aerobic exercise during exposure to different environmental conditions. **METHODS:** Recreationally active men (n=12, 24.4±3.1yrs, 1.81±0.07m, 81.5±8.0kg, 47.2±4.8ml/kg/min) completed 5 experimental trials: a VO_2max test and cycling trials in 22ºC/45% RH (MTMH), 22ºC/70% RH (MTHH), 35ºC/20% RH (HTLH), and 35ºC/45% RH (HTMH). In each condition, participants cycled for 60 minutes at 60% VO_2max, rested for 15 minutes, cycled at 90% VO_2max until exhaustion (TTE), then recovered for 60 minutes. Blood was obtained before exercise (PRE), after the hour of cycling (60), after the TTE (90), and after recovery (REC). Blood was assessed for serum IL-6, IL-10, IL-1ra, TNF-α, sIL-6r, and IL-1β. Data were analyzed with repeated measures or Friedman's ANOVA. **RESULTS:** Main effects of time ($F=97.13$, $p\leq0.001$) and condition ($F=4.08$, $p=0.018$) were observed for IL-6. IL-6 increased from PRE (0.67±0.07 pg/ml) to 60 (4.79±0.77; $p\leq0.001$pg/ml) and 90 ($p\leq0.001$; 6.69±0.89 pg/ml), and decreased from 90 to REC (2.90±0.37 pg/ml; $p=0.001$). Concentrations were elevated during HTLH (4.16±0.54 pg/ml) compared to MTMH (3.42±0.53 pg/ml; $p=0.037$) and MTHH (3.30±0.43 pg/ml; $p=0.041$), and HTMH (4.17±0.34 pg/ml) compared to MTHH ($p=0.038$). A time effect for IL-10 ($F=14.49$, $p=0.001$) was observed with increases from PRE (0.34±0.04 pg/ml) to 90 (0.71±0.09 pg/ml; $p=0.002$), and no difference between conditions. An interaction was observed for IL-1ra ($F=3.73$, $p=0.015$), with concentrations increasing from PRE (276.67±29.28 pg/ml) to 90 (356.12±45.63 pg/ml; $p=0.002$), before peaking at REC (571.80±83.26 pg/ml; $p\leq0.001$). Changes were greater ($p<0.05$) during HTLH (467.81±78.82 pg/ml) and HTMH (440.29±61.85 pg/ml) than MTMH (295.06±21.08 pg/ml) or MTHH (325.45±60.03 pg/ml). An interaction was also observed for TNF-α ($F=5.73$, $p=0.001$) with increases during HTLH and HTMH from PRE (0.10±0.06 pg/ml) to 60 (1.06±0.07 pg/ml; $p=0.002$) and 90 (1.09±0.06 pg/ml; $p\leq0.001$). **CONCLUSIONS:** Data suggests high temperatures will initiate a pro-inflammatory response that may be countered by contraction-induced IL-6 response, and downstream increases in IL-1ra and IL-10.

Study partially funded by the Kent State University Research Council.

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Examining the Impact of a Prospective WBGT Heat Policy on High School Football Practices

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(No relevant relationships reported)

A wet bulb globe temperature (WBGT) policy with suggestions for practice modifications can potentially help decrease the number of exertional heat illnesses (EHIs) reported in high school football. It is unknown what impact such a policy would have on the number of outdoor football practices that would be cancelled or modified. **Purpose:** To assess WBGT during a full season of football at various high schools in Florida to determine how a regional WBGT policy would have impacted football practices. **Methods:** Environmental data was collected daily throughout the duration of the regular football season by athletic trainers stationed at 10 high schools in west central Florida. WBGT measures were recorded at approximately 4PM (R1) and again at 6PM (R2) to correspond with practice start and end times. These measures were then allocated into 5 previously defined, regional WBGT categories which corresponded to different activity modifications ranging from no modifications (WBGT < 27.8ºC) to no outdoor practices (WBGT ≥ 33.4ºC). An ANOVA was used to determine differences in WBGT between schools and across the various months during football season. **Results:** There were no statistical differences in the WBGT measures between the 10 schools at the R1 (P= 0.655) and R2 (P=0.446) timepoints. Nearly 39% (n=169) of all WBGT measures at R1 (~4PM) across the 10 schools were < 27.8ºC and would not have required any practice modifications. Only 7.5% (n=33) of the measures for this same R1 timepoint were ≥ 33.4ºC which would have resulted in cancellation of practice. Fifty-seven percent (n=208) of R2 WBGT measures were < 27.8ºC while only 1.1% (n=4) were ≥33.4ºC. Also, the maximum WBGT measurement in August (33.1 ± 0.7ºC) was significantly higher than in October (28.6 ± 0.7ºC; P=0.000) but similar to maximum WBGT in September (32.7 ± 0.9 ºC) and November (31.0 ±1.9 ºC; P>0.05). **Conclusion:** Our findings revealed that if existing regional heat guidelines would have been applied in Florida during our study, the policy would have resulted in the cancellation of outdoor practices on only a few days. It is also clear that the risk of dangerously elevated WBGT was not limited to preseason practices in August. Finally, delaying practices to later in the afternoon would likely decrease the risk of EHI and minimize the number of practices affected by a heat policy.

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An Evaluation of Race Car Cockpit Temperature as an Indicator of Thermal Strain in Race Car Drivers

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(No relevant relationships reported)

Under current Federation Internationale de l'Automobile (FIA) rules, in endurance sports car racing, if ambient temperatures inside the cockpit of a racing car exceed 32°C, then the maximum time a driver spends in the race car is reduced. However, teams have instituted air conditioning in the car which may render this rule obsolete.
PURPOSE: To evaluate if cockpit temperature of a racing car effects the thermal strain of racing driver with and without an air conditioning (AC) system.
METHODS: Four male racing drivers had heart rate (HR), core temperature (Tcore), physiological strain index (PSI) measured continuously during over 38 driving sessions including testing, practice, qualifying and a race.
RESULTS: Cockpit temperature elicited a positive relationship, with each measured variable (slope ± SE, r2, p-value); HR (1.842 ± 0.01655, 0.62, <.0001), Tcore (0.08519 ± 0.002723, 0.32, <.0001), PSI (0.1899 ± 0.007706, 0.24, <.0001). There were no significant differences in slope with AC on or AC off when compared in each variable. HR with AC on (1.867 ± 0.0191) displayed no significant difference to AC off (1.784 ± .05187, p = 0.1332). Tcore with AC on (0.8546 ± 0.002751) exhibited no change compared to AC off (0.7572 ± 0.01899, p = 0.6118). Lastly, PSI with AC on (0.1910 ± .007686) showed no difference with AC off (0.1561 ± 0.06305, p = 0.5828).
CONCLUSIONS: Air conditioning systems that are administered through the driver's helmet do not change the thermal strain caused by an increase in cockpit temperature. This concludes that the FIA's current use of cockpit temperature remains the most accurate way to estimate the thermal strain on the driver.

2080 Board #236 May 30 2:00 PM - 3:30 PM

Relationships between Body Temperatures Changes with Exercise Performance

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(No relevant relationships reported)

Purpose: To examine the relationship between changes in body temperature, and time spent above critical temperatures with aerobic performance and drinking behavior. **Methods:** 12 recreationally active men (24.4 ± 3.1yrs; 1.81 ± 0.07m; 81.5 ± 8.0kg; 47.2 ± 4.8 ml/kg/min) completed five experimental visits: a VO_2 max test, and a cycling trial in 23°C/45%RH, 23°C/70%RH, 34°C/20%RH and 34°C/45%RH. During each cycling trial, participants completed 60 minutes of cycling at 60% VO2max, a 15min rest and a time to exhaustion (TTE) at 90% VO2max. Water intake, and TTE performance was collected in each condition. During each exercise session, participants were monitored continuously for their rectal temperature (T_{re}) and skin temperatures at five locations: Chest, Triceps, Forearm, Thigh and Calf. Total skin temperature (T_{sk}) and whole body temperature (T_{wb}) were calculated using weighted averages. The Area Under the Curve with respect to increase from baseline (AUCi) was then calculated for T_{re}, T_{sk} and T_{wb}. Data were analyzed as Pearson Product Moment Correlations between AUCi for T_{re}, T_{sk} and T_{wb} with water intake and TTE performance. Furthermore, the time spent above specific critical temperatures for T_{re} (37.5, 38.0, 38.5 and 39.0°C) and T_{wb} (35.0, 36.0, 37.0 and 38.0°C) were related to water intake at TTE performance using stepwise linear regression. **Results:** Significant correlations were observed between water intake with T_{sk} (r= 0.469; p=0.003) and T_{wb} (r= 0.511; p=0.001), though no significant correlation was observed for T_{re} (p=0.059). Time spent with a T_{wb} above 35°C related to total water intake (r= 0.521; p=0.001), though no critical Tre temperature was observed. TTE performance was significantly correlated with and T_{wb} (r= -0.338; p=0.036), but not with T_{re} (p=0.179) or T_{sk} (p=0.058). Time spent with a T_{wb} above 37°C and T_{re} above 38.5°C was related to TTE performance (r= 0.409; p=0.010; r= 0.481; p=0.002, respectively). **Conclusions:** Data indicate that total water intake is driven by T_{wb}, and likely not influenced by T_{re}. TTE performance, however, is influenced by both T_{wb} and T_{re}. Future research should focus on establishing critical body temperatures to determine the points at which performance declines on an individualized basis. *This investigation was partially funded by Kent State University Research Council.*

2081 Board #237 May 30 2:00 PM - 3:30 PM

Comparison of Physiological Strain Index and Core Temperature Rise for Classifying Heat Tolerance Among Warfighters

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(No relevant relationships reported)

The heat tolerance test (HTT) is used by the military to assist with return-to-duty decisions for heat-injured warfighters. Criteria for determining heat tolerance are generally accepted as core temperature (T_{core}) < 38.6°C and heart rate (HR) < 160 bpm during 120 min of treadmill walking in a compensable heat stress environment. Additional information for classifying heat tolerance may be gained by evaluating the final 60 min of an HTT, as Druyan et al. (2013) determined a limit of < 0.45°C T_{core} increase during the final 60 min ($\Delta T_{coreF60}$). Use of calculations that encompass both T_{core} and HR, such as the physiological strain index (PSI), may also provide useful information to aid in return-to-duty decisions.
PURPOSE: To determine the validity of PSI increase during the final 60 min (ΔPSI_{F60}) of an HTT for classifying heat tolerance and compare it with the $\Delta T_{coreF60}$ criterion established by Druyan et al. **METHODS:** Using traditional HR and T_{core} criteria, 15 males were classified as heat-tolerant (HT) (age: 27 ± 5 yrs, height: 177.2 ± 6.5 cm, weight: 82.4 ± 10.1 kg) and 15 males were classified as heat-intolerant (HI) (age: 27 ± 7 yrs, height: 177.3 ± 7.6 cm, weight: 86.7 ± 14.5 kg). ΔPSI_{F60} values were calculated for all subjects and compared with a previously determined ΔPSI_{F60} limit of 1.82 to confirm validity. Additionally, ΔPSI_{F60} was calculated for a sample of 77 male warfighters (age: 25 ± 5 yrs, height: 178.5 ± 7.1 cm, weight: 84.8 ± 10.1 kg) who were classified as HT/HI according to ΔPSI_{F60} and $\Delta T_{coreF60}$ thresholds. The number of misclassifications for ΔPSI_{F60} and $\Delta T_{coreF60}$ (Druyan et al.) were then compared. **RESULTS:** ΔPSI_{F60} threshold of 1.82 was validated by comparing it to ΔPSI_{F60} for HT and HI warfighters (HT: 0.54 ± 0.64, p < .001; HI: 1.95 ± 0.72, p = .318). Misclassifications of HT/HI for ΔPSI_{F60} and $\Delta T_{coreF60}$ were 8 (10%) and 7 (9%), respectively. Sensitivity and specificity of the proposed ΔPSI_{F60} HT/HI criterion were 97% and 54%, respectively, versus 95% and 70% for $\Delta T_{coreF60}$. **CONCLUSION:**

Findings suggest that 1.82 ΔPSI_{F60} and 0.45°C $\Delta T_{coreF60}$ thresholds to determine heat tolerance yield a similar number of misclassifications. Future work should aim to refine these techniques to reduce the number of HT/HI misclassifications.

2082 Board #238 May 30 2:00 PM - 3:30 PM

Establishing a Physiological Strain Index Criterion During the Final Sixty Minutes of Heat Tolerance Testing

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(No relevant relationships reported)

The heat tolerance test (HTT) assesses cardiorespiratory and thermoregulatory capacity during heat stress using heart rate (HR) and core temperature (T_{core}) as pass/fail criteria, where HR and T_{core} may not exceed 160 bpm and 38.6°C, respectively. Additional information regarding physiological stress and heat tolerance may be derived from the physiological strain index (PSI), which provides a singular physiological strain value using HR and T_{core} measurements. To our knowledge, the change in PSI during the final 60 min of an HTT (ΔPSI_{F60}) has not been evaluated as a potential criterion for classifying heat tolerance/intolerance during HTT. **PURPOSE:** The purpose of this study was to establish a criterion threshold for ΔPSI_{F60} and report on its ability to classify heat tolerance/intolerance during an HTT. **METHODS:** Seventy-seven US military men (age: 25 ± 5 yr, ht: 178.5 ± 7.1 cm, wt: 84.8 ± 10.1 kg) completed up to 120 min of continuous treadmill walking (3.3 mph, 4.0% grade) in 40ºC and 40% relative humidity and were classified for their heat tolerance (n = 64) or heat intolerance (n = 13) using established T_{core} and HR criteria. A ΔPSI_{F60} was calculated for, and compared between, heat tolerant (HT) and heat intolerant (HI) subjects using an independent sample *t*-test. A maximal normal accepted value for ΔPSI_{F60} was calculated by taking the mean value of ΔPSI_{F60} for HT subjects plus two standard deviations. **RESULTS:** ΔPSI_{F60} was significantly less in HT subjects than in HI subjects (0.54 ± 0.64 vs 1.95 ± 0.72; $p < .001$). For HT subjects, a ΔPSI_{F60} maximal normal accepted value was determined to be 1.82. **CONCLUSION:** Findings indicate that ΔPSI_{F60} appropriately differentiated HT from HI subjects during an HTT in this population of military personnel. Therefore, we report that exceeding a ΔPSI_{F60} of 1.82 may serve as an additional criterion for classifying heat intolerance during HTT. Further work on the validation of this maximal normal accepted value for ΔPSI_{F60} is needed.

2083 Board #239 May 30 2:00 PM - 3:30 PM

Interpretations of Physiological Strain Index During Heat Tolerance Testing

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The heat tolerance test (HTT) assesses cardiorespiratory and thermoregulatory capacity during heat stress using core temperature (T_{rec}) and heart rate (HR) as pass/fail criteria. Additional information regarding physiological stress and heat tolerance may be derived from the physiological strain index (PSI), which provides a representation of total physiological strain using T_{rec} and HR measurements. Currently, there is minimal information available on the efficacy of various PSI interpretations, with respect to accurately identifying differences in physiological strain between those that have passed and failed an HTT. **PURPOSE:** To report different methods to evaluate physiological strain during HTT using PSI. **METHODS:** Eighty-two military personnel (age: 25 ± 5 yrs, height: 178.2 ± 7.2 cm, weight: 84.5 ± 9.9 kg) completed up to 120 min of continuous treadmill walking (3.3 mph; 4.0% grade) in 40ºC and 40% relative humidity. PSI was calculated from T_{rec} and HR measurements that were recorded every 5 min. PSI was then interpreted as trial mean, end of test (EOT), slope, and time-weighted (0 min - EOT) area under the curve (AUC) for subjects that passed and failed an HTT and compared using independent samples t-tests ($p < .05$). **RESULTS:** The trial mean PSI was significantly less in those that passed compared with those that failed the HTT (3.7 ± 0.7 vs. 4.8 ± 0.3; $p < .001$). Similarly, EOT PSI was significantly less for subjects that passed compared with those that failed (4.7 ± 1.1 vs. 6.8 ± 0.6; $p < .001$). Graphed as a function of time, the slope of the best-fit line for PSI was less in those that passed compared with those that failed (0.02 ± 0.01 vs. 0.07 ± 0.03; $p < .001$). PSI was also calculated as AUC (pass: 416 ± 141, fail: 453 ± 87; $p = .299$) and, when adjusted for trial time, resulted in a significantly lower PSI value for those that passed compared with those that failed (3.8 ± 0.7 vs. 4.8 ± 0.3; $p < .001$). **CONCLUSION:** Findings indicate all PSI parameters investigated appropriately differentiated between subjects that passed and failed the HTT, resulting from either cardiorespiratory stress, thermoregulatory stress, or a combination of the two. Further work on the use of this index and its evaluation is warranted, as there are no defined criteria for HTT fail using PSI as an integrative value of total thermal strain.

2084 Board #240 May 30 2:00 PM - 3:30 PM

Thermal Behavior Does not Differ Between Sexes During and Following High Intensity Aerobic Exercise

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(No relevant relationships reported)

Females utilize thermal behavior more than males during low intensity aerobic exercise. Core temperature is elevated during high vs. low intensity aerobic exercise because of greater heat production. Thus, thermal behavior is greater during high intensity exercise because of the heightened stimulus to behave. It is unknown if sex modulates thermal behavior during high intensity exercise.
Purpose: Test the hypothesis that thermal behavior differs between males and females during high intensity exercise and recovery.
Methods: 10 males (M) and 10 females (F) (23±3y) underwent 30 min of cycling exercise at a power output that elicited 80±5% (F) and 78±4% (M) of VO_2peak (P=0.28) followed by 120 min seated recovery in a 27±1°C, 21±2% relative humidity environment. Subjects were instructed to maintain a thermally comfortable neck temperature throughout using a custom-made neck device. Neck device temperature provided an index of thermal behavior. Mean skin (10 site) and core (intestinal) temperatures, mean skin wettedness (8 site), neck device temperature, skin blood flow (laser Doppler) and local sweat rate (ventilated capsule) were measured continually.
Results: There were no sex differences in heat production during exercise (F: 399±68, M: 429±62 W/m², P=0.39). During exercise, core and mean skin temperatures, skin wettedness, skin blood flow and local sweat rate increased, while neck device temperature decreased (all P<0.01). There were no sex differences in core (F: 37.7±0.2, M: 37.9±0.3°C, P≥ 0.50), mean skin (F: 32.6±0.3, M: 32.6±0.3°C, P≥0.99) or neck device (F: 12.1±10.6, M: 11.9±10.2°C, P≥0.25) temperatures, mean skin wettedness (at 30 min: F: 0.50±0.06, M: 0.53±0.04 au, P≥0.99), skin blood flow (F: 163±50, M: 172±36 PU, P≥0.99) or local sweat rate (F: 0.72±0.20, M: 0.85±0.27 mg/cm²/min, P≥0.33) during exercise (data reported at 30 min). During recovery, core and mean skin temperatures, mean skin wettedness, skin blood flow and local sweat rate decreased, and neck device temperature increased back towards pre-exercise levels (all P<0.01). There were no differences in the dynamics of these changes between sexes (all P≥0.16).
Conclusions: Thermal behavior during and following high intensity aerobic exercise does not differ between males and females.
This study was funded by lululemon athletica inc.

2085 Board #241 May 30 2:00 PM - 3:30 PM

Exercise Intensity Independently Modulates Thermal Behavior During Exercise Recovery, But Not During Exercise

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Purpose: High intensity (HI) exercise stimulates greater heat production than moderate intensity (MI) exercise, but also reduces perceptual thermal sensitivity. Thus, thermal behavior may differ between HI and MI exercise. We tested the hypothesis that thermal behavior is greater during HI compared to MI exercise and recovery.
Methods: In a 27.0±0.4ºC, 21±3% RH environment, 20 subjects (10 females) cycled for 30 min at MI (53±6% VO_2peak) or HI (78±6% VO_2peak), followed by 120 min seated recovery. Mean skin (10 site) and core (telemetry pill) temperatures, and mean skin wettedness (8 site) were recorded continuously. Participants maintained a thermally comfortable neck temperature throughout using a custom-made device. Neck device temperature provided an index of thermal behavior. The weighted average of mean skin and core temperatures, and mean skin wettedness provided an indication of the mean afferent stimulus to thermally behave.
Results: Mean skin (by +0.4±0.7ºC, P<0.01) and core (by +0.4±0.3ºC, P<0.01) temperatures were higher at end exercise in HI. Mean skin temperature was not different between trials by 10 min recovery (P≥0.96). Core temperature was higher in HI until 90 min recovery (P≤0.01). Mean skin wettedness (by +0.04±0.06 a.u., P=0.03) and the mean afferent stimulus (by +2.5±3.5 a.u., P=0.01) were greater at 10 min of exercise in HI, and remained until 60 min into recovery (P<0.01). The decrease in neck device temperature was greater in HI during exercise (at 30 min: by -4.9±9.6ºC, P≤0.06), but did not differ after 20 min recovery (P≥0.60). There were negative relationships between the mean afferent stimulus and neck device temperature for exercise (HI: r=-0.91, MI: r=-0.96, both P<0.01) and recovery (HI: r=-0.98, MI: r=-0.96, both P<0.01). During exercise, there were no differences in the slope (HI: -0.93±0.31; MI: -0.87±0.14ºC/a.u., P=0.49) or y-intercept (HI: 43.4±11.6 a.u., MI:

43.8±4.9ºC a.u., P=0.91). During recovery, the slope was steeper (-0.94±0.06 vs. -0.77±0.78ºC/a.u., P<0.01) and y-intercept higher (49.3±2.0 vs. 41.7±2.3ºC, P<0.01) in HI.
Conclusions: Thermal behavior is greater during HI exercise due to a greater afferent stimulus to behave. However, the withdrawal of thermal behavior is augmented following HI versus MI exercise.
This study was funded by lululemon athletica inc.

2086 Board #242 May 30 2:00 PM - 3:30 PM

Circulating Mcp-1 Associated With Prolonged Cycling In Hot Temperature

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Purpose: The purpose of this investigation was to examine the recruitment of classical monocytes during prolonged aerobic exercise in high temperature and humidity conditions. **Methods:** Seven recreationally active men (23.4 ± 3.0 yrs; 180.9 ± 5.8 cm; 85.1 ± 11.3 kg; 3.7 ± 0.27 L·min^{-1}) completed five trials: a graded exercise test, and four cycling trials in 37°C/23% Relative Humidity (RH)(HTLH), 37°C/33%RH (HTMH), 24°C/38%RH (MTMH), and 24°C/51%RH (MTHH) in a counterbalanced fashion. During the exercise protocol, participants rested supine for 15 minutes before completing 60-min of cycling at 60% VO_2max, a 15-min rest, and cycling until exhaustion at 90% VO_2max (TTE), before 60 minutes of recovery. Blood samples were obtained prior to exercise (PRE), after 60 minutes of cycling (60), after the TTE (90) and following one hour of recovery (REC). Blood was assessed for plasma concentrations of Monocyte Chemoattractant Protein 1 (MCP-1) via ELISA, and CCR2 expression on classical monocytes (CD14++CD16-) via flow cytometry. Briefly, CCR2 expression was determined as fold change over fluorescence minus one (FMO). Data were analyzed using within-subjects repeated measures ANOVA. **Results:** A main effect for time was observed (F = 8.9; p = 0.003; η^2_p = 0.560) for MCP-1 in circulation. MCP-1 increased from PRE (183.8 ± 59.7 pg·mL^{-1}) to 60 (215.8 ± 74.1 pg·mL^{-1}; p = 0.009), 90 (231.6 ± 83.8 pg·mL^{-1}; p = 0.006), and REC (216.0 ± 88.3 pg·mL^{-1}; p = 0.019). Concentrations also increased from 60 to 90 (p = 0.018). A main effect of time was also observed (F = 11.6; p = 0.009; η^2_p = 0.659) for CCR2 expression on classical monocytes. No differences in CCR2 expression were observed between PRE (147.4 ± 50.6), and 60 (146.0 ± 70.8; p = 0.869), however decreases from PRE were observed at 90 (131.1 ± 39.7; p = 0.023), and REC (102.2 ±37.1; p < 0.001).
CONCLUSION: These data indicate that high temperature and/or humidity conditions do not impact recruitment of classical monocytes. Furthermore, prolonged cycling appears to increase circulating MCP-1 and decrease CCR2
expression on classical monocytes. Collectively, this may indicate a limited effect of aerobic exercise on the overall recruitment of classical monocytes, although further research is warranted.
This investigation was partially funded by the Kent State University Research Council.

2087 Board #243 May 30 2:00 PM - 3:30 PM

Heat Acclimation Causes Profound Post-Exercise Hypotension and Favorable Improvements in Lipid and Immune Profiles

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PURPOSE: We have previously reported that passive hyperthermic exposure causes an acute hypotensive response. The animal literature has shown that chronic heat stress causes alterations in metabolic and lipid metabolism. However, it is unknown if heat acclimation also causes chronic blood pressure and lipid responses in humans. This project tested the hypothesis that 10-day exercise-heat acclimation (HA) would cause greater post-exercise hypotensive responses and alter metabolic, lipid, and immune profiles compared to 10-day exercise under neutral conditions (CON).
METHODS: Twelve healthy sedentary subjects (7M/5F, 28±6y, 78±17kg), completed a 10-day (90min/day exercise bout) clamp controlled (internal work-rate) hyperthermia HA (42°C, 28% RH) and control (CON: 23°C, 42% RH) protocols in a counterbalanced design separated by at least 2 months. Pre- and post-exercise HA/CON blood pressure was taken post-exercise over 1 hour after day 1 and day 10 exercise. Metabolic, lipid and immune panels were taken pre-post HA/CON.
RESULTS: Exercise under heat stress had greater post-exercise hypotension (systolic; -6mmHg, diastolic -8mmHg; and mean arterial pressure, -7mmHg) on day 1 and day 10 compared to exercise under neutral conditions (main effect for condition, P≤0.004). Only from pre-to-post HA, total cholesterol (170±22 to 152±15; P<0.02) and triglycerides (130±63 to 93±27; P<0.03) were reduced. A trend for changes in glycemic control (%A1c; 5.4±0.3 to 5.3±0.4; P<0.06) neutrophils (52.3±5.6% to 57.5±4.0%; P<0.09), lymphocytes (37.9±5.7% to 32.9±3.0; P<0.07), and eosinophils (2.4±1.7 to 3.1±0.1; P<0.06) were found after HA.
CONCLUSIONS: These preliminary data indicate that HA causes a profound post-exercise hypotensive response and favorable metabolic, lipid, and immune profile changes. Further examination of heat acclimation on vascular, metabolic, and immune responses will offer insight for benefits in other clinical populations with vascular, metabolic and immune dysfunction.

2088 Board #244 May 30 2:00 PM - 3:30 PM

Quantifying the Environmental Thermal Conditions that Exist During Summer Track Meets in South Texas

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(No relevant relationships reported)

PURPOSE: To quantify the environmental thermal conditions that track & field officials, volunteers and track & field athletes are exposed during June and July in south Texas. **METHODS**: Five summer track meets were selected from the Texas Amateur Athletic Federation (TAAF) competition season during June and July for analysis. Air temperature, heat stress index, web bulb globe temperature, relative humidity, thermal work limit, and ultraviolet index (UVI) were recorded at 8 a.m., 10 a.m., Noon, 2 p.m., and 4 p.m. with a handheld wet bulb globe temperature (WBGT) Kestrel 0854TAN Heat Stress Tracker (TEquipment.net). **RESULTS**: The mean temperature reading, standard deviation, and standard error for the five track meets throughout the duration of the track meets were 8 am: 81.4ºF +/-2.02 (0.9); 10 am: 86.36ºF +/-3.73 (1.7); Noon: 91.68ºF +/-5.20 (2.3); 2 pm: 91.84ºF +/-6.34 (2.8); and 4 pm: 92.38ºF +/-10.16 (4.5). The mean heat stress values were 8 a.m. 89.56 +/-2.82 (1.3); 10 a.m. 98.66 +/-9.40 (4.2); Noon.106.22 +/-9.27 (4.1); 2 p.m.102.68 +/-8.19 (3.7); and 4 p.m. 103.68 +/-10.49 (4.7). The mean wet bulb globe temperature readings were 8 a.m. 76.8 +/-2.94 (1.3); 10 a.m. 82.2 +/-4.65(2.1); Noon. 81.4 +/-4.98 (2.2); 2 p.m. 80.32 +/-7.62 (3.4); and 4 p.m. 78.76 +/-5.95 (2.7). The mean relative humidity readings were 8 a.m. 80.32 +/-4.75 (2.1); 10 a.m. 72.8 +/-6.89 (3.1); Noon. 55.92 +/-7.97 (3.6); 2 p.m. 54.52 +/-11.03 (4.9); and 4 p.m. 59.08 +/-9.76 (4.4). The mean thermal work limit readings were 8 a.m. 161.56 +/-12.06 (5.4); 10 a.m. 155.8 +/-17.76 (7.9); Noon. 139.54 +/-26.98 (12.1); 2 p.m. 152.2 +/-46.21 (20.7); and 4 p.m. 166.56 +/-33.78 (15.1). The mean UVA index readings were 8 a.m. 0.1 +/-0 (0.0); 10:00 a.m. 2.68 +/-1.11 (0.5); Noon. 8.14 +/-1.60 (0.7); 2 p.m. 8.56 +/-2.23 (1.0); and 4 p.m. 6.66 +/-2.11 (0.9). **CONCLUSIONS**: Data suggests that the thermal conditions from June to July in south Texas are considered "low alert" based on the Event Alert System used by the ACSM and other organizations, such as the Bank of America Chicago Marathon. Based on UVA index data, participants and track meet officials should wear sunscreen. Although data suggest "low alert," track & field officials should consider starting summer track meets at 4 p.m. when heat variables begin to diminish.

2089 Board #245 May 30 2:00 PM - 3:30 PM

Metabolic Recovery Response During Seated Rest In Hot Environment

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(No relevant relationships reported)

Purpose: The purpose of this study was to examine the metabolic recovery response during seated rest in a hot and moderate environmental condition after a prolonged cycling bout. **Methods**: Eleven recreationally active men (23.6 ± 2.6yrs; 180.9 ± 6.8cm; 85.3 ± 10.8kg; 3.8 ± 0.42L•min^{-1}) completed a recovery session under two conditions: 22°C/45%RH (MT) and 35°C/45%RH (HT). Prior to recovery session, each participant completed a 60-min cycling trial at 60% $\dot{V}O_2$max and a time-to-exhaustion trial at 90% $\dot{V}O_2$max. Data were collected during the 3min (M3), 15min (M15) 30min (M30), and 60min (M60) of the 60-min recovery. Metabolic variables assessed were $\dot{V}O_2$, RER, $\dot{V}E$, and HR. Data were analyzed using within-subjects repeated measures ANOVA. **Results:** A significant interaction was observed for $\dot{V}O_2$ (F = 2.788, p = 0.043, η^2 = 0.258). Post-hoc analysis indicated a main effect of time during MT (F = 8.097, p < 0.001, η^2 = 0.503), but not HT condition (F = 2.433, p < 0.065, η^2 = 0.213). Specifically, during the MT, $\dot{V}O_2$ was significantly lower at M15 (p < 0.001), M30 (p = 0.015), M45 (p < 0.001) and M60 (p < 0.001) compared to M3. Furthermore, $\dot{V}O_2$ was significantly lower during the HT condition compared to MT during M60 (p < 0.001). No significant interaction was observed for $\dot{V}E$ (F = 1.384, p = 0.261, η^2 = 0.148). A significant main effect of time was observed (F = 11.818, p < 0.001, η^2 = 0.596). M15, M30, M45, and M60 were significantly lower compared to M3 (p = 0.05). No significant interaction was observed for RER (F = 1.566, p = 0.207,

$\eta^2 = 0.164$). A significant main effect of time was observed for RER ($F = 3.319$, $p = 0.022$, $\eta^2 = 0.293$). M15, M30, M45 and M60 were significantly lower compared to M3 ($p = 0.05$). A significant interaction was observed for HR ($F = 2.702$, $p = 0.046$, $\eta^2 = 0.231$). Post-hoc analysis indicated a main effect of time during both MT ($F = 21.441$, $p < 0.001$, $\eta^2 = 0.704$) and HT ($F = 11.022$, $p < 0.001$, $\eta^2 = 0.524$). Specifically, during both MT and HT, HR was significantly lower at M15, M30, M45, and M60 ($p < 0.05$) compared to 3M. Furthermore, HR was significantly lower during the MT compared to the HT condition during all time points ($p < 0.05$), except M30 ($p = 0.081$). **Conclusion:** Data suggests recovery is moderately impacted in a high temperature conditions compared to a moderate condition after a submaximal and maximal exercise bout determined by elevated HR.

2090 Board #246 May 30 2:00 PM - 3:30 PM

Wireless Real-Time Transistor-Based Skin Temperature Data Acquisition System

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(No relevant relationships reported)

Environmental physiology studies rely on the accurate measurement of skin and internal temperatures. Many traditional skin temperature systems utilize thermistor or thermocouple measurements. However, utilizing a transistor-based sensor allows for a more linear data set, which could provide more stability, thus allowing for a more robust and accurate measurement over a range of environmental conditions. Field Programmable Gate Arrays (FPGA) are relatively low cost and low power consuming programmable hardware devices that allows for a signal to be processed and viewed in real time. Combining the processing power of the FPGA and the heightened accuracy of transistor-based analog temperature sensors, a modernized data acquisition (DAQ) system could provide linearized real time data.
PURPOSE: To design a wireless patch-type transistor-based skin temperature DAQ system that will provide a more accurate and linear set of data for measurement in hot/humid/cold/altitude environments, and will be sufficiently robust for outdoor field studies.
METHODS: We designed and built a prototype wireless transistor-based skin temperature DAQ that implements a precision analog temperature sensor to acquire skin temperature and FPGA technology for signal processing. The tested accuracy for the precision analog temperature sensor is ±0.05-0.1°C in a temperature range of 20°C to 42°C. By utilizing FPGA technology, the system will process, pack, and wirelessly send data to a computer for real time monitoring.
RESULTS: In preliminary testing, the FPGA system showed an overall lower power consumption in addition to less variability in Voltage (V), the signal upon which temperature measurements depend. Over a 5°C temperature change it was seen that the FPGA system had a variance of 3.7*10^(-11) V, while a thermistor based temperature system had a variance of 1.3*10^(-3) V. In most settings, this will result in a substantially lower power consumption using our new system.
CONCLUSION: Our data suggest that our new FPGA approach is superior to traditional skin temperature measurements in its ability to rapidly attain and maintain accurate temperature readings. Next steps include field testing the device over a wide range of temperature, wind and humidity conditions.
Funded by USAMRMC; author views not official US Army or DOD policy.

2091 Board #247 May 30 2:00 PM - 3:30 PM

Prefrontal Cortex Oxygenation and Haemodynamics during a Long Duration Incremental Exercise Protocol while wearing Personal Protective Equipment

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(No relevant relationships reported)

Heat stress has been shown to effect cerebral oxygenation and haemodynamics. There is although limited research evaluating the effects of rapid and uncompensable core temperature (Tc) acquisition, as which occurs when one is wearing personal protective equipment (PPE), on cerebral oxygenation and haemodynamics. **PURPOSE:** To determine the effects of rapid and uncompensable Tc acquisition on cerebral oxygenation and haemodynamics. **METHODS:** Fourteen male subjects (33.6 ± 12.1 years) performed an incremental treadmill test to a termination point in a control session (CON) and an experimental session (PPE). Changes in oxy-haemoglobin (O_2Hb), deoxy-haemoglobin (HHb), total haemoglobin (tHb), and tissue oxygen saturation index (TSI %) were monitored in the left and right prefrontal cortex (PFC) using near-infrared spectroscopy (NIRS). Heart rate (HR), thermal comfort scale (TCS) and thermal sensation (TS) were also recorded at each 0.5°C increase in Tc. **RESULTS:** Time to termination (TTT) was significantly different ($p \leq 0.05$) between CON (77.3 ± 22.8 min) and PPE (50.3 ± 12.4 min). Subjects also showed significantly lower ($p \leq 0.05$) HR throughout CON (pre = 76.8 ± 8.6 bpm; post = 161.1 ± 20.7 bpm) when compared to PPE (pre = 86.5 ± 9.3 bpm; post = 179.6 ± 11.7 bpm). Significant differences were also between CON and PPE end-exercise Tc (CON = 38.57 ± 0.3°C; PPE = 39.01 ± 0.3°C), TCS (CON = 3.57 ± 0.6; PPE = 4.63 ± 0.3), and TS (CON = 7.57 ± 0.5; PPE = 8.67 ± 0.3). Lastly, there was a 0.04°C/min increase in Tc during PPE and a 0.02°C/min increase in Tc during CON. Important NIRS results were a plateau in left-side O_2Hb and tHb at Tc 38°C in both CON and PPE, 80% of TTT in CON, and 60% of TTT in PPE. Additionally, there was increased left-side PFC activation during PPE as indicated by a significant decrease ($p \leq 0.05$) in TSI % from start to end of exercise (Start = 70.9 ± 4.9%; End = 68.2 ± 5.9%) and double the decrease in TSI %/min in PPE when compared to CON. **CONCLUSION:** These data suggest that rapid and uncompensable Tc acquisition causes an altered cerebral oxygenation and haemodynamic response in the left-side PFC. There were no changes in the cerebral oxygenation and haemodynamic response during CON. The left-side response during PPE could have implications for cognitive processes during and/or following exercise in the heat.

2092 Board #248 May 30 2:00 PM - 3:30 PM

The Effect of Rapid and Slow Heat Acquisition on Body Weight and Blood Glucose Levels

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(No relevant relationships reported)

Body water loss due to thermoregulation during exercise in a hot environment may cause a significant decrease in body mass, affecting blood plasma volume and consequently parameters such as blood glucose (BG) concentration. It is not known if the increased rate of thermal acquisition that occurs as a result of exercise in a microclimate such as personal protective equipment impacts BG concentrations differently than a slower rate of thermal acquisition. **PURPOSE:** The purpose of this study was to determine if rapid heat acquisition impacts body mass, urine specific gravity (USG) and BG concentration differently than slow heat acquisition during exercise. **METHODS:** Fourteen healthy male subjects (mean age, 33.6 ± 12.1 years) performed an incremental exercise test to a termination criterion in a control session (CON) and an experimental session (PPE). Body mass, USG and BG were measured before and after each trial. **RESULTS:** Rate of thermal acquisition was significantly different ($p<0.001$) between CON (0.02±0.04 °/min) and PPE (0.04±0.19 °/min). Time to termination (TTT) was also significantly different between CON (77.3 ± 22.8 min) and PPE (50.3 ± 12.4 min) and subjects also showed a lower HR throughout CON (pre = 76.8 ± 8.6 bpm; post = 161.1 ± 20.7 bpm) when compared to PPE (pre = 86.5 ± 9.3 bpm; post = 179.6 ± 11.7 bpm). Both conditions resulted in an identical and significant loss of total body mass (1.45 ± 0.62 kg; $p<0.05$), with a corresponding increase in USG ($p<0.01$). Despite body water loss, no significant change in blood glucose concentration occurred pre- to post-exercise in either condition (BG_{CON}= -0.04±853 mmol·L^{-1}; BG_{PPE} = 0.34±93 mmol·L^{-}). **CONCLUSION**: This data suggests that constant levels of blood glucose concentration are maintained regardless of rate of heat acquisition and despite body water loss that would affect plasma concentration.

2093 Board #249 May 30 2:00 PM - 3:30 PM

Effect of Dietary Nitrate Supplementation with Beet Root Juice on Thermoregulatory and Cardiovascular Responses to Extreme Heat in Aged Humans

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(No relevant relationships reported)

PURPOSE: To test the hypothesis that dietary nitrate supplementation with beet root juice attenuates cardiovascular and thermal strain in aged individuals during prolonged non-encapsulated environmental heat stress. **METHODS:** Study participants were eight healthy, normotensive, non-obese, aged individuals (66 ± 5 years; BMI: 24.6 kg/m^2; five females). Before (PRE) and after (POST) 1 week of daily nitrate supplementation with concentrated beet root juice (140 ml twice daily), participants were exposed to 42.5°C and 35% relative humidity conditions for 2 h. Core and skin temperatures, arterial blood pressures, heart rate, cutaneous blood flow and vascular conductance, and forearm blood flow and vascular conductance were measured throughout the exposure. **RESULTS:** Following nitrate supplementation, mean arterial pressure decreased from 88 ± 5 to 80 ± 7 mmHg ($P = 0.02$) in thermoneutral conditions. During a subsequent heat stress, mean arterial pressure was significantly lower POST vs. PRE (treatment x time interaction: $P < 0.01$); however, this effect was limited to the first 30 min of the heat exposure. No effect of dietary nitrate supplementation was observed on core temperature, mean skin temperature, heart rate, cutaneous blood flow, cutaneous vascular conductance, forearm blood flow, and forearm vascular conductance throughout heat stress ($P > 0.05$). **CONCLUSION:** Our results indicate that in aged individuals, dietary nitrate supplementation does not attenuate thermal strain, and only transiently reduces cardiovascular strain, during extreme heat stress.

2094 Board #250 May 30 2:00 PM - 3:30 PM

Effects On Skin Temperature of Marathon Running in a Hot Humid Environment

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Participating in marathons in hot and humid weather may lead to fatigue, syncope, injuries or even death. In the diagnosis and monitoring of delayed onset muscle soreness and fatigue status, infrared thermography (IRT) has been used as a non-invasive method for the assessing skin temperature as a response of muscle hyperthermia after exercise.
Purpose: Analyze the effect of running a marathon in a hot and humid environment on skin temperature.
Methods: Seventeen amateur runners (age 35.82 ± 7.03 years, weight 66.79 ± 11.97 kg, height 168.44 ± 10.59 cm, VO_{2peak} 52.88 ± 7.09 ml/kg/min) had their lower limb skin temperature measured using trough IRT (FLIR T450) after running a marathon (0-80 m.a.s.l.) in a hot (thermal index 28.34 ± 3.27 ºC) and humid environment (~81 %), the measures were taken in a temperature controlled room (23°C). Both dominant (DLL) and non-dominant (NDLL) lowers limbs were divided for analysis into fourteen different areas and mean temperature of each area was used for analysis. A one-way ANOVA were used to compared thermal images taken 15 days and before marathon and 24 hours and 6 days after marathon.
Results: We found significant differences in skin temperatures: knee (DLL: $F_{(3.48)}$: 5.14, p= 0.004); Vastus lateralis (DLL: $F_{(3.48)}$: 7.191, p= <0.01; NDLL: $F_{(3.48)}$: 4.883, p= 0.005); Rectus femoris (DLL: $F_{(3.48)}$: 5.956, p= 0.002; NDLL: $F_{(3.48)}$: 5.521, p= 0.002); Vastus medialis (DLL: $F_{(3.48)}$: 5.079, p= 0.004; NDLL: $F_{(3.48)}$: 7.214, p= <0.001); Adductor (DLL: $F_{(3.48)}$: 4.097, p= 0.011; NDLL: $F_{(3.48)}$: 5.702, p= 0.002); biceps femoris (DLL: $F_{(3.48)}$: 18.952, p= <0.01; NDLL: $F_{(3.48)}$: 15.105, p= <0.01); popliteal fossa (DLL: $F_{(3.48)}$: 11.103, p= <0.01; NDLL: $F_{(3.48)}$: 11.598, p= <0.001); semitendinosus (DLL: $F_{(3.48)}$: 14.382, p= <0.01; NDLL: $F_{(3.48)}$: 15.000, p= <0.01); lateral gastrocnemius (DLL: $F_{(3.48)}$: 15.007, p= <0.01; NDLL: $F_{(3.48)}$: 10.316, p= <0.01); and medial gastrocnemius (DLL: $F_{(3.48)}$: 7.567, p= <0.01). Significant differences in all areas mentioned were found between measures: pre 15d < post 24h, pre marathon < post 24h y post 24h > post 6d.
Conclusions: Running a marathon in hot, humid environment leads to significant increases in lower limb skin temperature and the temperature levels returned to baseline values after 6 days of recovery.

D-66 Free Communication/Poster - Endocrinology

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

2095 Board #251 May 30 3:30 PM - 5:00 PM

Myokine Responses To Resistance Exercise In Prader-willi Syndrome

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Background: Caloric restriction and daily exercise are needed to prevent morbid obesity in individuals with Prader-Willi Syndrome (PWS). Resting and activity energy expenditure are lower in PWS than in BMI-matched controls. Hypotonia, decreased muscle mass, and cognitive impairment make exercise particularly challenging for this population. Myokine responses to RT may have beneficial metabolic effects and promote caloric expenditure.
PURPOSE: Determine if young PWS adults can perform a RT program and evaluate their myokine response compared to age & BMI-matched controls. **METHODS**: Each study group included 11 participants (7 men and 4 women), ages 30.7±4.6 & 30.1±4.3 years, and BMI 28.3±4.3 and 28.2±4.2 kg/m^2 for PWS & controls respectively (NS). Blood samples for glucose, creatine kinase (CK), lactate, HbA1C, and myokines were obtained before and after performing a program of eight resistance exercises of large muscle groups (3-4 sets of 12 repetitions). Additional blood samples were drawn 30 & 60 minutes after completing the RT. Myokines were assayed using a multiplex myokine panel (Mercke). Paired t-test was used for comparing results for PWS vs controls. The unpaired t-test was used for comparing peak laboratory values with basal levels.
RESULTS: Basal levels of glucose, HbA1C, and lactate were similar for PWS & controls but CK was lower in PWS vs controls (62±54 vs 322±333 U/L, p<0.04). Peak lactate was 3.7±2.2 in PWS vs 7.3±2.2 in controls (p<0.001). Interleukin-6 (IL-6) increased by 41±52 percent over baseline in PWS (p<0.03) and by 35±32 percent in controls (p<0.007). Following exercise, peak brain-derived neurotropic factor (BDNF) levels were 44±47 percent over baseline in control males (p<0.006) but did not increase in PWS males or in females. Positive responses of BDNF and irisin were associated with greater exertion compared to non-responders. **CONCLUSIONS**: PWS young adults are capable of performing strength-building exercise. IL-6 responses to exercise were similar in both PWS and controls but BDNF increased only in control males. Further studies of myokine levels in PWS may contribute to understand unique metabolic responses in this population.

2096 Board #252 May 30 3:30 PM - 5:00 PM

Endocrine Responses After Aerobic Exercise Under Inhibition/ Stimulation Of Hpa Axis In Healthy Adult Males.

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Exercise affects the homeostatic mechanisms of the human body, depending on the type, duration, intensity and frequency of exercise. The endocrine responses to acute and excessive exercise are comparable to those related to "stress". PURPOSE: Analysis of the hormonal responses under inhibition/stimulation conditions of the Hypothalamo-Pituitary Adrenal (HPA) axis after a selected aerobic protocol was performed in healthy male volunteers. METHODS: Eight healthy male volunteers (age: 29.2±3.1yrs, body mass: 84.5±5.2kg, height: 1.81±0.03m) performed a single bout of 30 min aerobic exercise at 70% VO2max on a treadmill, on three different conditions [control, HPA axis inhibition (induced by exogenous glucocorticoid administration), HPA axis stimulation (induced by exogenous ACTH administration)], following standard diet. Blood samples were collected before (t0), at the end of the exercise bout (t30), and 30 min later (t60). Serum cortisol (COR), adrenocorticotropin hormone (ACTH) and growth hormone (GH) were measured. Two-way ANOVAs were used for statistics. Data are presented as mean±SE. RESULTS: COR levels significantly decreased 30 min after exercise (p<0.05) (13.2±1.4; 10.8±1.5; 7.2±1.6 µg/dl; at t0, t30 and t60, respectively). ACTH significantly decreased 30 min after exercise (p<0.01) (25.2±2.9; 20±2.9; 15.7±2.1 pg/ml; at t0, t30 and t60, respectively). GH significantly increased after exercise (p<0.05) (0.1±0.1; 5.7±1.2; 2.3±1.1 ng/ml; at t0, t30 and t60, respectively). Under HPA axis stimulation conditions, COR significantly increased immediately after exercise (p<0.001) and remained increased 30 min after exercise (p<0.001) (15.7±1.6; 30.8±1.2; 32.4±5.4 µg/dl; at t0, t30 and t60, respectively). GH significantly increased immediately after exercise (p<0.001) and decreased 30 min after exercise (0.1±0.1; 9.4±3.5; 3.2±1.2 ng/ml; at t0, t30 and t60, respectively). This decrease between the end of exercise (t30) and 30 min after exercise (t60) was significant (p<0.01). CONCLUSION: This exercise regimen does not appear to trigger significant effects on the stress axis other than an HPA axis-independent increase of GH. Prescription of specific training programs should be characterised by stress-induced parameters before recommended for healthy and diseased population groups.

2097 Board #253 May 30 3:30 PM - 5:00 PM

Modeling Growth Hormone Dynamics through Indices of Cardiac Control at Rest and Exercise

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Growth hormone (GH) is released in a pulsatile manner from the anterior pituitary and these secretory dynamics provide important context to the functioning of the hypothalamic-pituitary (HP) axis. Similarly, heart rate variability (HRV) provides important context to cardiac control. These two systems are often investigated separately, however, evidence suggests that they share a common attractor. The PURPOSE was to examine how changes in cardiac-dynamics during daytime hours during rest and exercise could be used to predict GH output through machine-learning algorithms. METHODS: Seven-healthy males (25.4±2.6 yr, 174.7±7.8 cm) completed two 24hr profiles separated by a minimum of 8-weeks. Participants were randomly assigned to an exercise (5x30s sprints; 3-min of rec) and resting condition [Exercise: 71.2±10.8 kg, 9.8±3.3 %BF, VO_{2max}71.2±11.2 ml/kg/min; Rest:69.8±12.1 kg, 9.0±2.7 %BF, VO_{2max}67.8±9.0 ml/kg/min]. Serum was collected via intravenous catheter every 10-min and RR-intervals were collected continuously. The 24hr RR-interval was split into 3-min epochs taken every 10-min throughout the 24hr period; providing an index of acute cardiac regulation throughout the 24hr period. The sample entropy of each of these epochs was used to create an additional time-series ($SampEn_{EP}$) that was used to predict changes in GH output. A long-short-term-memory (LSTM) network was

used to model and predict GH output over time. The LSTM was trained on the first 14hr of each of the exercise and resting profiles using lagged GH and $SampEn_{EP}$. Five iterations of each model were run and the root mean square of the error (RMS) from each of these iterations were compared across conditions. RESULTS: The LSTM models trained on the exercise profiles provided significantly better fit compared to the resting condition (RMS_{EX}=0.28±0.29; RMS_{REST}=0.41±0.26; p=0.02), resulting in more accurate prediction of the nighttime changes in GH than resting profiles. CONCLUSIONS: The ability of these models to learn the relationship and accurately predict GH output based on the patterned regulation of cardiac control throughout the day represents a shared hierarchical regulation between the HP and cardiac axes. These methods capture the more rapid time-dependent relationships that are currently missed with common assessment techniques.

2098 Board #254 May 30 3:30 PM - 5:00 PM

The Effects of Acute Ultraviolet Light Exposure on Post-Resistance Exercise Serum Testosterone in Older Men

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(No relevant relationships reported)

Evidence tying ultraviolet (UV) light exposure to endogenous vitamin D synthesis presents a possibility for naturally enhancing serum testosterone via endogenous vitamin D. **PURPOSE:** 1) Determine the effect of an acute bout of UV light exposure on post-resistance exercise serum testosterone in older men and, 2) to investigate whether serum testosterone was influenced by endogenous vitamin D. **METHODS**: Six older adult men (age 62±1.79 yrs., height 179.92±1.12 cm., body mass 83.79±3.12 kg., BMI 25.95±1.15 kg/m^2) participated in two identical resistance exercise sessions followed by a 30-minute recovery. Sessions were approximately one week apart and the exercise protocol consisted of 4 sets of 10 repetitions of leg press, chest press, and back row with one minute of rest between sets. After the second exercise session, participants were exposed to an UV light source during the first 10 minutes of recovery. Serum testosterone and vitamin-D were measured pre- and post-resistance exercise in 5-minute increments during the 30-minute recovery. **RESULTS**: Exercise alone did not significantly affect serum testosterone or vitamin D. Exercise combined with acute UV light exposure significantly increased serum testosterone area under the curve (p<0.05) but did not significantly alter serum vitamin D. **CONCLUSION**: These findings suggest that acute UV light exposure may positively impact serum testosterone response following a single bout of resistance exercise in older adult men.

2099 Board #255 May 30 3:30 PM - 5:00 PM

Effects Of Exercise On The Expression Changes Of Kiss-1/gpr54 In Testis Of Rats In Growth Phase

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(No relevant relationships reported)

PURPOSE: To investigate the localization and expression level of KISS-1/GPR54 in testis and effects of exercise during the growth period of male rats .
METHODS:21D old weanling rats were randomly divided into group C (n=60) and group C E (n=65). CE group took 5-weeks trained (60-70% vVO2max, 1h/day, 5days/week). The rats of two groups were killed on the 21st D, 35th D, 43rd D, and 56th D old. The localization, mRNA expression and protein expression of KISS-1/GPR54 in the testis of each group were tested.
RESULTS: From 21st D to 56th D,, KISS-1and GPR54 were expressed firstly in rat testicular Spermatogenic cells, and then they expressed both in Spermatogenic cells and Leydig cells. Following the growth, the expression of testis KISS-1mRNA peaked at 35D, ($p < 0.01$), and then decreased without significantly difference. But the protein level of kiss-1 increased continuously and peaked at 56D ($p < 0.01$). The expression of GPR54 mRNA and protein peaked at 43D ($p < 0.01$), and then decreased without significantly difference.Exercise intervention had no effect on the localization of KISS-1 and GPR54, but induced the decrease of KISS-1 and GPR54 mRNA during the growth period, which were no significant difference compared with group C. After exercise intervention, the expression of KISS-1 protein in rats testis in each time point had the same trend as group C, but the expression level were significantly lower than group C ($p < 0.01$). The expression of GPR54 protein in rats testis of group CE were almost unchanged from 21D to 35D and increased significantly from 35D to 43D, then decreased from 43D to 56D. The GPR54 protein of 56th D was significantly lower than that of group C at 56th day ($p<0.01$).
CONCLUSIONS: During the growth period, the localization of KISS-1 and GPR54 expressed have stage characteristics, and the expression level of KISS-1 and GPR54 increases gradually, with some temporal characteristics. Although exercise will not influence the change trends of KISS-1 and GPR54, it will decrease their level .

2100 Board #256 May 30 3:30 PM - 5:00 PM

Effects Of Exercise On Hypothalamic Kisspeptin/gpr54 Signaling Pathway Of High-fat-diet-feeding Growing Rats

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(No relevant relationships reported)

Hypothalamic Kisspeptin/GPR54 system is the “control switch” for the onset of puberty. Obesity induced by high-fat diet and/or physical inactivity is a leading cause of precocious puberty.**PURPOSE**: To observe the effect of high-fat diet on the hypothalamic expression of KiSS-1, the G-protein coupled receptor (GPR) 54and GnRH mRNA and explore the modulatory role of moderate-intensity exercise in the high-fat-diet feeding male rars ,which are in growth period. **METHODS**: Male weanling rats (21std) were fed high-fat-die were randomly assigned to chow diet sedentary (CS, n=24), chow diet exercise (CE, n=24) and high-fat diet sedentary (HS, n=24), high-fat diet exercise (HE, n=24) groups. SE and FE groups did the 60%-70%V(•)O_2max treadmill training (5 days/week, 1 hour/day). The V(•)O_2 max of exercise groups were remeasured every two weeks. 6 rats of each group were killed on the 35th day, 42nd day and 56th day. The hypothalamic expression of KiSS-1, GPR54 and GnRH mRNA were tested in each group. **RESULTS**: During the growth period, the Kiss-1mRNA of FS group increased continusly, which was opposited with CS group. The GPR54 mRNA of FS group got to the maxium level on 42th day,which was similar with CS group. Both in CS and FS groups, GnRH mRNA decreased significantly before 56th day, which had the trend of increse. Both in CE and HE groups, the mRNA of Kiss-1 and GPR54 got the maxium levels on 42th day, which opposited with the lowest level of GnRH mRNA. **CONCLUSIONS**: The changed trend of kisspeptin/GPR54 signaling pathway during the growth period were obvious increase in high-fat diet rats. Exercise could change the trend of kisspeptin/GPR54 signaling pathway induced by high-fat diet espcially after puberty.

2101 Board #257 May 30 3:30 PM - 5:00 PM

Salivary and Serum Cortisol Proportion Dynamics Are Impacted by High-Intensity Exercise

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Salivary cortisol (C_{sal}) represents the free cortisol concentration of serum cortisol (C_{ser}). It has been suggested that C_{sal} is approximately 5-10% of total C_{ser}, however, the impact of diurnal variation in C, and how this pattern affects the proportion of C_{ser} and C_{sal} (C_{prop}), has yet to be explored. **PURPOSE:** Therefore, the purpose of this study was to assess the diurnal changes of C_{prop}, and the extent to which a high-intensity exercise bout may impact this relationship. **METHODS:** Male (n = 7) college-aged students (26.3±2.8 yrs, 176.5±8.1 cm, 73.6±12.6 kg, 9.9±3.2 BF(%), VO_2max: 68.9±9.5 ml.kg^{-1}.min^{-1}) completed two 24-hour (rest and exercise) cortisol profiles. Subjects had a catheter inserted at 0600hr and blood and saliva samples were collected simultaneously every 120 mins. During the exercise condition, subjects performed 5x30s sprinting intervals on the cycle ergometer, at a resistance of 7.5% of body mass. Subjects were permitted 3-min of passive recovery between bouts. C_{sal} and C_{ser} were analyzed via competitive-binding assay. C_{prop} was calculated as proportion of C_{sal} relative to C_{ser} at each time point. Multilevel growth models with varying fixed/random coefficients were tested and compared (AIC). The final cubic growth model controlled for condition and freely estimated the intercept, velocity, and acceleration terms while the initial trajectory of C_{prop} was fixed across all individuals. **RESULTS:** The IQR of C_{prop} was 3.56-6.29%. The greatest C_{prop} values were consistently observed during nighttime sampling with the magnitude of C_{prop} being greatest at 2300hr. The cubic growth models were determined to best-represent 24-hr changes in C_{prop}. The final model showed a significant effect for exercise (β = -1.37, p = 0.036; AIC = 1030.781). **CONCLUSION:** The greatest C_{prop} at 2300hr appears to be driven primarily by elevations in C_{sal}. This shift may be influenced by night time cortisol secretion interactions with binding proteins, alterations in salivary flow rate, or salivary gland enzymatic activity. Exercise appears to influence C_{prop} dynamics, especially during late afternoon and nighttime hours. It is therefore recommended that cortisol profiles be constructed from both total and free C_{ser} for the most accurate monitoring of the HPA-axis, especially within an exercise context.

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Effect of the Menopausal Transition on Physical Performance: A Longitudinal Study

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Low muscle strength and decline in the power are associated with low walking speed and with mobility limitations, disabilities and falls among older populations. Whether menopause per se accelerates decline in physical performance in women and in this way contributes to functional limitations in later years remains controversial. **PURPOSE**: The aim of this study was to examine changes in physical performance in women aged 47 to 55 following the menopausal transition. **METHODS:** This longitudinal study is a part of the Estrogenic Regulation of Muscle Apoptosis study. Women aged 47 to 55 were randomly selected from the Finnish National Registry (*n*=6878) and perimenopausal women (*n*=228) were followed until postmenopausal. The baseline menopausal status was defined based on menstrual cycle diary and follicle stimulating hormone (FSH) level. The progression of menopausal transition was followed at three-to-six months' intervals for early perimenopausal and late perimenopausal women, respectively. When FSH >30 IU/l was recorded, the measurement was repeated within two-to-four weeks and if FSH was determined in two consecutive blood samples to be elevated and no bleeding had occurred in past 6 months participant was considered to be postmenopausal. To capture a comprehensive understanding of the physical performance, measures of muscle power (vertical jump), muscle strength (grip and knee extension), aerobic capacity (6min walking distance), and walking speed were carried out. **RESULTS:** A significant decline in hand grip force for -2.9 % (95%CI -4.5, -1.1; *d*=0.20) in knee extension force for -3.1% (95%CI -4.8, -1.3; *d*=0.23) and in vertical jumping height for -3.24 % (95CI -4.6, -1.7; *d*=0.28) was observed following the menopausal transition. Walking distance significantly increased for 1.9 % (95%CI 1.2, 2.7, *d*=0.38) while in walking speed changes were 0.24 % (95%CI -1.1, 1.6; *d*=0.02) non-significant. **CONCLUSIONS:** The menopausal transition influences muscle strength and power, whereas the influence on mobility/walking was less evident and may follow after. Supported by the funding from the European Union's Horizon 2020 research and innovation Programme under the Marie Sklodowska-Curie grant agreement No675003, and by the Academy of Finland (ERMA study grant agreement 275323).

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The Relationship Between Oral Contraceptive Use With Total Hydroxyvitamin D And Its Metabolites In Young Adult Women

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Vitamin D deficiency, defined as total hydroxyvitamin D (25(OH)D) <50 nmol/L, is associated with poor bone health, impaired muscle function and increased risk of some diseases. The biologically active form of vitamin D is dihydroxyvitamin D ($1,25(OH)_2D$), but there is emerging evidence that the relative proportion of $1,25(OH)_2D$ to the catabolic metabolite ($24,25(OH)_2D$) determines biological activity. In women, higher 25(OH)D concentrations have been reported in oral contraceptive pill (OCP) users, but the influence of OCP and other hormonal contraceptives (HC) on vitamin D metabolites and their ratio is unknown. PURPOSE: To examine the relationship between vitamin D metabolites, the vitamin D metabolite ratio (VMR) and HC use in young adult women. METHODS: 512 female Army recruits, mean (SD) age 23 (3.2) years, height 1.66 (0.06) m, and body mass 64.8 (7.9) kg, volunteered to provide a venous blood sample at the start of basic military training. Samples were analysed for 25(OH)D, $1,25(OH)_2D$, $24,25(OH)_2D$, intact parathyroid hormone (iPTH), and albumin adjusted calcium (aCa). Participants had passed Army selection including medical screening and physical performance testing. Hormonal contraceptive use was assessed by questionnaire, and later verified from medical records. RESULTS: 163 women using vitamin D supplements were excluded from the analysis. Remaining participants were subdivided into groups: no-HC (n=157); OCP (n=95); progesterone-only pill (POP, n=25); injection (n=13); and, implant (n=59). There were no differences in participant characteristics between groups (p>0.05). Compared with no-HC, OCP users had higher 25(OH)D (61 (28) vs 73 (31) nmol/L), $1,25(OH)_2D$ (159 (38) vs 177 (50) pmol/L), $24,25(OH)_2D$ (6 (3) vs 7 (4) nmol/L), and lower iPTH (3.64 (1.04) vs 3.22 (1.05) pmol/L) (p<0.01). There were no differences in the VMR (25(OH) D:$24,25(OH)_2D$ and $1,25(OH)_2D$:$24,25(OH)_2D$), or in aCa, between groups (p>0.05). iPTH and 25(OH)D:$24,25(OH)_2D$ VMR were lower, and aCa was higher, in POP than in no-HC users (p<0.05). CONCLUSION: Oral contraceptive pill users have higher 25(OH)D, possibly from the stimulation of vitamin D binding protein and increased bioavailability of 25(OH)D, but the balance between the active and catabolic vitamin D metabolites is not dependent on HC use.

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Changes in Salivary Cortisol and Iga Levels are Associated with Fatigue after Acute Endurance Exercise.

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(No relevant relationships reported)

Several studies have investigated markers for exercise-induced fatigue. Physical and mental fatigues induce a secretion of salivary cortisol, and this hormone affects immunosuppression such as reduction of salivary immunoglobulin A (IgA) secretion. However, it is unclear whether the secretions of salivary cortisol and IgA levels in response to different exercise volumes are related to subjective fatigue and exercise performance. **PURPOSE**: The aim of this study was to investigate relationships among salivary cortisol and IgA levels, subjective fatigue, and exercise performance after acute endurance exercise.
METHODS:
Nine healthy young males voluntarily participated in this study. All subjects randomly performed the following three sessions: cycling exercise at 70%VO2max for 20-min (20-min session), cycling exercise at 70%VO2max until exhaustion (exhaustive session), and resting control for 20-min (resting session). Salivary cortisol and IgA levels, visual analog scale on subjective fatigue, and maximum voluntary contraction (MVC) in knee extensor muscle groups were measured before and immediately, 30, 60, and 120 min and 24 hours after each session.
RESULTS:
In the 20-min and exhaustive sessions, subjective fatigue increased at immediately after exercise and decreased 60, 120 min and 24 hours after exercise. However, MVC showed no change throughout the all sessions. In the resting sessions, no significant differences in salivary cortisol levels before and after exercise were observed. In the 20-min and exhaustive sessions, salivary cortisol levels were significantly higher 30 min after exercise as compared with before exercise and after then gradually decreased until 120 min after exercise. (p<0.05). No significant differences in salivary IgA levels before and after exercise were observed in all sessions. Additionally, salivary cortisol and IgA levels were positively correlated with the subjective fatigue (cortisol; r=0.243, p<0.05, IgA; r=0.167, p<0.05), but were not correlated with the MVC.
CONCLUSIONS:
These findings suggest that the changes in salivary cortisol and IgA levels may be related to increase in acute exercise-induced subjective fatigue.
Supported by Grants-in-Aid for Scientific Research (#17H02182 and #16K13059, M. Iemitsu).

D-67 Free Communication/Poster - **Genetics**

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

2105 Board #261 May 30 3:30 PM - 5:00 PM

Body Height Trajectories in Pediatric Competitive Athletes

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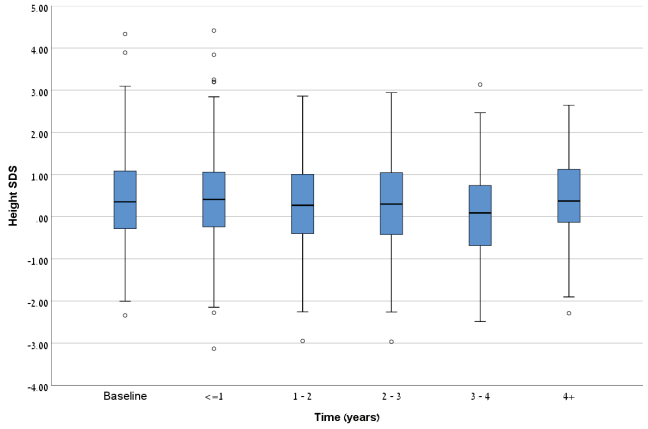
PURPOSE: There is a significant concern that competitive sports in children and adolescents might hinder growth. Currently available data are limited and conflicting. The purpose of this study was to examine the trajectories of body height in competitive pediatric athletes.
METHODS: Data on all child and adolescent athletes that underwent annual pre-participation examinations in a sports medicine center from 2007-2018 were extracted. Data included sport type, age, sex, weight and height. Height was transformed to age-

and sex- specific standard deviation scores (SDS) using the CDC growth charts. In athletes with >1 examination, generalized estimating equations were used for repeated measures analyses of height SDS changes over time.
RESULTS: Data on 2,287 athletes were available, of which 693 had >1 height measurement and formed the study population (70.4% males, mean age 11.5±2.4 years, range 6-18, from 46 sport types). The median duration between the first and last examinations was 1.9 years (IQR 0.99-2.93 years) with a maximum of 9.3 years. Height SDS was not significantly changed throughout the follow-up period in the total cohort (-0.13 per year, 95%CI -0.52-0.03, p=0.51), see Figure. In subgroup analyses, no significant change in height SDS was seen among athletes aggregated from classic height-advantageous sports (basketball, volleyball, tennis and swimming, p=0.73), basketball players (p=0.84) or gymnasts (p=0.24). No significant change in height SDS over time was seen when participants were stratified by first measurement age (<9, 9-12, 12+ years) and sex.
CONCLUSIONS: In this large cohort of pediatric athletes with repeated physical examinations, competitive sports were not associated with significant changes in body height relative to age. This finding remained true regardless of age at first measurement and sex, as well as when focusing on sports with typically tall or short statures. Competitive sports do not seem to hinder growth in children.



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Effects Of Collagen Gene Polymorphisms On Ligament Injury In Weight-lifting Athletes

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Previous studies have been reported that polymorphism is associated with injury in athlete and general populations. Some studies suggested that COL5A1 polymorphism is one of the risk factors of ligament and tendon injury in professional soccer players and others.**PURPOSE**: To investigate the association between COL1A1, COL5A1, COL11A1 and COL22A1 gene polymorphisms and ligament injury in Japanese weight-lifting athletes.
METHODS: A total of 174 Japanese weight-lifting athletes (Male: n=111, Height: 168.4 ± 6.8. Weight: 81.0±18.8, Age: 21.3 ± 6.2, Female: n=63, Height: 153.8 ± 20.2, Weight: 61.9 ± 11.0, Age: 20.5 ± 3.1) participated in present study. Subjects were divided into 2 groups based on their results of questioners (ligament injury group and no ligament injury group). Genotyping results were analyzed using the TaqMan approach for the COL1A1, COL5A1, COL11A1 and COL22A1 polymorphism.
RESULTS: the genotype frequency of the CC, CT, and TT genotypes in the COL5A1 gene were 0, 29 and 71 % in the no injury group and 5, 28, and 67 % in the injury group. COL5A1 CC genotype frequency was lower tendency in no injury group compared with injury group. However, there was no significant association between COL1A1, COL5A1, COL11A1, COL22A1 polymorphisms and ligament injury.
CONCLUSIONS: Our results suggested that COL5A1 CC genotype has tendency of low risk factor of ligament injury, however, there is no association between Each polymorphisms and ligament injury in Japanese weight-lifting athletes.

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The Effect Of FTO rs9969309 Polymorphism On Body Composition in Chinese adults

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The FTO (fat mass and obesity associated) gene, the first common obesity susceptibility gene in a Caucasian population, was reported by GWAS (genome-wide association studies) in 2007. **PURPOSE:** The aim of this study was to explore the effect of genotypes of FTO rs9969309 polymorphism on body composition related traits in Chinese adults. **METHODS**: Forty-three Chinese adults aged from 19 to 55 years old (32 males and 11 females) were recruited from Shenzhen University and a running club of local community. The subjects participated in physical activity at least three times per week with thirty minutes each session. Body composition related traits, including body weight (BW), hip circumference (HC), abdomen circumference (AC), waist-hip ratio (WHR), percentage of body fat (PBF), fat mass (FM), fat free mass (FFM) and body mass index (BMI), were analyzed by bioelectrical impedance analyzer (BH-380 in Beijing Acemeway Company). The genotypes of FTO rs9939609 were analyzed by the Beijing Genomics Institute. One-way ANOVA was used to compare between genotypes and body composition related data. **RESULTS**: There were three genotypes (TT, AT and AA) in rs9939609 polymorphism, in which 24 individuals with TT genotype, 16 individuals with AT genotype and 3 individuals with AA genotype. The body composition related traits, including HC, AC, BMI and FM, were significantly lower in TT genotypes than those in AA genotypes (p=0.017, p=0.004, p=0.002, p=0.006, respectively), and were significantly lower in TT genotypes than those in AT genotypes (p=0.025, p=0.023, p=0.010, p=0.041, respectively). Also, there was a significant difference only between TT and AA genotypes in WHR (p=0.015). No significant differences were found in the three genotypes with BW, PBF and FFM. **CONCLUSION**: The results indicate differences in several body composition parameters regarding the FTO rs9969309 polymorphism in a small sample of Chinese adults.

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The Association Between Mct1 T1470a And Ace I/d Polymorphisms And Athletic Status In Climbing Athletes

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Previous studies have shown a relationship between MCT1 T1470A polymorphism and blood lactate concentration during and after high-intensity intermittent exercise. In addition, the I allele seems associated with endurance-orientated events, while the D allele seems like to be the opposite with power- orientated events in the ACE I/D polymorphism. Sports climbing also required muscle power and endurance performance, therefore we hypothesis that MCT1 T1470A and ACE I/D polymorphisms associated with athletic performance in climbing athletes.
PURPOSE: To investigate the effects of the MCT1 T1470A and ACE I/D polymorphisms on athletic achievements (national or regional level) in climbing athletes.
METHODS: Sixty-nine climbers (49 men and 20 women) were genotyped for the MCT1 T1470A genotype (rs1049434) and ACE I/D (rs4341) using the TaqMan®Assay. All climbers were assigned to two groups (35 national level climbers and 34 regional level Climbers) based on their results of competitions.
RESULTS: The genotype frequency of the AA, TA, and TT genotypes in the MCT1gene were 43% , 49% and 8 % in the national level and 44%, 32%, and 24 % in regional level. TT genotype frequency was lower tendency in national level athletes (8%) compared with regional level athletes (24%) (P=0.089). The genotype frequency of the DD, ID, and II genotypes in the ACE I/Dgene were 16% , 38% and 46% in the national level and 3%, 38%, and 59% in regional level. There was no significant differences of frequency of the DD, ID, and II genotypes in the ACE I/D.
CONCLUSIONS: Conclusions: results were suggested that MCT1 T1470A polymorphism may associated with athletic performance in climbing athletes. The MCT1 T1470A and ACE I/D genotypes can provide useful information (e.g., talent selection and genotype-based customization for training) for athletes, especially well-trained men and their strength and conditioning coaches and sports coaches.

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Association Between Mitochondrial Dna Sequence, Heteroplasmy, And Indels With Response To Aerobic Exercise Training

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PURPOSE: Aerobic exercise training provides numerous biological and physiological health benefits towards the prevention and treatment of various chronic diseases. However, not all individuals increase cardiorespiratory fitness (CRF) with exposure to a given dose of aerobic training: some individuals are highly trainable and increase CRF, while others respond poorly. Genetic background is known to contribute to interindividual variation in adaptations to aerobic training. Our current understanding of genetics and exercise is limited primarily to the nuclear genome as only a few laboratories have investigated the role of the mitochondrial genome. The purpose of this study was to determine whether mitochondrial DNA (mtDNA) sequence, heteroplasmy, and indels differed among individuals previously characterized as elite endurance athletes, and high- or low-responders to aerobic training.
METHODS: DNA was isolated from whole blood in healthy subjects part of the GENATHLETE (world class endurance athletes; n=15) and HERITAGE (CRF response levels: high responders n=15; low responders n =15) study cohorts. mtDNA was amplified by long-range polymerase chain reaction, then tagged with Nextera libraries and sequenced on a Miseq instrument. Unique mtDNA sequence variants were called when at least two individuals in a group had the variant.
RESULTS: Compared to athletes and high-responders, low-responders had unique mtDNA single nucleotide polymorphisms (SNPs) in D-loop (displacement-loop) hypervariable region (HVR) 2 at positions 72, 152, 185, 188, 228, 295, 462, and 489. Of the HVR2 positions, position 188 was unique only to low-responders. Indels were unique to athletes and high-responders and located in D-loop HVR1 (16179, 16182, 16188, 16192), HVR2 (302), and HVR3 (567) positions. mtDNA Heteroplasmy was not different between groups.
CONCLUSIONS: Our results highlight an area of the mitochondrial genome responsible for DNA replication and transcription that may contribute to an individual's ability to improve CRF with aerobic training. Ongoing work aims to 1) confirm present findings in low responders through increasing sample size from the HERITAGE cohort, and 2) test for interactions between mitochondrial and nuclear genomes associated with response to a given dose of aerobic training.

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Circulating DNA As A Monitoring Tool In Professional Soccer

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PURPOSE: Player monitoring in elite sports settings is becoming increasingly important. Questionnaires or biomarkers, such as circulating, cell-free DNA (cfDNA) are possible approaches for load monitoring. cfDNA concentrations were shown to increase dependent on total distance covered in soccer and cfDNA was associated with overtraining in weightlifters. Thus, the purpose of this study was to examine whether cfDNA is feasible as a monitoring tool in elite soccer Players.
METHODS: Capillary blood from 22 elite male soccer players was collected on 40 time points during 4 months of a regular season. Moreover, 2 time points during pre-season were included. Blood samples were drawn on the day before and on days after season games. Players filled in a Visual-Analogue-Scale questionnaire (VAS) including the items "general perceived exertion" and "muscular fatigue". Performance was recorded by a GPS based (training) or a camera based (games) tracking system.
RESULTS: We observed a significant increase in mean cfDNA concentrations from the start of pre-season to the end of pre-season (1.6-fold, p=0.02). Moreover, cfDNA concentrations were significantly elevated in players on the day after regular season games (1.4-fold; p<0.001) in line with the VAS scores. cfDNA showed significantly higher values during weeks that included an additional midweek game (1.3-fold, p<0.001). While cfDNA concentrations correlated with performance data of the training, the VAS scores were correlated with the tracking of the season games. However, cfDNA concentrations and VAS scores did not significantly correlate with each other.
CONCLUSIONS: Here, we show that cfDNA concentrations at rest and VAS scores are influenced by previous load in professional soccer players. Moreover, a higher load due an additional midweek game led to significantly higher cfDNA concentrations. Future studies will reveal the full potential of cfDNA as a monitoring tool for player load in soccer Players.

2111 Board #267 May 30 3:30 PM - 5:00 PM

A Genome-wide Association Study For Muscle Fiber Composition

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Endurance-oriented athletes have a high proportion of slow-twitch muscle fibers (MF), whereas muscles of sprinters and strength athletes predominantly consist of fast-twitch MF. The heritability of the MF composition was estimated at 45%. **PURPOSE**: To perform a genome-wide association study for MF composition and to validate the results in additional studies using sport-related phenotypes. **METHODS**: MF composition of M. vastus lateralis in 168 physically active healthy Russian subjects (55 females, 113 males) was evaluated with immunohistochemistry. The case-control study involved 241 elite Russian athletes (89 sprinters, 49 strength athletes vs 103 endurance athletes). Twenty male wrestlers participated in the Wingate anaerobic test. Micro-array analysis (for detection of 700 K - 1.1 M single nucleotide polymorphisms (SNPs)) or whole-genome sequencing (wrestlers only) was used for genotyping. **RESULTS**: We first identified 929 SNPs that were associated (P<0.05) with the proportion of fast-twitch MF both in males and females. Next, we found that of the 929 SNPs, 37 variants were associated with sprinter athlete status (i.e. alleles associated with increased proportion of fast-twitch MF were over-represented in sprinters compared to endurance athletes). Of those, sprint-related alleles of 4 SNPs (rs7669580, rs1247330, rs2048968, rs2369665) were also over-represented in strength athletes (vs endurance athletes). Only rs7669580 SNP located in the *LDB2* gene (encodes cytoskeletal protein) was found to be associated with the relative peak power in wrestlers. **CONCLUSION**: We have identified the A allele of the *LDB2* rs7669580 SNP that was associated with increased proportion of fast-twitch MF (P=0.00046), ability to become a sprinter (P=0.021) or a strength athlete (P=0.016) and increased peak power of wrestlers (P=0.0187). The study was supported by grant from the Russian Science Foundation (Grant 17-15-01436).

2112 Board #268 May 30 3:30 PM - 5:00 PM

Genetic Modulation of Hypothalamic Pituitary Adrenal Function in Specialized Military Men

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Hypothalamic-pituitary-adrenal (HPA) hormone profiles are informative mediators of health status. Existing studies link candidate genetic variants in the corticosteroid and serotonin systems to basal cortisol function in diverse populations. Potential connections of such variants to the HPA end-product, dehydroepiandrosterone (DHEA), is essentially unexamined and virtually nothing is known of their effects in military populations. **PURPOSE:** To determine whether candidate genetic variants in the mineralocorticoid receptor (MR [i.e., −2C/G]), glucocorticoid receptor (GR [i.e., BclI]), and serotonin transporter (i.e., 5HTTLPR, triallelic version) modulate daily HPA function (cortisol and DHEA) of specialized military men. **METHODS:** Seventy-three elite military men were studied (mean ± SE age = 33.2±0.7 yrs). Salivary cortisol and DHEA were collected on 2 consecutive weekdays at wake, wake + 30 min, wake + 60 min, 1600, and 2100. TaqMan® genotyping assays were performed for BclI and −2C/G. Variable number tandem repeat analyses were conducted for 5HTTLPR. Unique and combined associations of the genetic variants were assessed with respect to daily patterns of salivary cortisol and DHEA. **RESULTS:** Homozygous GG carriers of −2C/G had higher DHEA concentrations across the day in comparison to C carriers ($F(1, 55) = 8.7$, $p = .005$). Homozygous SS carriers of 5HTTLPR had higher DHEA concentrations at wake + 30 and 60 min, followed by convergence with the L carrier profile in the afternoon and evening (interaction effect, $F(2.4, 132) = 4.2$, $p = .011$).

Combined effects on DHEA patterns: −2C/G + 5HTTLPR (interaction effect, $F(7.3, 126.3) = 3.7$, $p < .001$), −2C/G + BclI (group effect, $F(3, 53) = 4.2$, $p = .01$), and 5HTTLPR + BclI (interaction effect, $F(7.8, 134.8) = 3.7$, $p < .001$). Salivary cortisol profiles were not modulated by candidate variants. **CONCLUSION:** Whereas MR's affinity for cortisol and aldosterone is well researched, the link between −2C/G and DHEA helps to resolve equivocal literature regarding MR's potential compatibility with DHEA. Also, the connection between 5HTTLPR and DHEA implies the signaling between serotonergic and HPA systems extrapolates beyond the primary end-product, cortisol. Finally, this study demonstrates that genetic modulation of salivary DHEA profiles is additive, if not synergistic.

2113 Board #269 May 30 3:30 PM - 5:00 PM

Effects of Collagen Gene Polymorphisms on Tendon And Ligament Inflammations in Japanese Male Endurance Athletes.

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(No relevant relationships reported)

In endurance athletes, chronic mechanical stress to tendon and ligament induces local inflammation, leading to tendon and ligament injuries. Type 1, 5 and 12 collagen is the major structural component of tendon and ligament and other component is type 3 and 6 collagen. Several studies were identified the relationship between tendon or ligament injures and collagen gene polymorphisms such as, rs1800012 in COL1A1, rs12722 and rs3196378 in COL5A1, rs1800255 in COL3A1 and rs35796750 in COL6A1. However, effect of tendon and ligament inflammations on collagen-related gene polymorphisms remains unclear in Japanese endurance athletes. **PURPOSE**: This study aimed to clarify whether single nucleotide polymorphisms (SNPs) within the collagen genes were associated with the incidence of tendon and ligament inflammations in Japanese male endurance athletes.
METHODS: Twenty-four Japanese elite male long-distance runners participated in a cross-sectional study. All subjects were investigated the onset number of tendon and ligament inflammations in the student period of the university by using a questionnaire. SNPs of rs1800012 in COL1A1 gene, rs12722 and rs3196378 in COL5A1 gene, rs1800255 in COL3A1 gene and rs35796750 in COL6A1 gene were determined by real-time PCR with Taqman probe.
RESULTS: All subjects had GG genotype of rs1800012 in COL1A1 gene. The onset number of tendon and ligament inflammations in the student period of the university was significantly higher in CC genotype of rs12722 in COL5A1 gene as compared with CT and TT genotype individuals ($P<0.05$) and was significantly higher in CC genotype of rs3196378 in COL5A1 gene as compared with CA and AA genotypes individuals ($P<0.05$). Moreover, the onset number of tendon and ligament inflammations in the AA and AG genotype of rs1800255 in COL3A1 gene was tended to be higher than that in GG genotype individuals ($P=0.078$). However, the rs35796750 in COL6A1 gene polymorphism had no impact on differences of the onset number of tendon and ligament inflammations.
CONCLUSIONS: These results suggest that SNPs of rs12722 and rs3196378 in COL5A1 gene and rs1800255 in COL3A1 gene may affect incidence of tendon and ligament inflammations in Japanese male endurance athletes. Supported by Grants-in-Aid for Scientific Research (#17H02182 and #16K13059, M. Iemitsu).

2114 Board #270 May 30 3:30 PM - 5:00 PM

KCNA4 Gene Variant is Auxiliary in the Complex Phenotype of Endurance Running Performance Level

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(No relevant relationships reported)

To the best of our knowledge, the pertaining sources of information on the Potassium Voltage-Gated Channel Subfamily A Member 4 (KCNA4) gene do not evidence a single study evaluating the possible association between its genotypic and allelic frequencies with endurance performance. **PURPOSE**: We tested the hypothesis of an association between the prevalence of the genotypic and allelic frequencies distribution of the KCNA4 gene rs1323860 (C/T transition) and endurance performance level in Hispanic male marathon runners (MR). **METHODS**: The present is an observational study following a genetic epidemiology model using a case-control design. The subjects (n=1876) were adult Hispanic male MR. Fast-MR (Cases; n=938) were finishers in the top 3rd percentile. Slow MR (Controls; n=938) were finishers in the lowest 3rd percentile of their respective age. Genomic DNA was purified from a whole blood sample. Polymerase chain reaction was used to amplify a KCNA4 SNP which consists of a C/T (rs1323860) transition. The observed genotype frequencies, in both Cases and Controls, met Hardy-Weinberg equilibrium (X^2, P **RESULTS**: Genotype and allele frequencies were statistically different ($P<0.01$) between cases and controls. Odds ratio revealed that the C allele was 1.33 times more likely prevalent in the cases than in the controls (95% CI; 1.17, 1.51; $P<0.001$). The magnitude of the statistical power for the present study was 0.86. **CONCLUSIONS**: The findings strongly suggest that KCN4gene rs1323860 (C/T transition) is auxiliary in the complex phenotype of endurance running performance level in Hispanic male marathon runners.

2115 Board #271 May 30 3:30 PM - 5:00 PM

Association Of Circulating Cell-free Dna Released During Physical Exercise With Extracellular Vesicles

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(No relevant relationships reported)

Introduction Circulating cell-free DNA (cfDNA) has emerged as an important target for liquid biopsies including performance diagnostics. Extracellular vesicles (EVs) are important mediators of cell-to-cell communication and are demonstrated to deliver bioactive material, such as proteins, lipids and nucleic acids, via the circulation. The ability of EVs to transport DNA and, thus, contribute to the pool of cfDNA is controversially discussed. **Purpose** To gain more detailed information of the release mechanisms of cfDNA during physical exercise by estimation of the proportion of cfDNA associated with EVs. **Methods** Platelet-free plasma was collected prior and immediately after an incremental cycling test to exhaustion from a single healthy male athlete. Using size exclusion chromatography (SEC), 2 ml of plasma were separated into 16 fractions of 1 ml. cfDNA concentration in plasma and SEC fractions was measured by direct quantitative real-time PCR of the L1PA2-repeat sequence with or without prior treatment of the fractions with DNaseI. To take pre-analytical considerations into account, the analysis was performed on freshly prepared plasma in a technical duplicate, and frozen SEC fractions. Vesicular fractions 4 to 7 were defined by the presence of the genuine EV markers CD9 and CD63 as well as the platelet-EV marker CD41b in western blot analysis. **Results** Plasma cfDNA concentration increased from 14.05 ng/ml plasma Pre to 157,01 ng/ml Post the cycling test. The amount of DNA, recovered in differently prepared SEC samples (fraction 1-16), was 8.8 ± 0.9 ng in the pre samples and 108.8 ± 22.8 ng post samples. The run of the cfDNA curve in the SEC samples was very similar in the pre and post samples ($r = 0.90$, 95% CI: 0.82-0.94; $p<0.001$). In the vesicular fractions (SEC 4-7) 23.8 ± 1.9 % of the recovered DNA occurred. DNAseI treatment only slightly decreased the amount of DNA in fractions (4-7) from 2.18 ± 0.15 ng to 1.72 ± 0,52 ng in the Pre samples and from 24.9 ± 7.0 to 20.3 ± 0.4 ng in the Post samples. In the remaining SEC fractions 79.9 ± 6.4 % of the DNA was digested. **Conclusion** About 24% of the cfDNA in human plasma occurs in the vesicular Sec fractions. The larger amount seems to be independent of EVs and is prone to DNaseI digest. Further experiments are required to clarify if the DNA is inside of EVs or on the outside, protected from DNaseI.

D-68 Free Communication/Poster - Concussion II

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

2116 Board #272 May 30 3:30 PM - 5:00 PM

Athletic Training Educator Concussion Symptomology Prioritization for Clinical Decision-Making Compared to Typical Symptom Presentation

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Athletic training education program directors (PDs) are often tasked with setting the tone of their curriculum and prioritizing items of focus for students. Given the current attention on concussion, it is important to understand PDs' concussion knowledge and strategies for decision making. PDs personal strategies may influence educational content and student practices, implicating clinical practices for new athletic trainers (AT). **PURPOSE:** To determine whether educator-identified prioritized symptoms for removing an athlete from play align with common concussion-related symptoms experienced by athletes. **METHODS:** PDs from 32 professional-level athletic training education programs (n = 25 undergraduate; age = 43.8 ± 8.2; yrs experience = 21.1 ± 9.2) completed a validated survey examining concussion knowledge and the three symptoms most likely to cause them to remove an athlete from play. Participants responded to questions regarding symptoms and consequences of concussion on the

scale of 1 (definitely not a symptom/consequence) to 4 (definitely is). Total knowledge was summed for a possible range of 25-100. **RESULTS:** PDs' concussion knowledge was moderate (81.1 ± 6.7), primarily due to lack of confidence ("probably" vs. "definitely" is a symptom/consequence) in some items as opposed to being incorrect. The primary symptom reported by PDs as indicating necessary removal from play was headache (n = 23/32) followed by a three-way tie (n = 14/32 each): 1) amnesia/ trouble remembering, 2) trouble understanding/confusion, and 3) visual disturbances. Dizziness was the fifth most common symptom causing removal from play (n = 11/32). Previous literature supports headache as the most common symptom experienced by athletes, then dizziness and difficulty concentrating. Although after headache, most common symptoms may vary; however, memory problems, confusion, and visual disturbances are typically reported as some of the most common symptoms. **CONCLUSION:** These data suggest that in general, PDs are prioritizing the most common symptoms experienced for their removal from play decisions. This is encouraging as it suggests that PD's knowledge on key symptoms is appropriate. Future research should further investigate the role AT knowledge and symptom prioritization plays on content in educational programs.

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No Effect Of Randomizing Concussion Symptom Presentation On Symptom Number Or Severity Reporting

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Purpose: Concussion symptom evaluations are the most common tool used by clinicians to diagnose an injury. However, the most common post-concussion symptoms reported are also the symptoms that appear first on the Standardized Concussion Assessment Tool (SCAT) symptom list. The purpose of the current study was to evaluate whether SCAT symptom order influenced symptom reporting in healthy young adults with and without a prior concussion.
Methods: Previously concussed and non-concussed young adults completed a survey consisting of demographics, medical history, and SCAT symptoms. Participants were randomized to either complete the original SCAT form or the SCAT with randomized symptom order. Since the individuals were healthy, many participants reported zero symptoms. Thus, logistic regression and zero inflated negative binomial models compared the symptoms scores of the first 5 SCAT symptoms to determine whether presentation order influenced symptom reporting. The first five symptoms evaluated were headache, pressure in the head, dizziness, neck pain, and nausea.
Results: A total of 13 (n = 6 Female) participants completed the surveys who had an average age 25.07 ± 4.73. Participants who completed the randomized SCAT consisted of 2 females (33.3%), 5 males (71.4%), there was no significant effect of sex on likelihood of receiving the randomized SCAT order (p &gt 0.05). Three participants (60.5%) out of five with a concussion completed the randomized SCAT order. There was no significant effect of prior concussion on likelihood of receiving the randomized SCAT order (p &gt 0.05). Logistic regression and zero inflated negative binomial models yielded no significant effect of SCAT order on the likelihood to report symptoms or the severity of symptoms (all p's &gt 0.05).
Conclusions: In this small sample size of health young adults, SCAT symptom presentation does not appear to influence symptom reporting or severity. Follow up analyses should evaluate for this effect in a larger sample and in acutely concussed individuals.

2118 Board #274 May 30 3:30 PM - 5:00 PM

Adult Perception of a Child's Sport Concussion Risk

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(No relevant relationships reported)

Purpose: With increased media coverage on sport-related concussions (SRC), there has been a growing concern about the risks associated with contact sports. Previous literature reports a decrease in participation numbers stemming from increased perception of concussion risk in contact sports such as football. The purpose of this study was to evaluate the effect of adult profession and perception of their child's concussion risk while participating in contact sports. We hypothesized that adults with a medical background would be more educated about the consequences of SRC, and thus would be less inclined to choose high-contact sports participation for their own children compared to those without medical backgrounds. **Methods:** Data were collected through an anonymous electronic Qualtrics survey administered to faculty and staff at a large midwest university and associated medical center between 2017 to 2018 (n=5849, age=39.519 ± 13.802 years). Respondents indicated their gender, age, highest degree awarded, whether or not they were a medical professional, and in what sports they would allow their children to participate. Sports were subdivided into four categories (high-contact, partial-contact, non-contact, and all of the above) and analyzed using chi-square tests, followed by a logistic regression to investigate any differences between professional categories and rate of selection of high-contact sports. **Results:** Preliminary chi-square tests indicated no difference between medical (MP) and non-medical professionals (NMP) and the four sport subdivisions (x^2=5.58, p=0.23). Between-group nominal logistic regression was non-significant (p=0.20) in examining the effect of profession and selection of sports. More specifically, there was insignificance between professions and likelihood of choosing high-contact sports (p=0.092). **Conclusion:** Initial analyses suggest no difference in the choice of sport participation among children with parents in medical and non-medical backgrounds despite an increased attention on concussion in recent years. Future analyses will investigate the specific sports chosen, as well as additional covariates such as parental sport participation and concussion history.

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Changes in Fixational Eye Movements following Concussion

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Concussions can affect smooth pursuit, saccadic, and vergence eye movements. Fixational eye movements (FEMs) - the small, involuntary motion of the eye that occurs while focusing on a target - are affected by Alzheimer's, Parkinson's, and mild cognitive impairment. However, little is known about changes in FEMs following concussion.
Purpose:
To compare FEMs in concussed patients to controls using a retinal image-based eye tracking device.
Methods:
Participants included 50 patients with a concussion and 39 age- and gender-matched controls aged 13-27 years. FEMs were measured with a tracking scanning laser ophthalmoscope (TSLO) that tracks retinal image motion at 480 Hz with accuracy of ~0.2 arcmin. Eye traces were analyzed offline to compute microsaccadic amplitude, peak velocity, and peak acceleration. Fixational spread, using bivariate contour ellipse area (BCEA), intersaccadic intervals, blink rate, and total blink time were also analyzed. Concussed patients completed the Vestibular Oculomotor Screening (VOMS), Post-concussion Symptom Scale (PCSS), and Immediate Post-Concussion Assessment and Cognitive Test (ImPACT) for comparison with FEMs.
Results:
Microsaccades were larger (amplitude – controls: 0.397° SD 0.32, concussion: 0.597° SD: 0.45; p <0.001) and faster (peak velocity: control: 27.9°/sec SD: 22.2; concussion: 39.7°/sec SD: 30.3; p<0.001; peak acceleration: control: 6.27°/sec^2 SD: 9.29; concussion: 9.47°/sec^2 SD: 14.1) in concussed participants. Although concussed patients and controls made equal numbers of microsaccades during a 30 sec recording, concussion patients had a greater proportion of larger, faster microsaccades - with 19% more microsaccades at amplitudes greater than 0.75° and 22% more microsaccades ≥30°/sec. The BCEA was 221% larger in concussed patients (0.56°) compared to controls (0.26°).
Conclusions:
These findings support changes in FEMs following concussion as measured using retinal image-based eye tracking. Microsaccades in concussed patients were larger in amplitude, peak velocity, and peak acceleration compared to controls. Specifically, fixation is less precise, with a larger spread (i.e., increased BCEA). Retinal imaging and eye-tracking of FEMs may be useful in identifying and monitoring recovery following concussion.

2120 Board #276 May 30 3:30 PM - 5:00 PM

Examining Persistent Deficits in Gait Utilizing Inertial Measurement Units

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(No relevant relationships reported)

Purpose: The effects of concussion on gait have been studied using three-dimensional motion capture technology. However, the equipment expense may not be feasible for all clinicians and researchers. Inertial Measurement Units (IMU) are inexpensive, portable, and have been used to evaluate gait. The purpose of this study is to utilize IMU's to evaluate gait deficits in concussed participants (CON) (time >1 year since concussion incidence) compared to non-concussed participants (NC). **Methods:**

Fourteen participants (n=6 CON 22.87 ± 2.13 years, 3.16 ± 2.14 concussions, 4.49 ± 1.66 years from concussion, n=8 NC 26.42 ± 5.25 years) completed the 2-Minute Walk (2Walk), and Timed Up and Go (TUG) gait tasks while equipped with 10 IMU's . Exclusion criteria included no orthopedic injuries in the past year or condition that impedes gait, or the ability to jump. Additionally, control participants were excluded if they presented with any concussion history. Independent t-tests were utilized to examine the relationship between concussion history and motor function utilizing turn velocity, angle and duration, as well as double support gait percentage and TUG duration. For all TUG variables, the results from the participants' three trials were averaged before computation. **Results:** There was a significant difference amongst groups for turn duration ($p<0.01$), turn velocity ($p=0.04$), during the TUG gait task. Additionally, there was a significant difference for percentage of gait cycle in double support for the 2Walk ($p=0.011$). Turn velocity was faster for the concussed participants (mean CON= 238.4º/sec, NC= 208.2º/sec) while turn duration was shorter (mean CON=1.66 ± 0.1sec, NC=1.90 ± 0.13 sec) compared to controls. Concussed participants spent approximately 3.5% less of their gait cycle in double support during the 2Walk. However, no significant differences were noted in turn velocity and duration in the 2Walk task. **Conclusion:** Preliminary findings show altered gait and turning strategies among those with a concussion history. These differences may be explained by concussion history. Alternatively, differences in activity levels and sporting experience may also contribute. Future analyses will reassess these changes in addition to other kinematic metrics as sample size increases.

2121 Board #277 May 30 3:30 PM - 5:00 PM

Interrater And Intrarater Reliability Of The Standard Assessment Of Tackling Technique (SATT) On Secondary School Football Athletes

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BACKGROUND: Eighteen years after Guskiewicz et al. (2000) began studying sport related concussion in college and high school football players, head and spine injuries remain a very serious concern for the sport. An upward trend in serious catastrophic brain and spinal cord injuries still exists (Meehan and Landry, 2015), despite greater awareness of signs and symptoms, improved injury evaluation, more accurate symptom assessment, cautious return to play decisions, better helmet technology, new tackling styles, updated coach education, and rule changes limiting contact in practice (Yang et al., 2017). A consistent, cost effective method to evaluate and screen unsafe tackling behaviors has yet to be established. The Standard Assessment of Tackling Technique (SATT) is an observational tool designed to score movement proficiency on five critical elements of an American football tackle. Each element is rated on a four step, ordinal scale from zero - did not occur to three - performed with proficiency.
PURPOSE: of this study was to evaluate interrater and intrarater reliability of the SATT.
METHODS:Fifteen healthy subjects were videotaped while performing a tackle proficiency assessment (TPA) drill on a square blocking dummy. Twelve players (n=12) completed all three TPA sessions spaced 7 days apart, three players did not complete all trials and their data was removed. A total of 36 videos were independently scored by two, trained raters. Training required completion of a forty-five-minute session with explanation of the scoring rubric and scoring sample videos until 80% scoring agreement was obtained.
RESULTS: Interrater reliability was good for sessions 1 (ICC = 0.801; 95% confidence interval [CI]: 0.446-0.938) and 2 (ICC = 0.856; 95% CI: 0.575-0.956) and moderate for session 3 (ICC = 0.602; 95% CI: 0.076-0.867). The individual SATT components showed Arm Rip was the least reliable component (ICC = 0.40; 95% CI: 0.31-0.51) and leg drive was the most reliable component (ICC = 0.95; 95% CI: 0.92-0.97). Intrarater reliability was moderate to good for both raters (ICC = 0.57 - 0.79).
CONCLUSIONS: The results showed that the SATT can be independently scored by two raters, following a 45 minute training session and more experienced raters demonstrate increased intrarater reliability.

2122 Board #278 May 30 3:30 PM - 5:00 PM

Effects Of 3D Multiple Object Tracking On Head Impacts During A Collegiate Ice Hockey Season

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(No relevant relationships reported)

Player-to-player contact is the most frequent head impact mechanism in collegiate ice hockey. Training with three-dimensional multiple object tracking (3D-MOT) could potentially reduce the quantity and severity of head impacts by enhancing player anticipation of these impacts. **PURPOSE**: The purpose of this study was to utilize 3D-MOT training as a tool to reduce the quantity and severity of head impacts in NCAA Division III men's and women's ice hockey players.
METHODS: Collegiate men's and women's ice hockey players (N = 33; men = 17, women = 16) were randomly assigned to a 3D-MOT group (3D-MOT = 17) or control group (C = 16). 3D-MOT training occurred twice per week for 12 weeks throughout one regular season. Quantity, location, linear acceleration, and rotational velocity of head impacts were measured in practices and games. Independent samples t-tests compared peak linear acceleration and peak rotational velocity between groups. Pearson chi square analysis compared the quantity of impacts between groups. Independent groups ANOVAs compared peak linear acceleration and peak rotational velocity of impacts between player positions and peak linear acceleration and peak rotational velocity at five different helmet locations between groups. **RESULTS:** 3D-MOT forwards sustained head impacts with greater mean peak linear acceleration (3D-MOT = 41.33 + 28.54g; C = 38.03 + 24.30g) and mean peak rotational velocity (3D-MOT = 13.59 + 8.18 rad.sec-1; C = 12.47 + 7.69 rad.sec-1) in games, and greater mean peak rotational velocity in practices versus control forwards (3D-MOT = 11.96 + 6.77 rad.sec-1; C = 10.22 + 6.95 rad.sec-1). Conversely, 3D-MOT defensemen sustained fewer in-game head impacts (3D-MOT = 181 head impacts; C = 282 head impacts) and head impacts with a mean peak rotational velocity less than control defensemen (3D-MOT = 11.54 + 6.76 rad.sec-1; C = 13.65 + 8.43 rad.sec-1). There was no significant difference for all other parameters analyzed between 3D-MOT and control groups. **CONCLUSION:** 3D-MOT training reduced the quantity and severity of head impacts for defensemen in games, but not for forwards. Player position may play an important role in future interventions to reduce quantity and severity of head impacts in collegiate ice hockey.

2123 Board #279 May 30 3:30 PM - 5:00 PM

Concurrent Validity and Reliability of the XLNTbrain Balance Test with the Balance Error Scoring System

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(No relevant relationships reported)

Background: The Balance Error Scoring System (BESS) is a commonly used balance assessment, because it is cost-effective and requires minimal equipment. The XLNTbrain Balance Test, was recently developed and uses smartphone accelerometer technology to provide clinicians with a more objective measure. While the objective nature of the test is promising, the validity and reliability of the XLNTbrain Balance Test is unclear.
Purpose: To determine the concurrent validity and reliability of the XLNTbrain Balance Test compared to the BESS.
Methods: Thirty-seven physically active participants (15 males, 22 females, 20.73 ± 2.02 yrs, 169.60 ± 10.28 cm, 70.12 ± 14.15 kg) completed the BESS and XLNTbrain Balance Test in a counterbalanced order. A subset of the sample (n=33) repeated the tests one week later. Concurrent validity was established through correlation analysis examining the relationship between scores on the BESS and XLNTbrain Balance Test. Reliability was established using paired-samples t-tests and Intraclass Correlation Coefficients ($ICC_{3,1}$) computed for the BESS and XLNTbrain Balance Test.
Results: A significant moderate relationship was found between the total scores of the BESS and XLNTbrain Balance Test (r_s=0.43, p=0.008), and between the firm tandem stance condition of the BESS and the eyes closed tandem stance condition of the XLNTbrain Balance Test (r_s=0.41, p=0.013). There were no statistically significant differences in scores between testing sessions for the BESS total score (Time 1: 16.44 ± 8.01, Time 2: 14.64 ± 6.38, t_{32}= 1.64, p=0.11), or the XLNTbrain total score (Time 1: 12.85 ± 5.89, Time 2: 14.77 ± 10.30, t_{32}= -1.02, p=0.31). There was a moderate reliability score for the BESS total score ($ICC_{3,1}$=0.54, p<0.005) and a low reliability score for the XLNTbrain Balance Test ($ICC_{3,1}$=0.17, p=0.17).
Conclusions: Although the XLNTbrain Balance Test appears to demonstrate moderate concurrent validity against the BESS, it did not demonstrate improved reliability. Future research should determine if the XLNTbrain Balance Test demonstrates validity against force plates. Additionally, the sensitivity of the BESS and XLNTbrain Balance Test to the effects of concussion should be explored.

2124 Board #280 May 30 3:30 PM - 5:00 PM

Balance And Cognitive Recovery Following Concussion Injury Is Associated With Initial Symptom Severity

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Introduction: Symptoms remain a primary way to monitor recovery from concussion injury. However, the association between subjective symptoms and objective measures of balance and cognition is not entirely understood.

Purpose: To examine the association between objective and subjective measures during recovery from concussion injury. The primary hypothesis is to describe changes in cognition, balance, and symptom severity over a one month timeframe following concussion injury. A secondary hypothesis is that symptom severity at time of injury will be associated with objective measures during the recovery period.
Methods: Fifty-one young adults (18.01±5.96 years old) who recently sustained a concussion completed a battery of four cognitive tests, eight balance tests, and a 22 item symptom report using a commercially available assessment tool (ClearEdge, Quadrant Biosciences Inc; Syracuse, NY). All subjects completed test 1, on average, 5.45 ± 3.53 days after injury, and test 2, 23.06 ± 10.92 days following test 1. Group comparisons (repeated measures ANOVA or T-Test) and effect sizes (Cohen's d) were used to compare recovery across time. To address the secondary hypothesis, those within the group reporting low symptom severity (symptoms <10; n=18) and high symptom severity (symptoms > 40; n=14) were compared.
Results: Across the sample, symptom severity at initial testing ranged from 0-89. Statistically significant differences between test 1 and 2 were seen for all cognitive tests ($p<0.001$) and 1 of the 8 balance tests ($p=0.028$). When comparing symptom severity groups, significant differences ($p<0.05$) at the first testing session were seen on 3 cognitive tests and 2 balance tests. No differences were seen between groups at test 2. The low symptom severity group had no changes in cognitive or balance scores between test 1 and 2. The high symptom group had large effects sizes towards improvement on Tandem Stance Eyes Closed (d=1.16), and Simple Reaction Time 2 (d=1.36).
Conclusion: Symptom severity is associated with objective measures of balance and cognition during the recovery period. The low symptom group appears to have reached full recovery prior to initial testing. The high symptom group showed signs of injury at initial testing with large changes in cognitive and balance performance at re-test.

2125 Board #281 May 30 3:30 PM - 5:00 PM

Reliability of the Stability Evaluation Test Over Consecutive Annual Baseline Assessments

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PURPOSE: It is recommended athletes receive annual concussion baseline testing that includes an assessment of postural control. Research has found concussion history does not correlate to baseline Balance Error Scoring System (BESS) scores. However, the BESS is not as sensitive in detecting postural control changes when compared to force plate measurements. The Stability Evaluation Test (SET) on the VSR Sport™ by NeuroCom® is an instrumented BESS and measures sway velocity. The purpose of this study was to determine the reliability of baseline sway velocity measurements taken during consecutive annual baseline screenings in Division I lacrosse players.
METHODS: 44 healthy Division I Lacrosse Players (14 females, 30 males; age = 20.57 ± 0.99; height = 69.59" ± 3.38"; weight = 169.73lbs ± 31.24) from one university participated in the study. All players were medically cleared for full participation and did not have a history of a concussion in the last 12 months. At the start of each season, players performed the standard 3 stances of the BESS test (double leg, single-leg, tandem) on two surfaces, firm and foam, while standing on the VSR Sport™ force plate.
RESULTS: A Pearson correlation analysis of the 2017 and 2018 sway velocities during each stance of the Stability Evaluation Test, found that none of the stance trials met the a priori threshold of $r \geq 0.70$ to indicate good test-retest reliability.
CONCLUSIONS: There is not a strong correlation between baseline balance measurements taken at the start of consecutive seasons. To ensure the reliability of measurements, it is recommended annual baseline measurements be taken even in the absence of a concussion. An individualized approach is ideal in the management of a concussion injury, and baseline accuracy should be considered a critical component.

Mean Sway Velocity Scores & Stance Correlations

	Double Leg, Firm	Single Leg, Firm	Tandem, Firm	Double Leg, Foam	Single Leg, Foam	Tandem, Foam	Composite Score
2017 Mean Sway Velocity	.69	2.19	1.31	1.75	4.88	5.40	2.69
2018 Mean Sway Velocity	.63	2.18	1.38	1.58	3.60	3.61	2.17
Correlation (r)	.49	.40	-.01	.41	.18	.30	.34

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Relationship Of Vestibular/ocular Motor Symptoms And Impairment On State Anxiety In Athletes With Sport-related Concussion

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(No relevant relationships reported)

PURPOSE: This study 1) compared state anxiety scores between concussed athletes with and without vestibular/ocular motor symptoms/impairment, 2) documented changes in state anxiety throughout SRC recovery, and 3) examined the role that state anxiety has on SRC recovery in athletes with vestibular/ocular symptoms/impairment.
METHODS: Thirty-nine concussed athletes (17.23 ± 2.30 yrs, 62%-F) with vestibular/ocular motor symptoms/impairment (total symptoms ≥2 on any component) (VESTIB) and 40 concussed athletes (16.48 ± 1.15 yrs, 30%-F) without vestibular/ocular motor symptoms/impairment (NO VESTIB) completed the Vestibular/Ocular Motor Screening within 30 days of SRC. The State-Trait Anxiety Inventory (STAI) was administered at initial and clearance visits. Analysis of covariance (ANCOVA), controlling for symptoms, was used to examine state anxiety scores between groups, and a paired samples t-test was used to examine changes across time. Chi-square analyses with odds ratios (ORs) assessed the association of vestibular/ocular motor symptoms/impairment on clinical levels of state anxiety (STAI score ≥40) and prolonged SRC recovery (≥21 days). **RESULTS**: The VESTIB group reported higher state anxiety scores (38.95±11.15) than the NO VESTIB group (30.60±9.98) (F [1,79] = 5.58, p =.02, η^2= .07). State anxiety scores improved from the initial (35.11±11.83) to clearance visit (26.01±8.15)(t (73) = 6.30, p<.001). The VESTIB group was 3.64 times more likely to exhibit clinical levels of state anxiety at the initial visit (χ2[1, 79] = 6.35, p=.01, 95% CI = 1.30 - 10.29). Athletes in the VESTIB group with clinical levels of anxiety were 4.24 times more likely to have prolonged recovery than without (χ2[1, 38] = 3.75, p=.05, 95% CI = .94 - 19.26). **CONCLUSIONS**: Athletes with vestibular/ocular motor symptoms/impairment may experience higher anxiety following SRC, which may influence recovery. Clinicians should assess vestibular/ocular motor and anxiety domains following SRC.

D-69 Free Communication/Poster - Exercise Testing II

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

2127 Board #283 May 30 3:30 PM - 5:00 PM

Comparison of Whole and Regional Body Composition Testing Devices

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(No relevant relationships reported)

Obesity has increased exponentially within the last three decades and is now widely recognized as one of the leading health threats due to its association with such as type 2 diabetes, cardiovascular disease, and hypertension. In recent years, there have been advances in technology such as bioelectrical impedance analysis (BIA), dual-energy X-ray absorptiometry (DEXA), and air-displacement plethysmography that has been used to categorize individuals into percent fat categories. However, there are still concerns with the validity of these devices. **PURPOSE**: The purpose of this study was to analyze the validity of an 8-point electrode BIA, DEXA, and air-displacement plethysmography methods compared to hydrostatic weighing. **METHODS**: 32 male (mean age ± SD= 22.4 ± 2.5 years) and 30 female subjects (mean age ± SD= 21.9 ± 2.3 years) performed body composition testing using BIA, DEXA, air-displacement plethysmography, and hydrostatic weighing. All tests were conducted in one continuous two-hour session for each subject. Subjects were instructed prior to testing to refrain from eating for a minimum of five hours but no more than ten, to avoid consuming alcohol within twelve hours of testing, to avoid caffeine within three hours of testing, to avoid large amounts of liquid within four hours of testing, and to refrain from exercising within 8 hours of testing. **RESULTS**: The one-way ANOVA with repeated measures and follow-up paired samples t-tests indicated that percent body fat estimated from DEXA (mean ± SD = 31.0 ± 8.9%) resulted in significantly greater values than hydrostatic weighing (23.3 ± 9.2%), air-displacement plethysmography (23.3 ± 10.8%), and BIA (23.6 ± 10.5%). In addition, the constant error (CE) and total error (TE) values of predicting hydrostatic weighing percent body fat from DEXA (CE = -7.7%, TE = 8.2%) was significantly greater than those associated with

air-displacement plethysmography (CE = 0.1%, TE = 3.2%) and BIA (CE = -0.3%, TE = 8.2%). **CONCLUSION**: These findings indicated that the air-displacement plethysmography and BIA methods provided acceptable
estimates of body composition when compared to hydrostatic weighing. The DEXA method, however, displayed large CE and TE values and thus was not an accurate measure of percent body fat.

2128 Board #284 May 30 3:30 PM - 5:00 PM

Relationship Between Cardiorespiratory Fitness and Arterial Stiffness in Healthy Adults

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(No relevant relationships reported)

Aortic stiffness and cardiorespiratory fitness (CRF) are independent predictors of cardiovascular disease (CVD), cardiovascular (CV) events, and early mortality. However, the relationship between arterial stiffness and CRF is largely unknown. **PURPOSE**: To examine the relationship between arterial stiffness and CRF in apparently healthy adults. **METHODS**: Two hundred three subjects—97 men (aged 50±21 years) and 106 women (aged 47±20 years)—visited the Human Performance Lab to complete one round of testing. Each performed a maximal cardiopulmonary exercise test to determine CRF (i.e., VO_{2max}). Aortic stiffness was measured via carotid-femoral pulse wave velocity (cfPWV). Data were checked for normality, and pearson-product moment correlations were performed to determine the association between CRF and arterial stiffness. **RESULTS**: VO_{2max} for the entire cohort was 32.8±12.0 ml/kg/min (range 11.4-66.4). The entire cohort had a cfPWV (m/s) of 7.3±1.6 (range 4.8-12.2). cfPWV was moderately associated with CRF (r= -0.585, p<0.001). **CONCLUSION**: Arterial stiffness is inversely related to CRF. These data suggest that the beneficial effects of CRF on cardiovascular-related outcomes may be mediated, at least partially, through arterial stiffening.

2129 Board #285 May 30 3:30 PM - 5:00 PM

Relationships Among Muscle Function, Skeletal Muscle Mass, and Arterial Stiffness

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(No relevant relationships reported)

Skeletal muscle function (MF), skeletal muscle mass (SMM) and arterial stiffness are independent risk factors for all-cause mortality and cardiovascular events. Decreases in SMM are negatively associated with arterial stiffness, however, the relationship between MF and arterial stiffness remains unclear. **PURPOSE**: To examine the relationship between MF and SMM with arterial stiffness. **METHODS**: Participants (N=203, 97 males/106 females) were apparently healthy adults (Age 48.3 ± 20.2 years, BMI 26.8 ± 4.9 kg/m^2, VO_{2max} 32.8 ± 12.0 ml/kg/min). Arterial stiffness was assessed through carotid-femoral pulse wave velocity (cfPWV). SMM was assessed through dual-energy X-ray absorptiometry (DXA), while handgrip strength was measured with a hand dynamometer. Relationships for the entire cohort were analyzed using Pearson correlations between cfPWV, SMM, and MF. **RESULTS:** Inverse associations for the entire cohort were observed with MF and cfPWV (r= -0.343, p=0.001) while SMM was not associated with cfPWV (r= -0.007, p=0.911). All associations remained significant when divided into groups based on sex (p<0.05). **CONCLUSIONS:** These data suggest that muscle function, specifically handgrip strength, but not SMM are associated with arterial stiffness irrespective of sex. Interventions to improve arterial health should target measures of muscle function instead of skeletal muscle mass.

2130 Board #286 May 30 3:30 PM - 5:00 PM

Effect Of Exercise On Reserve Of Repolarization And Blood Stress Markers

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(No relevant relationships reported)

Reserve of repolarization of the heart (RoR) is a non-invasive method to monitor the heart's response to stress. RoR assess stability of cardiac membranes and when excitation becomes unstable. Previous studies reported RoR as a useful tool to determine cardiac risk in cardiac patients. In this study we compared two cohort groups, posttraumatic stress disorder (PTSD) which has a strong association with CVD and a group of apparently healthy subjects (AH). **Purpose:** To determine if RoR and blood stress markers in AH and PTSD cohorts are different at rest and in response to a graded exercise test to 85% HRmax. **Methods:** Ten young women with documented PTSD (23.2 ± 1.4 yrs.) and 8 AH individuals (24.1 ± 1.7 yrs) with normal BP arrived after overnight fast (7-9 am) and rested for 20 minutes. ECG's (12 lead) were monitored before, during and after exercise to obtain RoR. Blood was taken at rest and after exercise. Plasma samples were analyzed for stress proteins. **Results:** Resting HR's were statistically higher in the PTSD group compared to AH group (77.2 ±3.1; 67.7±2.6 bpm, P < 0.0001). Resting RoR between groups was not significantly different (AH=81±7%, PTSD = 78±5%, P > 0.2). RoR at the final exercise stage in AH group had significantly greater reserve (RoR = 40.4% compared to PTSD = 32.6%, P = 0.02) despite greater workload. Brain natriuretic peptide (BNP) increased in PTSD (pre =139.8 ±27.8, post = 232.8±47.8 pg/ml, P = 0.02) whereas AH showed no change (pre =123.9 ±30.2, post = 138±44.2 pg/ml). Plasma TnI was not different between groups at rest (P > 0.3) but increased significantly (P = 0.03) only in PTSD group with no changes in blood creatine kinase between groups and across time. **Conclusions**: These data suggest that PTSD individuals have less RoR in response to graded exercise compared to AH individuals. In addition, PTSD group had increased plasma BNP, and TNI suggesting an increased risk of having a cardiac event. It is suggested that this procedure may be useful as a screening process to help identify individuals with a risk of a coronary event.

2131 Board #287 May 30 3:30 PM - 5:00 PM

Poor Cardiorespiratory Fitness is Associated with Higher Risk of Infectious Events in Kidney Transplant Recipients

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(No relevant relationships reported)

Kidney Transplant Recipients (KTRs) have a reduced cardiorespiratory fitness, which is a well-known independent predictor of overall mortality in the general population and in patients with different chronic diseases. Although it is known that infections are one of the main cause of death in these patients, the possible correlation between cardiorespiratory fitness and the incidence of infectious events remains unexplored. **PURPOSE:** To investigate parameters of cardiorespiratory fitness as possible prognostic markers for infectious events in KTRs. **METHODS:** KTRs were evaluated at our outpatient clinic with an incremental, maximal CardioPulmonary Exercise Test (CPET), 3-12 months after transplantation. Cardiorespiratory fitness was analyzed with peak oxygen consumption (VO_2 peak) and the oxygen uptake efficiency slope (OUES). Laboratory data, drug therapy and history of infectious events were collected. The results of the study analysis were obtained with multivariate regression models. **RESULTS:** 157 KTRs (age 51±13 years, 64% men) were included in this study, with a mean BMI of 24.2±3.3 Kg/m^2, Glomerular Filtration Rate of 57±19 mL/min/1.73m^2, and hemoglobin concentration of 123.5±16.7 g/L. During a mean follow-up period of 33 months after the CPET, at least one infectious event occurred in 72 subjects (46%). The mean VO_2 peak of the entire population was 25.6±6.9 mL/Kg/min, corresponding to 81.3±21.6% of the VO_2 predicted for age and gender. 14.7% (n=22) of our patients had a VO_2 peak below the 5th percentile of a matched healthy population based on the FRIEND study results. This subgroup demonstrated an increased risk of infectious events with a Hazard Ratio of 2.11 (CI 95%, 1.19-2.73, p=0.01), which was independent of age, hemoglobin and immunosuppressive regimen. **CONCLUSION:** To our knowledge, this is the first clinical study associating a poor cardiorespiratory fitness with a higher risk of infectious events in KTRs. It can be speculated that an increased cardiorespiratory fitness, obtained by specific aerobic exercise training, may thus reduce infectious events and improve prognosis in this specific population.

2132 Board #288 May 30 3:30 PM - 5:00 PM

<Effect Of Menstrual Cycle On Resting, Exercise And Post-exercise Heart Rate In Healthy Women>

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(No relevant relationships reported)

Spontaneous heart rate (HR) is an important physiological measurement in the clinical and exercise contexts, however, it is not totally clear whether spontaneous HR could be influenced by menstrual cycle. **PURPOSE**: Our objective was to investigate the effect of menstrual cycle (Follicular and Luteal phases) on the HR at rest, during the maximal treadmill exercise (MTE) and post-exercise recovery in a clinically healthy woman.**METHODS**: We evaluated 11 healthy women (24.1 ± 4.4 years, BMI 22.5 ± 0.6 kg/m^2) with menstrual cycle lasting 28 ± 1.1 days. At rest, the HR was recordedin the supine and orthostatic positions. During the MTE, we recorded the chronotropic reserve with Maximum Heart Rate and Heart rate at the beginning of the test (HR_{max} - $HR_{1initial}$) and in the post-exercise recovery we recorded the HR recovery (HRR) at the 1st, 3th, and 5th min following MTE. The HR recovery coefficient referes to equation (HRmax - HRRmin/ Hrmax - HRI) x 100; HRmax: higher values on the stress test; HRmin: Heart Rate Values at each minute of recovery and HRI: initial test heart rate.

The evaluations were performed in the follicular phase between the 9th and 11th day and in the luteal phase between the 19th and 21st day after the beginning of the menstrual cycle. Statistical analysis employed parametric tests with two-tailed p value set at 5 %.**RESULTS**: At rest, HR was [supine: 64±2.8 bpm - 64.7±1.9 bpm, (p>0.05)] and [orthostatic: 82.6 ± 3.4 - 82.1 ± 3.4 bpm (p>0.05)] in during the follicular and luteal phases, respectively. Chronotropic reserve was not different (p>0.05) during Follicular (86.4 ± 2.2 bpm) and Luteal (86.9 ± 3.8 bpm) phases. Also, absolute HRR, Δ% HRR and HRR Coefficient did not show any difference between both phases of menstrual cycle (p>0.05).

Variables	Follicular		Lutea	*p*			
$HR_{INITIAL}$ (bpm)	96	±	3,3	95,18	±	4,4	0,84
HR_{MAX} (bpm)	182,5	±	3,2	182,1	±	2,9	0,93
C.R. (bpm)	86,4	±	2,2	86,9	±	3,8	0,91

CONCLUSIONS: We concluded that HR responses during rest, maximal treadmill exercise and 5 minutes post-exercise were not affected by the menstrual cycles, even with all physiliogical changes that occur during Follicular and Luteal phases.

2133 Board #289 May 30 3:30 PM - 5:00 PM

A Pilot Observational Study Investigating The Impact Of Glycogen Storage Disease III On Aerobic Capacity

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(No relevant relationships reported)

Glycogen storage disease 3 (GSDIII) is a rare inherited metabolic disorder caused by glycogen debranching enzyme (GDE) deficiency which primarily affects the liver, skeletal muscle and heart and results in muscle weakness and profound exercise limitation. Despite exercise intolerance being a major complication associated with the disease, the influence of GSDIII on aerobic capacity is largely unstudied. **PURPOSE:** To preliminary describe the impact of GSDIII on aerobic capacity and investigate potential mechanisms responsible for any impairment. **METHODS:** In this descriptive study 5 patients (3 female) (39 ± 11 years) with GSDIIIa underwent an incremental cycle exercise test to volitional exhaustion. During exercise breath-by-breath gas analysis took place to determine oxygen utilisation (VO_2), carbon dioxide production (VCO_2), and minute ventilation (VE) and heart rate (HR) was measured continuously. The study received institutional and NHS ethics approval. **RESULTS:** Peak VO_2 was lower in the GSDIII patients than predicted based on their demographic data (16.9±8.4 ml/kg/min, 52±23% of predicted), as was peak work rate (WR) (86±59 watts, 52±30% predicted), peak HR (139±26 bpm, 77±11% predicted), and VE peak (30±19 L/min, 36±13%) predicted). Peak RER was low for a test completed to maximal exertion (0.90±0.07). **CONCLUSION:** VO_2peak is lower in patients with GSDIII than would be expected for their age, height, mass and sex. The mechanisms responsible for this impairment are yet to be fully determined, but the small data set presented here indicate a reserve in respiratory and central cardiovascular function. Previous literature has identified energy deficiency as a primary cause of exercise intolerance in GSDIII due to impaired glycogen breakdown, and these results are supported here by the low RER values at peak exercise.

2134 Board #290 May 30 3:30 PM - 5:00 PM

Inflammation and Muscle Oxygen Saturation are Associated with Exercise Pressor Response in Peripheral Artery Disease

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(No relevant relationships reported)

Purpose: To determine whether calf muscle oxygen saturation (StO_2) and vascular biomarkers of inflammation and oxidative stress were associated with an exercise pressor response during treadmill walking in patients with symptomatic peripheral artery disease (PAD). **Methods:** A total of 179 patients were characterized on demographic variables, comorbid conditions, cardiovascular risk factors, ankle/brachial index, peak walking time (PWT), claudication onset time (COT), and calf muscle oxygen saturation (StO_2) during a graded maximal treadmill test. The exercise pressor response was measured as the change in blood pressure from rest to the end of the first 2-minute treadmill exercise work stage (2 mph, 0% grade). Patients were further characterized on endothelial effects of circulating factors present in the sera using a cell culture-based bioassay on primary human arterial endothelial cells, and on circulating inflammatory and vascular biomarkers. **Results:** During the maximal treadmill test, patients experienced COT at 197±164 seconds (mean±SD) and PWT at 395±254 seconds. There was a wide range in the change in systolic blood pressure (-46 to 50 mm Hg) and in diastolic blood pressure (-23 to 38 mm Hg), with mean increases of 4.3 mm Hg and 1.4 mm Hg, respectively. In multiple regression analyses, significant predictors of systolic blood pressure included glucose (p<0.001) and insulin (p=0.039). The significant predictors of diastolic blood pressure included cultured endothelial cell apoptosis (p=0.019), the percentage drop in exercise calf muscle StO_2 (p=0.023), high sensitivity C-reactive protein (p=0.032), and glucose (p=0.033). **Conclusion:** Higher levels in pro-inflammatory vascular biomarkers, impaired calf muscle StO_2 during exercise, and elevated blood glucose were independently associated with greater exercise pressor response in patients with symptomatic PAD. The clinical implication is that exercise and nutritional interventions designed to improve inflammation, microcirculation, and glucose metabolism may ameliorate the exercise pressor response in patients with symptomatic PAD.

2135 Board #291 May 30 3:30 PM - 5:00 PM

Effects of Combined Exercise on Vascular Inflammatory Markers and Arterial Stiffness in Elderly Women

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(No relevant relationships reported)

Women become more likely to develop chronic diseases as their metabolic function decreases after menopause. Vascular disease is a major problem for elderly women. The problem of these elderly women is due to a decline in health status due to lack of physical activity.
Purpose: The purpose of this study was to analyze the effects of a combined exercise training regimen on vascular inflammatory markers (WBC, CRP, fibrinogen) and arterial stiffness (blood pressure, pulse wave analysis and velocity) in elderly women. **Methods**: Forty-five healthy elderly female volunteers, aged 75.44 ± 5.30 years, were randomly assigned to combined exercise group (EX; n = 24) trained for 12-week or to a "non-exercise" control (CON; n = 21) group. The variables of vascular inflammatory markers, BP, PWA and PWV were measured in all the subjects before and after the 12-week combined exercise training. The 60 minute combined exercise program(aquatic exercise 1 time, strength exercise 2 times/week) was performed 3 times per week for 12 weeks, and the intensity was progressively increased every four weeks(1-4 weeks: RPE 12 to 13, 5-8 weeks: RPE 13 to 14, 9-12weeks: RPE 14 to 15). **Results**: The vascular inflammatory markers were as follows; All variables showed interaction effects and there was a significant difference in delta values between the two groups. WBC and CRP levels significantly decreased in the EX (p<.05). But control group CRP (p<.05) and fibrinogen (p<.01) levels significantly increased in the CON. SBP showed interaction effect and significant difference in delta-value. CON had significantly increased. However, there was no significant difference between PWA and PWV. **Conclusion**: Our findings indicate that regular aquatic and resistance exercise were effective in improving the serum vascular inflammatory makers and blood pressure of the elderly women with lower cardiovascular disease risk, which are all due to the decreased physical activities. Therefore, if senior citizens continuously improve their efficiency of
exercise, they can get the benefit of improving anti-inflammation and delaying the aging process with aging so that they can improve their level of healthy life in the old age.

D-70 Basic Science World Congress/Poster - Circadian Rhythms in Health and Performance

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

2136 Board #292 May 30 3:30 PM - 5:00 PM

Olympic Distance Amateur Triathlete Chronotype Profile

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(No relevant relationships reported)

It seems that the athletes tend to select and pursue sports that suited their chronotype. Elite triathletes show to comprise high proportions of morning-types (MTs), differently from general population. Possibly the early morning training sections, characteristics in

this sport modality, favors athletes presenting morning types profile. There are no data about amateur triathletes chronotype, but probably there are also a high percentage of morning type, mainly because the training sessions occur even earlier, once amateurs need to work after the training. As the training sessions occur early in the morning, it is possible for morning-type athletes are able to develop higher intensity trainings and thus having better physiological adaptations. However, there are no data about chronotypes and physiological profile.
PURPOSE: Characterize the chronotype profile in a group of triathlon amateur competitors who participate in the Olympic distance triathlon race. Verify if there are association between chronotype profile and physical fitness in amateur triathletes.
METHODS: Thirty-nine men and six women who had subscribed to compete in the sixth stage of the *26th Brazil Triathlon Trophy* (26º Troféu Brasil de Triathlon) in the Olympic distance participated in this cross-sectional observational study. Participants were evaluated for anthropometric characteristics (body mass, height, and body composition through [DXA]), aerobic physical fitness (maximum oxygen consumption [V O2max], anaerobic threshold and respiratory compensation point, maximum aerobic velocity [MAV] and running economy [RE]). Chronotype profile was evaluated using Horne-Ostberg morning-eveningness questionnaire.
RESULTS: According to the chronotype questionnaire 66.7% of the volunteers (69.2% men and 50.0% women were classified as morning profiles (22.2% definite morning and 44.4% as moderate morning) and only 6.7% were classified as evening profiles. There were no significant correlations between chronotype profiles and the physical fitness variables.
CONCLUSIONS: Amateur triathletes show to comprise high proportions of morning-types, but the physiological profile is similar between the different existing chronotypes.

2137 Board #293 May 30 3:30 PM - 5:00 PM

The Effect Of Time Of Day On Jump Potentiation In Distance Runners

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The Effect of Time of Day on Jump Potentiation in Distance Runners.
Time of day is a key factor that influences athletic performance. No study has specifically investigated the effect of early morning vs. late afternoon training on jump potentiation in distance runners. This is important because circadian rhythms and alterations in sleep patterns can affect training adaptations and athletic performance. **PURPOSE:** To determine whether the time of day influence jump potentiation in distance runners. **METHODS:** We recruited 18 male runners that were divided into two groups: novice runners (NOV) with ≤3 years of racing experience (n=6; age 34.7±6.4) and experienced runners (EXP) with ≥3 years of experience (n=12; age 34.5±5.1). Chronotypes were identified using the Horne-Ostberg's Morningness-Eveningness questionnaire and sleep quality was assessed with the Pittsburgh Sleep Quality Index. Counter movement jump (CMJ) was determined with the My Jump App. CMJ height was measured after 5 min warm-up and after 30 min test (70% HRR) of running on a treadmill at 8:00 am and 8:00 pm. Following the 30 min test treadmill CMJ height was measured at 0, 3, 6 and 9 minutes of recovery. **RESULTS:** The overall sleep quality of the athletes were poor (5.4 ±3.8, n=18). The NOV group were poor sleepers (6.5±3.6, n=6) whereas the EXP group were at the limit score to become poor sleepers (4.8±3.9 n=12). The majority (77.3%, n=14) of the runners were morning types and 22.2% (n=4) were intermediate types. CMJ height in the EXP group was increased at 0 min of recovery and was decreased to warm-up levels at 3, 6 and 9 min ($p< 0.01$) during morning test. Interestingly, jump potentiation only occurred in the morning while no significant increases were observed in the evening in the EXP group (p=0.6). The NOV group had no changes in jump potentiation in both morning and evening tests. **CONCLUSION**: We conclude that jump potentiation could be only observed during morning in experienced distance runners probably because of their chronotypes.

2138 Board #294 May 30 3:30 PM - 5:00 PM

Effects Of Time Restricted Feeding On Metabolism Depression And Circadian Rhythms

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(No relevant relationships reported)

Time restricted feeding (TRF) is a form of intermittent fasting limiting the time to intake calories throughout the day. TRF has been shown to affect substrate concentration and utilization at rest and exercise. Changing patterns in substrate availability and utilization can have effects on metabolism, cognitive functioning and circadian rhythms. **Purpose:** The purpose of this study was to evaluate the effects of TRF on overall physiological functioning, specifically sleep, resting energy expenditure (REE), resting respiratory quotient (RQ), and likelihood of depression. **Methods:** A longitudinal design was used to examine physiological changes associated with four weeks of TRF among 34 healthy adults between the ages of 18-60 years. Sleep was evaluated via self-report logs given to participants at testing sessions. REE and RQ were measured using a metabolic cart while subjects were in a fasted state. The Brief Anxiety and Depression Survey was administered, and each subject was given a score indicating their likelihood of depression at each testing session. Variable differences within subjects were determined using a repeated measures ANOVA or a paired samples T-test. **Results:** A significant decrease in total sleep ($p = 0.034$) and BADS scores (p=.046) occurred between non-TRF and TRF. Analysis revealed that resting RQ values experienced a significant increase (p=.002) between testing non-TRF and TRF testing periods (p=.034) and pre-test and TRF testing sessions (p=.008). Direct correlations were found between BADS, total sleep and resting RQ. **Conclusion:** TRF may influence glucose utilization during rest. Past studies have shown that different forms of intermittent fasting, such as TRF, enable an organism to create more regulated circadian rhythms, allowing less reliance on glucose, resulting in benefits in prevention and treatment of various diseases. The results of the present study are in opposition of previous literature and may provide insight into how glucose utilization affects other physiological processes. Increased glucose utilization may have been a factor in the decrease in total sleep and depression in the patients in the study. Future research is needed to verify if increased utilization of carbohydrates at rest influences changes of circadian rhythms and depression occurrence.

2139 Board #295 May 30 3:30 PM - 5:00 PM

Circadian Phase Is Associated With Self-reported Chronotype In Young, Sedentary Adults

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(No relevant relationships reported)

Chronotype, which is an individual's preferred timing of sleep and activity across the 24-hour day, is regulated by genetics, environmental exposure, and age. Chronotype is measured by subjective questionnaires that query the timing of daily behaviors. Late chronotype has been previously associated with lower level of physical activity, higher body mass index (BMI), and increased risk of type 2 diabetes and the metabolic syndrome. A well-established measure of an individual's circadian timing, or phase, is the onset of melatonin secretion measured in dim light conditions (dim light melatonin onset; DLMO). Despite previous investigations, the associations between DLMO and chronotype, as well as body composition, have not been fully elucidated in young, sedentary adults. **PURPOSE**: To examine the association between DLMO and chronotype; and the association between DLMO and body composition measures in young, sedentary adults. **METHODS**: Fifty-two adults (19 male, 25.8 ± 6.0 yrs; BMI 26.1 ± 5.4 kg/m2; %Fat 34.2 ± 8.8%) participated in this study. All subjects were sedentary (< 2 hrs weekly structured exercise), non-smokers, and did not use medication. Circadian phase was measured by DLMO (time of day when saliva melatonin ≥ 4 pg/ml). Chronotype was measured as the midpoint of sleep on free days (free of vocational responsibilities, corrected for sleep debt; MSFsc) calculated from the Munich Chronotype Questionnaire (MCTQ) and a composite score calculated from the Morningness-Eveningness Questionnaire (MEQ; range: 16-86). Percentage body fat (%Fat) was determined by total body DXA scanning. Pearson's correlation analysis was used to determine if significant ($p < 0.05$) associations were observed between DLMO and MSFsc, MEQ, BMI, and %Fat. **RESULTS**: DLMO (21:42 ± 01:31) was significantly associated with MSFsc (04:34 ± 01:11; $r = 0.66$; $p < 0.001$) and MEQ (50.0 ± 9.0; $r = -0.52$; $p < 0.001$). No significant associations were observed between DLMO and BMI ($r = -0.13$) or %Fat ($r = 0.04$). **CONCLUSION**: An objective measure of circadian phase was associated with subjective measures of chronotype. However, neither BMI nor %Fat was associated with DLMO in young sedentary adults. Supported by the University of Kentucky Pediatric Exercise Physiology Laboratory Endowment, the University of Kentucky, and the NIH TL1TR001997 and UL1TR001998.

2140 Board #296 May 30 3:30 PM - 5:00 PM

Social Jetlag Is Associated With Higher Eveningness Index

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Currently, the social demands imposed by work, school and academic activities prevent youth and adults from maintaining an ideal sleep routine. This situation causes

sleep restriction, reducing sleeping hours per night and leading to numerous health damages. This phenomenon has been conceptualized as social JetLag (SJL). **Purpose:** Investigate the association between chronotype and mood profile in presence of SJL of young adults. **Methods:** Participated in this study 68 male subjects (mean age 25.43±6.64 years, and BMI 24.59±4.25) and physically active. In a transversal study approved by our institutional ethics committee (nº 2.263.382), the subjects answered a sleep questionnaires battery composed by Pittsburgh Sleep Quality Index (PSQI), Morningness-Eveningness Questionnaire (MEQ), Munich Chronotype Questionnaire (MCTQ), Epworth sleepiness scale (ESS) and Brunel Mood Scale to determinate a mood profile (subscales: anger, confusion, depression, fatigue, vigor, tension). The SJL was categorized in accord to MCTQ results in 3 groups: a) No SJL (≤ 30 min), b) SJL until 1 h (31- 60 min), c) SJL more than 1h (>61 min). **Results:** The groups were compared, and no differences were found between all subscales of Brunel. Moreover, we didn't find any differences regard the sleep quality and diurnal excessive sleepiness. On the other hand, the groups were different on sleep duration and chronotype. Longer SJL is associated to higher Eveningness index (F(2,65)=7.48; p=0.001). **Conclusions:** Our finds suggest that the presence of SJL didn't impact the volunteer's humor profile and longer SJL is associated to higher eveningness index.

2141 Board #297 May 30 3:30 PM - 5:00 PM

Effects of Aerobic Physical Exercise Performed Under Hypoxic Conditions on Melatonin

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Melatonin is a hormone which controls sleep, inflammation, and oxidative stress. Aerobic physical exercise can influence melatonin in normoxia. However, there is controversy about the effects of exercise on the melatonin level in hypoxia, which is characterized by impaired sleep. **PURPOSE:** This work evaluated the effects of aerobic physical exercise on melatonin under hypoxic conditions. **METHODS:** Forty healthy men were randomized into 4 groups: Normoxia (N) - (22.1 ± 3.1 y, 69.1 ± 1.1 kg); Hypoxia (H) - (23.2 ± 2.1 y, 67.2 ± 4.1 kg); Exercise under Normoxia (EN) - (26.1 ± 3.2 y, 71.1 ± 3.2 kg); and Exercise under Hypoxia (EH) - (24.1 ± 3.1 y, 72.3 ± 2.1 kg). The observation period for all groups was 36 hrs, beginning with a first night devoid of any intervention.The normobaric hypoxia condition was conducted in a room equipped for altitude simulation that can reach up to 4,500 m (normobaric chamber, CAT - Colorado Altitude Training ™ / 12 CAT-Air Unit, USA). Aerobic exercise was performed by the EN and EH groups on a treadmill at 50% of $VO_{2'peak}$ for 60 minutes. Venous blood samples for the melatonin measurement were obtained on the 1st and 2nd days at 7:30 AM as well as on the1st and 2nd nights at 10:30 PM. Data are reported as mean ± standard deviation. A repeated measures and one-way analysis of variance (ANOVA) followed by the Tukey's post hoc test were used to detect significant differences between groups. The accepted significance level was $p \leq 0.05$. **RESULTS**: On the 2nd night, melatonin was higher in the H group compared to the N group (48.3 ± 2.2 vs. 26.1 ± 1.1, p< 0.05); low in the N group compared to the EH group (26.1 ± 1.1 vs. ± 59.2 ± 2.1, p< 0.05); low in the H group compared to the EH group (48.3 ± 2.2 vs. ± 59.2 ± 2.1, p< 0.05); and low in the EN group compared to the EH group (37.2 ± 1.0 vs. ± 59.2 ± 2.1, p< 0.05). On the 2nd day, melatonin was higher in the H group compared to the N group (39.1 ± 3.1 vs. 28.1 ± 2.1, p< 0.05); low in the N group compared to the EH group (28.1 ± 2.1 vs. 46.2 ± 2.0, p< 0.05); and high in the EH group compared to the H group (46.2 ± 2.0 vs. ± 39.1 ± 3.1, p< 0.05). **CONCLUSIONS**: Hypoxia acutely increases melatonin. Diurnal remission of the nocturnal increase in melatonin seems to be delayed by hypoxia and to an even greater extent if acting together with exercise.

D-71 Basic Science World Congress/Poster - Muscle, Movement and Sleep

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

2142 Board #298 May 30 3:30 PM - 5:00 PM

Investigations of Sleep Quality Disturbances and Its Associations with Respiratory Functions and Depression Level among Young Adults with Down's Syndrome

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Individuals with Down Syndrome (DS) have a broad range of respiratory problems. These problems are important cause of morbidity, mortality and may increase tendency to sleep disturbances. Also depression has been frequently reported in individuals with DS.
PURPOSE: To investigate of sleep quality disturbances and its associations with respiratory parameters and depression levels in young adults with DS.
METHODS:50 individuals with DS (28 male, 22 female; 21.5±3.39 year) were included in the study. Sleep quality components (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction) evaluated with Pittsburgh Sleep Quality Index (PSQI). According to PSQI guidelines, good sleep quality is indicated by a composite score of <5 (possible total=21), and poor sleep quality by a score of >5. Forced vital capacity (FVC), forced expiratory volume in one second (FEV1) and peak expiratory flow (PEF) values were recorded using with spirometry. Pearson correlation was used to relate variables.
RESULTS: Sleep quality parameters, respiratory values and depression scores of participants showed in Table 1. A total of % 52 (n=26) of participants have poor sleep quality. % 10 of participants (n=5) in severely depressed status. We found significant correlations of sleep quality parameters (habitual sleep efficiency; sleep disturbances, total PSQI) to depression level (r=0.68, r=0.75;r=0.72, p<0.05). Significant correlations were found between PEF values and total PSQI scores; habitual sleep efficiency (r=0.86; r= 0.69 p<0.05).
CONCLUSIONS: Our study suggest that sleep quality has a important effects on depression level. Also suggest that sleep quality and respiratory parameters are correlated, especially with PEF. All of this three parameters may affect each other. Further studies with bigger populations and controls needed for better results.

Table 1. Values of Sleep Quality, Respiratory Functions and Depression Scale

Pittsburgh Sleep Quality Parameters	Values(mean±standart deviation)
Sleep duration	0.47±0.28
Sleep latency	1.22±0.40
Subjective sleep quality	0.92±0.31
Habitual sleep efficiency	1.45±0.73
Sleep disturbances	0.97±0.6
Daytime sleep dyssfunction	0.52±0.25
Use of sleep medications Total	0.1±.23 6.72±2.23
Respiratory Parameters	%
Forced Expiratory Volume in 1 Second (FEV1)	64.83±20.11
Forced Vital Capacity (FVC)	69.33±16.93
Peak Expiratory Flow (PEF)	42.66±24.67
Self-Depression Scale	Score
	60±28.75

2143 Board #299 May 30 3:30 PM - 5:00 PM

Elastic Band Resistance Training Effects on Strength and Sleep of Shift Workers

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(No relevant relationships reported)

PURPOSE: To determine the effect of elastic band resistance training in strength, muscle mass and sleep of shift workers. **METHODS**: Twelve sedentary workers with weekly work schedule of 12 hours of work for 36 hours of rest (Age: 42.3±8.8 years, Body Mass Index: 27.6±3.7 Kg), performed 16 elastic band training sessions (2 sets until failed; 3 times by week, for 16 weeks). The initial training load was determined by color and/or number of elastic band test to 10RM (shoulder abduction and biceps curl) and 20RM to seated low row exercise. The push up exercise no used elastic band. In following training sessions, the participants were instructed to perform the four exercises in the maximal number of repetition possible each new session. The estimated arm muscle area, exercises repetition number and sleep (sleep duration, sleep latency, sleep efficiency and weak after sleep onset) were assessment pre and post-training. The sleep variables were determined by actigraphy technique for during seven days. The pre and post-test comparisons were made using paired t test. **RESULTS**: The arm muscle area, was improved after training (7015.5±1859.3 vs. 7571.179±1723.625, $p<0.05$) as well as exercises repetition number (shoulder abduction: 10.3±0.6 vs. 22.3±4.7; push up: 11.2±3.2 vs. 19.8±6.7; seated low row: 20.2±1.0 vs. 37.1±8.4; biceps curl: 10.2±0.6 vs. 23.7±7.7, $p<0.001$). There is no change in sleep variables after training (Sleep Duration: 386.3±36.7 vs. 384.6±43.8 min; Sleep Latency: 28.5±32.7 vs. 14.0±15.0 min; Sleep Efficiency: 86.7±7.7 vs. 86.5±7.5%; Weak after sleep onset: 34.4±22.2 vs. 38.3±23.7 min, $p>0.05$). **CONCLUSIONS**: Elastic band resistance training improved the strength and muscle mass of shift work without to change their sleep quality of shift workers. Supported by UFMG, FAPEMIG, MAFRE Foundation, CAPES and CNPQ.

2144 Board #300 May 30 3:30 PM - 5:00 PM

Impact Of Sleep Deprivation On Flexibility Performance

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to verify the impact of sleep deprivation in flexibility of young adults. **METHODS:** Ten sedentary male young adults (Mean age: 24.3 ± 3.8 years old, body mass index: 24,8 ± 2.5 kg/m^2) wore wrist actigraph before and during the 36-h of sleep deprivation to measure sleep-wake cycle, and Passive Maximal Range of Motion ($PROM_{max}$) was evaluated by the modified knee extension test with a fleximeter in 4 different moments: at onset of sleep deprivation (8:00am, day 1 = baseline), and after 12h (8:00pm, day 1), 24h (8:00am, day 2) and 36h (8:00pm, day 2) of sleep deprivation. Volunteers lay back with the hip flexed at 90º, and the initial knee ROM (0º) was considered as 90º right knee flexion. $PROM_{max}$ was measured 06 times, and mean values at the 03 lasts was analysed. Analyzes of Paired-Samples Variance were used to compare the variables in four moments, and statistical significance set at $p< 0.05$. **RESULTS:** $PROM_{max}$ values showed significative difference ($F_{1,38} = 51.148$, $p < 0.001$) after 12h (71.7 ± 0.27°; $CI_{95\%}$= 66.2-77.2), 24h (71.0 ± 2.6°; $CI_{95\%}$= 65.8-76.3) and 36h (69.8 ± 2.6°; $CI_{95\%}$= 64.5-75.1) of sleep deprivation compared with baseline (73.0 ± 2.7; $CI_{95\%}$= 67.6-78.4). Moreover, there was decrease of $PROM_{max}$ ($F_{1,38} = 17.951$, $p < 0.001$) from 12 h to 36 h and from 24 h to 36 h of sleep deprivation. **CONCLUSION:** Our findings suggest that sleep deprivation may have a negative impact on $PROM_{max}$. Furthermore, 12 h and 36 h after baseline moment showed reduction of the $PROM_{max}$, even as the time of maximal circadian rhythm values (acrophase) have generally observed between 4:00pm and 8:00pm. The duration of sleep deprivation and the circadian time are important in determining the impairment in passive flexibility performance. Acknowledgment: CAPES, CNPQ, FAPEMIG, CEMSA, CEPE.

2145 Board #301 May 30 3:30 PM - 5:00 PM

Effects Of Sleep Deprivation On Histopathological Changes And Oxidative Damage In Different Type Muscle Fibers

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(No relevant relationships reported)

Previous studies has shown that sleep deprivation (SD) induces muscle atrophy and histopathological changes, however, these effects may be different considering the type muscle fiber. **PURPOSE**: to analyze histopathological changes and oxidative damage after SD in different types of muscle fibers (oxidative and glycolytic) of rats. **METHODS**: 20 Wistar male rats (3 months, 300-350 g) were distributed in two groups, control group (CTL, n=10) and SD by 96 h group (SD96, n=10). The SD96 group was sleep deprived on consecutive 96 h, while the CTL group remained in the housing box. At the end of SD, the soleus and plantar muscles were analyzed for lipid peroxidation by concentrations of malondialdehyde (MDA), oxidative damage to DNA by nuclear labeling of 8-OHdG and histopathological changes. **RESULTS**: it was observed increased MDA concentrations in the soleus of SD96 compared to CTL (0.0134±0.0009 vs 0.0121±0.0009 mmol/mg, P=0.01). Comparison between muscles revealed that the soleus had higher concentrations of MDA than plantar to both groups (P<0.001 for both). Regarding 8-OHdG, there was increased nuclear labeling to the plantar muscle in the SD96 compared to CTL (25.4±3.6 vs 7.2±1.9 positive cells, P<0.001). In the soleus, greater nuclear labeling was observed in SD96 compared to CTL (60±13.6 vs 9.6±3.6 positive cells, P<0.001), already the comparison between the muscles revealed a greater nuclear labeling of 8-OHdG in the soleus muscle compared to plantar in the SD96 group (P<0.001). The histopathological evaluation of the soleus revealed the presence of interstitial edema in SD96 compared to CTL (19.5±4.2% vs 0%, P<0,001), associated with intense cellular infiltration, alterations in the arrangement of muscle fibers, as well as areas of tissue degeneration and reduction of muscle parenchyma (72,7±2,7 vs 92,4±1,6%, P<0,01). In the plantar muscle, the changes were more subtle, with slight increase in cellularity in the SD96 and fibers presenting smaller cross-sectional area in SD96 group. **CONCLUSIONS**: SD induces degenerative process and oxidative damage in the skeletal muscle, being more intense in type I fibers.

2146 Board #302 May 30 3:30 PM - 5:00 PM

The Effect of Acute Sleep Restriction on Running Mechanics during an Exhaustive Run

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(No relevant relationships reported)

Purpose: Inadequate sleep is a known risk factor for injury, but the mechanisms by which sleep restriction increases injury risk remain unknown. The purpose of this study was to determine if running mechanics during an exhaustive run, including average peak impact accelerations between the tibia and the forehead, would be altered following one night of sleep restriction.
Methods: Two male and seven female subjects (21 ±3yrs, 55 ±10kg) completed an exhaustive treadmill run following either 8 hours (well-rested, WR) or 3 hours of sleep (sleep-restricted, SR) in a randomized crossover design, separated by at least one week. The exhaustive treadmill run was performed at an intensity equal to the subject's ventilatory threshold until volitional fatigue. Wireless inertial measurement units (IMUs) were placed on the right tibia and forehead. Average right tibia peak impact accelerations (RtPk), average head peak impact accelerations (HdPk), and shock attenuation (ratio of RtPk to HdPk) were measured for 3 minutes during the first 2-5 minutes and final 3 minutes. Paired t-tests were used to compare each dependent variable (shock attenuation, RtPk, HdPk) between conditions (WR vs SR).
Results: Time to exhaustion during the exhaustive treadmill test was not significantly different between the WR and SR conditions respectively (38.5 ±15.3 minutes, 40.0 ±14.7 minutes, $p = 0.69$). There were no significant differences in shock attenuation between conditions during the first 2-5 minutes (WR: 58.96 ±7.09, SR: 57.72 ±7.33, $p = 0.55$) and final 3 minutes (WR: 58.00 ±8.73, SR: 57.53 ±7.58, $p = 0.84$). No significant differences were found between conditions for RtPk (WR: 5.19 ±0.73g, SR: 5.07 ±0.92g, $p = 0.49$, WR: 5.38 ±0.87g, SR: 5.29 ±0.96g, $p = 0.64$) and HdPk (WR: 2.12 ±0.44g, SR: 2.11 ±0.37g, $p = 0.79$, WR: 2.22 ±0.45g, SR: 2.20 ± 0.36g, $p = 0.76$) during the first 2-5 minutes and final 3 minutes respectively.
Conclusion: Running mechanics were not altered following one night of sleep restriction. These data suggest that one night of inadequate sleep is not sufficient to alter running mechanics, however more research is needed to understand the possible effects of chronic sleep restriction and its potential influence on injury risk during running.

2147 Board #303 May 30 3:30 PM - 5:00 PM

Landing Mechanics And Muscular Strength Are Not Altered Following Acute Sleep Restriction

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PURPOSE: Inadequate sleep is associated with an increased risk of injury, however it is unknown what physical risk factors for injury are altered by inadequate sleep. We hypothesized that one night of sleep restriction would affect reaction times and landing mechanics but not leg strength. **METHODS**: Ten healthy subjects (5 males, 5 females, 21±3 yrs, 1.67±0.11m, 59.8±11.8kg) completed cognitive testing, strength testing and a series of jump assessments following 8 hours (well-rested, WR) or 3 hours sleep (sleep-restricted, SR) in a randomized crossover design. Subjects woke at the same time for each assessment and testing was conducted at the same time of day, in the same order, and separated by at least one week. Reaction time was assessed using the computerized Automated Neuropsychological Assessment Metrics (ANAM) assessment. Strength testing (isokinetic dynamometer-60°/s) included maximal knee extension (KE) and flexion (KF) strength for each leg. Subjects completed 5 trials of a double leg drop-landing task, as well as 5 trials on each leg of a single leg stop-jump task. Peak knee flexion angles (PkKF) were captured using 3D motion capture. Vertical ground reaction forces (VGRF) for each leg were captured with two flush mounted force plates. **RESULTS**: There were no significant differences between conditions for reaction time (p=0.894), or KE (p=0.882, p=0.568) and KF (p=0.295, p=0.156) in the left or right legs respectively. VGRF was not significantly different between the WR and SR conditions during the drop-landing task (Left: p=0.216, Right: p=0.082). Although not significant, a trend of greater PkKF was found (Right WR: 68.7 ±32.7°, SR: 49.5 ±34.4°, p=0.068) (Left WR: 68.8 ±32.1°, SR: 51.1 ±34.2°, p=0.097), when comparing the WR to the SR condition during the drop-landing task. The difference in VGRF during the single leg stop-jump task approached significance for the left leg (WR: 2.52±0.41, SR: 2.72 ±0.44, p=0.052). No other significant differences in VGRF or PkKF were observed during the single-leg stop-jump task (all p>0.362). **CONCLUSIONS**: No significant differences in strength and landing mechanics were observed following one night of sleep restriction. Knee flexion angle data trends suggest additional nights or chronic sleep restriction may be required to significantly alter movement mechanics.

D-71b Free Communication/Poster - Sports Medicine Fellow Research Abstracts

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

2148 Board #304 May. 30 3:30 PM - 5:00 PM

Parameters Associated with Abnormal Cardiac Conditions in Adolescent Athletes: Analysis using Simon's Heart Heartbytes Registry

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PURPOSE: To determine clinical parameters that are related to abnormal cardiac conditions in the physically active youth.
METHODS: We used the Simon's Heart Heartbytes National Youth Cardiac Registry to collect cardiac related data from middle and high school athletes in southeastern Pennsylvania. We collected age, race/ethnicity, symptoms suggestive of abnormal cardiac conditions, past medical history, medication use, caffeine intake and family history. We also obtained height, weight, blood pressure, and cardiac murmur findings, as well as an ECG in all individuals. Binary logistic regression analysis was performed to identify an independent association between abnormal cardiac symptoms and potential indicators (all collected variables). The odds ratio (OR), 95% confidence interval (95% CI), and p-values were used as critical statistical values. **RESULTS**: There were a total of 887 athletes (543 males and 344 females, age=16.9±2.1, height=166.9±11.4, weight=62.0±16.0). There was an independent association between abnormal symptoms and presence of significant past medical history (OR: 4.75, 95%CI: 3.17, 7.10, p=0.001) and prescribed medication use (OR: 1.71, 95%CI: 1.04, 2.79, p=0.034). Although the association between the presence of abnormal symptoms and African-American race (OR:2.01, 95%CI: 0.95, 4.28, p=0.069) and average daily consumption of at least 2 types of caffeine drinks (soda, energy drinks, tea, and coffee) (OR:2.11, 95%CI: 0.87, 5.07, p=0.097) were not significant, there was a trend to reach the a priori significance level.
CONCLUSIONS: The current study identified several clinical parameters that are associated with symptoms suggestive of abnormal cardiac conditions. Further research needs to be done on a larger scale to better sort out the clinical history that may contribute to false positives in an effort to reduce false positives at heart screenings.

2149 Board #305 May. 30 3:30 PM - 5:00 PM

Evaluation of Shoulder Health of Collegiate Wheelchair Basketball Athletes

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Shoulder pain is the most commonly reported musculoskeletal complaint among manual wheelchair users. Wheelchair basketball athletes may be at a higher risk of shoulder injury given the additional demands of their sport, but there is little research on the prevalence of shoulder injuries in this population. Shoulder injuries affect both sport participation and ability to perform activities of daily living for manual wheelchair users. Identifying shoulder injuries in wheelchair basketball athletes is important to provide better context in injury treatment and prevention. **PURPOSE**: Determine the prevalence of shoulder injuries using questionnaires, physical exams, and ultrasound evaluations in collegiate wheelchair basketball athletes. **METHODS**: Observational cross-sectional study of collegiate wheelchair basketball athletes at a single institution. Inclusion criteria were participation on a collegiate wheelchair basketball team and use of a manual wheelchair for ≥50% of mobility. Each athlete completed a baseline questionnaire that included a Visual Analog Scale (VAS) for shoulder pain in the last month, the American Shoulder and Elbow Surgeons Score (ASES), the Wheelchair User's Shoulder Pain Index (WUSPI) and then underwent a physical exam and musculoskeletal ultrasound evaluation of both shoulders. The Ultrasound Shoulder Pathology Rating Scale (USPRS) was used to grade pathologic ultrasound findings. 2-tailed t-tests were used to compare shooting arms to non-shooting arms. **RESULTS**: Seven males and eight females completed the study. Ten of the fifteen athletes had experienced shoulder pain or an injury during the time they had used a wheelchair. Mean VAS in the shooting arm was 2.78 (±2.24) and non-shooting arm was 1.50 (±1.89) (p =.11). Mean ASES score was 89.92 (±11.28). Mean WUSPI was 7.12 (±9.46). There were nineteen positive physical exam findings in the shooting arms, compared to eight in the non-shooting arms (p=.05). Mean USPRS for the shooting arm was 2.13 (±1.73) and non-shooting arm was also 2.13 (±1.25) (p >.99). **CONCLUSIONS**: Shoulder injury and pain are prevalent in wheelchair basketball athletes based on questionnaires, physical exams and ultrasound findings.
Supported by the Craig Neilsen Foundation.

2150 Board #306 May. 30 3:30 PM - 5:00 PM

Descriptive Analysis of Youth American Football Quarterback Injuries: A 15-years of Retrospective Data Study

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PURPOSE: To describe the common injuries of youth American football (FB) quarterbacks (QBs) within the last 15 years. **METHODS**: A retrospective chart review of all patients cared for in a sports medicine clinic of an academic pediatric medical center between 01/01/2003 - 10/01/2018. Patients were identified using the search engine *HoundDog* to search the term "quarterback." Records were then reviewed to identify all QBs ≤ 18 years of age. Injures that were not associated with FB participation were excluded. Main outcome variables were injured anatomic locations, injury types, surgical status, and settings in which the injury was sustained. Descriptive statistics were used to analyze the outcome variables. **RESULTS**: A total of 374 male QBs (mean age: 14.6±2.1) sustained a total of 423 injuries. The top 5 injured anatomic locations (Figure 1) were shoulder (22.2%), knee (15.5%) head/neck (14.5%), elbow (13.6%), and wrist/hand/lower arm (11.3%). The injuries consisted of 64.3% in acute mechanism and 35.7% chronic in nature. The acute injuries occurred during game competition (55.5%), practice (14.3%), and off-season (6.7%); for the remaining 23.5% there was not sufficient documentation in the medical record to determine the setting. Of the chronic injuries, 47.0% occurred during off-season and 34.4% occurred in-season; for 15.2% of the chronic injuries there was not sufficient documentation in the medical record to determine the setting. Among all injuries, 22.9% were surgical cases, and the top 3 anatomic locations of surgery were knee (35.0%), shoulder (20.7%), and elbow (18.7%). **CONCLUSIONS**: The shoulder is the most commonly injured body part among young QBs seeking care in a specialty sports medicine clinic,

although the knee is the most commonly injured body part that requires surgery. Quarterback injuries are primarily acute in mechanism, and the majority of these acute injuries occur during game competition.

2151 Board #307 May. 30 3:30 PM - 5:00 PM

Spine Injuries and Concussions among Figure Skaters

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(No relationships reported)

PURPOSE: To determine the prevalence and mechanism of spine injuries and concussions among a sample population of figure skaters. To assess for potential risk factors for these injuries.
METHODS: This is a cross-sectional analysis of spine injuries and concussions reported by figure skaters. Data was obtained through an anonymous, confidential online questionnaire distributed to members of participating figure skating clubs. The main outcomes included diagnoses, mechanism and source of medical care. Simple descriptive statistics were used; Fisher's exact test was used to assess for statistical differences in categorical variables between groups. SPSS was used for all analyses.
RESULTS: Thus far, 88 participants have completed questionnaires (recruitment ongoing). The mean age of participants is 25.2 years (SD 17.1). Most (79%) respondents are female. Most (85%) practice figure skating year-round; 85% participate in competitions. Some skaters participate in more than one discipline including singles(n=68), pairs(n=3), ice dance(n=21), synchronized skating(n=29), theatre on ice(n=17). More than a quarter (27%; n=24) of participants reported spine injuries/back pain. The most common diagnosis was muscular back pain. Treatment was primarily guided by primary care(n=10), sports medicine(n=13), physical therapists(n=14) and athletic trainers(n=10). Almost half of those who reported back pain did not present to a health care provider (HCP) (45%; n/N=11/24). All injuries occurred in practice. More than a quarter of participants (27%; n=24) sustained at least one concussion; 7 sustained two concussions. Several (42%; n/N=10/24) skaters did not present to a HCP for evaluation of their first concussion. All concussions occurred during practice and most (92%; n/N=22/24) were during on-ice activities. The most common mechanism of injury was a fall (62%; n/N=15/24). The sex of the skater was not associated with either mechanism of spine injury or history of concussion.
CONCLUSIONS: Nearly a third of skaters sustained a concussion or spine injury, yet nearly half did not report their injuries to a HCP. Our findings warrant further investigation into the reasons for such a low reporting rate among figure skaters and the potential effect on injury outcomes.

2152 Board #308 May. 30 3:30 PM - 5:00 PM

Development and Evaluation of an Electronic Preparticipation Physical Evaluation System: A Pilot Feasibility Study

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(No relationships reported)

The preparticipation physical evaluation (PPE) is important for athlete health and safety, and is required for participation in collegiate sports and the majority of US high schools. The vast majority of PPEs are completed using a paper PPE form. Previous work had developed an ePPE system and found it was efficient and yielded good athlete compliance and high physician satisfaction. Another study showed ePPE's value for collecting and analyzing college athlete injury and illness data, suggesting strong potential for the ePPE to improve injury analysis as well as efficiency of the PPE. Despite these reports, use of electronic PPE forms has not become widespread.
PURPOSE: 1) to develop and implement an ePPE system for collegiate athletes that simultaneously serves as a relational database for research purposes, 2) to assess perceptions of providers on the ePPE system compared to paper PPE forms, and 3) to demonstrate the research potential of an ePPE system by conducting a sample epidemiologic analysis using electronically collected data.
METHODS: In this pilot feasibility study, researchers developed an ePPE system using REDCap, a HIPPA-compliant web application designed for academic research purposes. The ePPE form had the identical contents and questions as the paper PPE form already in use at the NCAA Division I institution. Athletes on three teams at were randomized to use the ePPE (n = 22) or the paper PPE (n = 21) form. Providers and athletes were later surveyed regarding their perceptions of the two systems. A sample epidemiologic analysis using ePPE data was conducted.
RESULTS: The ePPE system was successfully developed and implemented. All athletic trainers and physicians preferred the ePPE over the paper PPE, and felt that the ePPE was more efficient. Data were easily extracted for analysis from the ePPE system. A sample epidemiologic analysis established concerns about concussions sustained by athletes (27.3% of athletes) and some behavioral and psychological symptoms reported by athletes (trouble sleeping, depression, and anxiety; 13.6-22.7% of athletes).
CONCLUSIONS: While this was only a pilot feasibility study involving relatively small teams, we show that development and implementation of an ePPE system is technically feasible, is preferred by users, and facilitates sports research.

2153 Board #309 May. 30 3:30 PM - 5:00 PM

Psychological Factors Related to Return to Sport After ACL Reconstruction in Adolescents

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(No relationships reported)

PURPOSE: The present study aimed to assess the relationship between psychological factors, including perceived social support and pre-operative expectations, and return to sport after ACL reconstruction in adolescents.
METHODS: 56 participants completed the Hospital for Special Surgery Pediatric Functional Activity Brief Scale (HSS Pedi-FABS), the Psychovitality (PV) questionnaire, and the Multidimensional Scale of Perceived Social Support (MSPSS) prior to undergoing ACL reconstruction. We performed a multiple linear regression to assess if MSPSS score was associated with confidence in returning to sport (total PV score). Additionally, we divided participants into competitive and non-competitive groups based on their response to the HSS Pedi-FABS. Outcome variables obtained from the PV questionnaire addressing pre-operative expectations of returning to sport following surgery were compared between the competitive and non-competitive groups using a series of Chi-square analyses.
RESULTS: Among all participants, 86% (n=48) reported that they expected to return to sport within less than six months of surgery. A higher proportion of competitive athletes (81%) expected to return to sport within six months post-operatively compared to the non-competitive athletes (63%; p=0.18). In addition, a significantly lower proportion of competitive athletes (14%) compared to non-competitive athletes (39%) reported that they would be content returning to an activity level that was less than their pre-injury activity level (p=0.037) and would be willing to settle for a less strenuous sport than their pre-injury sport (16% vs 42%; p=0.034). There was no significant association between MSPSS total score (mean= 6.22±0.375, range= 4-7) and PV total score (mean= 13.8±3.0, range= 8-18; β coefficient= -0.63, 95% CI= -1.77, 0.52, p = 0.28).
CONCLUSIONS: The majority of all participants reported the expectation of returning to sport within six months of surgery. A significantly lower proportion of competitive athletes compared to non-competitive athletes reported that they would be content returning to a lesser activity level or less strenuous sport. There was no significant association between perceived social support and confidence in returning to sport.

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A Review of the Injury Pattern of the 2018 Chicago Marathon

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(No relationships reported)

Marathon racing is increasingly popular and it is estimated that 25 out of every 1000 finishers will seek medical help during their race. Some studies have shown that the most common injuries are musculoskeletal and the volume of runners seeking medical care increases as the race progresses. However, there is a lack of information that illustrates a specific injury pattern along a race course.
PURPOSE: To measure the volume and types of injuries sustained by 2018 Chicago Marathon runners at the various medical stations to determine the impact that distance has on injury pattern.
METHODS: In this retrospective chart review of records collected at the 2018 Chicago Marathon (N=1016), the diagnoses of runners seeking medical care was taken at 21 course medical tents and 2 finish line tents and categorized as either musculoskeletal, medical, wound care, or other. The data was divided into quartiles: miles 0-10, 10-18, 18-26.2, and finish line. The rate of each diagnosis was then compared between the quartiles using a chi-square analysis.
RESULTS: 3.8% of the runners visited the medical tents. Visit volumes had a bimodal distribution in the 2nd and 4th quartiles. 41.6% of runners seeking medical help did so at the finish line compared to 8.6%, 32.8%, and 17.0% in the first three quartiles respectively. 50.6% of all complaints were musculoskeletal, followed by 15.2% medical, 7.9% wound care, and 15.1% other. The percentage runners with musculoskeletal complaints were 24%, 75%, 16%, and 51% in the first, second, third, and fourth quartile respectively. Conversely, the percentage of medical complaints peaked in the 4th quartile with percentages of 1.1%, 5.8%, 1.7%, and 31.0%

respectively. When comparing the diagnosis of musculoskeletal, medical, wound care, and other complaints, there was a statistically significant difference in incidence with p<0.001.
CONCLUSIONS: The most common presenting complaints were musculoskeletal, followed by medical, other, and then wound care. The largest number of runners seeking medical care were at the finish line and halfway point of the race and so the majority of resources should be focused at these locations. While there was a larger proportion of musculoskeletal complaints near the halfway point of the course, the higher percentage of medical complaints was at the finish line.

2155 Board #311 May. 30 3:30 PM - 5:00 PM

Iron and Vitamin D Deficiency in D1 Female Track & Field Athletes

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(No relationships reported)

PURPOSE: To identify the prevalence of Iron and Vitamin D deficiency in D1 female track and field (T&F) athletes
METHODS: In a retrospective review of medical records at a single institution, laboratory data were reviewed for female T&F athletes [BT1] from 2013 to 2019. Labs were acquired as part of the entrance pre-participation physical (PPE) including ferritin, hemoglobin, and Vitamin D. Iron deficiency was defined as serum ferritin below 30ng·mL-1 with severe deficiency below 13 ng·mL-1. Vitamin D was classified as; below 15 ng/mL - deficient, 16-29 ng/mL insufficient, and above 30 ng/mL sufficient. Anemia was defined as hemoglobin (Hgb) < 11.1 g·dL-1.
RESULTS: Seventy-seven student-athletes were screened, 48% were iron deficient, and a further 13 % had severe iron deficiency. Of those with iron deficiency (ferritin <30, n= 37), four had anemia (n=3). For Vitamin D, 7% were deficient, 24% were insufficient, and 69% were sufficient. **CONCLUSIONS**: When compared to the prevalence of iron deficiency in the general US female population ages 16-49 (11%), there was an increased prevalence in our sample (48%). Interestingly, we noted a similar prevalence of iron deficiency anemia (3-5% general population vs. 4.3% in our sample). Furthermore, our results showed a 24% prevalence for Vitamin D Insufficiency consistent with the general US female population of similar age at 24-26%. The prevalence of Vitamin D deficiency was higher in the US population at 10-11% when compared to our study at 7%. The effects and benefits of screening, intervention, and performance outcomes are a topic of ongoing investigation.

2156 Board #312 May. 30 3:30 PM - 5:00 PM

The Impact of Clinical Factors in Physician and ATC Decision Making for Concussion Return to Play: Insight froma Policy Capturing Study

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(No relationships reported)

PURPOSE: To scrutinize the role of several clinical factors in physician and clinical athletic trainer (ATC) return-to-play (RTP) decision making in high school athletes who sustained a concussion.
METHODS: Sports Medicine physicians and ATCs completed a policy capturing survey of 50 clinical scenarios and rated how likely they were to clear the athlete for RTP. Nine factors were randomly varied within the scenarios: age, gender, sport, prior concussion, initial symptom score, symptom duration, and ImPACT performance. Participants then ranked how important each variable was in their decision making process.
RESULTS: 16 physicians (87.5% CAQSM, 12.5% Fellows, mean 9.2 concussions managed per month) and 29 ATCs (mean 4.8 concussions managed per month) participated. ImPACT testing was the most significant contributor in RTP decisions. Physicians and ATCs weighed ImPACT changed from baseline (β 0.42±0.23 and 1.28±1.18 respectfully) and ImPACT compared to normative values (0.39±0.24 and 1.38±0.90 respectfully) most heavily. Respondents self-ranked prior concussion and age as most influential in their RTP decision making. There was no correlation between participants self-ranking of importance and the observed contribution of a variable to decision making.
CONCLUSIONS: Respondents displayed poor insight to the role of various clinical factors in their management of concussion RTP. ImPACT testing has a greater influence on RTP decisions than physicians and ATCs realize. Despite having low self-ranked importance, variables related to ImPACT results were among the most influential. Self-ranking importance of clinical variables is similar between physicians and ATCs; however, symptom duration is less important to ATCs compared to physicians. Although age was considered important in self-ranking it was not a significant contributor to RTP decision making.

2157 Board #313 May. 30 3:30 PM - 5:00 PM

Evaluating Patient Reported Outcomes in a Pediatric Sports Medicine Practice: A Look at the FAAM

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Purpose: Foot and ankle injuries account for up to 30% of all pediatric sports medicine visits. Self-reported outcome measures can be utilized to capture the patient's perspectives on their injury and monitor recovery, however, this has not been well studied in youth athletics. The objective of this study is to examine the relationship between patient injury characteristics and FAAM scores. **Methods:** A retrospective cross-sectional pilot study was conducted on patients that completed the Foot and Ankle Ability Measure (FAAM) survey as standard of care for either their first clinic or physical therapy visit. Factors of interest include age, sex, diagnosis and type of rehabilitation program. Descriptive statistics and multiple linear regression models were performed. **Results:** In this pilot study, 457 individuals were identified as having completed the FAAM over the 3 year review period. A sample of 36 patients with 42 distinctive injuries were reviewed. The average age of the sample was 16.38 years, 53% were female. Only 8 athletes (22%) identified as participating in multiple sports. Soft tissue injury was the most common diagnosis (65% of encounters) and more than half of the patients were referred to physical therapy. The average time from injury to presentation was 63 days (RNG: 1-694 days). The average initial FAAM score was 0.52 (SD ± 0.28, RNG: 0.03-0.96). Multiple linear regression models showed no significant predictors. Only time from injury to initial FAAM score approached a p-value of 0.10. **Conclusions:** The use of the FAAM may provide insight into patient perception of function and recovery from a musculoskeletal injury. Our study unveils characteristics of one cohort of adolescents from a pediatric sports medicine clinic with foot and ankle injuries. Time to presentation was significantly longer than expected but perceived level of dysfunction was higher. The multiple linear regression models showed no strong predictors of FAAM scores, however, this pilot study was underpowered. Future efforts will focus on further evaluation of this entire cohort and the interaction between injury characteristics, management recommendations, and FAAM scores.

2158 Board #314 May. 30 3:30 PM - 5:00 PM

Application of Quantitative Balance Testing to Office Based Concussion Care: A Feasibility Study

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(No relationships reported)

PURPOSE
Assessment of concussion in the ofiice should be multimodal, including a clinical interview, neurocognitive and balance assessment. Access to baseline, pre-injury measures have been identified as having greater clinical utility than single assessments. Our institution offers baseline ImPACT neurocognitive assessment to pediatric contact sport athletes. The goal of this study was to determine the feasibility of quantitative balance testing of individuals to improve quality of our concussion care.
METHODS
Following Institutional Review Board (IRB) approval, patients were offered objective balance assessment using a modified Balance Error Scoring System (mBESS) conducted using a combination motion analysis video/force plate of postural stability (Equilibrate; Balance Engineering LLC, Henrietta, NY). Baseline balance testing obtained was compared to published normative data (Howell & Meehan, J Pediatr Orthop, 2016); results were segmented by age and gender using unpaired Student-t test with significance set at p<0.05.
RESULTS
80 patients (December 2014-present) conducted a balance assessment: (43 Female/ 37 Male); age (14.5±4.1 yrs); Body Mass Index (21.7±5.6 Kgm^{-2}), previous concussion 7/80 (9%) and history of lower extremity musculoskeletal injury 15/80 (19%).
18 patients over the age of 18 years were excluded from comparative analysis to published pediatric normative data, leaving 62 patients. Two stances were directly compared and analyzed: double leg stance and tandem stance (non-dominant behind) with eyes closed. There were significantly better performances in our study groups in tandem stance for 16-18 yrs females, 8-12 yrs males and females compared to the normative data (Table. 1).
CONCLUSION
Quantitative baseline balance testing was deliverable in our office and our results indicate better performance for some populations than previously published normative data.

2159 Board #315 May. 30 3:30 PM - 5:00 PM

Specific Dietary Practices In Female Athletes And Their Association With Disordered Eating

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PURPOSE: Health and weight management benefits may influence athletes' decisions regarding specific dietary practices. Eating disorders/disordered eating (ED/DE) are highly prevalent in the athletic population. The purpose of this study was to determine if following specific diets correlated with a greater likelihood of responding positively to ED/DE screening tools compared to not adhering to a diet. **METHODS:** 1000 female athletes (15-30 yrs) were asked to complete a comprehensive health and wellness survey. Athletes were asked to specify their diet and completed 3 ED/DE screening tools: the Brief Eating Disorder in Athletes Questionnaire, the Eating Disorder Screen for Primary Care, and self-reported current or past history of ED/DE. We hypothesized that athletes adhering to specific diets were more likely to score positively on ED/DE screening tools than those not following a diet. The most common diets were included in the analyses: vegan, vegetarian, pescatarian, gluten free, low carbohydrate, low dairy, and ≥2 diets. Athletes following diets for health issues (e.g. Celiac disease) were excluded. Descriptive statistics were calculated for all study measures and Chi-square testing was performed to assess relationships between athletes' dietary practices and their responses to ED/DE screening tools. **RESULTS:**234 of 1000 female athletes reported adherence to specific diets; 766 reported no diet adherence. 69 of the 234 athletes were excluded due to medically-related dietary practices or vague dietary descriptions. 133 athletes reported following 1 of the diets and 32 athletes reported following ≥2 diets. Of the diet-adherent athletes, 67.9% responded positively to ≥1 of the 3 ED/DE screening tools. Athletes practicing vegetarian, vegan, low carbohydrate, low dairy, or ≥2 diets were more likely to respond positively to ≥1 ED/DE screening tool vs. athletes without dietary restrictions (70.0%, 77.8%, 79.5%, 60.0%, and 65.6%, respectively vs. 41.8%; p≤0.048). **CONCLUSION:** Specific diet adherence in female athletes is associated with greater likelihood of positive screening for ED/DE using survey self-report. Health practitioners should consider further ED/DE questioning of athletes reporting specific diet adherence in order to enhance nutritional knowledge and help treat and prevent ED/DE.

2160 Board #316 May. 30 3:30 PM - 5:00 PM

Concussion Symptom Reporting Across Age Levels

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Purpose: To evaluate differences in concussion symptom reporting across age levels
Methods: Between 2008-2018 post-concussion symptoms were reported by Middle School (MS), High School (HS) and Collegiate athletes (CA) utilizing the post-concussion symptom scale after a concussive injury. Repeat evaluations and initial evaluations with a symptom score of zero were excluded. ANOVA was performed assessing total symptom scores and number of symptoms reported by age group and gender.
Results:
1,748 athletes (65.2% male, 22 sports) were included: Middle School (6.3%, n=110), High School (86.4%, n=1511) and Collegiate (7.3%, n=127). Significant differences were found in total symptom scores (p=0.006) and number of symptoms reported (p=0.00003). Symptom scores were highest in High School athletes (23.37, SD 20.2) compared to MS (mean 17.78, SD 18.5) and CA (20.13, SD 21.3). Total number of symptoms reported was also highest in High School athletes (9.73, SD 6.1) compared to MS (7.55, SD 5.4) and CA (8.02, SD 5.9). High School females report significantly higher symptom scores (27.5+/-22.5 vs 21.6+/-18.9, p<0.0001) and number of symptoms (10.7+/-6.1 vs 9.4+/-6.1, p=0.0002) relative to male peers.
Conclusion:
In student athletes who have suffered a concussion, the post injury symptom scores and total number of symptoms and individual symptoms reported varied significantly across age levels, with significantly less symptoms being reported in the middle school athletes.

2161 Board #317 May. 30 3:30 PM - 5:00 PM

The Role of Resistance Training Dosing on Pain and Quality of Life in Individuals with Knee Osteoarthritis: A Systematic Review

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(No relationships reported)

Purpose: To determine whether resistance training effects pain and quality of life in individuals with knee osteoarthritis (OA), and whether or not a dose-response relationship exists. Secondly, we will investigate if the effects of resistance training are influenced by KL grade or location of OA (tibiofemoral and/or patellofemoral).
Methods: A systematic literature search of three electronic databases (PubMed, CINAHL, and EMBase) was performed for English studies to identify RTCs comparing resistance interventions with no intervention or education in knee OA and reporting changes in pain and physical function. Articles meeting inclusion criteria were assessed independently by two reviewers for methodological quality using the CONSORT 2010 scale and bias assessed by the Cochrane Collaboration's tool for assessing risk of bias.
Results: Four hundred and sixty-nine studies were found in the initial search. Fourteen were included for analysis after screening. Thirteen trials were rated with high methodological quality based on the CONSORT scoring system. One study was excluded due to poor CONSORT score (9). Thirteen eligible trials with 1,521 participants were therefore included in the subsequent analysis. The average CONSORT quality score was 20.3 (range 17 to 24.5). Evidence from eleven studies revealed resistance training significantly improved pain and/ or quality of life. No trends were identified with maximum strength, and frequency of exercise sets or repetitions, and thus trends between strength training outcomes and location or KL grade of knee OA were unable to be evaluated.
Conclusion: This systematic review suggests that resistance training improves pain and quality of life for patients with knee OA, but specific optimal dosing strategies remain unknown. Further high quality prospective studies with homogenous populations and interventions aimed to investigate precise dosing parameters are needed.

2162 Board #318 May. 30 3:30 PM - 5:00 PM

Distribution of Sonographically Guided Injections of the Subgluteus Minimus and Medius Bursae in Cadaveric Model

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PURPOSE: The primary purpose of this investigation was to describe and validate sonographically guided techniques for injecting the subgluteus minimus bursa (SGMinB) and subgluteus medius bursa (SGMedB) in a cadaveric model.
METHODS: A single experienced operator completed all injections under ultrasound guidance in 12 unembalmed cadaveric specimens. SGMinB injections (N=12) placed 3mL of diluted blue latex into the bursa using an in-plane, anterior-inferior to posterior-superior approach in short axis (SAX) to the gluteus minimus (GMin) tendon. SGMedB injections (N=12) placed 3 mL of diluted yellow latex into the bursa using an in-plane, anterior to posterior approach in SAX to the gluteus medius (GMed) tendon. For comparison with more commonly performed injections, the same operator completed sonographically guided injections into the subgluteus maximus bursa (SGMaxB, N=12) and sonographically guided intraarticular hip injections (N=2) in the same 12 specimens. 10 specimens were subsequently dissected and 2 specimens were frozen and cut into cross sections.
RESULTS: All 12 SGMinB injections accurately placed latex deep to the GMin tendon without intraarticular communication. All 12 SGMedB injections accurately placed latex deep to the GMed tendon. In 3/12 specimens some latex communicated between SGMinB and SGMedB, 2 of which occurred in the setting of pre-injection documented tendinosis. No injections communicated with the SGMaxB or intraarticular space.
CONCLUSIONS: Sonographically guided SGMinB and SGMedB injections can accurately target specific locations of tendon-bursa pathology in patients with greater trochanteric pain syndrome. In the presence of tendon pathology, communication between SGMinB and SGMedB may occur.

D-71c Free Communication/Poster - Sports Medicine Fellow Clinical Cases

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

2163 Board #319 May. 30 3:30 PM - 5:00 PM

Field Of View: A Football Player With Acute Visual Changes

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(No relationships reported)

HPI
A 23 year old professional football player self-reported abnormal vision during a game. He had two episodes of blurriness in the superior visual field of the right eye lasting 15-20 minutes each and separated by 15 minutes. He had no eye pain or headache. No identified head trauma preceding symptoms. He was not removed from play.
Exam
At halftime: Blood pressure 130/83. Normal appearing conjunctiva and clear corneas. Pupils equal, round, and reactive to light. Normal extra-ocular movements. Visual fields full to confrontation. Decreased visual acuity in right eye. Undilated fundoscopic exam revealed crisp vessels and normal optic discs. Neurologic exam normal.
Post-game: Normal visual acuity and remainder of exam normal.
Differential Diagnosis
1. Retinal detachment
2. Retinal vessel occlusion
3. Acephalgic migraine
4. Concussion
5. Optic nerve lesion
Tests and Results
Athlete referred to ophthalmology for full eye exam the day following the game.
Ophthalmology Findings:
- normal intraocular pressure
- bilateral AV nicking consistent with hypertensive retinopathy
- right retinal venous engorgement with few dot blot hemorrhages consistent with central retinal vein occlusion
- no retinal detachment
Carotid artery ultrasound and transthoracic echocardiogram were unremarkable. Laboratory tests for coagulopathy and systemic inflammatory disease were negative. Sleep study was notable for severe supine obstructive sleep apnea with associated episodic hypoxia and severe sleep fragmentation.
Final/Working Diagnosis
Central retinal vein occlusion and hypertensive retinopathy, likely associated with obstructive sleep apnea, an association described in the literature, with no other identified etiology.
Treatment and Outcomes
- Athlete did not miss any football practices or games
- Vision remained normal and follow up retina exam was unchanged
- Blood pressure monitored frequently without any documented daytime hypertension
- Began to use CPAP at night
- Reported improved sleep quality and reduced daytime fatigue

2164 Board #320 May. 30 3:30 PM - 5:00 PM

It's More Than A Headache

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HISTORY:
15yo male high school soccer player with headache and dizziness following injury 1 month prior.
Event was soccer ball striking right temporal area with fall to the ground without secondary head trauma or loss of consciousness. On rising, patient was knocked down by the opponent. He removed himself from the game due to symptoms of headache, balance problems, dizziness, sensitivity to light and noise, irritability, feeling slowed down, feeling mentally foggy, difficulty concentrating, and having visual problems. He had associated neck pain, numbness and tingling in the left upper extremity and left lower extremity after the injury.
No weakness in the upper or lower extremities.
No retrograde or anterograde amnesia reported.
He continued to play the game.
Reported his symptoms to the coach and licensed athletic trainer (LAT) when the game finished.
History of congenital C2-C3 autofusion, concussion 4 years prior with loss of consciousness, and posterior tension-like headaches with coughing and laughing.
PHYSICAL EXAM:
NECK: Neck supple without rigidity. FROM without tenderness on movement or palpation
NEURO: alert, oriented, normal speech. Normal neurological exam of arms. Normal DTRs, motor, sensory exam.
No focal findings or movement disorder noted.
Finger to nose testing normal.
Cranial nerves II-XII intact.
Motor and sensory grossly normal bilaterally, normal muscle tone, no tremors, strength 5/5
GAIT: normal
Post Concussion Symptom Scale: 46
DIFFERENTIAL DIAGNOSIS:
1. Post-concussion syndrome
2. Cervical Spinal Stenosis
3. Cerebral Herniation
TEST & RESULTS:
MRI of brain & C-spine: Chiari 1 malformation with cerebellar tonsils extending 2 cm below the foramen magnum. Dens angled posteriorly, increasing the degree of crowding at and below the foramen magnum. There is associated slight indentation of the ventral aspect of the upper cervical spinal cord. Congenital partial fusion of C2 and C3. The posterior arch of C1 appears incomplete. No spondylolisthesis.
FINAL WORKING DIAGNOSIS
Chiari Type 1 malformation
TREATMENT & OUTCOMES
1.
Avoid athletic activities and referred to neurosurgery for treatment.
2.
Neurosurgery performed posterior fossa decompression and duraplasty procedure successfully.
3.
Discharged from hospital to home after 3 days with full resolution of headaches and symptoms.

2165 Board #321 May. 30 3:30 PM - 5:00 PM

When Leg Pain In A Runner Does Not Mean Stress Fracture Or Shin Splints

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HISTORY: A 17-year-old male participating in high school middle-distance running presented with a 6-week history of lower left leg pain and limp. The pain was getting worse with increased training. He was running an average of 12-15 miles per day five days a week. This was evenly split on streets and cross-country roads. Although he had taken analgesics, the pain did not improve. He had no pain at rest but had noted some occasional pain at night. There was no history of antecedent trauma and the remaining history did not reveal any significant abnormalities.
PHYSICAL EXAMINATION: Local examination revealed diffuse tenderness over the anterior aspect of the lower left leg. There was no bruising or palpable swelling noted. The musculature and strength was normal. The range of motion of the left knee and ankle joints was normal and there was no neurovascular deficit noted. General physical examination did not reveal any significant abnormalities.**DIFFERENTIAL DIAGNOSIS**: 1-Shin Splint 2-Stress Fracture 3-Brodie Abscess 4-Osteoid Osteoma **TEST AND RESULTS**: Plain radiographs revealed cortical thickening in the middle 3rd of medial cortex of Tibia(Figure-1). The central nidus and the surrounding sclerosis of the bony lesion was apparent on the CT scan (Figure-2).
FINAL/WORKING DIAGNOSIS: Osteoid Osteoma
TREATMENT AND OUTCOMES: The patient underwent surgical en bloc excision as an oupatient procedure. A shark bite excision of cortical lesions along with the surrounding sclerotic bone was performed under image guidance. The specimens were sent for histopathological examination which was consistence with Osteoid Osteoma. He was kept partial weight bearing for 6 weeks, followed by gradual progression to full weight bearing. Three months post-surgery, the patient was completely asymptomatic. Follow-up radiographs revealed a well-healed excision site and no evidence of recurrence. He returned to his running without problems .

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Doc, My Leg Is Numb.

Justin R. Thompson[1], P. Patrick Mularoni[2], Sayedmajidreza Alavidehkordi[1]. *[1]Bayfront Health, Saint Petersburg, FL. [2]Johns Hopkins All Childrens Hospital, Saint Petersburg, FL.*

(No relationships reported)

HISTORY: An 18 year old, high school, football kicker suffers a leg injury during his last regular season game. He kicked his last PAT of the game when he reported tightness in his anterior leg. During the following kick off, he felt a pop in his right upper thigh as he kicked the ball. He reported immediate pain and difficulty walking. He was able to independently limp off the field. That night he elevated and iced his leg. He reported that he fell asleep with his leg elevated with ice on the area. Upon waking the next morning he felt numbness in the outside of his right thigh. He continued experiencing the soreness in the anterior portion of his thigh, but reported it was no worse than the day before. He denied any back pain, prior back injury, or history of trauma to his back. **PHYSICAL EXAMINATION:** General: NAD, crutch assisted ambulation, athletic build CV: 2+ dorsalis pedis pulses bilaterally, warm extremities Pulm: no dyspnea GI: abdomen soft, non-tender Skin: no bruising Neuro: decreased sensation subjectively along the outer right thigh from hip to knee MSK: Pain to palpation along proximal hip flexors and AIIS, no defect in muscle palpated, full AROM, PROM of hips. 4/5 strength of right hip flexion secondary to pain, 5/5 on left. 5/5 strength bilaterally with hip extension, adduction, abduction, as well as knee flexion and extension. No spinous process or SIJ tenderness to palpation, no step offs appreciated. **DIFFERENTIAL DIAGNOSIS:** 1. Avulsion fracture of AIIS with associated nerve injury 2. Hip flexor strain with meralgia paresthetica 3. hip flexor strain with direct nerve injury from ice 4. FAI with acute hip labral tear 5. Lumbar disc herniation **TEST AND RESULTS:** Pelvis XR: Normal radiographic examination of the hips and the remainder of the pelvis**FINAL/WORKING DIAGNOSIS:** Hip flexor strain with associated meralgia paresthetica **TREATMENT AND OUTCOMES:** 1. Rest from kicking over the following 10 days. 2. Active recovery with ATC at school 3. Numbness resolved at time of follow up in clinic, strength was returning without pain with hip flexion 4. Released to increase kicking distance from PAT to less than 30 yards with plans to increase as tolerated, recommended no kick offs for the remainder of playoffs 5. Athlete had complete resolution of symptoms and was back to full kicking duties approximately 4 weeks after initial injury

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"Not Just Another Ankle Sprain"-an Interesting Case Of Chronic Ankle Pain

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(No relationships reported)

HISTORY: 22-year-old female presented with progressively worsening ankle pain, swelling, catching, and locking over a five year period. She denied recent or prior trauma. Her limitation was inability to stand throughout a full work day. Past medical history was significant for morbid obesity s/p sleeve gastrectomy 4 years ago. She was seen in the past and told it was "just another ankle sprain" or "from her weight". The pain has worsened despite claims it would improve "once she lost weight".
PHYSICAL EXAMINATION: Mild circumferential swelling with moderate pes planus noted. Tenderness: talar dome, post.-tib. tendon, posterior talar processes. Full ROM, with 4/5 strength appreciated in all planes. Able to walk on heels and toes, with a limp. Unable to hop. Anterior Drawer: positive w/excessive laxity and crepitus. Talar Tilt: positive. Anterior impingement and impaired proprioception noted. Sensation and pulses intact.
DIFFERENTIAL DIAGNOSIS:
1. Talar Stress Fracture
2. Tarsal Coalition
3. Os Trigonum
TEST AND RESULTS:
Radiographs: 3-view Left Ankle
-Degenerative changes of the tibiotalar joint.
-Osteochondral lesions of the medial talar dome and medial shoulder of the tibial plafond.
-Hypertrophic changes concerning for enthesitis about the tendinous insertions.
MRI: Left Ankle:
-Chronic OCD lesion to medial talar dome with large subchondral cysts, measuring 16mm x 8mm.
-Talar Dome collapse with Outerbridge Grade 3/4 articular cartilage loss of the overlying tibial plafond and talar dome.
-Enthesophytes of the dorsal and plantar calcaneus.
FINAL/WORKING DIAGNOSIS:
Large medial talar dome OCD lesion with subchondral cysts (Grade 5 Hepple MRI Staging) and evidence of enthesitis and degenerative talonavicular changes concerning for longstanding inflammatory arthritic condition.
TREATMENT AND OUTCOMES:
1. Tall walking boot and ice therapy, with work modifications to limit weight bearing status
2. Ortho Foot and Ankle referral to address operative management in process.
3. Referral to Rheumatology after case discussion given concern for inflammatory arthritis.
4. Final Outcome pending; patient has yet to consult with either of the above.

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Tumbling Triceps in Gymnastics

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(No relationships reported)

HISTORY:21 year old female, D-1 gymnast, with 2 weeks of tight and achy right triceps pain. Athlete noted pain after practice, denies specific injury. Her pain is worse with resisted elbow extension. She is treating conservatively, rehabbing with ATC with strengthening both shoulder and arm, and is now tolerating forward tumbling, but soreness remains with backward tumbling. She feels she has plateaued in progress. **PE**:Grossly unremarkable, no ecchymosis or swelling. She has tenderness to triceps muscle belly without palpable muscle defect. ROM and strength are intact at her shoulder and elbow. She is neurologically intact distally. **DDX**:Triceps tear, triceps tendinopathy, shoulder pathology **TEST & RESULTS**:MSK US-proximal, mid belly of long head of triceps muscle fiber disruption with 2 cm fiber gap and hematoma. Extensive hyperemia in zone of injury and 8 cm of fascial thickening. Active contraction demonstrates fiber gap without contraction at zone of injury and abnormal contraction of surrounding fibers. **FINAL/WORKING DX**:Acute tear of right triceps, long head, grade 2b **TREATMENT & OUTCOMES**:Platelet-rich plasma injection into triceps tear followed by compression and 2 days rest. Progressive, sport-specific, pain-free strengthening with ATC guidance. Athlete avoided weight bearing on hands and stretching of triceps. She tolerated dance and trampoline work without issue. Upon reaching 80% speed/power without pain or functional limitation, 2 weeks after diagnosis, we performed serial US exams to evaluate tissue healing and guide progressive muscle loading. 2 week US demonstrated decreased fascial thickening, 2 cm fiber gap w/hyperemia persisted. Absent contraction at site of injury remained, abnormal contraction of surrounding fibers was improved. Continued rehab, did not progress beyond 80% at this time regardless of pain-free status. 4 week US revealed resolution of hematoma and fascial edema. Mild hyperemia remained at zone of injury. Some abnormal contraction at site of injury present, and normalized contraction of surrounding fibers. Athlete was released to gradually RTP under ATC guidance. Athlete progressed overhead loading, reached 100% power/speed and was advanced to forward and eventually backward tumbling. She tolerated full RTP 8 weeks after initial US. Athlete remains without re-injury.

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Knee Pain in a 7th Grade Runningback

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(No relationships reported)

Authors: Michael J. Bradburn, E. Ray Stewart, E. Lyle Cain
Affiliation: The University of Alabama, Tuscaloosa, AL, Andrews Sports Medicine and Orthopaedic Center, Birmingham, AL
Title: Knee pain in a 7th Grade Runningback
Case History: Patient is a 13-year-old male 7th grade runningback who sustained a left knee injury at practice. He reported running the football and dragging a defender who was holding onto the patients left leg. He felt a pop in his knee and reported immediate swelling. He was evaluated later that night at the Varsity football game and was referred to the sports medicine office in Tuscaloosa for evaluation.
Physical Exam
Inspection: non-weight bearing left lower extremity, assistance with crutches
Mild ecchymosis, severe effusion, maximal tenderness: lateral joint line, medial patellar, moderate swelling
Tests: left knee: negative Lachman's, guarded medial and lateral McMurray's. Negative valgus and varus stress, negative anterior and posterior drawer
Range of motion left knee: painful active and passive range of motion, 45 degrees of flexion active and passive, 0 degrees extension active and passive
Positive patellar apprehension on left
Lower extremity strength is normal
Lower extremity neurovascular exam is normal
Differential Diagnosis
#1: patellar subluxation
#2: femoral condyle fracture
#3: lateral collateral ligament sprain
#4: lateral meniscus tear
#5: femoral / tibial bone contusion
Tests and Results

X-ray Knee 4 views Left: avulsion fracture of lateral femoral condyle – minimally displaced
MRI Left knee without contrast: popliteus tendon rupture with retraction. Edema surrounding ACL
Final / Working Diagnosis
Left popliteus tendon femoral avulsion
Discussion
Isolated popliteus tendon rupture is a rarely reported finding in the literature. The vast majority of popliteus tendon ruptures occur in combination with other ligamentous injuries specifically in the posterolateral structures of the knee. Generally, reported cases are treated non-operatively with a high rate of return to play at previous level.
Outcome
Patient was evaluated by an orthopedic surgeon at Andrews Sports Medicine and Orthopaedic Center in Birmingham, AL and underwent arthroscopic left popliteus tendon repair
Return to Activity and Follow Up
After surgery the patient followed an ACL rehabilitation protocol, weight bearing as tolerated in a controlled motion brace, locked in extension for two weeks and began physical therapy after his initial post-operative appointment two weeks after surgery. At his 2-week post-operative appointment he could wean off crutches and weight bear as tolerated with his knee brace locked in extension. Physical therapy following ACL rehab protocol was initiated for the next 4 weeks, allowing for range of motion exercises out of the brace. After six weeks total he was released to return to full activities.

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Hurting Humeri in a Teenage Fencer

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(No relationships reported)

HISTORY: Patient is a 13-year-old right-hand-dominant male fencing athlete who presented with one year of intermittent right upper arm pain without a specific injury. The pain was diffuse throughout the entire upper arm. The dull, achy pain rated 5/10 and last weeks at a time. The pain was worse at night, causing him to cry. Advil and BenGay helped with the pain. PT did not seem to help. He had seen by two other physicians previously and had a working diagnosis of referred pain from the shoulder. He had shoulder x-rays that were reportedly normal.After initial evaluation and imaging, the patient rested from fencing and restarted upper extremity PT. At 2 month follow-up, he endorsed similar symptoms on his left upper extremity, despite not using the arm for any strenuous activities apart from PT **PHYSICAL EXAMINATION**: Normal cervical ROM. Normal posture.Bilateral upper extremities: No scapular dyskinesia. No pain with palpation over clavicle, SC joint, AC joint, biceps tendon, humerus, elbow. Full ROM of both shoulders and elbows. Negative rotator cuff, AC, labrum provocative tests. Nerves intact. **DIFFERENTIAL DIAGNOSIS**:Biceps/ Triceps strain, Humeral stress injury, Cervical spine radiculopathy, Thoracic Outlet Syndrome, Leukemia
TEST AND RESULTS: Right humerus xray: Cortical thickening of the right mid humeral shaft, with subtle periosteal reaction. Mottled cortical thickening which could represent an atypical stress reaction location.Left humerus xray: Unremarkable. Right humerus MRI: Diffuse, primarily diaphyseal marrow and periosteal edema of the right humerus. Findings could be consistent with chronic stress injury. Left humerus MRI:Diffuse bone marrow edema of the left humerus, with adjacent periosteal and mild muscular edema, consistent with left humeral stress reaction with no fracture line. Labs: BMP, Mg, TSH, Free T4, PTH, Vit D, Celiac panel are normal. Phos mildly elevated. **FINAL/WORKING DIAGNOSIS**: Bilateral humeral stress reactions
TREATMENT AND OUTCOMES: PT to work on upper extremity strengthening. Rest from fencing for 3 months. Recommended formal evaluation by bone specialist but family declined. Patient returned to full fencing activity 5 months after his initial right arm stress injury diagnosis without any return of symptoms

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Different Strokes for Different Folks

Shannon Carroll. *Edward Via College of Osteopathic Medicine at Auburn University, Auburn, AL.*
(No relationships reported)

HISTORY: A 21 year-old right-hand dominant Division I women's golfer presented with gradual onset right wrist pain starting July 2018 without change in equipment, technique, grip or shaft, but did increase tournament play over the summer. She was initially diagnosed with radiocarpal impingement and treated with posterior interosseous nerve injection at the fourth dorsal compartment. Shortly after she began to have right medial elbow pain with associated fourth and fifth digit numbness and tingling. She had an injection of the cubital tunnel as well with immediate pain relief, though the pain returned shortly after injection and continued to worsen. Particularly noted pain was worsened with full extension mid-swing. She had minimal playing time through the fall season (unable to chip and putt secondary to pain) and has been unable to participate in spring practice for more than 10 minutes at a time without pain. At this time she is also having resting pain.
PHYSICAL EXAMINATION: Right Wrist/Hand: No muscular atrophy, full range of motion active and passively, non-tender to palpation, ligamentously stable Right Elbow: No soft tissue swelling, bruising, or muscle atrophy, tender to palpation over the flexor pronator mass, medial epicondyle, and sublime tubercle with resisted digital and wrist flexion as well as pronation, stable in varus and valgus at 0 and 30 degrees, positive Tinel's test and elbow flexion test, negative subluxable ulnar nerve, negative moving valgus test, negative Milking maneuver, decreased sensation in the distribution of the ulnar nerve, negative Froment sign, negative Scott Earl test, negative Wartenberg syndrome. **DIFFERENTIAL DIAGNOSIS**: 1. Medial Epicondylitis 2. Cubital Tunnel Syndrome 3. Flexor Pronator Syndrome **TEST AND RESULTS**: 1/2/19 MRI Right Elbow - minimal tendinopathy of the common flexor tendon without tear, small spurring at the sublime tubercle with subtle marrow edema, possibly reflecting low-grade stress reaction, intact UCL, anconeus epitrochlearis identified T2-weighted axial images 11-12 1/10/19 Right Upper Extremity EMG/NCV - no evidence of right cervical radiculopathy or ulnar neuropathy 2//19 Right Upper Extremity Dynamic EMG/NCV - no significant change in activity, recruitment or motor unit seen pre- or post-exertion of right upper extremity; parenthetically despite normal studies, significant tenderness palpated in the area of the anconeus/flexor carpi ulnaris origin on the median elbow region**FINAL/WORKING DIAGNOSIS**: Dynamic Compression of Ulnar Nerve secondary to Anconeus Epitrochlearis with Medial Epicondylitis **TREATMENT AND OUTCOMES**: Surgical cubital tunnel release with anterior subcutaneous nerve transposition with a nerve protection wrap, neurolysis of the posterior medial antebrachial cutaneous nerve and excision of the Flexor Carpi Ulnaris. Post-operatively she will be in a long arm splint for two weeks followed by a removable long arm splint with 30 degrees extension at the wrist and 90 degrees flexion at the elbow. Continue progression at 4 weeks post-operatively to full active range of motion, then 6 weeks full passive range of motion if indicated. At 8 weeks patient can begin sport-specific activity with full return to play after 12 weeks of post-operative recovery.

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An Unusual Presentation of an Increasingly Common Infection

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HISTORY: 20-year-old female collegiate basketball player with no medical history presented to training room for 1 day history of epigastric abdominal pain. Pain initially generalized but then localized to epigastric region with nausea and non-bloody diarrhea but no emesis or urinary symptoms. Patient's last menstrual period ended 2 days prior to presentation, was normal. She is sexually active but uses condoms inconsistently. No vaginal complaints. She tried ibuprofen for pain which helped somewhat. No history of GERD, but given location of her symptoms and benign examination, treated with Tums with follow up in 1-2 days. She presented to the emergency department that evening as pain acutely increased.
PHYSICAL EXAMINATION: (in emergency department)
General: fatigued, moderate distress
HEENT: dry mucus membranes
Gastrointestinal: tender in the bilateral upper quadrants, normal bowel sounds, no rebound or guarding.
Psychiatric: appropriate affect
DIFFERENTIAL DIAGNOSIS:
1. Gastroesophageal reflux
2. Viral gastroenteritis
3. Anxiety
TESTS AND RESULTS:
1. Negative labs: comprehensive metabolic panel, lactate, blood cultures (eventually)
2. Abnormal labs: complete blood count (CBC) (high white blood cell count)
3. Imaging studies: abdominal ultrasound unremarkable, CT of abdomen and pelvis negative.
FINAL/WORKING DIAGNOSIS:
Gonorrhea
TREATMENT AND OUTCOMES:
Two days after initial emergency room (ER) visit, patient returned and was feeling a bit better, but was still having abdominal pain in the right upper and bilateral lower quadrants. Examination reassuring, but repeat CBC obtained given leukocytosis in ER and sexually transmitted infection (STI) testing ordered. White blood cell count decreased. Prior to STI testing resulting, patient's abdominal pain increased and she was directed again to the ER. There, she had pelvic examination which revealed yellow cervical discharge. STI testing done, in addition to urine pregnancy testing. Transvaginal ultrasound was negative. At the time of discharge from the ER, STI test results pending. Treated empirically in ER for STI with azithromycin and ceftriaxone.

Both STI tests (from training room and ER) positive for gonorrhea after discharge from ER. In follow up with patient, she is feeling better and has returned to normal activities.

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A Narrow Wrestling Decision

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(No relationships reported)

HISTORY: A 25 year-old male college wrestler presented to the training room the day after a wrestling match complaining of neck soreness. He had unintentionally fallen backwards on the mat and sustained a hyperextension injury of his neck. Immediately after the trauma, he felt an "electrical sensation" traveling down both of his arms into his hands, which resolved within 24-48 hours. At the time of evaluation, he denied any weakness, bowel or bladder retention or incontinence, or numbness or tingling. His only complaint was residual neck pain which was previously treated with oral prednisone and NSAIDS.
PHYSICAL EXAMINATION: A young healthy male in no distress. Normal ambulation. Neck range of motion demonstrated full flexion, but 50% in extension, right and left rotation and lateral tilting. Pain reproduced with neck extension. There was left and right cervical paraspinal tenderness to palpation with no step-off or crepitus noted. Bilateral upper and lower extremity strength, sensation, and reflex testing were normal. No clonus and negative Babinski, Spurling's, and Hoffman's signs.
DIFFERENTIAL DIAGNOSIS:
1. Cervical paraspinal muscle strain
2. Cervical Cord Neurapraxia
3. Fracture of cervical vertebrae
4. Congenital Cervical Stenosis
TEST AND RESULTS:
Cervical Spine AP and Lateral Radiographs: Seven cervical vertebrae seen in AP view. Pedicle shadows intact. Lateral view shows loss of cervical lordosis. Intervertebral disc spaces are well maintained.
CT Cervical Spine WO Contrast: No evidence of fracture or subluxation. Mild congenital cervical canal stenosis.
MRI Cervical Spine WO Contrast: No evidence of acute injury. Multilevel cervical spondylosis with congenital stenosis with the diameter of the spinal canal measuring 6-7 mm. No significant CSF surrounding the spinal cord.
Torg ratio measured on all imaging had values of 0.7 or less.
FINAL/WORKING DIAGNOSIS:
Congenital Cervical Stenosis with associated Cervical Cord Neurapraxia and Cervical strain
TREATMENT AND OUTCOMES:
Based off of imaging and Torg ratio of 0.7 or less, the athlete was not cleared to return to participation. Although he had wrestled for 20 years without issues, he did sustain a transient spinal cord injury necessitating a visit to the ER. He was referred for a second opinion to a neurosurgeon regarding clearance for return to play.

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A Jaw Crushing Line Drive in a Baseball Pitcher

Joshua I. Wilner, Michael Fong. *Kaiser Permanente, Los Angeles, CA.* (Sponsor: Aaron Rubin, FACSM)
(No relationships reported)

Title: A Jaw Crushing Line Drive in a Baseball Pitcher
Authors: Joshua Wilner, MD, Michael Fong, MD (Sponsor: Aaron Rubin, FACSM)
Institutions: Kaiser Permanente Los Angeles
History: A 23 year old collegiate baseball pitcher sustained a line drive off the right body of his mandible. The patient had a few seconds in which he reported loss of consciousness. After regaining consciousness, he found the baseball at his feet and threw to first in time for the out. At initial medical evaluation, patient complained of pain and bleeding at the right body of his mandible where the baseball made struck him. However, the site of maximal pain was the left superior mandible, where there was no direct trauma. The patient also had concussion symptoms, including headache, confusion, and photophobia.
Physical Examination: Examination on the field indicated a superficial laceration over the right body of the mandible. There was tenderness and swelling at the right body and left subcondylar aspect of the mandible. He had trismus, but no dysphagia or malocclusion. Patient had a positive concussion evaluation. There was no dental or oral trauma. There was no airway compromise or cervical spine abnormalities. There were no neurological deficits. The patient was sent to the emergency room for further evaluation and imaging.
Differential Diagnosis:
1. Mandible fracture
2. Mandible contusion
3. Mandible dislocation
Test and Results:
CT Scan Head and Mandible:
1. Non-displaced left subcondylar mandible fracture
2. No fracture of right body of mandible
3. No acute intracranial hemorrhage or pathology
Final Diagnoses:
Non-displaced, closed left subcondylar mandible fracture
Concussion
Facial laceration
Treatment and Outcomes:
1. Mandible fracture was treated with observation and soft diet for 4 weeks.
2. All concussion symptoms resolved within 4 days, and the patient graduated return to play protocol.
3. The laceration was treated with simple interrupted suture repair for 7 days. There were no wound complications.
4. The patient returned to full baseball activities 4 weeks after date of initial injury.

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A Real Pain in the Neck: A Football Player with Atypical Post-Traumatic Neck Pain

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(No relationships reported)

HISTORY:
18 yo M football player presented to college training room clinic with painful right-sided neck swelling after blunt neck trauma from another player's shoulder pad 2 weeks prior. He had presented to ER 2 days after the incident with acute neck pain and limited ROM, headaches, and difficulty concentrating. CT head & cervical spine were unremarkable. Diagnosed with concussion and SCM strain. He started concussion and muscle strain rehab. Concussion symptoms improved over the next two weeks, but his cervical pain and ROM didn't, and his neck became more swollen. He denied recent illness, cough, rash, fever, chills, dyspnea, dysphagia. POCUS was performed before referal to ER. **PHYSICAL EXAMINATION**: VS: Normal; Gen: No acute distress HEENT: tender 5 x 3 cm subcutaneous mass on the antero-lateral neck, no bruits appreciable; MSK (Neck): tenderness to palpation along the entire right SCM, no spinous process tenderness, decreased lateral flexion and rotation towards the contralateral side; Card: Regular rate and rhythm, no murmurs; Resp: Clear bilaterally **DIFFERENTIAL DIAGNOSIS**: Occult cervical spine fracture, Intramuscular infection, Ruptured sternocleidomastoid, Internal jugular thrombosis, Arterial pseudoaneurysm
TEST AND RESULTS: POCUS: diffuse heterogenous regions throughout the SCM musculature, increased vascularity; ED Labs: WBC: 15.40; ED CT Neck with Contrast: diffuse inflammation of the right SCM muscle with multiple intramuscular abscesses collections in the deep aspect, largest measuring 2.1 x 2.4 x 6.0 cm with associated narrowing of the right internal jugular vein. **FINAL/WORKING DIAGNOSIS**: Traumatic SCM myositis with intra-muscular abscesses
TREATMENT AND OUTCOMES:
Hospitalized and started on IV Unasyn and Decadron. Ultrasound guided needle aspiration collected 2 cc purulent fluid that grew 2+ strep pyogenes. Symptoms didn't improve, so sent to OR for I&D where purulent fluid was drained from cavities superficial to and within the SCM. Neck swelling, pain, and range of motion improved. Repeat neck CT confirmed resolution of infection. Discharged on oral Augmentin. Over several weeks rehabbed to full strength and range of motion in the neck. Given the duration of time away from sport, patient decided to red-shirt the rest of his football season.

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Atypical Shortness of Breath in Division 1 Athlete

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(No relationships reported)

HISTORY: This patient a 20-year-old NCAA Division 1 Field Hockey player who presented with shortness of breath, early fatigue, weakness, and achiness with aerobic training for the past several years. She had symptoms almost immediately with aerobic conditioning that would progress as she continued to exercise. Our athlete reported a trial of pre-exercise albuterol which did not improve her symptoms or exercise tolerance.
PHYSICAL EXAMINATION: Lungs were clear to auscultation bilaterally, with appropriate inspiratory and expiratory effort and normal lung sounds. The patient was able to speak in full sentences without hoarseness. Pulse oximetry 99% and resting

heart rate was 64. There was no cyanosis or clubbing of the nails, with normal capillary refill. Cardiac exam revealed regular rate and rhythm without murmurs, rubs, gallops. PMI was not displaced.
DIFFERENTIAL DIAGNOSIS:
1. Reactive Airway Disease 2. Exercise Induced Bronchospasm 3. Valvular Heart Disease 4. Vocal Cord Dysfunction **TEST AND RESULTS**:
Chest X-rays —no focal consolidation, trachea is midline, no masses, no pneumothorax, full inspiratory effort. EKG —within normal limits. Echocardiogram --within normal limits, preserved ejection fraction and without significant stenosis or regurgitation Spirometry —Pre albuterol administration - FVC 3.33L, FEV1 3.01L, FEV1% 90.5% —Post albuterol administration - FVC 3.4L, FEV1 3.00L, FEV1% 88.9% —Normal lung volumes Flexible Laryngoscopy —appropriate vocal cord movement with respiration and phonation. **FINAL/WORKING DIAGNOSIS**:
Exercise-Induced Laryngeal Obstruction, Vocal Cord Dysfunction
TREATMENT AND OUTCOMES:
1. Referred to Otolaryngologist for diagnosis and treatment; diagnosed with Exercise-Induced Laryngeal Obstruction as diagnosis of exclusion 2. Treated with botox to the bilateral thyro-arytenoid muscles on 3 separate occasions separated by 4 months with positive clinical response. 3. Regular behavioral voice/speech therapy with Speech Language Pathologist tolerated well. 4. Sport psychology counseling was utilized and subjectively helpful to address the underlying anxiety associated with her dyspnea. 5. Patient with improved exercise tolerance, although continues to have symptoms and was unable to return to NCAA Division 1 competition level.

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Eosinophilic Fasciitis Presenting as Benign Subcutaneous Emphysema

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(No relationships reported)

HISTORY: A previously healthy 12 year old female presented with left forearm pain and subcutaneous crepitus of one week duration. She sustained a minor fall 6 weeks ago where she scratched her forearm against a wooden deck. No bruising, cut wounds or penetrating injury. Few days later she developed dull aching pain and subcutaneous crepitus at the front of her left forearm. No redness, warmth, swelling or limitation of movement. X-rays showed air under the skin. She was started on oral antibiotic without improvement. Ten days later, she was admitted to the hospital and started on IV antibiotics with partial improvement. After 2 days she was discharged on oral antibiotics. Symptoms resolved within 10 days of discharge. A week from finishing antibiotics, she presented with similar symptoms without new injuries. No fever, malaise, weight loss or joint pains. She has family history of JIA in a 19 year old brother and Psoriasis in a 15 year old sister.
PHYSICAL EXAM: She looked non-ill and non-toxic with normal vital signs. There was a mildly tender palpable crepitus over the antero-lateral aspect of her left forearm. No localized swelling, erythema or fluctuation. Normal active range of motion at shoulder, elbow, forearm and wrist. Intact sensation to light touch. Intact radial pulse and brisk cap refill.
DIFFERENTIAL DIAGNOSIS:
1.Necrotizing fasciitis
2.Benign subcutaneous emphysema
3.Autoimmune disease
TESTS AND RESULTS:
Forearm AP and lateral radiographs:
-Moderate subcutaneous gas in the left volar forearm
MRI left forearm:
-Subcutaneous, muscle as well as superficial and deep fascial edema suggestive of cellulitis, myositis and fasciitis. Multiple foci of gas within the subcutaneous tissues and deep fascia-No osteomyelitis or abscess
CBC, CRP and ESR:
-Normal
Tissue biopsy and cultures:
-Severe eosinophilic inflammation, no bacterial growth
FINAL/WORKING DIAGNOSIS:
Eosinophilic fasciitis
TREATMENT AND OUTCOMES:
1.Surgical I&D. No fluid or gross tissue abnormality was noted
2.No antibiotics post-operatively, only one prophylactic dose intra-operatively after cultures were collected
3.Her symptoms resolved and she remained symptom free for 2 months
4.Symptoms recurred without new injury
5.She was referred to pediatric rheumatology for further management
6.Symptoms resolved spontaneously within 2-3 weeks

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Tunneling Away Lateral Ankle Pain

Geoffrey Dreher, David Webner, Kevin DuPrey. *Crozer-Keystone Health Newtowrk, Springfield, PA.* (Sponsor: Thomas Kaminski, FACSM)
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(No relationships reported)

TITLE: Tunneling Away Lateral Ankle Pain
AUTHORS: Geoffrey M. Dreher, DO; David Webner, MD; Kevin DuPrey, DO
ACSM Sponsor (if you accept): Thomas Kaminski, PhD, ATC (kaminski@udel.edu)
HISTORY:
60-year-old boilermaker presented with 2-month insidious onset left lateral ankle pain, localized to the lateral malleolus, described as achy and throbbing, 7/10, worse with walking, stairs and climbing ladders. No relief with Acetaminophen or NSAIDs.
PHYSICAL EXAMINATION:
Left ankle: no edema or ecchymosis, full range of motion with pain in active dorsiflexion and plantarflexion. Strength 5/5, gross sensation intact and 2+ dorsalis pedis and posterior tibial pulses. Tenderness to palpation along the lateral malleolus extending distally approximately 5 cm along lateral ankle.
DIFFERENTIAL DIAGNOSIS:
1.
Chronic lateral ankle instability
2.
Peroneal tendinosis with subluxation
3.
Lateral malleolar stress fracture
4.
Ankle osteoarthritis
5.
Talar osteochondral lesion
TEST AND RESULTS:
•
Left ankle 3 view x-ray: Normal.
•
Left ankle MRI: Anatomic variant involving conjoined peroneus brevis and longus tendons, located along the anterolateral aspect of distal fibula. Deficient/absent peroneal groove along posterior fibula, which also suggests congenital abnormality. Mild conjoined tendinosis, without surrounding edema.
•
Left lateral ankle ultrasound: Intact peroneal tendon overlying the lateral maleolus with trace fluid in sheath. The peroneal tendons split just before brevis insertion onto base of 5th metatarsal.
FINAL/WORKING DIAGNOSIS:
1.
Conjoined left peroneal tendon subluxation with tenosynovitis and absence of fibular groove.
TREATMENT AND OUTCOMES:
1.
Physical therapy for 6 weeks led to improved balance and walking mechanics, but no change in pain.
2.
Immobilization in CAM boot for 6 weeks caused no improvement in pain or swelling out of boot.
3.
Corticosteroid injection to peroneal tendons at level of lateral malleolus lead to no improvement.
4.
Podiatry referral and surgery including tubularization of peroneal tendons, creation of 6mm fibular groove and repair of peroneal retinaculum. 3 months post-operatively, the patient was full weight bearing pain free with daily activities in lace-up ankle brace.

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Shoulder Pain in a Weightlifter

Kelly Joy Valignota, Terry Nicola, FACSM, Melody Hrubes. *UIC Sports Medicine, Chicago, IL.* (Sponsor: Dr. Terry Nicola, FACSM)
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(No relationships reported)

HISTORY: A 20-year-old male weightlifter presented as a new patient to a sports medicine clinic with left shoulder pain. Pain began five months prior while the patient was performing overhead presses with a 205 lb barbell. While pushing up into his 5th repetition, he felt a “shift” in his left shoulder. He did not have a significant amount of pain at the time. In the following weeks, he began to have more pain in the left shoulder and decreased his weight during overhead presses and chest presses due to pain and weakness. He tried taking two weeks off from lifting, but when he resumed

he was unable to complete any overhead or chest work due to pain. The pain is focal over the anterior-lateral shoulder with no radiation. No numbness or tingling. He is unsure if his weakness is due to pain or a separate issue.
PHYSICAL EXAMINATION: There was no bony abnormality or muscle atrophy. Patient had full active range of motion of the left shoulder in forward flexion and abduction, with mild pain at end range. Passively, he had 85 degrees of external rotation and 85 degrees of internal rotation with arm abducted to 90 degrees. There was tenderness to palpation along the distal clavicle and acromion, as well as over the supraspinatus, infraspinatus, teres minor/major, biceps, and anterior deltoid. Jobe's test positive for pain and weakness. Positive cross-arm test. Negative Hawkin's, Neer's, O'brien's, Speed's, and Yergason's. Pain with resisted external rotation and shoulder abduction. Strength was 5/5 at bilateral deltoid, biceps, triceps, wrist extensors, finger flexors, and finger abductors, but 4/5 during resisted left glenohumeral external rotation due to pain.
DIFFERENTIAL DIAGNOSIS: 1) Glenohumeral subluxation 2) Rotator cuff tear 3) Labral tear 4) AJ joint sprain/separation 5) Clavicle fracture
TESTS AND RESULTS: 1) XR Chest from ER visit for unrelated incident: Visualized left clavicle normal, shoulder not visualized. 2) MRI left shoulder without contrast: Nondisplaced fracture of the distal clavicle with associated bony edema of the clavicle and acromion at the AC joint with mild surrounding soft tissue edema. Low grade tendinosis of the infraspinatus and supraspinatus with suspicion for a tiny undersurface tear without retraction.
3) XR Clavicle: Clavicle is intact and negative for fracture.
FINAL/WORKING DIAGNOSIS: Nondisplaced fracture of distal clavicle
TREATMENT AND OUTCOMES:
1.
Given no signs of fracture healing after 5 months, ordered laboratory work which revealed Vitamin D deficiency. Patient started on Vitamin D 1200mg and Calcium 800mg daily.
2.
Activity modified to abstain from weight bearing exercises through the left upper extremity until next follow up visit.

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Is it Friction? A Rare cause of Medial Knee Pain

Wade Johnson, Jeffrey Payne. *Mayo Clinic, Minneapolis, MN.* (Sponsor: Jonathan Finnoff, FACSM)
(No relationships reported)

HISTORY: A 22-year-old male with no significant past medical history presents with reports of two weeks of progressive medial knee pain, after beginning training for a sprint triathlon. Prior to starting his training, he primarily lifted weights and ran only sporadically. He increased his running significantly up to 3 to 4 miles 4 to 5 times per week. Pain was initially only present while running, but became present with any activity including swimming, especially with a frog-leg kick, after cycling, and finally with day-to-day walking. He notes mild swelling in the medial knee. He denies any catching, locking, buckling, or give-way of the knee. He denies any paresthesias in the right lower extremity.
PHYSICAL EXAMINATION: Pain in the right medial knee with single leg squat on the right. No knee effusion, however, there is mild swelling located just below the medial joint line over the proximal medial tibia on the right. Knee range of motion is full bilaterally. Ligamentous exam stable. Pain with valgus stress testing at 30 degrees on the right without laxity. No tenderness over the medial or lateral joint lines. Tenderness to palpation over the proximal medial tibia a few centimeters distal to the joint line and over the MCL in this region. No tenderness to palpation over the proximal MCL or pes anserine bursa. **DIFFERENTIAL DIAGNOSIS**: 1. Medial tibial plateau stress reaction 2. Distal MCL sprain 3. Pes anserine bursitis
TEST AND RESULTS: Plain radiographs: — No acute osseous abnormality. MRI right knee: — focal subcortical marrow edema within the medial aspect of the tibia 2.5cm below the joint line at the site of a bony protuberance compatible with prominent medial tibial cress — No fracture line, or soft tissue mass
FINAL/WORKING DIAGNOSIS: Medial tibial crest friction syndrome
TREATMENT AND OUTCOMES:
1. Voltaren gel and activity modification with cessation of cycling, and reduction in training volume, with reported improvement. 2. Patient wanted to return to training for a triathlon and ultrasound-guided corticosteroid injection, deep to the MCL over the tibial protuberance, was performed. 3. Patient reported complete resolution of pain immediately after injection that was maintained at 2 weeks. 4. Patient completed his sprint triathlon without development of pain and he was instructed to follow-up should his symptoms recur.

2181 Board #337 May. 30 3:30 PM - 5:00 PM

Osteitis Pubis: A Career Ending Diagnosis?

Stephen Sanker, Amanda Goodale. *TriHealth, Cincinnati, OH.* (Sponsor: Henry Stiene, FACSM)
(No relationships reported)

HISTORY:
A 19-year-old Division III collegiate basketball player presents with gradual onset of right groin pain during training. There is no known acute injury. He notes increasing pain during basketball workouts which occurs with running, squatting, and standing from a seated position. There are no radicular symptoms. No numbness, tingling. No genital pain or bulges in the groin. Of note, patient had similar symptoms in high school which reportedly never fully subsided. Treatment has included occasional NSAIDS and intermittent rest.
PHYSICAL EXAMINATION:
Skin intact. No warmth, erythema, or swelling
Full active and passive range of motion of bilateral hips, pain at extremes of external rotation
Tender anteriorly at bilateral groin and over pubic symphysis. Mildly tender proximal adductor tendons.
Pain with FADIR and FABER testing, resisted straight leg raise, and abdominal crunch
5/5 strength of major muscle groups of the lower extremity
NVI
DDX:
1.
Hip flexor strain / tear
2.
Adductor strain
3.
Femoroacetabular impingement syndrome
4.
Osteitis pubis
5.
Athletic pubalgia
TESTING:
AP and lateral Xrays of right hip:
-
No acute osseous abnormalities. No signs of degenerative changes
MRI of the pelvis:
-
Symmetric stress edema on either side of pubic symphysis consistent with osteitis pubis.
FINAL/WORKING DIAGNOSIS:
Osteitis pubis
TREATMENT AND OUTCOMES:
1.
Several weeks of rest and oral NSAIDS with mild improvement in symptoms, followed by athletic trainer supervised therapy focused on core and pelvic strengthening.
2.
Corticosteroid injection of pubic symphysis two months after initial presentation with modest improvement in symptoms, though short-lived.
3.
Patient continues to have significant pain with any increased levels of activity.
4.
Recently prescribed topical NSAID.
5.
Consult with local surgeon recommended against surgical intervention at this time. Discussed further work-up and treatment options with patient including: protected weight-bearing with crutches, repeat MRI with athletic pubalgia protocol, diagnostic femoroacetabular injection, MRI arthrogram of hips evaluating for labral pathology, platelet rich plasma injections, pubic symphysis excision.
Patient has recently been only exercising in limited fashion, and is not currently participating in collegiate athletic due to pain.

2182 Board #338 May. 30 3:30 PM - 5:00 PM

Left Knee Pain In A 9-year-old Female

Branden Turner. *Kaiser Los Angeles Sports Medicine, Los Angeles, CA.* (Sponsor: Aaron Rubin, FACSM)
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(No relationships reported)

HISTORY: 9yo female presents with 2 years of recurring left knee pain. Patient is unable to extend the knee and has pain with ambulation. History of a fall, 1 year ago and worsening pain at the lateral patella. Patient worked with PT after initial fall with resolution of symptoms. Subsequently, the patient had multiple episodes of acute pain and decreased extension of knee with no acute trauma. Patient was referred to Sports Medicine for further evaluation. There is a 2-year history of symptoms since onset. Patient with 2/10 left lateral knee pain with sensation of pressure and inability

to completely extend knee. Denies acute trauma. Pain is improved with massage and stretching. Occasionally taken NSAIDS for pain management. Denies numbness, tingling, weakness, swelling, redness, fever, or chills XR and US performed in clinic. Subsequently, MRI of left knee was ordered.
PHYSICAL EXAMINATION: LEFT KNEE Symmetric, no quadriceps atrophy No effusion No TTP over quadriceps tendon, patella, patella tendon, medial joint line, MCL or LCL Left: Active ROM: 5-135, PROM 0-135 Right: Active ROM: -3-135 Clark Inhibition: neg Bounce test: neg Patella grind: neg Varus stress 0 and 30: neg Valgus stress 0 and 30: neg Lachman: neg Anterior drawer: neg Posterior drawer: neg Mc Murray: + palpable lateral knee click without pain Thessaly/Apley: neg Ober: very flexible at level of hip Short and hypertonic hamstrings on left, w/o tenderness to palpation No tenderness along IT band Thomas: positive Strength 5/5: hip and knee flexion and extension Sensation intact to light touch
DIFFERENTIAL DIAGNOSIS: Hamstring hypertonicity, Mass/tumor, Reactive arthopathy, Enteropathic arthopathy, Meniscus tear
TEST AND RESULTS: X-ray left knee, standing: flattening of the lateral tibial plateau and tibial spines, no acute fracture, no joint disease, open physis
US left knee: normal hamstring tendon and muscle no fluid appreciated along tendon sheath, no pes anserine bursitis, no IT band bursitis, no effusion, meniscus not visualized
MRI Left knee: discoid lateral meniscus with horizontal tear
FINAL/WORKING DIAGNOSIS: Discoid meniscus with tear
TREATMENT AND OUTCOMES: Left discoid meniscus saucerization and Physical therapy for rehabilitation. Patient doing well after surgery, with return to full activity without pain or other symptoms

D-75 Clinical Poster/Reception - **Clinicians' Reception with Poster Presentations**

Thursday, May 30, 2019, 6:00 PM - 7:00 PM
Room: Hotel-Signature 1 Meeting Room

2197 Board #1 May 30 6:00 PM - 7:00 PM
The Relationship between Bone Mineral Accrual and Changes of Body Composition in Competitive Girl Runners

Norimitsu Kinoshita[1], Eriko Uchiyama[1], Kenta Okuyama[2]. *[1]Hosei University, Tokyo, Japan. [2]Shimane University, Shimane, Japan.*
(No relevant relationships reported)

Low bone density is a complication of a long-term strict weight control during adolescence in women.
PURPOSE: To assess whether decrease in percent body fat (%BF) is associated with an impaired bone mineral accrual in girl runners.
METHODS: Consecutive 22 freshmen girl runners (15y/o, 158cm, 45kg) during 7 years in competitive high school teams were evaluated over 2 years of training. DXA was performed at the preparatory phase (baseline) and repeated after 23 ± 2 months (follow-up). The runners were divided into 2 groups; negative (DEC, n=11) or positive (GAIN, n=11) changes of %BF (Δ%BF) during the period. The effect of the period and the group on the changes in bone mineral content (BMC) and density (BMD) of total body less head and z-score were analyzed by 2-way repeated measures ANOVA. As for lean soft tissue mass (LSM) and fat mass (FM), paired t-test was used to compare between baseline and follow-up. Bivariate correlation analysis was used to examine the relationship between bone mineral accrual (ΔBMC and ΔBMD) and Δ%BF as well as the changes of FM (ΔFM) and LSM (ΔLSM). Written informed consent was obtained from the runners and their parents. $P<0.05$ was considered as statistically significant.
RESULTS: %BF changed from 17.4 to 14.3 (DEC) and 15.0 to 18.4 % (GAIN). The period had significant effects on BMC, BMD, and z-score without interactions. Contrast showed significant increases in those variables, while the group of Δ%BF had no significant effect, indicating the values of DEC and GAIN were similarly increased; 1.57 to 1.64 and 1.66 to 1.77 kg, 0.98 to 1.00 and 1.00 to 1.03 g/cm^2, and -0.25 to -0.20 and 0.04 to 0.22, respectively. The DEC runners gained LSM (34.2 to 36.1 kg) and reduced FM (7.7 to 6.4 kg) significantly, while the GAIN runners significantly increased FM (6.9 to 9.0 kg) without LSM change (36.6 to 37.0 kg). Neither Δ%BF nor ΔFM, but ΔLSM was significantly correlated with ΔBMC (r=0.45) and ΔBMD (r=0.55).
CONCLUSIONS: Bone mineral was equally accrued among the runners of which %BF increased or decreased, where the accretion was associated with LSM gain. Competitive distance runners would develop leanness by not only losing FM but also gaining LSM (i.e., skeletal muscle) along with long-term exercise training. This would ameliorate an impairment of bone mineral acquisition by strict weight control.

2198 Board #2 May 30 6:00 PM - 7:00 PM
Pre-Race Risk Screening and Stratification Predicts Adverse Events - SAFER Study In 76654 Distance Runners

Martin Schwellnus[1], Sonja Swanevelder[2], Esme Jordaan[2]. *[1]SEMLI, University of Pretoria, Pretoria, South Africa. [2]South African Medical Research Council, Capetown, South Africa.*
(No relevant relationships reported)

PURPOSE: The purpose of this study was to determine if a pre-race medical screening and risk stratification program predicts adverse events (ability of a runner to finish the race, or develop a medical complication) during an endurance running event.
METHODS: This prospective study, conducted during the Two Oceans marathon races (21.1km and 56km) in South Africa over 4 years, involved 76654 consenting race entrants. Race entrants completed a pre-race medical screening questionnaire at registration (3-4 months before the race), and were risk stratified into four groups: very high risk (VHR; existing cardiovascular disease - CVD), high risk (HR; risk factors for CVD), intermediate risk (IR; existing other chronic disease, medication use or injury), and low risk (LR). All runners in the VHR and HR categories were provided with educational information to decrease the risk of medical complications, and were also advised to undergo a pre-race medical assessment. Runners were tracked from registration to starting and finishing the race, and medical encounters (ME) were documented. Main outcome variables were the did-not-start rate (DNS; % runners registering but not starting) and the adverse event rate (AE) [defined as % starters that did-not-finish (DNF) or had an ME] in each risk category.
RESULTS: The DNS rate (%: 95% CI) for runners was similar in all risk categories (VHR=19.5; 17.9-21.2, HR=18.8; 18.0-19.7, IR=18.4; 18.0-18.9, and LR=18.6; 18.2-19.1)($p=0.604$). The DNF rates in the VHR (2.2; 1.6-3.0)($p=0.005$), HR (1.8; 1.5-2.1)($p=0.017$), and IR (1.9; 1.8-2.1)($p<0.001$) were significantly higher compared to the LR (1.4; 1.2-1.5). The overall AE rates for runners in the VHR (2.3; 1.8-3.0) ($p=0.0017$), HR (1.8; 1.5-2.1)($p=0.0323$), and IR (2.0; 1.9-2.2)($p<0.001$) were significantly higher compared to the LR (1.5; 1.3-1.6).
CONCLUSIONS: A pre-race medical screening, risk stratification and educational intervention program did not change the DNS in the risk categories. However, runners in the higher risk categories, that chose to start the race, were more likely to suffer an adverse event (not finish the race or present with a medical encounter) compared with runners in the lowest risk category.

2199 Board #3 May 30 6:00 PM - 7:00 PM
Impact of Silver Ion Laundry Treatment on Athletic Gear and Environmental Pathogens and Athlete Health

Priya Balachandran[1], John J. Openshaw[2]. *[1]Applied Silver, Hayward, CA. [2]Stanford University, Palo Alto, CA.*
(No relevant relationships reported)

Community-acquired infections caused by *Staphylococcus* and MRSA can spread easily through sharing towels, gear and contaminated surfaces. The resulting skin infections can lead to athlete disqualifications, cancellations of competitions and potential impact on team performance. In this study, we evaluate a residual antimicrobial textile treatment as an environmental hygiene and infection control strategy through improved textile cleanliness and reduced athlete risk for infection.
PURPOSE: To determine the impact of silver-based residual antimicrobial textile treatment on *Staphylococcus* and MRSA levels on athletic gear, environmental surfaces, athlete infection rates and number of missed play days. **METHODS**: The study, conducted at a professional sports facility over a six-month period, included pre-season and regular season use. Residual antimicrobial silver ion laundry additive was injected onto textiles during the final rinse stage of the facility's standard laundry process. Bioburden data for *Staphylococcus* and MRSA was collected approximately every 4 weeks using contact plates. Athletes' shirts, shorts, jerseys, girdles and towels, and locker room surfaces including carpets, upholstery and other hard surfaces were sampled. Infection rates and number of days missed pre- and post-laundry treatment are also being recorded. Samples collected before initiating the silver ion textile treatment served as the control data set. **RESULTS**: Prior to silver-ion treatment implementation, significant levels of *Staphylococcus* were measured on athlete textiles (average 75 CFU/100 sq. cm.) and on environmental surfaces (average 16 CFU/100 sq. cm.). Silver ion treatment of the textiles resulted in dramatic decreases in *Staphylococcus* by 77% on textiles and by 37.5 % on environmental surfaces. Similar trends were also observed with MRSA. The overall bioburden levels continue to trend downward during the period of treatment. **CONCLUSIONS**: The current results demonstrate that a normal laundry process augmented with an active antimicrobial treatment provide athletic gear and a locker room environment that are and stay cleaner. Final data related to cleanliness, infection rates and player days will be tallied at the close of 2018.

2200 Board #4 May 30 6:00 PM - 7:00 PM

Association Between Sport Specialization and Low BMD Among Female High School Distance Runners

Mitchell J. Rauh[1], Michelle T. Barrack[2], Adam S. Tenforde[3], Michael D. Rosenthal[1], Jeanne F. Nichols, FACSM[4]. *[1]San Diego State University, San Diego, CA. [2]California State University Long Beach, Long Beach, CA. [3]Spaulding Rehabilitation Hospital/Harvard Medical School, Charlestown, MA. [4]University of California San Diego, La Jolla, CA.*

(No relevant relationships reported)

Sport specialization has become increasingly common and has been related to sports injury and menstrual dysfunction among female high school distance runners. The association between sport specialization and low bone mineral density (BMD) is poorly described in this population. **PURPOSE:** To determine the association between sports specialization and low BMD in female high school distance runners. **METHODS:** Participants consisted of 64 female runners (age 15.6 ± 1.4y), not currently on birth control medication, who competed in interscholastic cross-country and distance track events in southern California. Each runner completed a survey on sport participation and menstrual function, and had her height and weight measured. Each runner's spine and hip BMD were assessed using DXA, standardized to BMD Z-score by age and sex normative values. Sport specialization classifications were: low specialization (distance running sport(s) for ≤8 months/year and participation in ≥1 other non-running high school sports); moderate specialization (*only* distance running sport(s) for ≤8 months/year, or participation in distance running sport(s) ≥9 months/year and ≥1 other non-running sports); and high specialization (participation in distance running sport(s) for ≥9 months/year and no other sports. Multivariable logistic regression was performed to determine the adjusted odds ratio (OR) and 95% confidence interval (CI), adjusting for BMI and gynecological age. **RESULTS:** Overall, 21.9% of the runners were high sport specializers, and 37.5% and 40.6% were moderate and low sport specializers, respectively. Twenty-three (35.9%) runners had low BMD (Z-score < -1.0). After adjusting for gynecological age and BMI, high sport specializers were five times more likely (OR=5.4, 95% CI: 1.3-23.3; p=0.02) to have low BMD than low sport specializers. **CONCLUSIONS:** Our findings indicated that high sport specialization was associated with low BMD among female high school distance runners. Further investigation of this association is warranted as low BMD has been related to increased risk of stress fracture.

2201 Board #5 May 30 6:00 PM - 7:00 PM

The Effects Of Subconcussive Impacts On The Neurocognitive Function Of Men's Collegiate Lacrosse Players From Pre-season To Post-season

Caroline Varlotta (Sponsor: Dr. Gerard P Varlotta, FACSM), Joshua Giordano, Joseph Miceli, Brandon Burg, Haille Zwibel, Matthew VarlottaHeller. *NYIT-COM, Old Westbury, NY.*

(No relevant relationships reported)

There is an estimated 1.6 to 3.8 million sports-related mild traumatic brain injuries (mTBI) per year in the United States. Football is more commonly studied than other sports, even though men's lacrosse has almost as great of a risk of mTBI. Since many players of this age group are in schools of higher education, mTBI can inhibit their ability to learn in the classroom.PURPOSE: To examine the effects of total number of impacts, cumulative magnitude, and cumulative rotation, as measured by accelerometer, on neurocognition, as measured by time to complete the Trails A task in pre- and post-season.METHODS: We examined 10 male freshmen NCAA Division II collegiate lacrosse players in pre- and post-season (January and May). Subjects wore the Vector mouthguard, which contains accelerometers, during full contact practices and 18 games. Vector mouthguard recorded impact number and magnitude. Subjects' cognition was evaluated by C3logix Trails A test.RESULTS: The data was analyzed by comparing athletes' mean scores of Trail A between pre- and post-season with paired samples t-test and correlating it with the total number of impacts, cumulative impact, and cumulative rotation with computation of Pearson correlation coefficients. Statistical significance was determined by p-value<.05.The association between completing the Trails A task and the following variables was statistically significant with a positive Pearson coefficient: total number of impacts (0.80, 0.006), cumulative impact (0.74, 0.014) and cumulative rotation (0.71, 0.022).CONCLUSIONS: The athletes took longer to complete the Trails A task in post-season if they experienced an increased total number of impacts, cumulative impact, or cumulative rotation. These changes may indicate the number of impacts, cumulative impact, and cumulative rotation affects athletes" cognitive abilities without clinical symptoms or reporting of mTBI. The results of this pilot study suggests further investigation is warranted.

2202 Board #6 May 30 6:00 PM - 7:00 PM

International Clinical Scholar Award - Effects of Mistletoe Extract Supplementation on Inflammation Markers after Strenuous Exercise in Rowers

Soo-Min Ha[1], Jung-Sook Kim[1], Bo-Sung Kim[1], Jeong-Ah Lee[2], Yoon-Jung Choi[1], Do-Yeon Kim[1]. *[1]Pusan National University, Busan, Korea, Republic of. [2]Kyungsung University, Busan, Korea, Republic of.*

(No relevant relationships reported)

Excessive long-term training and extensive exertion during exercise can inflammatory cytokine expression. Various measures have been explored to minimize this, and dietary supplements having anti-inflammatory and antioxidant functions can help athletes recover from repetitive intensive exercises, thereby preventing reduced vitality. **Purpose**: This study aimed to identify the effect of mistletoe extract consumption on inflammatory markers of university male rowing athletes for 8 weeks during the winter training period. **Methods**: This study included 20 male rowing athletes divided into the Korean Mistletoe extract supplement group (KME, $n = 10$) and the control group (CON, $n = 10$). The KME group took 110 mL of mistletoe extract every morning and evening after meals (total of 220 mL) for eight weeks. Before and after taking mistletoe for eight weeks, 2,000 m rowing performance capabilities were measured, and KME group took 110 mL of mistletoe extract after recovery from the rowing exercise. Blood samples were collected during the rest, immediately after exercise, and after 30 min of recovery. Among inflammatory markers, IL-6 and TNF-α were analyzed. **Results**: Both groups showed a significantly reduced 2,000-m rowing time (KME; $p<0.001$, CON; $p<0.01$), and the total number of strokes were significantly fewer in the KME group than in the CON group ($p<0.05$). After supplementation the levels of IL-6 and TNF-α were lower in the KME group than in the CON group in all periods of the rest ($p<0.001$), immediately after exercise (IL-6; $p<0.01$, TNF- α; $p<0.001$), and after 30 min of recovery ($p<0.01$). **Conclusion**: Therefore, mistletoe extract intake can reduce the serum inflammatory cytokine levels (which are otherwise increased due to high-strength exercise) among active individuals, indicating improved anti-inflammatory activity.

2203 Board #7 May 30 6:00 PM - 7:00 PM

Specific Dietary Practices In Female Athletes And Their Association With Disordered Eating

Celina Francesca de Borja, Lauren M. McCall, Bryan Holtzman, Laura Moretti, Nicole Farnsworth, Kathryn E. Ackerman, FACSM. *Boston Children's Hospital, Boston, MA.*

(No relevant relationships reported)

PURPOSE: Health and weight management benefits may influence athletes' decisions regarding specific dietary practices. Eating disorders/disordered eating (ED/DE) are highly prevalent in the athletic population. The purpose of this study was to determine if following specific diets correlated with a greater likelihood of responding positively to ED/DE screening tools compared to not adhering to a diet. **METHODS:** 1000 female athletes (15-30 yrs) were asked to complete a comprehensive health and wellness survey. Athletes were asked to specify their diet and completed 3 ED/DE screening tools: the Brief Eating Disorder in Athletes Questionnaire, the Eating Disorder Screen for Primary Care, and self-reported current or past history of ED/DE. We hypothesized that athletes adhering to specific diets were more likely to score positively on ED/DE screening tools than those not following a diet. The most common diets were included in the analyses: vegan, vegetarian, pescatarian, gluten free, low carbohydrate, low dairy, and ≥2 diets. Athletes following diets for health issues (e.g. Celiac disease) were excluded. Descriptive statistics were calculated for all study measures and Chi-square testing was performed to assess relationships between athletes' dietary practices and their responses to ED/DE screening tools. **RESULTS:**234 of 1000 female athletes reported adherence to specific diets; 766 reported no diet adherence. 69 of the 234 athletes were excluded due to medically-related dietary practices or vague dietary descriptions. 133 athletes reported following 1 of the diets and 32 athletes reported following ≥2 diets. Of the diet-adherent athletes, 67.9% responded positively to ≥1 of the 3 ED/DE screening tools. Athletes practicing vegetarian, vegan, low carbohydrate, low dairy, or ≥2 diets were more likely to respond positively to ≥1 ED/DE screening tool vs. athletes without dietary restrictions (70.0%, 77.8%, 79.5%, 60.0%, and 65.6%, respectively vs. 41.8%; p≤0.048). **CONCLUSION:** Specific diet adherence in female athletes is associated with greater likelihood of positive screening for ED/DE using survey self-report. Health practitioners should consider further ED/DE questioning of athletes reporting specific diet adherence in order to enhance nutritional knowledge and help treat and prevent ED/DE.

2204 Board #8 May 30 6:00 PM - 7:00 PM

The Impact of Clinical Factors in Physician and ATC Decision Making for Concussion Return to Play: Insight froma Policy Capturing Study

Darwin McKnight, Vicki Nelson, Franklin Sease, FACSM, Rg Gilliland. *Greenville Health System, Greenville, SC.*

(No relevant relationships reported)

PURPOSE: To scrutinize the role of several clinical factors in physician and clinical athletic trainer (ATC) return-to-play (RTP) decision making in high school athletes who sustained a concussion.
METHODS: Sports Medicine physicians and ATCs completed a policy capturing survey of 50 clinical scenarios and rated how likely they were to clear the athlete for RTP. Nine factors were randomly varied within the scenarios: age, gender, sport, prior concussion, initial symptom score, symptom duration, and ImPACT performance. Participants then ranked how important each variable was in their decision making process.
RESULTS: 16 physicians (87.5% CAQSM, 12.5% Fellows, mean 9.2 concussions managed per month) and 29 ATCs (mean 4.8 concussions managed per month) participated. ImPACT testing was the most significant contributor in RTP decisions. Physicians and ATCs weighed ImPACT changed from baseline (β 0.42±0.23 and 1.28±1.18 respectfully) and ImPACT compared to normative values (0.39±0.24 and 1.38±0.90 respectfully) most heavily. Respondents self-ranked prior concussion and age as most influential in their RTP decision making. There was no correlation between participants self-ranking of importance and the observed contribution of a variable to decision making.
CONCLUSIONS: Respondents displayed poor insight to the role of various clinical factors in their management of concussion RTP. ImPACT testing has a greater influence on RTP decisions than physicians and ATCs realize. Despite having low self-ranked importance, variables related to ImPACT results were among the most influential. Self-ranking importance of clinical variables is similar between physicians and ATCs; however, symptom duration is less important to ATCs compared to physicians. Although age was considered important in self-ranking it was not a significant contributor to RTP decision making.

2205 Board #9 May 30 6:00 PM - 7:00 PM

Spine Injuries and Concussions among Figure Skaters

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(No relevant relationships reported)

PURPOSE: To determine the prevalence and mechanism of spine injuries and concussions among a sample population of figure skaters. To assess for potential risk factors for these injuries.
METHODS: This is a cross-sectional analysis of spine injuries and concussions reported by figure skaters. Data was obtained through an anonymous, confidential online questionnaire distributed to members of participating figure skating clubs. The main outcomes included diagnoses, mechanism and source of medical care. Simple descriptive statistics were used; Fisher's exact test was used to assess for statistical differences in categorical variables between groups. SPSS was used for all analyses.
RESULTS: Thus far, 88 participants have completed questionnaires (recruitment ongoing). The mean age of participants is 25.2 years (SD 17.1). Most (79%) respondents are female. Most (85%) practice figure skating year-round; 85% participate in competitions. Some skaters participate in more than one discipline including singles(n=68), pairs(n=3), ice dance(n=21), synchronized skating(n=29), theatre on ice(n=17). More than a quarter (27%; n=24) of participants reported spine injuries/back pain. The most common diagnosis was muscular back pain. Treatment was primarily guided by primary care(n=10), sports medicine(n=13), physical therapists(n=14) and athletic trainers(n=10). Almost half of those who reported back pain did not present to a health care provider (HCP) (45%; n/N=11/24). All injuries occurred in practice. More than a quarter of participants (27%; n=24) sustained at least one concussion; 7 sustained two concussions. Several (42%; n/N=10/24) skaters did not present to a HCP for evaluation of their first concussion. All concussions occurred during practice and most (92%; n/N=22/24) were during on-ice activities. The most common mechanism of injury was a fall (62%; n/N=15/24). The sex of the skater was not associated with either mechanism of spine injury or history of concussion.
CONCLUSIONS: Nearly a third of skaters sustained a concussion or spine injury, yet nearly half did not report their injuries to a HCP. Our findings warrant further investigation into the reasons for such a low reporting rate among figure skaters and the potential effect on injury outcomes.

2206 Board #10 May 30 6:00 PM - 7:00 PM

Lisa S. Krivickas Clinician/Scholar Travel Award: Characterizing the Prevalence of Cam-Type Hip Impingement in Women's Professional Ice Hockey Players

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(No relevant relationships reported)

Purpose Recent studies have demonstrated an increased prevalence of femoroacetabular impingement (FAI) in elite men's ice hockey players, yet little is known about the hips of players in the National Women's Hockey League (NWHL). The primary purpose of this study was to determine the prevalence of radiographic cam-type FAI in women's professional ice hockey players. The secondary purpose was to analyze the relationship between the presence of cam deformity and hip ROM; clinical impingement signs; and age of menarche.
Methods Clinical, radiographic and demographic data were collected for NWHL players during pre-participation physicals. Alpha angles were measured on 45° Dunn radiographs, with alpha angles >55° defined as cam-positive. Spearman correlations were performed to analyze the relationship between alpha angle and both ROM measurements and menarchal age. Players were grouped into those with and without cam lesions and group differences were assessed using the student's t-test.
Results Twenty-seven athletes were included. Nineteen (70%) had alpha angles >55°; 14 (52%) had bilateral cam deformity. Average menarchal age was 13.9 ±1.5 years. There was a significant association between age of menarche and alpha angle (right hips, p=0.01; left hips, p=0.04). There was no significant association between alpha angle and either hip ROM or clinical impingement signs.
Conclusion This study suggests that elite female ice hockey players have a higher prevalence of cam-type morphology than the general population. The positive association between alpha angle and age of menarche lends additional support to the etiological hypothesis of the cam lesion resulting from activity-related stress at the proximal femoral physis; players with earlier menarche (and therefore earlier physeal closure) seem to be less vulnerable to the development of cam deformity of the proximal femur. Thus, professional women's ice hockey players have a high risk of developing cam-type morphology of the proximal femur, although each player's age of menarche may mediate her individual risk for cam lesion development.