

Patterns of healthy lifestyle behaviours in older adults: Findings from the Chilean National Health Survey 2009–2010

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ABSTRACT

The purpose of this study was to investigate healthy lifestyle behaviours across age categories in the older population in Chile. Data from 1390 older adults (≥ 60 years), in the 2009–2010 Chilean National Health Survey were analyzed. We derived the following age categories: 60–65, 66–70, 71–75, 76–80 and > 80 years. The associations between age and compliance with healthy lifestyle behaviours (smoking, sitting time, physical activity, sleep duration and intake of salt, alcohol, fruit and vegetables) were investigated using logistic regression. The probability of meeting the guidelines for alcohol intake (OR trend: 1.35 [95% CI: 1.11; 1.64], $p = 0.001$) and smoking (OR trend: 1.23 [95% CI: 1.13; 1.33], $p < 0.0001$) increased with age, whereas spending < 4 h per day sitting time or engaging in at least 150 min of physical activity per week or sleep on average between 7 and 9 h per day were less likely to be met with increasing age (OR trend: 0.77 [95% CI: 0.71; 0.83], $p < 0.000$; OR trend: 0.73 [95% CI: 0.67; 0.79], $p < 0.0001$, and OR trend: 0.89 [95% CI: 0.82; 0.96], $p = 0.002$, respectively). No significant trend across age categories was observed for fruit and vegetables, and salt intake. The probability of meeting at least 3 out of 7 healthy lifestyle behaviours across the age categories was also lower in older age categories compared to those aged 60 to 65 years. Overall, in older adults the probability of having the healthy lifestyle behaviours of physical activity, sitting time and sleeping behaviours was low but not for smoking or alcohol consumption. With an increasingly ageing population, these findings could inform

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stakeholders on which lifestyle behaviours could be targeted in the older adults and therefore which interventions should take place to promote healthy ageing.

1. Introduction

The major demographic shift towards a higher proportion of older adults within the population of many countries, and the health and social care costs associated with ageing, makes ageing-research a public health priority (WHO, 2017a). The World Health Organization has projected that by 2050 the population aged 60 years and older will increase to 2 billion individuals, which is equivalent to one-fifth of the population worldwide (WHO, 2017a). However, low- and middle-income countries will experience the greatest increase in the number of older adults.

Chile is one of the middle-income countries that are expected to experience an important shift towards population ageing. In the last 25 years, the proportion of older population in Chile has increased from 6.6% in 1992 to 11.4% in 2017 (WHO, 2017a), however by the middle of the century the proportion of older adults in Chile will be similar to Japan, a country with one of the largest proportions of older population in the world (WHO, 2017a). Although Chile has already developed different actions and public health policies to improve the condition of, and quality of life in, older adults such as an active ageing programme (Guevara, 2016), little is known with regard to how the Chilean population is ageing and what the main social and economic consequences of this population transition will be. Moreover, there is a lack of evidence regarding the adherence to healthy lifestyle behaviours in the Chilean older population.

Since lifestyle factors play a key role in promoting and maintaining health and wellbeing as we age (Sodergren et al., 2014; WHO, 2015a), increasing our understanding of how adherence to healthy lifestyle behaviours changes across different age categories during older age could be important for informing stakeholders on which lifestyle factors should be promoted through public health policies and intervention programmes. Therefore, the aim of this study was to investigate healthy lifestyle behaviours across age categories in the older population of Chile.

2. Materials and methods

2.1. Study design

The Chilean National Health Survey (CNHS) is a large, nationally representative population-based study of biological and lifestyle risk factors, dietary status and health, conducted every six years in Chile (MINSAL, 2009). Complex random stratified sampling was used to recruit 5293 individuals as a nationally representative sample based on statistics from the 2002 Chilean National Census, which included strata from administrative regions (county), sex and urban/rural locations, as described in detail elsewhere (MINSAL, 2009). The CNHS 2009–2010 response rate from the eligible population was 85% (5293 out of 6100 individuals accepted the invitation to take part in the study). However, a subset of participants aged ≥ 60 years from the 2009–2010 Chilean National Health Survey (CNHS) was included in this cross-sectional study ($n = 1390$ participants).

The CNHS was funded by the Chilean Ministry of Health and led by the Department of Public Health, The Pontificia Universidad Católica de Chile. The CNHS was approved by the Ethics Research Committee of the Faculty of Medicine at the Pontificia Universidad Católica de Chile (Application reference number 09-113). All participants who participated in the CNHS provided written informed consent.

2.2. Data sources

Data collection was via face-to-face interviews by trained interviewers, using a validated questionnaire. The preferred respondent for the household socio-demographics was the reported head of household, followed by their spouse or an adult household member. For questions on health status and health outcomes, all household members of 15 years of age or older were asked to complete the questionnaire individually.

2.3. Socio-demographic characteristics

Socio-demographic data were collected for all participants using nationally validated questionnaires, and included age, sex, education level (primary, secondary or beyond secondary) and monthly household income ($\leq$ US \$480 (lowest), US \$480–1250 (middle) and $>$ US \$1250 (highest)). Following the World Health Organization recommendations, older adults were considered all participants aged ≥ 60 years. For the purposes of this study, individuals were then grouped into five age categories (60–65, 66–70, 71–75, 76–80 and $>$ 80 years).

2.4. Anthropometric measures

Height was measured to the nearest 0.1 cm using a portable stadiometer and weight was measured to the nearest 0.1 kg using a digital scale (Tanita HD313) with participants removing their shoes and wearing light clothing. Body mass index (BMI) was calculated as weight/height^2 and classified using the World Health Organization criteria for older adults (underweight: $< 22.9 \text{ kg/m}^2$; normal: 23.0 to 27.9 kg/m^2 ; overweight: 28.0 to 31.9 kg/m^2 ; obese: $\geq 32 \text{ kg/m}^2$) (PAHO, 2003). Waist and hip circumference (WC) was measured using standardised protocols. Central obesity was defined as waist circumference $> 88 \text{ cm}$ for women and $> 102 \text{ cm}$ for men (MINSAL, 2010). Waist to hip ratio (WHR) was derived and the WHO cut-off point was used to define obesity (WHR > 0.90 for men and > 0.85 for women) (WHO, 2008).

2.5. Lifestyle behaviours

Physical activity level, including moderate and vigorous intensities and transport-related physical activity, were measured using the Global Physical Activity Questionnaire version 2 (GPAQ v2) (WHO, 2009). Physical activity was categorised into: inactive individuals ($< 600 \text{ MET/min/week}$) and active individuals ($\geq 600 \text{ MET/min/week}$) (IPAQ, 2004). Sedentary behaviour was derived using the following question: ‘How much time do you usually spend sitting or reclining on a typical day?’ (WHO, 2009). Participants were then classified as having low or high sitting behaviour using the population median as the cut-off point (4 h/day) (Celis-Morales et al., 2015b). The GPAQ has been previously validated in the Chilean population, showing a moderate agreement with objectively measured physical activity data (Aguilar-Farias and Leppe Zamora, 2016).

Sleep duration was collected through questionnaires where participants were asked ‘in a normal day how many hours do you sleep?’ This variable was then categorised into normal sleepers (sleep duration between 7 and 9 h/day) and as abnormal sleepers (including short sleepers $< 7 \text{ h/day}$ and longer sleepers $> 9 \text{ h/day}$) as suggested in previous observational studies (Celis-Morales et al., 2017; Gallicchio and Kalesan, 2009).

Smoking behaviour was collected using a self-reported questionnaire where participants classified themselves as current smokers, ex-smokers or non-smokers (PAHO, 2012). Daily salt intake was determined through sodium levels in a urine sample collected by trained nurses using a standardised protocol. To calculate the 24-hour excreted sodium from urine, a conversion formula by Tanaka et al., which has been previously validated (Tanaka et al., 2002), was used. Alcohol consumption was self-reported and collected using the “Alcohol Use Disorders Identification Test” (AUDIT) questionnaire developed by the World Health Organization (Saunders et al., 1993) and adapted for use in Chile (Alvarado et al., 2009). The “units of alcohol” indicator represented the number of self-reported 200 ml glasses of alcohol consumed. This was a standard measure adapted from one of the 10 items of the AUDIT questionnaire and an AUDIT score > 8 was used as cut-off point for hazardous consumption (Saunders et al., 1993). Dietary intake of fruit and vegetables (F&V) was self-reported and participants were asked “In a typical/ordinary week, how many days do you eat fruit?” and “In a typical/ordinary week, how many days do you eat vegetables?” This was then converted to grams and ≥ 400 g/day was used as

cut-off point for healthy intake (MINSAL, 2010).

2.6. Healthy lifestyle index

Based on the data collected by the CNHS, seven lifestyle behaviours were used to derive a healthy lifestyle index score including the following cut-off points: a) consumption of ≥ 5 portions of fruit and vegetables per day; b) salt intake < 8 g/day (WHO, 2015b); c) alcohol intake < 8 AUDIT score points (Santis et al., 2009; Saunders et al., 1993); d) self-reported sleeping time between 7 and 9 h/day; e) smoking (being a non-smoker); f) physical activity > 600 MET/min/week; and g) sedentary behaviour < 4 h per day. Individuals who meet these healthy recommendations were given 1 point for each recommendation met whereas those who did not follow them were assigned 0 points. The maximum possible score was 7 points which represented a healthy lifestyle behaviour score. In addition, and only for the purpose of this study, individuals were classified as having a healthy lifestyle if they scored ≥ 4 points and an unhealthy lifestyle if they score ≤ 3 points.

Table 1
Cohort characteristics by age categories in older adults.

	Age categories				
	60–65	66–70	71–75	76–80	> 80
Socio-demographic					
Total, n	441	318	235	203	193
Age (years), mean (SD)	62.3 (1.7)	67.8 (1.4)	72.9 (1.5)	77.9 (1.4)	85.0 (4.1)
Sex, (female n, %)	263 (59.6)	192 (60.4)	131 (55.7)	125 (61.6)	135 (70.0)
Education level (n, %)					
Up to primary (< 8 years)	225 (51.7)	187 (58.8)	155 (67.9)	152 (75.6)	144 (76.2)
Up to secondary (< 12 years)	165 (37.9)	104 (32.7)	59 (25.9)	44 (21.9)	38 (20.1)
Beyond secondary	45 (10.3)	27 (8.5)	14 (6.1)	5 (2.5)	7 (3.7)
Income (n, %)					
Low	264 (62.3)	208 (67.5)	164 (75.6)	154 (78.6)	152 (82.2)
Middle	132 (31.1)	74 (24.0)	41 (18.9)	41 (20.9)	28 (15.1)
High	28 (6.6)	26 (8.4)	12 (5.5)	1 (0.5)	5 (2.7)
Anthropometric					
Body weight (kg), mean (SD)	72.1 (2.9)	71.8 (14.5)	70.9 (14.0)	68.8 (16.1)	61.7 (12.3)
Height (m), mean (SD)	1.57 (0.1)	1.56 (0.1)	1.58 (0.1)	1.54 (0.1)	1.53 (0.1)
BMI (kg/m ²), mean (SD)	29.1 (5.6)	29.1 (5.3)	28.6 (5.1)	28.6 (5.6)	26.2 (4.6)
BMI categories (n, %)^a					
Underweight (< 22.9 kg/m ²)	149 (8.5)	102 (9.9)	80 (11.3)	59 (12.8)	56 (22.4)
Normal (23.0–27.9 kg/m ²)	121 (34.3)	80 (32.7)	63 (34.6)	47 (30.1)	40 (29.2)
Overweight (28.0–31.9 kg/m ²)	128 (27.8)	99 (25.6)	62 (27.3)	65 (24.0)	53 (20.8)
Obese (≥ 32.0 kg/m ²)	37 (29.4)	31 (31.7)	26 (26.8)	25 (33.1)	43 (27.6)
WC (cm), mean (SD)	96.1 (11.3)	95.9 (12.8)	95.6 (13.1)	96.9 (13.6)	91.5 (11.2)
Central obesity, n (%)	236 (53.5)	168 (52.8)	128 (54.5)	118 (58.1)	92 (47.7)
WHR, mean (SD)	0.96 (0.07)	0.95 (0.09)	0.96 (0.08)	0.96 (0.08)	0.94 (0.08)
Obesity based on WHR, n (%)	424 (96.2)	291 (91.5)	225 (95.7)	192 (94.5)	177 (91.7)
Lifestyle					
Total physical activity (MET/h/week), mean (SD)	93.2 (125.9)	92.7 (118.8)	59.9 (84.7)	54.7 (88.2)	30.9 (65.6)
Transport physical activity (min/day), mean (SD)	34.1 (55.8)	43.9 (71.9)	36.2 (68.4)	35.8 (85.4)	30.9 (65.6)
Moderate PA (min/day), mean (SD)	86.7 (132.1)	80.1 (120.8)	71.4 (119.3)	52.9 (97.7)	31.4 (76.1)
Vigorous PA (min/day), mean (SD)	39.5 (105.2)	37.4 (98.1)	10.4 (47.4)	14.2 (52.1)	7.6 (34.7)
Physical inactivity, n (%)	131 (30.5)	83 (26.4)	86 (36.9)	93 (47.2)	114 (60.9)
Sitting time (h/day), mean (SD)	3.2 (2.6)	3.3 (2.4)	3.3 (2.4)	3.8 (2.7)	4.8 (3.1)
F&V intake (g/day), mean (SD)	229.9 (142.9)	230.8 (150.6)	230.9 (147.3)	223.8 (141.1)	208.9 (124.4)
Salt intake (g/day), mean (SD)	9.9 (2.4)	9.7 (2.3)	10.6 (5.6)	10.6 (4.1)	10.2 (4.1)
Alcohol intake (g/day), mean (SD)	42.3 (61.8)	46.5 (2.3)	32.4 (32.4)	49.7 (79.5)	25.8 (20.8)
Smoking status, n (%)					
Never	197 (45.2)	143 (45.1)	138 (60.3)	124 (62.0)	118 (61.5)
Ex-smoker	128 (29.4)	115 (36.3)	70 (30.6)	65 (32.5)	63 (32.8)
Current smoker	111 (25.4)	59 (18.6)	21 (9.1)	11 (5.5)	11 (5.7)

Data presented as mean and SD for continuous variables or n and % for categorical variables. Central obesity was defined using waist circumference (> 102 for men and > 88 cm for women) and WHR-obesity was defined using waist to hip ratio (> 0.90 for men and > 0.85 for women).

BMI: body mass index; N: numbers; SD: standard deviation; PA: physical activity; g: grams; min: minutes; h: hours; kg: kilograms; m: metres; WC: waist circumference; whr: waist to hip ratio.

^a Older adult BMI categories.

2.7. Statistical analyses

Statistical analyses were conducted in STATA 14 (StataCorp; College Station, TX) using survey-weighted values. Descriptive characteristics are presented as means and standard deviations (SD) for continuous variables and as percentages for categorical variables by age categories (60–65, 66–70, 71–75, 76–80 and > 80 years).

Logistic regression analysis was performed to investigate the odds of meeting each of the healthy lifestyle recommendations by age categories and results were presented as odds ratios (OR) and its respective 95% confidence intervals (95%CI). Those individuals aged 60 to 65 years were used as a reference group. Individuals who met the lifestyle recommendations (consumption of five portions of fruit and

vegetables, salt intake lower < 8 g/day, alcohol intake with an AUDIT score < 8 points, average sleeping time between 7 and 9 h/day, non-smokers, physically active (> 600 MET/min/week) and sitting time < 4 h/day) were coded as 1 whereas those who did not meet these recommendations were coded as 0. In this context, an OR < 1 would represent a lower probability of meeting the healthy lifestyle recommendations and an OR > 1 would represent a higher probability of meeting the recommendation. Odds ratios for trend were estimated by coding the age categories in an ordinal manner (i.e. 0, 1, 2, 3 and 4), therefore the OR for trend represents the odds of meeting the healthy lifestyle behaviour by one age category increase. All analyses were adjusted for sex, residence zone (urban, rural), education, gross income and BMI. A p-value < 0.05 was considered statistically significant in

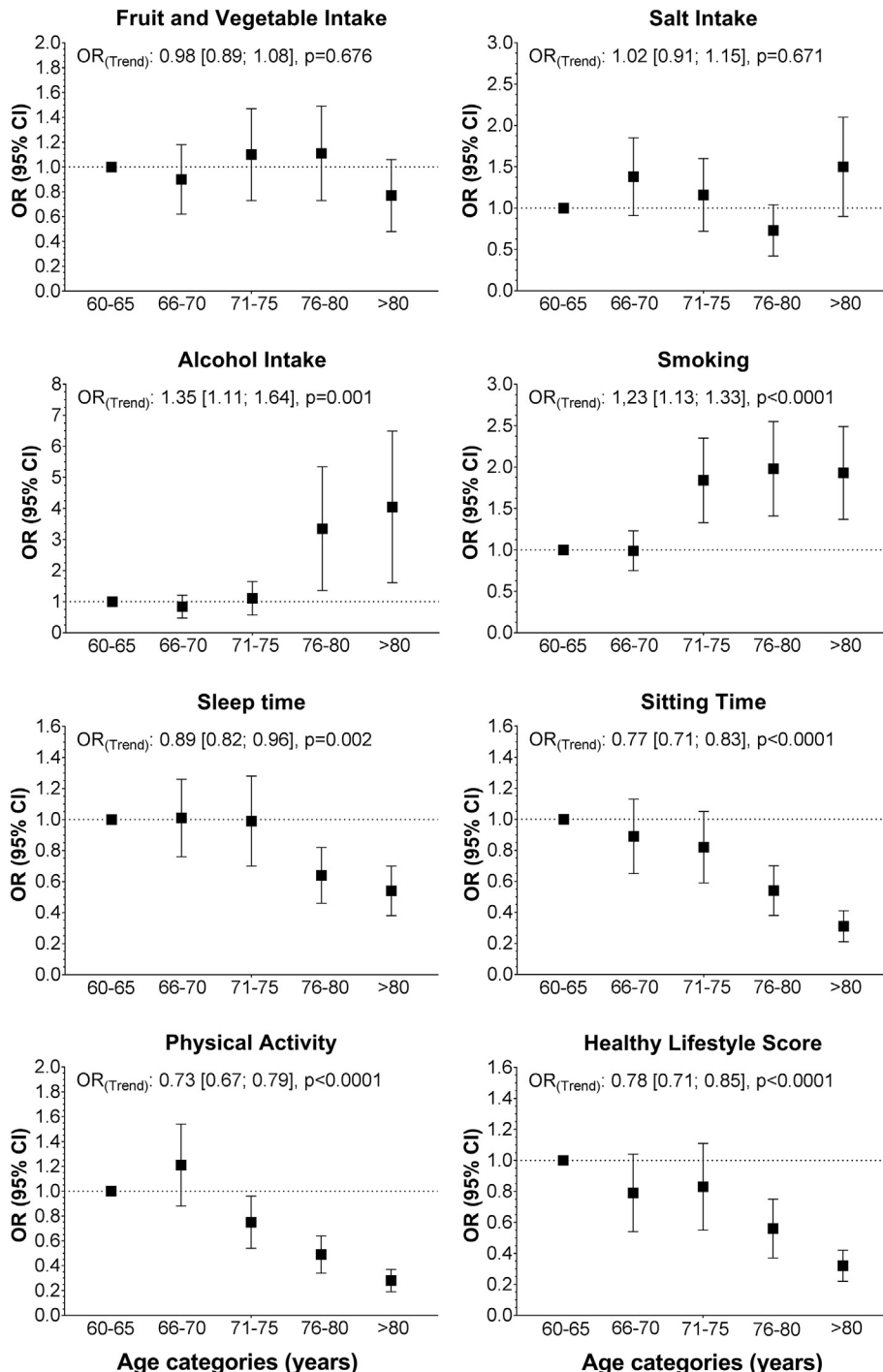


Fig. 1. Association between healthy lifestyle recommendations and age categories in older adults. Data is presented as odds ratio and their respective 95% CI (OR (95% CI)). Trends for OR were estimated by fitting age as an ordinal variable in our models, therefore the OR value represent the odds equivalent to moving one category up in age. For age categories, those participants with ages between 60 and 65 years were used as reference group. For lifestyle-related behaviours, meeting the recommendation was used as reference group. The cut-off points used for each lifestyle behaviour were as follows: fruit and vegetable intake (consumption of ≥ 5 portions of fruit and vegetables per day); b) salt intake (< 8 g/day), alcohol intake (< 8 AUDIT score points), Self-reported sleeping time (between 7 and 9 h/day), smoking (being a non-smoker), physical activity (> 600 MET/min/week) and sitting time (< 4 h/day). For the healthy lifestyle score, those with a score ≥ 4 points (healthy individuals) were used as a reference group. All analyses were adjusted for sex, education, gross income, residence zone (urban, rural), education, gross income and BMI.

all analyses.

3. Results

The main participant's characteristics by age categories are summarised in Table 1. Briefly, a higher proportion of women and individuals with lower education level and monthly household income were predominant characteristics among older age groups. Body weight, height, BMI, WC and WHR showed a trend to be lower with increasing age. Similarly, the proportion of underweight individuals increases in the older age categories compared to the youngest one. Physical activity related behaviour shows a decreasing trend with increasing age, whereas sitting time was higher in older ages compared to the younger categories. The prevalence of physical inactivity was 30.5% in the youngest age category but increased to 60.9% in those individuals aged 80 years and above. The proportion of individuals who reported never smoking was higher in older age compared to the youngest age categories. There were no clear differences for alcohol, salt, or fruit and vegetable, consumption across age categories (Table 1).

The probability of meeting healthy lifestyle recommendations for alcohol consumption (AUDIT score < 8 points) and being a non-smoker increased with increasing age as shown in Fig. 1. The odds of meeting these guidelines increase by 35% (OR trend: 1.35 [95% CI: 1.11; 1.64], $p = 0.001$) and 23% (OR trend: 1.23 [95% CI: 1.13; 1.33], $p < 0.0001$) per 5-year age increment, respectively. However, for normal sleep duration (7–9 h), there was an 11% decrease in the probability of meeting these guidelines with increasing age (OR trend: 0.89 [95% CI: 0.82; 0.96], $p = 0.002$). Similarly, the odds of being physically active decreased by 27% with increasing age (OR trend: 0.73 [95% CI: 0.67; 0.79], $p < 0.0001$), whereas spending < 4 h a day sitting was 23% less likely in older ages compared to the reference group (OR trend: 0.77 [95% CI: 0.71; 0.83], $p < 0.0001$). Overall, for every 5 year increment in age, individuals were 22% less likely to achieve the healthy behaviour guidelines (meeting 4 or more healthy behaviours) (OR trend: 0.78 [95% CI: 0.71; 0.85], $p < 0.0001$).

4. Discussion

4.1. Main findings of this study

The main findings of this study were that within the Chilean population, older adults were less likely to meet the healthy lifestyle guidelines, especially those related to physical activity, time spent sitting and sleep duration. However, older adults were more likely to meet alcohol intake recommendations and be non-smokers compared to those aged between 60 and 65 years. With an increasing proportion of older adults in Chile, clear policies are needed to promote healthy lifestyle behaviours across the lifespan especially in older adults, who will be more likely to become ill (Freitas et al., 2016), and therefore increase the personal burden and the social and health care expenses of the National Health System (WHO, 2017a). These findings could also inform stakeholders on which lifestyle behaviours should be targeted through public health policies or early interventions in order to promote healthy ageing in the older population.

The older Chilean population are characterised by being represented by a high proportion of individuals with low income, low levels of education (up to primary), lack of physical activity and too much time spent sitting, which as shown previously may lead to social isolation, disability, fragility, depression, cognitive impairment, and therefore a reduced well-being (WHO, 2015a; WHO, 2017b). These characteristics are to some extent similar to those reported for other older European and Latin-American populations (Koh et al., 2014; MSSSI, 2012; Wong et al., 2017). However, this study is one of the first ones to investigate how the adherence to healthy lifestyle behaviours varies across the Chilean older population. Our findings are comparable

to those results reported in other Latin-American countries with regard to changes in smoking (MSSSI, 2012), physical activity (MSSSI, 2012), alcohol (Carrasco et al., 2010), salt, fruit and vegetable intake (Machado et al., 2016; Sánchez-Ruiz et al., 2014) in the older population. Moreover, studies conducted in high income countries have reported that maintaining healthy behaviours in older adults such as sufficient levels of physical activity (Daskalopoulou et al., 2017), low levels of sitting time (Dogra and Stathokostas, 2012; Viña et al., 2016), and adequate levels dietary intake (Kieft-de Jong et al., 2014) could predict healthy ageing.

The findings of this study contribute to answering a major gap in our current knowledge with regard to adherence to lifestyle behaviours in the Chilean older population. Moreover, it could help with informing future interventions or public health policies with regards to identify healthy lifestyle behaviours that are more likely to be above or below current guidelines.

4.2. Strengths and limitations of the study

Although the CNHS 2009–2010 is a nationally representative sample of the adult Chilean population, this study used a subset of the original cohort including only participants aged > 60 years. This could reduce the generalisability of our findings. However, the inclusion of a wide range of health, demographic and behavioural variables in the dataset allowed for a comprehensive adjustment for the effect of confounding factors. Nevertheless, the lifestyle exposures such as alcohol, fruit and vegetable intake and physical activity were self-reported which have previously been shown to be prone to self-reported bias (Celis-Morales et al., 2015a; Celis-Morales et al., 2012). This could obscure the true association between lifestyle factors and ageing, and therefore future studies using objective measures for physical activity and better methods for dietary intake assessment are required. Coding our outcomes as binary did also reduce our ability to explore a dose-response association between the exposure and the outcome. Moreover, the derived unweighted lifestyle score assumes an equal contribution of each of the lifestyle factors, which may not be true. Therefore future studies should explore whether the trends observed in this study are replicated when a weighted-lifestyle score is used as the exposure. It is also relevant to consider the potential survival bias effect. Smokers and individuals with high alcohol intake across the lifecourse may be less likely to have survived to the oldest age categories, which could influence our findings. Similarly, due to the cross-sectional nature of the study, differences by age observed in this study could also be explained by cohort effects. Finally, this study does not permit any causal inference from these results due to its cross-sectional nature.

In conclusion, lack of physical activity, too much time spent sitting and abnormal sleep behaviour are the main factors associated with ageing in the Chilean population. In this context, and considering the fast demographic changes of ageing due to the increase in life expectancy in Chile, identifying patterns of lifestyle behaviours that are likely to change as we age could inform stakeholders on the design of policies and interventions to promote healthy ageing through maintaining healthy lifestyle behaviours across the lifespan but especially in older adults.

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Declarations of interest

None.

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