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**DEVELOP OF A NEURAL NETWORK TO EVALUATE THE
CARDIOVASCULAR RISK USING BODY COMPOSITION DATA**

INTRODUCTION

The cardiovascular disease (CVD) is the main world cause of morbidity and mortality, continually, are searching early diagnostic strategies with enough sensibility and specificity to be used massively in the population.

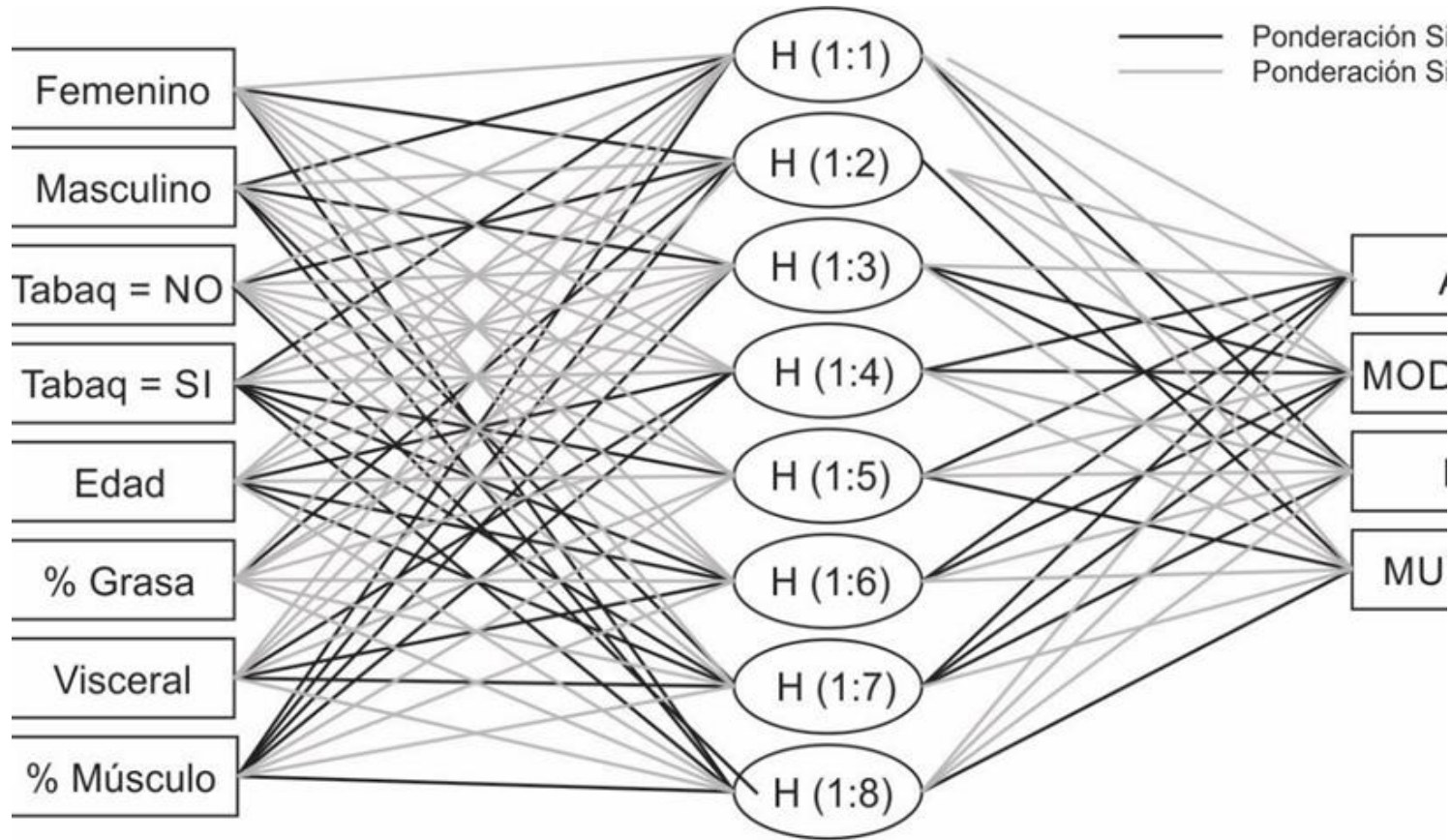
OBJECTIVE

To develop an artificial neural network (ANN), to prediction the cardiovascular risk using anthropometric variables, age, and habits.

METHODS

Was analyzed 256 subjects, aged 16 to 60 years old, the ANN was feed with the variables: age, gender, smoking, fat percentage, visceral fat and muscular percentage, the ANN training was made with 183 subjects (69%), the output variable was the CVD probability to ten years prognosticated using ASSIGN scale, the classification was high risk > 10%, moderate risk 5 – 10%, low risk 1 – 4,9%, very low risk < 1%.





The model show significant differences in the blood chemical variables and the body composition between groups $p < 0.0001$.

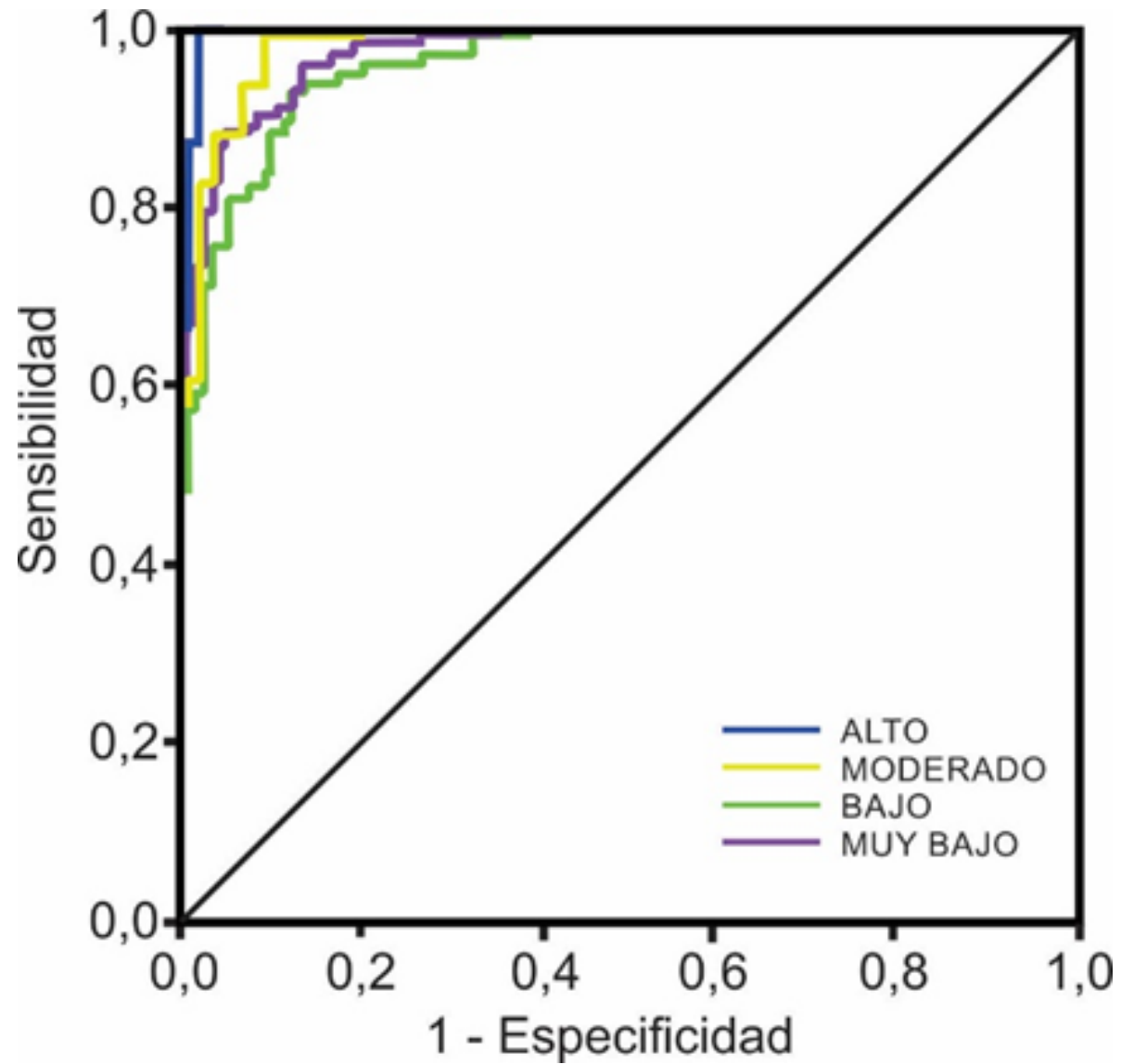
The area under the curve for the prediction was: high risk = 0.999, moderate risk = 0.967, low risk = 0.986, very low risk = 0.981.

RESULTS

The sensitivity was between 0.750 y 1.000 and specificity was between 0.833 and 1.000

RESULTS

Curva ROC (Receiver Operating Characteristic) de la evaluación del modelo



RESULTS

Características generales de la población, clasificados por el nivel de riesgo cardiovascular. Datos expresados en promedio \pm Desviación Estándar.

	Alto > 10%	Moderado 5 – 10%	Bajo 1 – 4,9%	Muy bajo < 1%	<i>p</i>
	Mujeres = 1 Hombres = 7	Mujeres = 3 Hombres = 15	Mujeres = 10 Hombres = 83	Mujeres = 98 Hombres = 48	
Edad (años)	60,0 \pm (2,6)	48,7 \pm (5,4)	28,7 \pm (9,0)	19,0 \pm (3,1)	<0,001 ^b
PAS (mmHg)	108,8 \pm (7,9)	111,0 \pm (13,9)	105,9 \pm (11,0)	98,0 \pm (8,8)	<0,001 ^b
PAD (mmHg)	67,5 \pm (11,6)	67,0 \pm (11,4)	69,3 \pm (12,0)	64,2 \pm (7,8)	0,001 ^b
Glucosa (mg/dl)	82,9 \pm (11,3)	82,3 \pm (7,4)	87,7 \pm (11,4)	93,8 \pm (8,7)	<0,001 ^b
C-total (mg/dl)	208,5 \pm (37,2)	246,1 \pm (42,6)	190,6 \pm (29,7)	156,1 \pm (30,7)	<0,001 ^b
Trig (mg/dl)	248,1 \pm (146,6)	218,3 \pm (102,4)	142,5 \pm (50,4)	124,3 \pm (29,3)	<0,001 ^b
C-HDL (mg/dl)	48,6 \pm (10,9)	51,3 \pm (8,7)	45,6 \pm (10,5)	43,3 \pm (9,4)	0,005 ^b
C-LDL (mg/dl)	110,3 \pm (35,6)	151,1 \pm (45,7)	118,1 \pm (25,3)	92,7 \pm (28,1)	<0,001 ^b
Tabaquismo (%)	25,0%	33,3%	33,3%	16,4%	0,019 ^a
ASSIGN (%)	11,3 \pm (1,2)	7,1 \pm (1,3)	2,0 \pm (1,0)	0,5 \pm (0,2)	<0,001 ^b
Grasa (%)	28,9 \pm (9,0)	29,2 \pm (7,4)	25,4 \pm (7,4)	29,5 \pm (10,4)	0,011 ^a
Visceral (%)	12,9 \pm (6,2)	10,9 \pm (2,9)	7,3 \pm (3,0)	4,1 \pm (1,6)	<0,001 ^b
Músculo (%)	31,4 \pm (4,5)	32,2 \pm (4,1)	36,1 \pm (5,1)	30,7 \pm (8,1)	<0,001 ^b

^a = $p < 0,05$, ^b = $p < 0,01$, PAS = Presión Arterial Sistólica, PAD = Presión Arterial Diastólica, C-total = Colesterol Total, Trig = Triglicéridos, C-HDL = Colesterol HDL, C-LDL = Colesterol LDL.

RESULTS

Resultados de la Validación del modelo

	ALTO	MODERADO	BAJO	MUY BAJO
Sensibilidad	1,000	1,000	0,750	0,885
Especificidad	1,000	0,987	1,000	0,833
VPP	1,000	0,750	1,000	0,902
VPN	1,000	1,000	0,929	0,806
ABC-ROC	0,999	0,967	0,986	0,981

VPP = Valor Predictivo Positivo, VPN = Valor Predictivo Negativo,
ABC = Área bajo la curva de la curva ROC.

CONCLUSION

An ANN that uses like prediction variable the body composition has a high predictive value, besides it is a good tool for the cardiovascular risk estimation and can be used for the screening in different populations.