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## ORIGINAL RESEARCH

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## Nutritional status, cardiovascular health, VO<sub>2</sub> max and habits in university students: a comparison between two health promotion careers

*Estado nutricional, salud cardiovascular, VO<sub>2</sub> máx y hábitos de vida en estudiantes universitarios: comparación entre dos carreras promotoras de salud*

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### | Abstract |

**Introduction:** University students are at a moment of their life cycle that is key for the adoption of different lifestyles.

**Objective:** The purpose of this study was to determine and compare VO<sub>2</sub> max, fat mass percentage, biochemical profile, and alcohol and tobacco consumption in university students of two undergraduate programs.

**Materials and methods:** 53 first year students with an average age of 19.25 years were included in this study. 30 were enrolled in the in Physical Education Pedagogy program, and 23 in the Nutrition and Dietetics program offered by Universidad La Frontera, class of 2014. Assessment included weight, size, BMI, waist circumference, fat mass percentage, blood pressure, biochemical profile and VO<sub>2</sub> max.

**Results:** 32% of the students were overweight, 50.9% reported altered blood pressure, 28.3% had prehypertension, and 22.6% had high blood pressure. Furthermore, 50.9% had a fat mass level above normal, 18.8% were regular smokers, and 41.5% reported frequent alcohol use. Regarding VO<sub>2</sub> max, 48.9% were in the poor to fair range. The comparison by program showed significant differences in the variables height, VO<sub>2</sub> max (maximum aerobic capacity) and fat mass percentage ( $p < 0.05$ ).

**Conclusions:** Students are prone to develop chronic noncommunicable diseases, which is a worrying situation since they will become promoters of healthy lifestyles according to their career path.

**Keywords:** Obesity; Oxygen Consumption; Lifestyle; Hypertension (MeSH).

**Rivera-Torres I, Floody-Munita M, Delgado-Floody P, Schifferli-Castro I, Osorio-Poblete A, Martínez-Salazar C.** Nutritional status, cardiovascular health, VO<sub>2</sub> max and habits in university students: a comparison between two health promoter careers. Rev. Fac. Med. 2017;65(3):447-51. English. doi: <http://dx.doi.org/10.15446/revfacmed.v65n3.55185>.

### | Resumen |

**Introducción.** Los estudiantes universitarios se encuentran en una etapa del ciclo vital clave para la adopción de estilos de vida.

**Objetivo.** El propósito de este estudio fue determinar y comparar el VO<sub>2</sub> máx, el porcentaje de masa grasa, el perfil bioquímico y el consumo de alcohol y tabaco en estudiantes universitarios de dos carreras.

**Materiales y métodos.** Participaron en la investigación 53 estudiantes universitarios de primer año con un promedio de 19.25 años de edad. 30 eran de la carrera de Pedagogía en Educación Física y 23 de Nutrición y Dietética de la Universidad de La Frontera en el año 2014. Se evaluó peso, talla, índice de masa corporal, contorno cintura, porcentaje de masa grasa, presión arterial, perfil bioquímico y VO<sub>2</sub> máx.

**Resultados.** El 32% de los estudiantes presentó exceso de peso, 50.9% reportó alteración de la presión arterial, 28.3% tuvo prehipertensión y 22.6%, hipertensión arterial. A su vez, el 50.9% presentó un nivel sobre lo normal de masa grasa, el 18.8% manifestó hábito tabáquico y el 41.5% reconoció consumir alcohol con frecuencia. En relación al VO<sub>2</sub> máx, se observó que un 48.9% estaba ubicado en el rango de malo a regular. Respecto a la comparación por carreras, se encontraron diferencias significativas en las variables talla, VO<sub>2</sub> máx (capacidad aeróbica máxima) y porcentaje de masa grasa ( $p < 0.05$ ).

**Conclusiones.** Los estudiantes son propensos al desarrollo de enfermedades crónicas no transmisibles, lo que supone una situación preocupante, pues en el área profesional se transformarán en promotores de estilos de vida saludable.

**Palabras clave:** Obesidad; Consumo de oxígeno; Estilo de vida; Hipertensión (DeCS).

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## Introduction

Overweight and obesity affect a large percentage of adults worldwide, reducing life expectancy and posing a great economic burden for society. Between 2009 and 2010, the National Health Survey (ENS in Spanish) reported a high prevalence of overweight (64.5%), sedentary lifestyle (88.6%) and metabolic syndrome (35%) in the adult Chilean population (1). These high figures have also been obtained in young university students (2,3).

There is a clear relationship between lifestyles and risk factors (4), which are also associated with cardiovascular diseases (CVD). Currently, obesity is the leading cause of death in adults (5,6), thus generating a serious public health problem around the world (7). In Chile, the situation is similar due to the demographic and epidemiological transition of the last decades (8,9).

Physical inactivity is a risk factor (10) that can be observed in the alteration of muscles when metabolizing fats and glucose, resulting in modern chronic, metabolic and cardiovascular pathologies (11). In this sense,  $VO_2$  max measuring is recommended as an indicator of aerobic capacity, as it shows the real health status and allows to detect risk groups prone to suffer morbidity conditions, since a healthy person should have an acceptable aerobic capacity (12).

University students are at a point in their lives that is key for adopting different lifestyles, which they will share with their relatives, and in social and work environments (13). For this reason, in order to achieve successful prevention programs, several studies have suggested the importance of identifying risk factors in young adults (14-16).

The purpose of this study was to determine  $VO_2$  max, fat mass percentage, biochemical profile, and alcohol and tobacco consumption in first year university students enrolled in the Nutrition and Dietetics and Physical Education Pedagogy programs at a Chilean university.

## Materials and methods

53 students voluntarily participated in this research during their first year in two health promotion careers at Universidad de La Frontera in 2014. 30 were enrolled in the Physical Education Pedagogy program (62.5%), and 23 in the Nutrition and Dietetics program (52.3%).

This study followed the agreements of the Declaration of Helsinki 2013 (17) and was approved by the Ethics Committee of Universidad de La Frontera. Each student signed an informed consent to participate in the research.

## Data collection

The students were summoned to a lecture where the objectives of the research were exposed. Personal history (age, date of birth, contact data), and smoking and alcohol consumption were determined after interviewing each participant. Smoking one or more cigarettes per day, as well as drinking alcohol one or more times per week were considered relevant for the study, since these two factors generate alterations at the endothelium level.

Blood pressure (BP) measurement complied with the procedure established by the Clinical Guide for Primary or Essential Hypertension in persons aged 15 years and over (18). An arm digital blood pressure monitor CITIZEN CH-452 was used. Prior to the evaluation, the subjects were asked to have a 10-minute rest period sitting down. Values of  $\geq 130/85$  mmHg were considered as prehypertension and values of  $\geq 140/90$  mmHg as hypertension, according to the classification of the European Society of Hypertension (19).

Weight and fat mass percentage (FM%) were determined through bioimpedanciometry using Tanita TBF-300A. During this stage, participants were barefoot and in underwear. Ranges from 8% to 15% (men), and from 13% to 20% (women) were considered as normal for fat mass percentage (20). In order to calculate height, a portable ADE set in millimeters was used. Size was classified as normal from  $18.5 \text{ kg/m}^2$  to  $24.9 \text{ kg/m}^2$ , overweight from  $25 \text{ kg/m}^2$  to  $29.9 \text{ kg/m}^2$ , and obesity  $\geq 30 \text{ kg/m}^2$ . The waist circumference (WC) was established with a Lufkin W606PM anthropometric tape set in centimeters, yielding normal values of  $<90$  for men and  $<80$  for women (21).

The assessment of the biochemical parameters was done taking blood samples after fasting for eight hours or more. Samples were centrifuged at 2500 rpm for 10 minutes. Basal glycemia was determined through the GOD-PAP method, with normal values of  $<100 \text{ mg/dl}$ . Basal insulin was measured by chemiluminescence, with normal values of  $<12 \text{ mg/dl}$ . The lipid profile was obtained using CHOD-PAP for total cholesterol, with normal total cholesterol values of  $<200$ , LDL  $<100$  and HDL  $>45$ . Finally, triglycerides were measured through immunological GPO-PAP-HDL, with normal triglycerides values of  $<150$  (22). In addition, insulin resistance was observed through HOMA based on the formula fasting insulin values  $\times$  fasting glycemia/405, obtaining  $<2.5$  as a normal value (23).

In turn, aerobic capacity was assessed using a cycle ergometer (Corival-Lode, Groningen) and a gas analyzer (Ultima™ CPX Medgraphics, Minesotta), previously calibrated for volume and reference gases.  $VO_2$  max was evaluated through continuous heart rate monitoring (Polar FT4, Finland) using the modified Astrand Test (24). The parameters considered for men were: poor  $<24.8 \text{ ml/kg/min}$ ; fair from  $25 \text{ ml/kg/min}$  to  $33.9 \text{ ml/kg/min}$ ; average from  $34 \text{ ml/kg/min}$  to  $42 \text{ ml/kg/min}$ ; good from  $43 \text{ ml/kg/min}$  to  $52.9 \text{ ml/kg/min}$ , and excellent  $>53 \text{ ml/kg/min}$ . On the other hand, the parameters considered for women were: poor  $<23.9 \text{ ml/kg/min}$ ; fair from  $24 \text{ ml/kg/min}$  to  $30.9 \text{ ml/kg/min}$ ; average from  $31 \text{ ml/kg/min}$  to  $38.9 \text{ ml/kg/min}$ ; good from  $39 \text{ ml/kg/min}$  to  $49 \text{ ml/kg/min}$ , and excellent  $>49 \text{ ml/kg/min}$  (24).

## Statistical analysis

Data were presented as mean  $\pm$ SD, frequencies and percentage (%). The normality of the variables was measured through the Kolmogorov-Smirnov test. The Student's T test was used for comparing quantitative parametric variables between two groups, and the Mann-Whitney U-Test for the non-parametric variables. All analyzes were done using the SPSS program, version 22.0. The confidence level was 95% ( $p < 0.05$ ).

## Results

When comparing by academic programs, significant differences were found in the variables  $VO_2$  max and body fat mass ( $p < 0.05$ ). The other study variables did not report any statistical differences (Table 1).

**Table 1.** Comparison of variables per academic program.

Characteristics	Total (n=53)	Nutrition and dietetics (n=23)		Physical Education Pedagogy (n=30)		p value
		n	%	n	%	
Age	19.25±1.59	18.61±1.08		19.73±1.76		-
BMI (kg/m <sup>2</sup> )	24.38±4.74	25.27±6.37		23.69±2.87		0.851
WC (cm)	78.51±10.93	79.659±13.80		77.67±8.40		0.897
Fat mass (%)	24.34±10.33	28.47±11.05		21.18±8.65		<0.001
Systolic pressure (mmHg)	126.10±13.13	123.36±12.34		128.10±13.52		0.379
Diastolic pressure (mmHg)	72.29±11.78	73.73±9.70		71.23±13.17		0.162
Basal glucose (mg/dl)	89.94±6.77	89±7.03		90.67±6.59		0.380
Basal insulin	10.01±6.08	11.46±7.44		8.90±4.63		0.311
IR index	2.24±1.47	2.53±1.83		2.01±1.12		0.467
Total cholesterol (mg/dl)	157.22±33.71	157.04±39.91		157.37±28.78		0.547
cHDL (mg/dl)	68.94±11.95	68.04±12.90		69.63±11.34		0.973
cLDL (mg/dl)	69.62±23.39	68.45±25.25		70.47±22.33		0.636
Triglycerides (mg/dl)	89.45±61.42	90.70±83.11		88.50±39.10		0.154
$VO_2$ max	34.67±11.39	30.27±10.50		38.55±10.90		0.005

Data presented as mean ±SD; p values <0.05 are significant; BMI: body mass index; WC: waist circumference. cHDL: HDL cholesterol; Total Col: total cholesterol; cLDL: LDL cholesterol; IR index: insulin resistance index. Source: Own elaboration based on the data obtained in the study.

32% of the students had excess weight, of which 18.8% were overweight and 13.2% were obese. 50.9% had pressure alteration; 28.3% prehypertension, and 22.6% hypertension. Regarding fat mass percentage, 50.9% of students reported a level above normal, being higher in Nutrition and Dietetics students with 69.5% versus 36.6% in Physical Education Pedagogy (Table 2).

**Table 2.** Frequency of students.

	Nutrition and Dietetics (n=23)		Physical Education Pedagogy (n=30)		Total (n=53)	
	n	%	n	%	n	%
Thin	0	0	0	0	0	0
Normal	14	60.8	22	73.3	36	67.9
Overweight	4	17.3	6	20	10	18.8
Obese	5	21.7	2	6.6	7	13.2
Prehypertensive	8	34.7	7	23.3	15	26.4
Hypertensive	3	13	9	30	12	22.6
High FM%	16	69.5	11	36.6	27	50.9

Data presented as number of students by category and percentages according to the study sample. FM%: fat mass percentage. Source: Own elaboration based on the data obtained in the study.

Moreover, Table 3 shows that 18.8% of the students had a smoking habit, and 41.5% reported frequent alcohol use.

**Table 3.** Frequency of students who smoke and consume alcohol.

	Nutrition and Dietetics		Physical Education Pedagogy		Total	
	n	%	n	%	n	%
Alcoholic consumption	9	17	13	24.5	22	41.5
No alcohol consumption	14	26.4	17	32.1	31	58.5
Smoker	4	7.5	6	11.3	10	18.9
Non-smoker	19	35.8	24	45.3	43	81.1

Data presented as number of students by category and percentage according to the study sample.

Source: Own elaboration based on the data obtained in the study.

Regarding  $VO_2$  max, the students, in general, were in the range between poor and fair (48.8%). Similarly, 27.6% were included in the parameters good and excellent; most of them were students of the Physical Education Pedagogy program (36%), and 18.1% of the Nutrition and Dietetics program (Table 4).

**Table 4.**  $VO_2$  max per academic program.

$VO_2$ max level	Nutrition and Dietetics		Physical Education Pedagogy		Total	
	n	%	n	%	n	%
Poor	7	31.8	0	0	7	14.8
Fair	7	31.8	9	36	16	34
Average	4	18.1	7	28	11	23.4
Good	3	13.6	6	24	9	19.1
Excellent	1	4.5	3	12	4	8.5
Not rated	1	4.5	5	20	6	12.8

Data presented as number of students by category and percentage according to the study sample.

Source: Own elaboration based on the data obtained in the study.

## Discussion

The results of this study show low levels of physical fitness, since 48.8% of the evaluated students presented a  $VO_2$  max between fair and poor, which are negative values compared to the results of a study conducted at other Chilean universities (27).

The mean BMI was 24.38 kg/m<sup>2</sup>, which is lower than that reported in a sample of Mexican students (27). 32% of the students evaluated had excess weight, of which 18.8% were overweight and 13.2% were obese. These values are similar to those of university students in the same city—in which 35.6% were overweight or obese (28)—and to the findings obtained in students from Saudi Arabia, which reached 31.2% (29). However, differences can be found with other research works that assessed Chilean students as well, obtaining a figure of 78.6% students with normal ranges and only 12% overweight (26).

Regarding fat mass percentage, 50.9% of the evaluated students had excess body fat, which is lower than the results in São Paulo, where the same measurement characteristics were used, finding that 60% of the students reached these levels (30). Furthermore, Cossio *et al.* (31) found 55%, and Zea *et al.* (32), 56.3% of body fat excess in university students.

It should be noted that excess body fat and sedentary lifestyle determine the true risk for health-related obesity. Therefore, including their assessment in health and lifestyle studies is highly relevant (33).

The students had a mean blood pressure of 126.10 mmHg, similar to that reported in university students from northern Turkey (34), but higher than that reported in university students from southern Chile (35,36) and from Somaliland (37). It is alarming that 34.7% of Nutrition and Dietetics students were prehypertensive, and that 30% of students of Physical Education Pedagogy had high blood pressure, which are results similar to those in students from the same country, where 35.1% were prehypertensive (38), although the classification criteria were different. The latter condition is associated with alcohol and nicotine consumption, as well as with poor diet schedules and quality, and physical inactivity.

This work showed alcohol consumption in 41.5% of the students, which coincides with the results of a research conducted in Colombian medical students (39). Regarding tobacco consumption, 18.9% claimed they were smokers, which is lower than numbers of sedentary university students from Temuco, who reached 45.1% (40). These results are alarming, since, in most cases, these habits have been proven to increase as university studies advance (41). For this reason, reducing tobacco use would reduce plasma disorders caused by smoking (42). In relation to this, total cholesterol, HDL-C, LDL-C and triglycerides showed lower values in these students than in other investigations, in which smoking was higher (36,40), as in basal glucose (35).

The university population is considered essential for the promotion and prevention of health for future generations (43). Studies have shown that risk factors in students tend to increase, even during the first semester in the university (44). In consequence, identifying their nutritional status and the frequency of physical activity is crucial to actually understand the resources necessary to promote a healthy lifestyle (45).

## Conclusions

The results obtained in this research show a poor physical condition in students, who have high fat mass percentages and high levels of overweight or obesity and blood pressure. This proves that they are in a critical period, during which they are prone to develop noncommunicable diseases. This is a highly concerning situation, since they will turn into professional role models of healthy lifestyles. Thus, it is necessary to create greater and better instances of education in order to generate an impact, that is to say, to improve the quality of life and to create concrete habits in relation to food consumption and physical activity.

## Conflict of interests

None stated by the authors.

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