

ORIGINAL RESEARCH

DOI: <http://dx.doi.org/10.15446/revfacmed.v65n3.55185>

Nutritional status, cardiovascular health, VO₂ max and habits in university students: a comparison between two health promotion careers

Estado nutricional, salud cardiovascular, VO₂ máx y hábitos de vida en estudiantes universitarios: comparación entre dos carreras promotoras de salud

Received: 15/01/2016. Accepted: 14/04/2016.

Ingrid Rivera-Torres¹ • Melisa Floody-Munita² • Pedro Delgado-Floody³ • Ingrid Schifferli-Castro⁴ • Aldo Osorio-Poblete⁵ • Cristian Martínez-Salazar³

¹ Universidad Católica de Temuco - Technical Faculty - Temuco - Chile.

² Departamento de Salud Municipal - Gorbea - Chile.

³ Universidad de La Frontera - Faculty of Education, Social Sciences and Humanities - Department of Physical Education, Sports and Recreation - Temuco - Chile.

⁴ Universidad de La Frontera - Faculty of Medicine - Department of Public Health - Temuco - Chile.

⁵ Universidad Santo Tomás - School of Education - Physical Education Undergraduate Program - Temuco - Chile.

Corresponding author: Pedro Delgado-Floody. Department of Physical Education, Sports and Recreation, Faculty of Education, Social Sciences and Humanities, Universidad de La Frontera. Francisco Salazar 1145, office 5. Temuco. Chile. Phone number: +56 45 2325206, ext.: 5206. Email: pedro.delgado@ufrontera.cl.

| 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 VO₂ 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 VO₂ 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 VO₂ max, 48.9% were in the poor to fair range. The comparison by program showed significant differences in the variables height, VO₂ 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, VO₂ 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 VO₂máx, 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 VO₂máx.

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 VO₂máx, 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, VO₂máx (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).

.....
Rivera-Torres I, Floody-Munita M, Delgado-Floody P, Schifferli-Castro I, Osorio-Poblete A, Martínez-Salazar C. [Estado nutricional, salud cardiovascular, VO₂máx y hábitos de vida en estudiantes universitarios: comparación entre dos carreras promotoras de salud]. *Rev. Fac. Med.* 2017;65(3):447-51. English. doi: <http://dx.doi.org/10.15446/revfacmed.v65n3.55185>.

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, VO₂ 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 VO₂ 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 kg/m² to 24.9 kg/m², overweight from 25 kg/m² to 29.9 kg/m², and obesity ≥ 30 kg/m². 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 mg/dl. Basal insulin was measured by chemiluminescence, with normal values of <12 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 x 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. VO₂ 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 ml/kg/min; fair from 25 ml/kg/min to 33.9 ml/kg/min; average from 34 ml/kg/min to 42 ml/kg/min; good from 43 ml/kg/min to 52.9 ml/kg/min, and excellent >53 ml/kg/min. On the other hand, the parameters considered for women were: poor <23.9 ml/kg/min; fair from 24 ml/kg/min to 30.9 ml/kg/min; average from 31 ml/kg/min to 38.9 ml/kg/min; good from 39 ml/kg/min to 49 ml/kg/min, and excellent >49 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 VO₂ 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 ²)	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 onsumption	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 VO₂ 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. VO₂ 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 VO₂ 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/m², 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.

Funding

Project funded by the research funds of Universidad de La Frontera (DIUFRO), code DI14-0035.

Acknowledgement

None stated by the authors.

References

- Chile. Ministerio de Salud. Encuesta Nacional de Salud 2009-2010. Santiago: MINSAL; 2010.
- Espinoza L, Rodríguez F, Gálvez J, McMillan N. Hábitos de alimentación y actividad física en estudiantes universitarios. *Rev Chil Nutr*. 2011;38(4):458-65. <http://doi.org/b5bt>.
- Leiva AM, Martínez MA, Celis-Morales C. Efecto de una intervención centrada en la reducción de riesgo cardiovascular en estudiantes universitarios. *Rev. Méd. Chile*. 2015;143(8):971-8. <http://doi.org/b5bv>.
- Zimmermann M, González MF, Galán-Labaca I. Perfiles de exposición de riesgo cardiovascular según la ocupación laboral en la Comunidad de Madrid. *Rev. Esp. Salud Pública*. 2010;84(3):293-308.
- Pencina MJ, D'Agostino RB Sr, Larson MG, Massaro JM, Vasan RS. Predicting the 30-year risk of cardiovascular disease. *Circulation*. 2009;119(24):3078-84. <http://doi.org/brvkk6>.
- Organización Mundial de la Salud. Informe sobre la salud en el mundo. Ginebra: OMS; 2013.
- World Health Organization. The world health report 2002: Reducing Risks, Promoting Healthy Life. Geneva: WHO; 2002 [cited 2017 Apr 7]. Available from: <http://goo.gl/4VdN6C>.
- Bustos P, Amigo H, Arteaga A, Agosta AM, Roña RJ. Factores de riesgo de enfermedad cardiovascular en adultos jóvenes. *Rev. Méd. Chile*. 2003;131(9):973-80. <http://doi.org/dfpt7t>.
- Villalón-Cárdenas G, Ghio-Suárez G, Vera-Schneider S. Evolución de la mortalidad en Chile según causas de muerte y edad: 1990-2007. Publicación Especial. Chile: Instituto Nacional de Estadísticas; 2010.
- Moreira LD, Oliveira ML, Lirani-Galvão AP, Marin-Mio RV, Santos RN, Lazaretti-Castro M. Physical exercise and osteoporosis: effects of different types of exercises on bone and physical function of postmenopausal women. *Arq Bras Endocrinol Metabol*. 2014;58(5):514-22. <http://doi.org/f7c3s3>.
- Egan B, Zierath JR. Exercise metabolism and the molecular regulation of skeletal muscle adaptation. *Cell Metab*. 2013;17(2):162-84. <http://doi.org/f25jzv>.
- Kalichman L, Livshits G, Kobylansky E. Association between somatotypes and blood pressure in an adult Chuvasha population. *Ann Hum Biol*. 2004;31(4):466-76. <http://doi.org/dp6cb7>.
- Becerra-Bulla F, Pinzón-Villate G, Vargas-Zárate M. Hacia la creación del programa Universidad Promotora de la Salud desde la alimentación y la nutrición en la Universidad Nacional de Colombia, sede Bogotá. *Rev. Fac. Med*. 2011;59(1):67-76.
- Fernandes J, Arts J, Dimond E, Hirshberg S, Lofgren IE. Dietary factors are associated with coronary heart disease risk factors in college students. *Nutr Res*. 2013;33(8):647-52. <http://doi.org/f46fpg>.
- Becerra-Bulla F, Pinzón-Villate G, Vargas-Zárate M. Prácticas alimentarias de un grupo de estudiantes universitarios y las dificultades percibidas para realizar una alimentación saludable. *Rev. Fac. Med*. 2015;63(3):457-63. <http://doi.org/b5b3>.
- Feliciano-Alfonso JE, Mendivil C, Sierra I, Pérez CE. Cardiovascular risk factors and metabolic syndrome in a population of young students from the National University of Colombia. *Rev. Assoc. Med. Bras*. 2010;56(3):293-8. <http://doi.org/bmxxq5>.
- Asociación Médica Mundial. Declaración de Helsinki de la Asociación Médica Mundial. Principios éticos para las investigaciones médicas en seres humanos. Fortaleza: 64.ª Asamblea General de la AMM; 2013 [cited 2017 Apr 25]. Available from: <https://goo.gl/SSm0WS>.
- Chile. Ministerio de Salud. Guía Clínica: Hipertensión Arterial Primaria o Esencial en personas de 15 años y más. Serie Guías Clínicas MINSAL. Santiago: MINSAL; 2010.
- Vasan RS, Larson MG, Leip EP, Kannel WB, Levy D. Assessment of frequency of progression to hypertension in non-hypertensive participants in the Framingham Heart Study: a cohort study. *Lancet*. 2001;358(9294):1682-6. <http://doi.org/ccj34>.

20. **Jebb S, Cole T, Doman D, Murgatroyd P, Prentice A.** Evaluation of the novel Tanita body-fat analyser to measure body composition by comparison with a four-compartment model. *Br J Nutr.* 2000;83(2):115-22.
21. Chile. Ministerio de Salud. Guía Clínica: Examen de Medicina Preventiva. Serie Guías Clínicas MINSAL. Santiago de Chile: MINSAL; 2008.
22. Chile. Ministerio de Salud. Guía Clínica: Diabetes Mellitus Tipo 2. Serie Guías Clínicas MINSAL. Santiago de Chile: MINSAL; 2010.
23. **Carrasco F, Galgani J, Reyes M.** Síndrome de resistencia a la insulina: estudio y manejo. *Rev. Méd. Clín. Condes.* 2013;24(5):827-37. <http://doi.org/f2x5hd>.
24. **Astrand PO.** Physical performance. In: Astrand PO, Rodahl K, Dahl H, Stromme S, editors. Textbook of work physiology: Physiological basis of exercise. 4th ed. Champaign: Human Kinetics; 2003. p. 237-72.
25. **McArdle WD, Katch FI, Katch VL.** Exercise physiology: Nutrition, energy and human performance. 7th ed. Baltimore: Lippincott Williams & Wilkins; 2009.
26. **Aránguiz H, García V, Rojas S, Salas C, Martínez R, MacMillan N.** Estudio descriptivo, comparativo y correlacional del estado nutricional y condición cardiorrespiratoria en estudiantes universitarios de Chile. *Rev. Chil. Nutr.* 2010;37(1):70-8. <http://doi.org/dvbwzc>.
27. **Lorenzini R, Betancur-Ancona D, Chel-Guerrero L, Segura-Campos M, Castellanos-Ruelas A.** Estado nutricional en relación con el estilo de vida de estudiantes universitarios mexicanos. *Nutr Hosp.* 2015;32(1):94-100. <http://doi.org/b5df>.
28. **Durán S, Valdés P, Godoy A, Herrera T.** Hábitos alimentarios y condición física en estudiantes de pedagogía en educación física. *Rev. Chil. Nutr.* 2014;41(3):251-9. <http://doi.org/b5dg>.
29. **Ibrahim NK, Mahnashi M, Al-Dhaheri A, Al-Zahrani B, Al-Wadie E, Aljabri M, et al.** Risk factors of coronary heart disease among medical students in King Abdulaziz University, Jeddah, Saudi Arabia. *BMC Public Health.* 2014;14(11):411. <http://doi.org/f55rdx>.
30. **Savegnago-Mialich M, Covolo N, Cheli-Vettori J, Jordao AA Jr.** Relationship between body composition and level of physical activity among university students. *Rev. Chil. Nutr.* 2014;41(1):46-53. <http://doi.org/b5dh>.
31. **Cossio-Bolaños MA, De Arruda M, Moyano-Portillo Á, Gañán-Moreno E, Pino-López LM, Lancho-Alonso JL.** Composición corporal de jóvenes universitarios en relación a la salud. *Nutr. Clín. Diet. Hosp.* 2011;31(3):15-21.
32. **Zea-Robles A, León-Ariza H, Botero-Rosas D, Afanador-Castañeda H, Pinzón-Bravo L.** Factores de riesgo cardiovascular y su relación con la composición corporal en estudiantes universitarios. *Rev. Salud Pública.* 2014;16(4):505-15. <http://doi.org/br5m>.
33. **Rodríguez F, Berral F, Almagià A, Iturriaga MF, Rodríguez F.** Comparación de la composición corporal y de la masa muscular por segmentos corporales, en estudiantes de educación física y deportistas de distintas disciplinas. *Int. J. Morphol.* 2012;30(1):7-14. <http://doi.org/b5dj>.
34. **Kutlu R, Erdem M.** Evaluation of cardiovascular risk factors among university students in Turkey: a cross-sectional survey. *Russian Open Med J.* 2013;2(3):0307. <http://doi.org/b5dm>.
35. **Caamaño F, Alarcón M, Delgado P.** Niveles de obesidad, perfil metabólico, consumo de tabaco y presión arterial en jóvenes sedentarios. *Nutr Hosp.* 2015;32(5):2000-6. <http://doi.org/b5dm>.
36. **Delgado P, Alarcón M, Caamaño F.** Análisis de los factores de riesgo cardiovascular en jóvenes universitarios según su estado nutricional. *Nutr Hosp.* 2015;32(4):1820-4. <http://doi.org/b5dn>.
37. **Ali M, Yusuf HI, Stahmer J, Rahlenbeck SI.** Cardiovascular risk factors and physical activity among university students in Somaliland. *J Community Health.* 2015;40(2):326-30. <http://doi.org/f64mtp>.
38. **Martínez M, Leiva M, Sotomayor C, Victoriano T, Von Chrismar A, Pineda S.** Factores de riesgo cardiovascular en estudiantes de la Universidad Austral de Chile. *Rev. Méd. Chile.* 2012;140(4):426-35. <http://doi.org/br5h>.
39. **Becerra F, Pinzón G, Vargas M, Vera S, Ruíz M.** Estilos de vida de estudiantes universitarios admitidos al pregrado de la carrera de medicina, Bogotá 2010-2011. *Rev. Fac. Med.* 2014;62(Suppl. 1):51-6. <http://doi.org/bdt9>.
40. **Alarcón M, Delgado P, Caamaño F, Osorio A, Rosas M, Cea F.** Estado nutricional, niveles de actividad física y factores de riesgo cardiovascular en estudiantes de la Universidad Santo Tomás. *Rev. Chil. Nutr.* 2015;42(1):70-6. <http://doi.org/br5q>.
41. **Halperin AC, Smith SS, Heiligenstein E, Brown D, Fleming MF.** Cigarette smoking and associated health risks among students at five universities. *Nicotine Tob Res.* 2010;12(2):96-104. <http://doi.org/bg6gcb>.
42. **Hernández-Escobar J, Herazo-Beltrán Y, Valero M.** Frecuencia de factores de riesgo asociados a enfermedades cardiovasculares en población universitaria joven. *Rev. Salud Pública.* 2010;12(5):852-64. <http://doi.org/d5m3nq>.
43. **Rodríguez F, Palma X, Romo Á, Escobar D, Aragón B, Espinoza L, et al.** Hábitos alimentarios, actividad física y nivel socioeconómico en estudiantes universitarios de Chile. *Nutr Hosp.* 2013;28(2):447-55. <http://doi.org/b5dq>.
44. **Deliens T, Clarys P, Van Hecke L, De Bourdeaudhuij I, Deforche B.** Changes in weight and body composition during the first semester at university. A prospective explanatory study. *Appetite.* 2013;65:111-6. <http://doi.org/f5c389>.
45. **Varela MT, Duarte C, Salazar I, Lema LF, Tamayo JA.** Actividad física y sedentarismo en jóvenes universitarios de Colombia: prácticas, motivos y recursos para realizarlas. *Colomb Med.* 2011;42(3):269-77.