Prevalence of Dyslipidemia in Military Students and Military Personnel Attending Primary Care in Ecuador and Correlation with Anthropometric Values*

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Objective: to establish the prevalence of dyslipidemia and its relationship with the body mass index, waist-height index and waist circumference in students of the higher technology specialization in military sciences, as well as military personnel who work at the University of the Armed Forces of Ecuador - ESPE.

Methodology: this was an analytical, non-experimental study with a sample of 495 second-year students of the Superior Technology Specialization in Military Sciences and 196 military personnel who work at ESPE.

Results: the study found 8,48 % (n: 42) prevalence of general dyslipidemia in students, differentiated by hypercholesterolemia 1,82 % (n: 9), hypertriglyceridemia 6,26 % (n: 31) and mixed dyslipidemia 0,4 % (n: 2). Additionally, it found 58,67 % (n: 115) prevalence of general dyslipidemia in professional military personnel, with hypercholesterolemia 9,18 % (n: 18), hypertriglyceridemia 25,51 % (n: 50) and mixed dyslipidemia 23,98 % (n: 47). Finally, the lower limit to diagnose dyslipidemia for body mass index in students was 25,67 kg/m^2, for waist circumference 76,5 cm and for waist height ratio 0,47, and in professional military personnel, body mass index of 26,3 kg/m^2, waist circumference of 86 cm and waist height ratio of 0,52.

Conclusions: the students and military personnel studied have a significantly low prevalence of dyslipidemia compared to the general student and military personnel population and the values of WC and WHtR were seen to be good predictors of dyslipidemia in military personnel but not in the students.

Keywords: anthropometry; cardiovascular disease; dyslipidemia; military personnel; young adults

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* Research article.

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Prevalencia de dislipidemia en estudiantes militares y personal militar de atención primaria en Ecuador y correlación con valores antropométricos

Objetivo: establecer la prevalencia de dislipidemia y su relación con el índice de masa corporal, índice cintura-talla y circunferencia de cintura en estudiantes de la especialización tecnológica superior en ciencias militares, así como en personal militar que labora en la Universidad de las Fuerzas Armadas de Ecuador - ESPE.

Metodología: este es un estudio analítico, no experimental, con una muestra de 495 estudiantes de segundo año de la Especialización Tecnológica Superior en Ciencias Militares y 196 militares que laboran en la ESPE.

Resultados: el estudio encontró un 8,48 % (n: 42) de prevalencia de dislipidemia general en estudiantes, diferenciada por hipercolesterolemia 1,82 % (n: 9), hipertrigliceridemia 6,26 % (n: 31) y dislipidemia mixta 0,4 % (n: 2). Adicionalmente, encontró una prevalencia de dislipidemia general en personal militar profesional de 58,67 % (n: 115), con hipercolesterolemia 9,18 % (n: 18), hipertrigliceridemia 25,51 % (n: 50) y dislipidemia mixta 23,98 % (n: 47). Finalmente, el límite inferior para diagnosticar dislipidemia para índice de masa corporal en estudiantes fue de 25,67 kg/m^2, para circunferencia de cintura 76,5 cm y para índice de altura de cintura 0,47, y en personal militar profesional, índice de masa corporal de 26,5 cm. 3 kg/m^2, circunferencia de cintura de 86 cm e índice de altura de cintura de 0,52.

Conclusiones: los estudiantes y militares estudiados tienen una prevalencia de dislipidemia significativamente baja en comparación con la población general de estudiantes y militares y los valores de WC y WHtR se consideraron como buenos predictores de dislipidemia en militares, pero no en estudiantes.

Palabras clave: antropometría; enfermedad cardiovascular; dislipidemia; personal militar; adultos jóvenes

Prevalência de dislipidemia em estudantes militares e pessoal militar da atenção primária no Equador e correlação com valores antropométricos

Objetivo: estabelecer a prevalência de dislipidemia e sua relação com o índice de massa corporal, índice cintura-estatura e circunferência da cintura em estudantes da especialização tecnológica superior em ciências militares, bem como militares que trabalham na Universidade das Forças Armadas do Equador - ESPE.

Metodologia: trata-se de um estudo analítico, não experimental, com uma amostra de 495 alunos do segundo ano da Especialização Tecnológica Superior em Ciências Militares e 196 militares que atuam na ESPE.

Resultados: o estudo encontrou 8,48 % (n: 42) prevalência de dislipidemia geral em estudantes, diferenciada por hipercolesterolemia 1,82 % (n: 9), hipertrigliceridemia 6,26 % (n: 31) e dislipidemia mista 0,4 % (n: 2). Além disso, encontrou 58,67 % (n: 115) prevalência de dislipidemia geral em militares profissionais, com hipercolesterolemia 9,18% (n: 18), hipertrigliceridemia 25,51% (n: 50) e dislipidemia mista 23,98 % (n: 47). Por fim, o limite inferior para diagnóstico de dislipidemia para o índice de massa corporal em escolares foi de 25,67 kg/m^2, para circunferência da cintura 76,5 cm e razão cintura-estatura 0,47, e em militares profissionais, índice de massa corporal de 26, 3 kg/m^2, circunferência da cintura de 86 cm e relação altura da cintura de 0,52.

Conclusões: os estudantes e militares estudados apresentam uma prevalência de dislipidemia significativamente baixa em comparação com a população geral de estudantes e militares e os valores de CC e RCE foram vistos como bons preditores de dislipidemia em militares, mas não em estudantes.

Palavras-chave: antropometria; doença cardiovascular; dislipidemia; pessoal militar; jovens adultos

Introduction

Cardiovascular disease CVD is the leading cause of morbidity and mortality worldwide, present in all countries, regardless of whether they are considered developed or not, with a progressive growth in prevalence and incidence, which implies that, in low- and middle-income countries, there is a greater challenge in the health sector to face these diseases [1, 2]. Thus, according to World Health Organization (WHO) data, CVD caused 17.9 million deaths (31 % of all deaths) worldwide in 2016, of which 75 % were in low and middle income countries; furthermore, 85 % of all global disabilities were caused or related to these diseases [3,4].

According to the WHO, to reduce CVD mortality, it is crucial to understand and adequately manage risk factors, including dyslipidemia, hypertension, diabetes mellitus, and smoking [5]. It is also indicated that the highest number of CVD deaths are due to the high prevalence of dyslipidemia and diabetes mellitus, related to the increase of obesity in the population; high blood pressure and smoking have been controlled to a certain extent. Therefore, the early diagnosis and treatment of dyslipidemias, which represents the most important risk factor for the development of atherosclerosis, are considered fundamental to reduce the incidence and mortality from CVD [6].

Lipoprotein metabolic disorders are known as dyslipidemia, characterized by decreased HDL levels, or elevated plasma levels of cholesterol, LDL and/or triglycerides [7, 8].

Dyslipidemia has become a public health problem in many countries due to its high prevalence and due to its causal relationship with chronic non-communicable diseases. At an early age, it can cause an atherosclerotic process and contribute to the development of CVD in adulthood [9].

Although the prevalence of dyslipidemia increases with age, it can also be present in young individuals; around 36 % of adults between 20 and 29 years old and 43 % between 30 and 39 years old have elevated lipid levels [10].

In developed countries such as the United States, up to 53 % of the population has some lipid disorder, and in 2011 the number of deaths from CVD represented 1 in 3 deaths [11]. In Latin America, in 2010 it was reported that the prevalence rates of dyslipidemia in men and women, from 25 to 65 years old, were respectively: 75.5 % and 48.7 % in Barquisimeto-Venezuela; 70 % and 47.7 % in Bogotá; 50.4 % and 24.1 % in Buenos Aires; 73.1 % and 62.8 % in Lima; 62.5 % and 37.5 % in Mexico City; 52.2 % and 38.1 % in Quito, and finally 50.8 % and 32.8 % in Santiago de Chile [12]. In addition, it is estimated that during 2020, seven out of ten deaths are due to non-communicable diseases and that coronary heart disease will be the main cause in the Latin American region [13].

The traditional management of dyslipidemia according to several international societies includes lifestyle modification and pharmacotherapy, based on groups considered as at low, medium or high risk for cardiovascular events [14]. Thus, due to the asymptomatic nature of dyslipidemia, its identification requires adequate screening, which is beneficial for its early management and resolution.

The literature on the prevalence of dyslipidemia in the young population is scarce; in a systematic review of 352 articles made by Chou et al. for age groups from 21 to 39 years, no studies were identified that determine benefits or harms of screening, treatment in this specific population group, or strategies additional to screening, so extrapolation with the data obtained in clinical trials in adults is required [15].

Thus, the objective of the study was to determine the prevalence of dyslipidemia and its relationship with body mass index and waist circumference in students of the Superior Technology Specialization in Military Sciences and military personnel at University of Armed Forces of the Ecuador (ESPE). Likewise, it aimed to identify correlation between the prevalence of dyslipidemia with body mass index and waist circumference and determine the lower limits of the anthropometric indices studied to present dyslipidemia.

Materials and methods

This was an analytical, non-experimental study with a universe of 1100 students of Superior Technology Specialization in Military Sciences, class of

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2019 - 2021, as well as 366 military personnel from ESPE. This academic and formative institute is in Ambato - Ecuador.

The studied looked at a sample of 495 students and 196 military personnel who meet the established inclusion and exclusion criteria and corresponds to a confidence level of 95 % and a margin of error of 3 %. The inclusion criterion included second-year students of the Superior Technology Specialization in Military Sciences, class of 2019-2021 as well as military personnel working at the ESPE; exclusion criterion was the presence of an injury that does not allow daily physical activity.

Annual medical checkups were used as a source of information collection for both the students as well as military personnel . The medical records were from 2020, based on exams at Health Center B "Esforse" from October to December. The annual medical record includes personal information, medical check-up, laboratory tests, dental check-up, vital signs, anthropometry and psychological check-up.

The lipid profile was obtained with the chemical analysis equipment - Erba Mannheim, model XL-100, using reagent Cholesterol Liquid A (ref.: 990159, lot.: 190560) and Triglycerides MR (ref. 1155055, lot.: 15898) respectively.

The anthropometric values were obtained by measuring weight and height without shoes, in underwear, with a weight scale with manual altimeter -Seca model 700-; waist circumference (WC) was measured with a non-elastic measuring tape – Premax model 19394 at the level of the widest part of the buttocks, and at the level of the iliac crests.

The diagnosis of dyslipidemia was established according to Aguilar et al. (2004), and Latin-American Diabetes Association ALAD (2013): a) normal total cholesterol (<200mg/dl), b) high total cholesterol (> 200mg/dl), c) normal triglycerides (<150mg/dl), d) high triglycerides (> 150mg/dl) and, e) mixed dyslipidemia (Total-C> 200mg / dl and TG> 150mg / dl) [16, 17].

The information obtained from the medical records was entered into a previously established Microsoft Excel matrix. Subsequently, the statistical analysis and correlation of the variables were carried out with the statistical program SPSS v22, and MedCalc, using Pearson's index and ROC curve, respectively.

The study information was obtained with prior authorization from the Director of the Escuela de Formación de Soldados del Ejército "Vencedores del Cenepa" and with individual informed consent. None of the participants was exposed to any risk and all data was managed with confidentiality according to the Helsinki declaration and the ethic principle within the institution.

Results

The study was carried out on 495 students of the Superior Technology Specialization in Military Science, class of 2019-2021 with an age range between 19 and 23, and 196 military personnel at ESPE, with an age range between 23 and 51. In addition, all subjects were men (n: 495 and n: 196), and 91,9 % (n: 455) of the students and 97,45 % (n: 191) of the military personnel identified themselves as Latino (Table 1).

The mean value of total cholesterol was 148,65 mg/dl and triglycerides 106,55 mg/dl in students, and 185,59 mg/dl and 146,33 mg/dl, respectively in military personnel. In addition, the presence of hypercholesterolemia was 1,82 % (n: 9), hypertriglyceridemia 6,26 % (n: 31) and mixed dyslipidemia 0,40 % (n: 2) in students and hypercholesterolemia 9,186 % (n: 18), hypertriglyceridemia of 25,51 % (n: 50) and mixed dyslipidemia of 23,98 % (n: 47) in military personnel. Therefore, general dyslipidemia occurred in 8,48 % (n: 42) of students and 58,67 % (n: 115) of military personnel (Table 1).

Table 2 shows that the lower limit for body mass index to present dyslipidemia in students is 25,67 kg/m² (AUC: 0,523, 95 % IC: 0,478-0,568, p: 0,898), waist circumference is 76,5 cm (AUC: 0,506, 95 % IC: 0,461–0,551, p: 0,569), and waist height ratio of 0,47 (AUC: 0,555, 95 % IC: 0,510–0,599, p: 0,177), in addition, in military personnel the optimal cut of body mass index is 26,3 kg / m² (AUC: 0,681, 95 % IC: 0,610-0,745, p: <0,0001), waist circumference is 86 cm (AUC: 0,716, 95 % IC 0,647-0,778, p: <0,0001), and waist height ratio of 0,52 (AUC: 0,740, 95 % IC: 0,662–0,808, p: <0,0001) respectively (Table 2, Figure 1 and 2).

Table 1. Characteristic of the study population, according to study, in Ecuador, 2020.

Variable		Student (n: 495)						Personnel (n: 196)					
		n	%	SD	Mean	Min	Max	n	%	SD	Mean	Min	Max
Dyslipidemia	Normal	453,0	91,5					81,0	41,3				
	Cholesterolemia	9,0	1,8	24,8	148,7	99,0	280,0	18,0	9,2	29,1	185,6	100,0	310,0
	Triglyceridemia	31,0	6,3	31,4	106,6	52,0	430,0	50,0	25,5	48,2	146,3	60,0	380,0
	Mixed dyslipidemia	2,0	0,4					47,0	24,0				
BMI	Normal	220,0	44,4					38,0	7,7				
	Overweight	272,0	54,9	2,2	24,4	19,5	31,3	147,0	29,7	2,4	26,1	20,1	36,4
	Obesity	3,0	0,6					11,0	2,2				
WC	Normal	488,0	98,6	80,9	5,6	57,0	98,0	152,0	77,6	6,6	88,8	71,0	108,0
	High	7,0	1,4					44,0	22,5				
WHtR	Normal	284,0	57,4	0,0	0,5	0,4	0,6	32,0	16,3	0,0	0,5	0,4	0,7
	High	211,0	42,6					164,0	83,7				

n: number, %: percentage, SD: standard deviation, Max: Maximum, Min: Minimum, BMI: Body mass index, WC: Waist circumference, WHtR: Waist height ratio
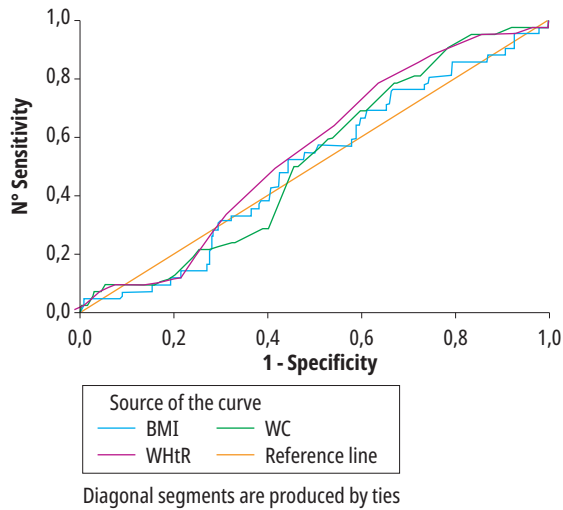**Source:** Authors

Table 2. Prediction of anthropometric index values for diagnosis of dyslipidemia, according to study, in Ecuador, 2020.

Dyslipidemia Student (n: 42, %: 8,48)						
Variable	AUC (IC: 95 %)	Optimal cut offs	Sensitivity %	Specificity %	Standard error	Youden index	p
WC_Student	0,506 (0,461-0,551)	76,5	90,48	21,63	0,041	0,121	0,569
BMI_Student	0,523 (0,478-0,568)	25,67	14,29	73,07	0,043	0,126	0,898
WHtR_Student	0,555 (0,510-0,599)	0,47	78,57	36,42	0,041	0,15	0,177
Dyslipidemia Personnel (n: 115, %: 58,67)						
WC_ Personnel	0,716 (0,647-0,778)	86	76,52	60,49	0,037	0,371	<0,0001
BMI_ Personnel	0,681 (0,610-0,745)	26,3	53,04	76,54	0,038	0,295	<0,0001
WHtR_ Personnel	0,740 (0,662-0,808)	0,52	72,06	65,43	0,041	0,375	<0,0001

n: Number, %: Percentage, WC: Waist circumference, BMI: Body mass index, WHtR: Waist height ratio.
Source: prepared by the authors from the results obtained.

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Figura 1. ROC curve for anthropometric indices to predic Dyslipidemia student in all the poblation.

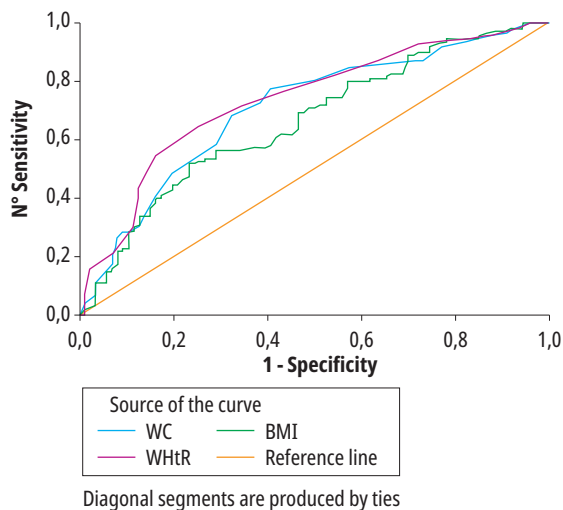ROC: Receiver operating characteristics; WC: Waist circumference; BMI: Body mass index; WHtR: Waist height ratio.

Source: prepared by the authors from the results obtained.

Figura 2. ROC curve for anthropometric indices to predic Dyslipidemia professional in all the poblation.

ROC: Receiver operating characteristics; WC: Waist circumference; BMI: Body mass index; WHtR: Waist height ratio.

Source: prepared by the authors from the results obtained.

Discussion

The periodic medical checkups carried out by the "Esforse" Health Center search for risk factors in the students of the Superior Technology Specialization in Military Science that can alter their academic performance and in the military personnel of the University of the Armed Forces of Ecuador - ESPE that subsequently can alter their professional activity.

A study by Shahid R (2019), in Saudi Arabia, in a young population of 85 patients, with ages between 18 and 45, 79 % male and previous diagnosis of ischemic stroke, indicated that 43,5 % have a history of dyslipidemia, showing that in young people with cardiovascular diseases, almost half have a previous alteration of lipids [18].

The prevalence of dyslipidemia in our study is remarkably low in contrast to the data obtained in the study by Martinez et al. in 2009, carried out at the Central Military Hospital in Mexico City, with a sample of 9784 soldiers with an age range of 35 to 65, where 27,17 % had hypercholesterolemia, 37,85 % hypertriglyceridemia and 25,51 % mixed hyperlipidemia; likewise, a study by Tovar et al. in 2012, in the Colombian Army, with a sample of 1,317 medical records of male patients with an average age of 31 years, evidenced 56,9 % of the population with dyslipidemia. Both studies showed significantly higher dyslipidemia than that observed in our population [19, 20].

In Ecuador, the incidence of dyslipidemia in students and military personnel differs from our study. Muñoz and Muñoz in 2018 studied a military unit in Zamora, with a sample of 80 soldiers between 30 and 59 years old, finding the prevalence of hypercholesterolemia was 41.25 % [21]. Likewise, Castillo's study in 2018, with 178 soldiers, without a specific age range, from a military unit in Quito, observed that 57 % had dyslipidemia [22]. Similarly, a study by Pacheco and Romero (2019), with a sample of 248 individuals with an average age of 36 years, treated at the Military Hospital of Guayaquil, evidenced that 42,7 % had hypercholesterolemia and 51,2 % hypertriglyceridemia [23].

When comparing our results with studies of the general university population, a difference is also observed in the prevalence of dyslipidemia. In a study carried out by Llamazares et. al. in 2005, in a population of 111 students between 17 and 23 years of age, from a university in Mexico, 14,4 % showed hypertriglyceridemia [24]. Similarly, a study by Llive and Trujillo in 2013 of undergraduate students at the Pontifical Catholic

University of Ecuador, with a sample of 902 students (men: 363 and women: 539) with an average age of 21, evidenced that in male students, 12,4 % had hypercholesterolemia, 13,5 % had hypertriglyceridemia, and 9,9 % had mixed dyslipidemia [25].Therefore, students of the Superior Technology Career in Military Science and military personnel working at ESPE, show a low prevalence of dyslipidemia, in comparison with similar age groups within the region and the country, and this difference is more marked when compared with older age groups.

In addition, physical exercise is well known as a protective factor, as seen in the study by Carrasco et. al. in 2005, in a population of 200 participants, of which 79 were men, between 25 and 45 years old and 34 % performed physical activity. This study showed that 1,3 % had hypercholesterolemia and 11,4 % hypertriglyceridemia. Similar values to those were found in the students of our study, all of whom perform daily physical activities as part of their academic and professional training respectively [26].

In this way, this study associated the intensive daily physical activities carried out by students of the Superior Technology Career in Military Sciences and military personnel at University of Armed Forces of the Ecuador (ESPE) as part of their academic and professional formation respectively as a preamble for early prevention actions to reduce future morbidity and mortality of cardiovascular disease in professional military personnel.

Finally, there is no scientific literature on the lower limit values of the anthropometric indices in students and military personnel to present dyslipidemia, however, the results of this study (BMI: 25.67 kg/m², WC: 76.5 cm, WHtR: 0.47 in students and BMI: 26.3 kg/m², WC: 86 cm, WHtR: 0.52 in military personnel) serve as a guideline for future studies, in order to improve the primary prevention of dyslipidemia by assessing anthropometry values as primary care predictors.

Conclusion

The results obtained evidence that the prevalence of dyslipidemia in students and military personnel is smaller than the general university population and military personnel of similar age.

According to this study, a WC of 86 cm and a WHtR of 0.52 are the lower limit anthropometric indices to predict dyslipidemia in professional military personnel; however, in the university students studied the anthropometric indices do not show a significant value acceptable as predictors for dyslipidemia.

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