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Original / *Ancianos*

Lipid profile and associated factors among elderly people, attended at the Family Health Strategy, Viçosa/MG

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Abstract

Background: **the aging population has been accompanied by epidemiological changes of the Brazilian population, with the highlight being the continued growth of the prevalence of non-communicable chronic diseases especially cardiovascular or artery-coronary, resulting from changes in the lipid profile of the elderly.**

Objective: **this study had the aim to describe the behavioral, anthropometric, lifestyle and body composition factors and their association with changes in the lipid profile of elderly people.**

Methodology: **the sample included 402 participants attended at the Family Health Strategy, Viçosa (MG), to which a questionnaire with socio-demographic, behavioral and lifestyle information was applied. Blood sample was collected to obtain the lipid fractions, and the weight, height, waist circumference and body fat percentage were measured. Multiple linear regression was performed to identify independently associated factors with changes in each of the selected lipid fractions.**

Results: **the factors independently associated with increased levels of total cholesterol were the presence of sedentary behavior, high body fat percentage, greater waist height and greater waist circumference. The consumption of alcoholic beverages and a higher waist-hip ratio remained independently associated with decreased high-density lipoprotein levels. The increased waist circumference was independently associated with low values of the low-density lipoprotein levels. The value of increased triglyceride was independently associated with higher waist-hip ratio, higher body mass index and smoking.**

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PERFIL LIPÍDICO Y FACTORES ASOCIADOS EN LOS ANCIANOS ATENDIDOS EN LA ESTRATEGIA DE SALUD DE LA FAMILIA, VIÇOSA/MG

Resumen

Introducción: **el envejecimiento de la población ha ido acompañado de cambios epidemiológicos de la población brasileña, destacando el crecimiento continuo de la prevalencia de enfermedades crónicas no transmisibles, especialmente cardiovasculares o de la arteria coronaria, como resultado de los cambios en el perfil lipídico de las personas mayores.**

Objetivo: **describir las variables antropométricas, estilo de vida y composición corporal como factores de comportamiento y su asociación con los cambios en el perfil lipídico de las personas de edad avanzada.**

Metodología: **la muestra incluyó a 402 participantes que asistieron a la Estrategia Salud de la Familia, Viçosa (MG), a los que se aplicó un cuestionario con información socio-demográfica, de comportamiento y de estilo de vida. Se recogió una muestra de sangre para obtener las fracciones de lípidos, y se midió el porcentaje de peso, talla, circunferencia de la cintura y grasa corporal. La regresión lineal múltiple se realizó para identificar factores independientemente asociados con los cambios en cada una de las fracciones de lípidos seleccionados.**

Resultado: **los factores asociados de forma independiente con un aumento de los niveles de colesterol total fueron la presencia de conducta sedentaria, un porcentaje de grasa corporal alto, mayor altura de la cintura y una mayor circunferencia de la cintura. El consumo de bebidas alcohólicas y una proporción cintura-cadera más alta se mantuvo asociado de forma independiente con la disminución de los niveles de lipoproteínas de alta densidad. El aumento de la circunferencia de la cintura se asoció de forma independiente con valores bajos de los niveles de lipoproteínas de baja densidad. El valor del aumento de triglicéridos se asocia de forma independiente con una mayor relación cintura-cadera, un mayor índice de masa corporal y tabaquismo.**

Conclusions: **modifiable risk factors associated with a changed lipid profile should be prioritized among the actions to be considered in structuring health programs for the elderly.**

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Keywords: *Elderly. Dyslipidemia. Health of the elderly.*

Conclusión: **los factores de riesgo modificables asociados con un perfil lipídico cambiado deben priorizarse entre las acciones a considerar en la estructuración de los programas de salud para los ancianos.**

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Palabras clave: *Ancianos. Dislipidemia. Salud de las personas mayores.*

Introduction

The aging population is a worldwide trend, revealed by the decline in fertility and sustained decrease in mortality. With increasing life expectancy, Brazil will be the sixth country in the world with the largest number of elderly people by 2025[1,2].

The transition from a young to an aging population has been accompanied by epidemiological changes of the Brazilian population, with the highlight being the continued growth of the prevalence of non-communicable chronic diseases (NCDs). Aging is considered the greatest risk factor for chronic diseases, especially cardiovascular (CVD) or artery-coronary (ACD), resulting from changes in the lipid profile of the elderly[3].

Dyslipidemia is defined as a clinical condition characterized by abnormal concentrations of lipids or lipoproteins in the blood, one of the main factors that determine the development of CVD. High concentrations of triglycerides (TG), total cholesterol (TC) and their LDL-cholesterol (LDL-c) fraction, related to the decrease in HDL-cholesterol values (HDL-c) increase the likelihood of occurrence of these diseases. With age, the aging of organs and the emergence of concomitant illnesses make elderly patients the preferred target for changes in lipid fractions. A comprehensive view of factors associated with changes in plasma levels of lipid fractions contributes to the understanding of the different characteristics that lead to the development of dyslipidemia in the elderly population[4,5]. However, studies that address the different changes in lipid profile in the elderly population are scarce.

Objective

This study aimed to describe the behavioral, anthropometric, lifestyle and body composition factors and their association with changes in the lipid profile of elderly patients in the Family Health Strategy, Viçosa (MG).

Methodology

Epidemiological, cross-sectional study in random sample of elderly (age > 60 years) of both genders, attended in all units of the Family Health Strategy (FHS) in the municipality of Viçosa (MG).

The calculation of sample size considered a level of 95% confidence, with prevalence of 65% dyslipidemia and 5% tolerated error. Thus, the sample was calculated in 331 seniors, to which was added 20% to cover possible losses, totaling 398 seniors to be studied. However, seniors who were already scheduled were serviced, and the final sample included 402 seniors.

Data collection was conducted in two meetings at the FHS units. In the first meeting, a questionnaire was applied with socio-demographic information (gender, age, social class, education, ethnicity and marital status), as well as behavioral (physical activity level) and lifestyle (smoking and drinking) information. In the second meeting, blood collection was performed with the elderly previously fasting for 12 hours, together with the measurement of different anthropometric measurements (weight, height and waist circumference measures), as well as the performance of the tetrapolar bioelectrical impedance test to obtain the percentage of body fat (% BF).

Weight was obtained by digital electronic scale, *Kratos* brand, with capacity of 150 kg and sensitivity of 50 g. Height was determined using millimetered vertical anthropometer (Welmy), with length of 2 m and 0.5 cm wide. Evaluations followed the methodology recommended by Lohman[6].

From these data, the Body Mass Index (BMI) was calculated using the formula: BMI = Weight (kg)/Height^2 (m). The cutoff points used for classification were proposed by Lipschitz[7].

Waist circumference (WC) was obtained using an inelastic tape. The measure was assessed on the umbilicus with three replications. The used cutoff points were those suggested by the International Diabetes Federation[8], considering women with values of waist circumference over 80 centimeters (cm) and men with values over 94 cm classified as having an accumulation of abdominal fat.

The procedures for application of bioimpedance test (*Byodinamics* 310) were performed by a nutritionist with the participant rated at 12 hours of fasting, lying with empty bladder, barefoot and with legs apart and feet away from each other about 30 cm and no metal material. The electrodes were placed in the hand, wrist, foot and ankle, after being properly sanitized with 70% ethanol, for purposes of standardization. The electrodes were placed on the right side of the body, following all the protocol[7].

The waist-stature ratio (WST) was determined by dividing the waist circumference by the height, both in cm. The cutoff point for discriminating the cardiovascular risk was WST>0.5[9].

The waist-hip ratio (WHR) was estimated dividing the waist circumference (cm) by the hip circumference (cm), the latter measured as the largest circumference of the gluteal region. The data obtained by WHR was compared with proposed references, with those females who had WHR>0.85 and males who had WHR>0.9 being considered as having central obesity[10].

The conicity index (CI) was determined by measuring the waist weight, height and circumference, using the mathematical equation proposed by Valdez[11]: CI = [WC (m)/0.109 x √ weight (kg) / height (m) and the cutoff points used by the author to classify the rich ones.

The body mass index (BMI) was used to measure the body fat using the hips and height measure. The BMI classification was based on the one proposed by Bergman[12]: [Hip (cm) / (height (m) x √ height (m))] – 18[13].

Blood tests were performed at the Laboratory of Biopharmaceuticals, Department of Biochemistry and Molecular Biology, Federal University of Viçosa, consisted of fasting glucose dosage, TC, HDL-c, TG and LDL-c, the latter being measured by the formula proposed by Friedewald[14].

According to the IV Brazilian Guidelines on Dyslipidemia and Prevention of Atherosclerosis[14], the following values of lipid fractions are considered lipid change: LDL-c (≥160 mg/dL), TG (≥150 mg/dL), TC (≥200 mg/dL) and low HDL-c (men <40 mg/dL and women <50 mg/dL).

Table I
Lipid profile, according to sociodemographic, behavioral and lifestyle variables of the elderly in the Family Health Strategy. Viçosa, Minas Gerais, Brazil, 2013

Variable	TC			HDL-c			TG			LDL-c		
	Mean	s.d	p*	Mean	s.d	p*	Mean	s.d	p*	Mean	s.d	p*
Gender												
Male	195.0	43.6	0.84	40.4	11.8	**<0.05**	127.3	74.9	0.55	126.2	36.1	0.84
Female	196.0	48.0		46.9	11.6		131.6	62.2		125.3	40.4	
Age												
60-69	197.4	47.7	0.78	42.6	11.7 [a]	**0.03**	132.7	76.3	0.19	128.5	38.5	0.53
70-79	193.8	45.3		44.6	12.1		132.5	65.5		123.6	38.5	
≥80	196.4	45.2		47.7	12.7[a]		115.1	43.7		124.3	39.2	
Social class												
AB	203.1	45.7	0.28	43.7	13.3	0.77	143.7	69.9	0.17	128.6	42.8	0.61
CDE	194.7	46.2		44.3	12.0		128.2	67.3		125.3	38.1	
Education												
Illiterate	192.7	53.1	0.64	45.3	13.1	0.27	124.4	65.9	0.45	122.9	42.6	0.50
1-5	195.9	43.9		44.4	12.4		130.1	69.7		125.6	37.0	
≥5	200.0	41.8		41.9	8.8		138.8	62.2		130.7	37.3	
Ethnicity												
White	200.3	49.0	0.23	45.4	13.5	0.27	140.1	75.0	**0.05**	126.7	38.7	0.74
Non-White	193.8	44.9		43.8	11.6		125.9	64.3		125.2	38.6	
Marital Status												
Married	193.4	45.6	0.29	42.7	11.9	**<0.05**	134.6	74.2	0.11	124.4	37.0	0.50
Living alone	198.6	46.8		46.3	12.1		123.3	56.9		127.2	40.6	
Smoking Habits												
Never	194.2	43.6	0.48	45.5	12.0	**0.02**	125.7	60.5	0.17	124.8	37.0	0.65
Yes	197.6	49.4		42.6	12.1		135.3	76.0		126.7	40.7	
Drinking Habits												
No	194.3	45.5	0.60	44.7	11.4	0.40	129.9	61.0	0.97	125.4	38.6	0.87
Yes	197.2	47.2		43.6	13.3		129.7	76.7		126.1	38.6	
NAF												
Active	195.3	48.6	0.93	44.9	11.3	0.52	132.1	72.0	0.71	125.2	40.9	0.90
Non-active	195.7	45.4		44.0	12.4		129.1	66.2		125.8	37.8	
Sedentary Bevahior												
No	210.8	41.4	**0.03**	44.6	12.1	0.84	138.1	58.2	0.41	136.0	36.4	0.08
Yes	193.8	46.4		44.2	12.1		128.8	68.6		124.4	38.7	

*Student's t test, [a] Difference between groups, s.d = standard deviation.

To identify the level of leisure physical activity (LPA) and sedentary behavior, the longer version of the *International Physical Activity Questionnaire* (IPAQ) was applied. Individuals who spent more than two hours in a sitting position were considered as having sedentary behavior. Individuals classified as not active were those who reported not having 150 minutes of leisure-time activities, and the active ones reported performing over 150 minutes[13,15].

The statistical analysis included the frequency distribution of qualitative variables of interest and estimates of measures of central tendency and variability for quantitative variables. To assess the normality of the variables, the *Kolmogorov-Smirnov* test was performed. Bivariate assessments were performed to identify the association between the explanatory variables of interest (sociodemographic, behavioral, lifestyle, anthropometric and body composition) and the variables of response (TC, HDL-c, LDL-c, TG). At this stage, we used the Student's t test to compare the means of two independent groups and ANOVA to compare the means of three or more independent groups. In the latter case, we used the Post-Roc Tukey test.

The correlation analysis was performed between the anthropometric and body composition variables and the lipid profile. The evaluation of the independently associated factors was performed using multiple linear regression to obtain adjusted b coefficients and their confidence intervals (CI) of 95%. The variables having *p* lower than 0.2 in the bivariate analysis were included in the final multiple regression model. The variables that were associated with the response variable with level less than or equal to 5% significance remained in the final model.

The analyses were performed using Stata software, version 9.1. The level of significance for all tests was ≤0.05.

The participation of individuals in the survey was voluntary, upon authorization by signing the Statement of Informed Consent, approved by the Ethics Committee on Research with Human Beings of the Federal University of Viçosa Of. Ref. No. 03/2013/CEP/07-12-E2[16,17].

Results

Of the 402 subjects studied, there was a predominance of females (60.4%) with mean age of 72.2 (±7) years. The table I shows the lipid profile of the elderly according to sociodemographic, behavioral and lifestyle variables. The TC levels were statistically diffe-

Table II

Correlation coefficient and p *values among anthropometric variables, of body composition variables and of the lipid profile of the elderly in the Family Health Strategy. Viçosa, Minas Gerais, Brazil, 2013*

	TC	*HDL-c*	*TG*	*LDL-c*	*CCum*	*BMI*	*WST*	*WHR*	*CI*	*BMI*	*%BF*
TC	1										
Hdl-c	0.19 **<0.001**	1									
TG	0.20 **<0.001**	-0.34 **<0.001**	1								
Ldl-c	0.92 **<0.001**	0.09 0.07	0.04 0.45	1							
CCum	-0.008 0.14	-0.16 **0.001**	0.29 **<0.001**	-0.08 0.10	1						
BMI	-0.02 0.63	-0.11 **0.04**	0.26 **<0.001**	-0.04 0.43	0.86 **<0.001**	1					
WST	-0.06 0.89	-0.07 0.16	0.29 **<0.001**	-0.02 0.58	0.87 **<0.001**	0.86 **<0.001**	1				
WHR	-0.02 0.73	-0.25 **<0.001**	0.30 **<0.001**	-0.02 0.62	0.50 **<0.001**	0.33 **<0.001**	0.64 **<0.001**	1			
CI	-0.02 0.67	-0.10 **0.05**	0.25 **<0.001**	-0.03 0.54	0.52 **<0.001**	0.27 **<0.001**	0.76 **<0.001**	0.84 **<0.001**	1		
BMI	0.002 0.97	0.09 0.08	0.15 **0.004**	-0.02 0.66	0.66 **<0.001**	0.79 **<0.001**	0.81 **<0.001**	0.04 0.41	0.30 **<0.001**	1	
%BF	0.09 0.08	0.08 0.16	0.10 0.06	0.04 0.48	0.34 **<0.001**	0.35 **<0.001**	0.49 **<0.001**	0.17 **0.002**	0.39 **0.002**	0.53 **<0.001**	1

CCum = waist circumference measured at the umbilicus; BMI = body mass index; WST = waist height; WHR = waist-hip ratio; CI = conicity index; % BF = percentage of body fat.

Table III
Coefficient of linear regression (crude and adjusted), respective confidence intervals and p *value for TC and HDL-c of the elderly in the Family Health Strategy.Viçosa, Minas Gerais, Brazil, 2013*

Variables	*TC*					*HDL-c*				
	ß	*CI(95%)*	*$ß_{adjuested}$*	*CI(95%)*	*p**	*ß*	*CI(95%)*	*$ß_{adjuested}$*	*CI(95%)*	*p**
Gender										
Male	1					1				
Female	-0.002	-0.05; 0.04				0.15	0.10; 0.21			
Age	< -001	-0.004; 0.002				0.006	0.002; 0.01			
Social Class										
AB	1					1				
CDE	-0.04	-0.13; 0.03				0.02	-0.06; 0.11			
Education										
Illiterate	1					1				
1-5	0.03	-0.03; 0.09				-0.01	-0.08; 0.05			
≥5	0.02	-0.01; 0.06	-0.03	-0.08; 0.11	0.14	-0.02	-0.07; 0.01			
Ethnicity										
White	1					1				
Non-White	-0.02	-0.08; 0.02	-0.05	-0.10; 0.01	0.12	-0.02	-0.09; 0.03			
Marital Status										
Married	1					1				
Living alone	0.02	-0.02; 0.07				0.08	0.02; 0.14			
Smoking Habits										
Yes	1					1				
No	0.01	-0.03; 0.06				-0.07	-0.12; -0.01			
Drinking Habits										
Yes	1					1				
No	0.01	-0.03; 0.06				-0.03	-0.09; 0.02	0.09	0.03; 0.16	**0.005**
NAF										
Active	1					1				
Non-Active	0.006	-0.05; 0.06				0.03	-0.09; 0.03			
Sedentary Behavior										
No	1					1				
Yes	-0.09	-0.17; -0.01	-0.09	-0.18; 0.009	**0.03**	-0.01	-0.10; 0.08			
WC	-0.001	-0.003; 0.001	-0.009	-0.01; -003	**0.003**	-0.004	-0.006; -001			
BMI	-0.001	-0.007; 0.004	-0.02	-0.06; 0.03	0.44	0.007	-0.01; <-001			
WST	-0.02	-0.34; 0.29	1.05	0.14; 1.96	**0.02**	-0.27	-0.62; 0.08			
WHR	-0.04	-0.37; 0.28				-0.91	-1.27; -0.55	-1.03	-1.40;.65	**<0.001**
CI	-0.06	-0.34; 0.22	-1.02	-3.53; 1.48	0.42	-0.31	-0.63; 0.005			
BMI	-0.001	-0.006; 0.005				0.005	<-0.001; 0.01			
%BF	0.003	-0.004; 0.006	0.005	0.001; 0.01	**0.01**	0.002	<0.001; 0.006			

rent only in relation to sedentary behavior. HDL-c differed with respect to gender, age, marital status and smoking. TG levels were significantly higher among the elderly who declared themselves white in comparison to the others. The LDL-c levels showed no significant differences with respect to the variables.

Significant correlations were observed between HDL-c with WC, BMI, WHR and CI. Positive and significant correlations were observed between levels of TG and all anthropometric variables. TC and LDL-c did not correlate significantly with any anthropometric variable.

Only variables that were associated independently with altered lipid levels were included in the final model, where TC remained independently associated with the presence of sedentary (0.002), elevated %BF (0.01), higher WST (0.02) and larger WC (0.003) behavior. Low HDL-c was associated with the consumption of alcohol (0.005) and higher WHR (<0.001). Increase in the LDL-c levels was independently associated with

Table IV
Coefficient of linear regression (crude and adjusted), respective confidence intervals and p *value for LDL-c and TGA of the elderly in the Family Health Strategy.Viçosa, Minas Gerais, Brazil, 2013*

Variables	*LDL-c*					*TGA*				
	ß	*CI(95%)*	*ß*							

Variables	*LDL-c* ß	*LDL-c* CI(95%)	*LDL-c* $ß_{adjuested}$	*LDL-c* CI(95%)	*LDL-c* p*	*TGA* ß	*TGA* CI(95%)	*TGA* $ß_{adjuested}$	*TGA* CI(95%)	*TGA* p*
Gender										
Male	1					1				
Female	-0.016	-0.08; 0.05				0.08	-0.01; 0.18			
Age	-0.002	-0.007; 0.002				0.004	-0.01; 0.002			
Social Class										
AB	1					1				
CDE	-0.02	-0.13; 0.08				-0.13	-0.28; 0.02	-0.08	-0.23; 0.06	0.26
Education										
Illiterate	1		1			1		1		
1-5	0.04	-0.04; 0.11	-0.03	-0.13; 0.06	0.50	0.06	-0.04; 0.18	-0.06	-0.20; 0.07	-0.91
≥5	0.08	-0.02; 0.19	-0.08	-0.20; 0.04	0.18	0.07	-0.003; 0.14	-0.13	-0.29; 0.02	-1.65
Ethnicity										
White	1					1		1		
Non-White	-0.01	-0.08; 0.06				-0.10	-0.20; 0.007	-0.08	-0.18; 0.01	0.09
Marital Status										
Married	1					1				
Living alone	0.01	-0.05; 0.08				-0.05	-0.15; 0.04			
Smoking Habits										
Yes	1					1		1		
No	0.004	-0.06; 0.07				0.04	-0.05; 0.13	0.11	0.009; 0.22	**0.03**
Drinking Habits										
Yes	1					1				
No	0.004	-0.06; 0.07				-0.04	-0.14; 0.05			
NAF										
Active	1					1				
Non-Active	0.01	-0.06; 0.08				0.01	-0.06; 0.08			
Sedentary Behavior										
No	1					1				
Yes	-0.10	-0.21; 0.005	-0.09	-0.13; 0.06	0.10	-0.09	-0.25; 0.06			
WC	-0.002	-0.005; <0.001	0.01	0.02; 0.003	**0.01**	0.01	0.009; 0.01			
BMI	-0.003	-0.001; 0.004	0.02	-0.001; 0.04	0.07	0.03	0.02; 0.04	0.01	0.005;0.03	**0.005**
WST	-0.13	-0.55; 0.27				1.99	1.42; 2.56			
WHR	-0.12	-0.56; 0.31				2.11	1.51; 2.71	1.64	0.98; 2.31	**<0.001**
CI	-0.13	-0.51; 0.24	0.80	-0.03; 1.65	0.06	1.56	1.04; 2.08			
BMI	-0.002	-0.009; 0.005				0.02	0.009; 0.031			
%BF	0.001	-0.003; 0.005	0.004	0.001; 0.009	0.16	0.009	0.002; 0.01			

increased WC (0.01). The increased TG was positively associated with higher BMI (0.005), smoking (0.03) and the largest WHR (<0.01).

Discussion

Studies that relate the distribution and factors associated with different types of dyslipidemia in the elderly population are scarce. This fact asserts the importance of developing follow-up studies of the health profile of the elderly, covering different aspects that contribute to the reorganization of primary care through a holistic approach to lipid profile, associating epidemiological reflection and targeting prevention measures[18].

At the end of this study, it was possible to establish different associations related to changes in serum levels of lipids. The TC was independently associated to the presence of sedentary behavior in the elderly and to the increase in %BF, higher WST and WC. The study by Oliveira et al. (2014)[19] observed a positive association between individuals with high WC and high levels of TC with cardiovascular risk. With this, it is important to strengthen the use of these two parameters as a global cardio metabolic risk, being an indicator of low cost and easy application. Studies that took into account the physical activity and its contribution to improvement of the lipid profile also showed that physical inactivity is considered a risk factor for different changes in lipid levels, because it is related to obesity and associated comorbidities. The absence of sedentary behavior contributes to a favorable lipid profile, since changes in lifestyle involving dietary modifications and increased physical activity are recommended. The established relationship of increased TC and different anthropometric measurements is also explained by the presence of poor dietary habits[20-22].

Obesity, as well as high levels of body fat, higher WST and WC have a direct association with the presence of cardiovascular disease and other comorbidities. The positive association between high %BF and changes in TC levels in the evaluated elderly corroborates the findings of Cabrera and Jacob Filho[23], where obese elderly showed worsening in health indicators, characterized by a higher prevalence of diabetes, low HDL-c and hypertriglyceridemia among elderly males. For women, there was only association with higher frequency of hypertension in obese patients. The study Roriz et al.[24] related anthropometric measurements with visceral adipose tissue, verifying a positive association between Waist-to-Height Ratio and Sagittal Abdominal Diameter Height index with visceral adipose tissue in the elderly. The study of Bueno[25] revealed that elderly people with high %BF presented high risk (35.5%) and moderate risk (38.7%) for CVD, indirectly demonstrating the risk relationship between % BF and TC plasma levels. In the same study, as to TC, it was evident that 50% of individuals with borderline levels were overweight, and that 58.3% with elevated levels were overweight. However, no association was found between cholesterol and overweight[24,25].

HDL-C showed a positive association with the consumption of alcoholic beverage and higher WHR, so seniors who reported drinking alcohol or having routinely consumed it in the past had lower levels of HDL-c. This fact contradicts the effect of elevated levels of HDL-c in individuals who perform regular alcohol consumption. It is important to note that alcohol may act as a protector when in moderate amounts, decreasing LDL and increasing HDL, but it may be a risk factor when consumed in excess, since it can cause atrial fibrillation and cardiac arrhythmias. The lack of consensus on the assessment of alcohol consumption and the lack of explanation about the type of drink consumed by the seniors of the study are limiting factors in the analysis of the results[26].

Excess of alcohol causes elevated plasma TG levels and is related to high mortality rates. Moreover, the heightened alcohol intake may predispose to acute pancreatitis, accentuating hypertriglyceridemia and chylomicronemia. Alcohol consumption by the elderly population is cited as a multifactorial, complex and poorly understood problem. In a study that investigated patterns of alcohol consumption in the Brazilian population, it is estimated that 7% of seniors consume alcohol daily, 8% 1-4 times a week and 10% make occasional use (1-3 times a month)[27].

Regarding the low levels of HDL-c, this was related independently with the largest WHR. In the study with elderly women, Krause[28] found that the WHR was inversely associated with HDL-c levels, corroborating this study. Similar results were found by Cabrera and Jacob Filho[23] in Brazilian elderly women, where the prevalence of low HDL-c levels was found in women with high levels of central fat mass, suggesting an inverse relationship between central obesity and HDL-c. The most significant relationship between WHR with the components of the lipid profile may be explained by the fact that central obesity is directly linked to visceral fat. This effect influences the atherogenic development and leads to reduced levels of HDL-c.

It is noted that WHR has been used in population studies as a predictor of risk of cardiovascular disease, but a major limitation of WHR is the absence of specific cutoff points for the elderly population. The proposed criteria for young adults are used as reference for classification, not considering the changes in fat distribution inherent to the aging process[24,27-29].

Changes in LDL-c were independently associated with increased WC of the assessed elderly. It is known that significant relationships between increased WC and higher LDL-c is an indicator of unfavorable metabolic changes that lead to the emergence of CVD. This positive relationship was observed by Koster[30] where individuals with increased circumference had higher risk of mortality. In a study of Moretti[29], regardless of age, excess weight in the elderly was related to changes in the lipid profile, such as elevated LDL-C plasma levels and a consequent reduction in HDL-c. Different recommendations envisage the reduction of LDL-c due to its proven effectiveness in reducing CVD mortality, and especially in reducing the recurrence of cardiovascular events such as acute myocardial infarction. However, obtaining lipid levels has not been widely achieved by various groups and ages[30-32].

The increase in TG levels was independently associated with greater BMI, higher values of WHR and smoking habits of the seniors. In a study with adult men, Lakka[33] examined the variance between tertiles of WC and WHR with lipid profile and showed that the greater was the global obesity, the higher were the TG values and the lower were the HDL-c values. This study presents a similarity with the results found in this study, where WHR and BMI were directly associated with levels of TG and WHR was inversely associated with HDL-c. Cabrera and Jacob Filho[23], in a study of Brazilian elderly women, established direct relationship between central obesity and TG, corroborating the results presented herein.

The scarcity of studies correlating the different aspects related to possible changes in lipid levels in the elderly, using similar methodology employed in this work, limits the comparisons of our results. The fact that cross-sectional studies with work collecting data on exposure and outcome in a single moment in time must be taken into consideration, as they limit associations of cause and effect among the assessed variables.

Conclusion

Understanding the distribution and factors associated with different types of dyslipidemia in the elderly population is of great relevance to target prevention and control of NCDs in the elderly.

The promotion, health education, prevention and retardation of diseases and weaknesses are actions that should be promoted in an integrated and expanded way, aiming not the management of the chronic disease, but monitoring the health profile of the patient. So, it will be possible to ensure better quality of life for the elderly and the well-being of the population. Studies that report a high prevalence of modifiable and treatable risk factors for dyslipidemia are important to restructure the primary care model focused on prevention of this reversible problem that affects a substantial portion of the elderly population.

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