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ANALYSIS OF THE LIPID PROFILE OF ELDERLY PEOPLE: A POPULATION-BASED STUDY

E.J. Muller Uliano[1], M. Constante Dutra[1], T. Martins[2], D.F. Grassi de Paula Machado[3], R.A. Vieira e Silva[4], D.J. Trevisol[5], F. Schuelter Trevisol[5]

Abstract: *Objectives:* To examine the lipid profile of elderly people living in Tubarão, state of Santa Catarina, and the prevalence of dyslipidemia among them. *Methods:* Cross-sectional study. We studied 822 elderly people living in Tubarão, state of Santa Catarina, Brazil, between September 2010 and May 2011. Consenting participants were interviewed about their socio-demographic characteristics, lifestyle, clinical and family history of cardiovascular events. We determined the lipid profile and anthropometric measurements (weight and height). *Results:* Dyslipidemia was found in 152 (48.1%) men and 310 (55.9%) women. Isolated hypertriglyceridemia was the most commonly found form of fat. The mean serum total cholesterol level in the study was 204.5±42.4 mg/dL. Dyslipidemia was significantly more common in women than in men, especially among white, obese men living alone. However, only obesity was an independent risk factor for dyslipidemia. *Conclusion:* A high prevalence rate of dyslipidemia was found in the surveyed population, which implies a major risk factor for coronary artery disease.

Key words: Elderly, dyslipidemia, cardiovascular disease.

Introduction

In the last ten years, the Brazilian elderly population increased by 2.5 times more than the young population (1, 2), and it is believed that in 2020, Brazil will rank as the sixth country in the world with the largest number of elderly people (3). This rapid population growth causes a significant impact on society, especially on the health system (4).

With an aging population, there is a significant increase in diseases, especially cardiovascular disease (CVD) (5, 6). Data from the World Health Organization (WHO) (7) suggest that each year 17 million people die worldwide due to CVD. In Brazil, cardiovascular diseases are the leading cause of death among the elderly population, accounting for about 40 percent of deaths (6).

Many risk factors are considered important triggers for the development of CVD. Dyslipidemia is one of the most significant factors (8), since it contributes for the progression of atherosclerosis (9). The rapid growth of the elderly population leads to increased incidence of cardiovascular events, mainly associated with dyslipidemia. Thus, this study aimed to analyze the lipid profile and examine dyslipidemia prevalence of the elderly population living in Tubarão, Santa Catarina.

Methods

This study was approved the Research Ethics Committee of Unisul.

A cross-sectional population-based epidemiological study was conducted. The sample was drawn from the health study of the elderly population living in Tubarão, a project carried out between September 2010 and May 2011. The project aims to assess the health status and quality of life of elderly people living the municipality of Tubarão, state of Santa Catarina. Participants were recruited from the elderly registered by the community agents working in different areas of the Family Health Strategy (FHS) program, which covers more than 90 percent of the area, totaling 9.009 elderly residents. The sample size was calculated considering a dyslipidemia

1. Undergraduate Medical Student, University of Southern Santa Catarina (Unisul); 2. Master's Degree in Health Sciences form Unisul. Professor of the School of Pharmacy and the School of Medicine, University of Southern Santa Catarina; 3. Master's Degree in Health Sciences from Unisul. Epidemiological Surveillance Nurse in Tubarão, State of Santa Catarina; 4. Specialized Physician. Professor of the School of Medicine, University of Southern Santa Catarina; 5. PhD in Cardiology and Cardiovascular Sciences (UFRGS). Professor of Postgraduate Health Sciences and the School of Medicine, University of Southern Santa Catarina. Clinical Research Center Coordinator, Hospital Nossa Senhora da Conceição.

Corresponding Author: Profa. Dra. Fabiana Schuelter Trevisol, PhD in Cardiology and Cardiovascular Sciences (UFRGS). Professor of Postgraduate Health Sciences and the School of Medicine, University of Southern Santa Catarina. Avenida José Acácio Moreira, 787, CEP 88704-900, Tubarão – Santa Catarina, Fone: (48) 36221442 ou 36317239, E-mail: fastrevisol@gmail.com

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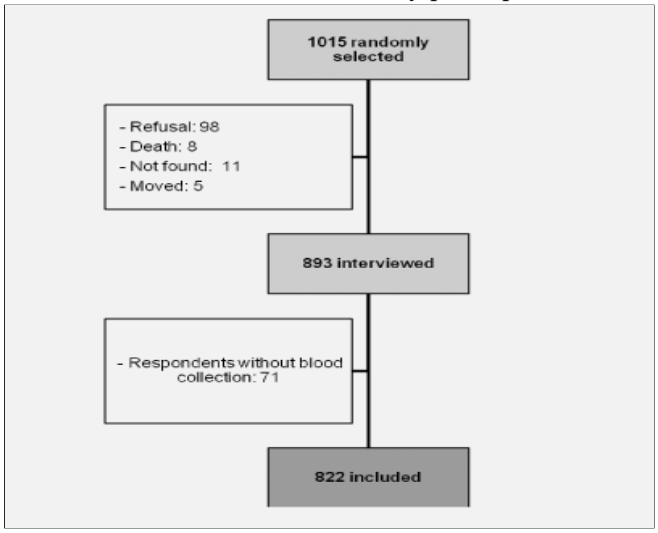
prevalence rate of 35.5 percent (10, 11), and a five percent margin of error, resulting in a minimum sample of 239 individuals for a 95 percent confidence level, and 405 individuals for a 99 percent confidence level. Simple random sampling was used to select the participants.

The study included people aged 60 years (completed in 2010) and over, residents in the municipality of Tubarão, state of Santa Catarina, that agreed to participate in the study and ensured the blood collection. Individuals with cognitive disorders (mental illness or degenerative disorder), unable to respond to inquiries or to decide on their participation, were excluded from the study. Selection of participants is described in Figure 1.

Figure 1
Selection criteria of the study participants



Interview

The sampled subjects were invited to participate in the study through community health workers and asked to sign the consent form. Subsequently, they were interviewed and asked to answer a questionnaire containing socio-demographic and socio-economic data (age, gender, skin color, marital status, employment status and education), behavioral data (physical activity, alcohol consumption and tobacco use), medical condition and clinical status (history of cardiovascular disease and comorbidity, use of lipid-lowering medications and family history of dyslipidemia). Then, they were scheduled an appointment at the Basic Health Unit (BHU) located near the area in which they lived for blood collection and anthropometric measurement.

Ever smokers were defined as those who had smoked at least 100 cigarettes during their lifetime (12). The CAGE questionnaire (13) was administered to the elderly who said they consume or had consumed alcohol. The CAGE (cut-annoyed-guilty-eye) is an internationally assessment instrument used for identifying problems with alcohol.

Physically active individuals were considered those who performed at least 30 minutes of physical activity, five days a week or more, resulting in a cut-off point of 150 or more minutes per week of physical activity as recommended (14). Sampled subjects were asked about the current or past year use of lipid-lowering drugs.

Blood collection and anthropometry

Patients were attended at the BHU for blood collection and anthropometric measurement. Ten ml of peripheral venous blood was collected for the determination of total cholesterol, high-density lipoprotein (HDL) fraction, low-density lipoprotein (LDL) fraction and triglycerides (TG). A 12-hour fast was recommended before blood collection. In addition to fasting, alcohol should not be consumed for 72 hours prior to the time of the cholesterol test. The tests were performed at the Clinical Laboratory of the University of Southern Santa Catarina, using a dry chemistry system (Vitros, Johnson & Johnson Company) for determining the total lipid profile. The chosen laboratory has a strict quality control and is accredited by the Brazilian Society of Clinical Analysis. The LDL fraction was determined by the Friedewald equation: Total cholesterol - (HDL + TG/5), if TG <400mg/dL. LDL-cholesterol was not calculated for patients with triglycerides greater than 400 mg/dL (15).

Body weight was measured in kilograms while individuals were wearing light clothing and no shoes. The measurement of the height in meters was performed with patients standing erect and motionless in the center of the scale, looking at a fixed point on the horizon, using a Wiso W721 height measuring scale. The body mass index (BMI) was calculated as the ratio of weight (kg)/height^2 (m) and classified according to the values established by the WHO. Obese individuals were considered those with a BMI equal to or greater than 30 kg/m^2.

Dyslipidemia

Reference values of laboratory tests were categorized according to the National Cholesterol Education Program (NCEP-III). Dyslipidemia was defined as the condition of individuals who were included in at least one of the four biochemical classifications of the 4th Brazilian Guidelines on Dyslipidemia and Prevention of Atherosclerosis: (a) isolated hypercholesterolemia, in which there is isolated elevation of LDL cholesterol ≥160 mg/dL; (b) isolated hypertriglyceridemia when there is isolated elevation of TG ≥150 mg/dL; (c) mixed hyperlipidemia with increased values of LDL ≥160 mg/dL and TG ≥150 mg/dL; and (d) reduced HDL levels (below <40 mg/dL in men and <50 mg/dL in women) in isolation or in association with increased LDL or TG (16).

Statistical Analysis

The sample size was calculated through the StatCalc Epi Info™ software version 3.5.1 (Centers for Disease Control, Atlanta, GA). The collected data were entered into the EpiData version 3.1 (EpiData Association, Odense, Denmark), and statistical analysis was performed using the Statistical Package for Social Sciences (SPSS for Windows v 18; Chicago, IL, USA). Quantitative variables were described as measures of central tendency and dispersion, and qualitative variables as absolute numbers and proportions. To examine the degree of correlation between variables, Pearson's Chi-square test was used for qualitative variables and Student's t-test for mean comparison. Multivariate analysis of Poisson regression with robust variance was performed to control for confounding variables. The confidence interval was set at 95 percent.

Results

A total of 822 elderly was surveyed, of whom 506 (61.6%) were women. The mean age was 68 (SD+7) years. The sociodemographic characteristics of the surveyed population are shown in Table 1.

Table 1
Sociodemographic characteristics of the surveyed elderly population (n = 822)

	Total	Men n (%)	Women n (%)	P value*
Age (years)				0.4
60-69	502	186 (37.1)	316 (62.9)	
70-79	248	98 (39.5)	150 (60.5)	
80 and over	72	32 (44.4)	40 (55.6)	
Skin color				0.2
White	758	296 (39.1)	462 (60.9)	
Non White	64	20 (31.2)	44 (68.8)	
Education (years of schooling)				0.7
< 4	614	234 (38.1)	380 (61.9)	
≥4	206	82 (39.8)	124 (60.2)	
Marital status				<0.001
Yes	545	279 (51.2)	266 (48.8)	
No	277	37 (13.4)	240 (86.6)	
Working in the last month				<0.001
Yes	80	49 (61.3)	31 (38.7)	
No	742	267 (36.0)	475 (64.0)	
Alcoholic (CAGE)				
Yes	83	64 (77.1)	19 (22.9)	<0.001
No	739	252 (34.1)	487 (65.9)	
Smoking				<0.001
Yes	333	220 (66.1)	113 (33.9)	
No	485	96 (19.8)	389 (80.2)	
Physically active				0.09
Yes	141	68 (48.2)	73 (51.8)	
No	680	248 (36.5)	432 (63.5)	

*Pearson's Chi-square test (95% CI)

Serum cholesterol levels were categorized according to the NCEP-III, and are shown in Table 2. Dyslipidemia was found in 152 (48.1%) men and 310 (55.9%) women. Dyslipidemia was significantly more prevalent in women than in men (p<0.001).

Table 2
Lipid levels of elderly people according to the categorization of the NCEP (n = 822)

Lipid level	n(%)	Men n(%)	Women n(%)	P value*
Total cholesterol in mg/dL				<0.001
Great < 200	391 (47.6)	176 (55.7)	215 (42.5)	
Borderline 200-239	269 (32.7)	104 (32.9)	165 (32.6)	
High ≥ 240	162 (19.7)	36 (11.4)	126 (24.9)	
LDL in mg/dL (n=806)				0.015
Great< 100	235 (29.2)	104 (33.7)	131 (26.3)	
Desirable 100-129	274 (34.0)	106 (34.4)	168 (33.8)	
Borderline 130-159	188 (23.3)	71 (23.1)	117 (23.5)	
High 160-189	75 (9.3)	20 (6.5)	55 (11.0)	
Very high ≥ 190	34 (4.2)	7 (2.3)	27 (5.4)	
Triglycerides in mg/dL				0.038
Great < 150	482 (58.7)	205 (64.9)	277 (54.7)	
Borderline 150-200	187 (22.7)	59 (18.7)	128 (25.3)	
High > 200	153 (18.6)	52 (16.4)	101 (20.0)	
HDL in mg/dL				<0.001
>60	219 (26.7)	54 (17.1)	165 (32.6)	
40 – 60	487 (59.2)	190 (60.1)	297 (58.7)	
<40	116 (14.1)	72 (22.8)	44 (8.7)	

*Chi-square test (95% CI)

The mean serum total cholesterol, HDL and LDL cholesterol fractions and triglycerides are described in Table 3.

Table 3
Mean serum total cholesterol, HDL and LDL fractions and triglycerides, by gender (n=822)

	Total Mean (SD)	Variation	Men Mean (SD)	Women Mean (SD)	P vaue*
Total colesterol (mg/dL)	204.5 (42.4)	91-418	193.9 (41.0)	211.1 (41.9)	<0.001
LDL (mg/dL) (n=806)**	119.7 (36.1)	32-253	113.7 (34.3)	123.4 (36.8)	<0.001
Triglycerides (mg/dL)	153.9 (85.8)	43-999	149.3 (95.8)	156.8 (78.8)	0.2
HDL (mg/dL)	53.9 (14.3)	24-122	50.1 (13.5)	56.3 (14.2)	<0.001

* Student's t-test (95% CI); ** Fifteen patients had triglyceride levels ≥ 400mg/dl.

There was no association between dyslipidemia and alcohol abuse, smoking, physical activity, employment status and current use of lipid-lowering drugs, but the subjects who had used lipid-lowering medication in the past year had significantly more dyslipidemia than individuals who did not use this type of drug (p<0.001).

With regard to skin color, dyslipidemia was more common in elderly whites than non-whites (p<0.037). A stable relationship was also statistically significant (p<0.048), since dyslipidemia was more common in elderly people living without a partner (single, widowed, divorced) than their married counterparts.

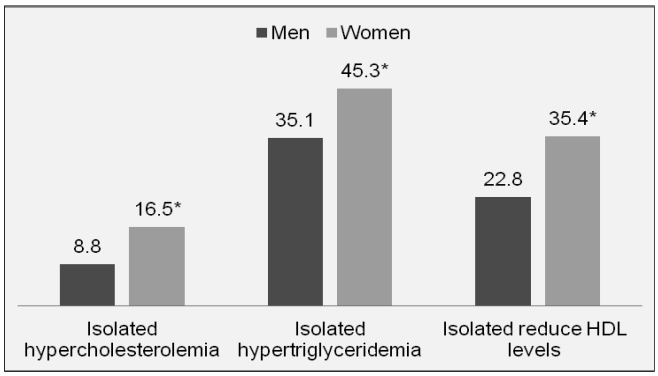
The elderly who had been previously diagnosed with dyslipidemia maintained their condition as shown in the recent biochemical tests performed. Individuals previously diagnosed with obesity had a higher prevalence of dyslipidemia than non-obese individuals, and this difference was statistically significant ($p<0.001$). Likewise, individuals classified as obese based on BMI ≥ 30 kg/m^2, had higher rates of dyslipidemia ($p<0.001$) than subjects with BMI <30 kg/m^2.

Findings reveal that individuals who reported previous episodes of stroke, myocardial infarction or angina, or who had performed procedures such as catheterization, angioplasty or coronary artery revascularization with saphenous vein bypass graft, had a higher prevalence of dyslipidemia than individuals who had never experienced such cardiovascular events. No statistically significant result was found between family history of cardiovascular events and dyslipidemia.

After the analysis of confounding variables that were associated with the outcome in the univariate analysis (gender, skin color, marital status, age and BMI), only a higher BMI showed to be independently associated with the presence of dyslipidemia ($P<0.001$).

Figure 2 illustrates the percentage of each type of dyslipidemia found in accordance with the 4th Brazilian Guidelines on Dyslipidemia and Atherosclerosis Prevention, distributed by gender.

Figure 2
Distribution of dyslipidemia phenotypes according to gender



* $p<0.05$

Discussion

In this study, dyslipidemia was detected in 152 (48.1%) men and 310 (55.9%) women. These findings are consistent with other studies of the Brazilian population (17-19), in which dyslipidemia was also more common in females than males, especially when it comes to cholesterol levels in all age groups.

Isolated hypertriglyceridemia was the most commonly found phenotype in 45.3 percent of women and 35.1 percent of men, which is similar to the data found in the study by Oliveira and Mancini Filho (20), in which 54 percent of the surveyed women had hypertriglyceridemia.

In the present study, mean total cholesterol level was 204.5±42.4 mg/dL among the elderly, which is above the recommended level by the NCEP-III guidelines (8). A study conducted in 13 Brazilian cities to assess total cholesterol levels in 81,262 participants, aged 18 years and above, found a mean level of 199.0±35.0mg/dL (17), of whom 40 percent had levels above 200 mg/dL. Populations with serum total cholesterol level above 200 mg/dL are at increased risk for fatal and nonfatal cardiovascular events (21). Dyslipidemia was the third largest risk factor predisposing to acute myocardial infarction among the participants in the INTERHEART US study (22). Of the elderly participants, 52.4 percent had total cholesterol levels above 200 mg/dL, but it is known that body composition changes with age due to the lower metabolic rate, muscle mass decrease, and increased body-fat accumulation in the abdominal region, which favors the development of obesity and dyslipidemia (23).

This study found that 22.8 percent of men and 35.4 percent of women had HDL levels below target, which is similar to findings in a study conducted in Tibet with people between 30 and 70 years old, of whom 24.3 percent had unsatisfactory levels of HDL (24). The importance of maintaining a targeted HDL level is supported by the scientific evidence that the reduction of HDL by itself is considered a risk factor for the development of coronary artery disease (25, 26).

In this study, patients who reported previous use of lipid-lowering drugs and had a previous diagnosis of dyslipidemia continued to have unsatisfactory cholesterol levels in the blood tests. However, neither was the time of lipid-lowering drug use evaluated nor was the serum lipid profile examined at the beginning of drug treatment.

The Minnesota Heart Survey, a cohort study with 20 years of monitoring, found that only 33 percent of women and 28 percent of men knew their lipid profile. More than 50 percent of the respondents had total cholesterol levels above 200 mg/dL, and were unaware of this condition (27). A Brazilian multicenter study on elderly people in cardiology outpatient clinics showed that among 2,196 elderly patients surveyed, one-third of them had high total cholesterol levels, but only seven percent of them were being treated with lipid-lowering drugs (28).

Lowering cholesterol levels with lifestyle changes and drug treatment is vital to primary and secondary prevention of major cardiovascular events. However, even with proven effectiveness, cholesterol treatment goals have not been widely achieved. Factors such as the cost of medication, social behavior and lack of awareness contribute to patients' failure to follow medical advice (16, 29).

There are several factors influencing the development

of dyslipidemia, such as genetics, gender, age, physical inactivity and dietary habits. Changes in eating habits and physical activity significantly improve the lipoprotein profile, in addition to being low-cost interventions (30, 31). Physical activity was not considered a protective factor for dyslipidemia in this study, which can be justified by the difficulty in assessing the physical activity and because of the low prevalence of physically active elderly in the sample. The American College of Sports Medicine recommends prevention and combating dyslipidemia through exercise (32). Regular aerobic physical activity was effective in improving lipid profile in the long run (33, 34). Veríssimo et al. (2002) (35), in a study of elderly people aged between 65 and 94 years, participating in an exercise program for eight months, confirmed that this practice reduced the risk of cardiovascular events. However, many elderly people may be unable to perform the physical activities suggested, since many of them suffer from debilitating diseases. In addition, there are environmental factors, such as the lack of incentive programs for these population groups, appropriate and safe places, and support from professionals to prescribe adequate exercises.

This study found that the subjects showed a positive association between obesity and dyslipidemia, similarly to what was found in a study conducted in Korea, in which the elderly obese people also had more dyslipidemia than non-obese individuals (36).

One of the limitations to perform this study was the lack of assessment of the dietary patterns in the surveyed elderly, since high-calorie and fatty foods contribute directly to dyslipidemia. However, fasting for 12 hours before blood collection prevents abnormalities in triglyceride dosage. Thus, the levels of total cholesterol and fractions are more influenced by internal conditions than by food intake patterns. In addition, the study design does not allow determining causality and temporality of the outcomes studied. Therefore, monitoring the population is essential to know the local situation and allow preventive and curative measures for the health problems detected.

It should be noted that population-based studies on lipid profile among elderly people and the prevalence of dyslipidemia are scarce in the literature. The sample size in this study is representative of the surveyed population, ensuring the validity of the findings.

Conclusions

This study allows us to conclude that more than half of the surveyed population has some type of dyslipidemia, which is more often found in females. Thus, this study calls the attention of authorities and healthcare providers about the need to educate and support elderly people to managing abnormal blood lipids and pursue cardiovascular risk reduction strategies.

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