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Research

*Corresponding author
Sydney Correia Leao, MD
Medical Pathology Assistant
Department of Pathology
Federal University of São Paulo
Botucatu Street, 740
Vila Clementino Neighborhood
P. O. Box: 04038-032
São Paulo, SP, Brazil
Tel. +551155764522
E-mail: sydneyleao@hotmail.com

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A Decade of Lipid Profiles: A Gender Focus

Sydney Correia Leao, MD[1*]; Ticiana Sirqueira Carvalho, MSc[2]; Manoela Pellegrini Galvão[2]; Rene Vasconcelos Silva[2]; Marlon Fontes Rocha[2]; Alex André Ferreira Queiroz[2]; Rodrigo Oliveira Almeida[2]; Rafael Rocha Araujo[2]; Maria Julia Silveira Souto[2]; Tania Maria de Andrade Rodrigues, MD, MSc, PhD[2]

[1]Department of Pathology, Federal University of São Paulo, São Paulo, SP, Brazil
[2]Group of Molecular Anatomy, Department of Morphology, Federal University of Sergipe, São Cristóvão, SE, Brazil

ABSTRACT

Introduction and Objectives: The lipid profile is an important predictor of the risk of coronary heart disease (CHD). Higher rates of total cholesterol (TC) and cholesterol of low-density lipoprotein (LDL-C) increase the chances of developing this disease. However, it is known that women due to hormonal factors would have fewer cardiovascular events. The main objective of this article is to assess the association among different parameters of the lipid profile between the different sexes in the population of a city in Brazil.
Methods: This is a descriptive, longitudinal and retrospective study based on secondary data collected in the period from 2003 to 2013 in a medical laboratory in Aracaju, Brazil. The lipid profile was determined using the following markers: total cholesterol (TC); high-density lipoprotein cholesterol (HDL-C); low-density lipoprotein cholesterol (LDL-C) and triglycerides (TG). Statistical analysis was performed using measures of central tendency and variance. The inferential analysis was performed by student's *t* test and the *p*-value was 0.05.
Results: The sample consists of 63,396 people, 24,425 male and 38,971 female, with mean age of 42.02±17.38 years. The mean value of total cholesterol, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol and triglyceride was respectively, 193.39±43.62 mg/dl, 48.80±11.24 mg/dl, 118.35±36.75 mg/dl and 131.28±82.21 mg/dl. Between the genres, it was observed statistical significant differences between all parameters of lipid profile ($p<0.0001$).
Conclusion: We concluded that women have higher rates of total cholesterol and low-density lipoprotein cholesterol; while men have lower rates of high-density lipoprotein cholesterol and higher of triglyceride, which predisposes males to the development of metabolic syndrome.

KEYWORDS: Dyslipidemia; Epidemiology; Lipid profile; Metabolic syndrome; Genres.

ABBREVIATIONS: CHD: Coronary Heart Disease; TC: Total cholesterol; HDL-C: High density lipoprotein cholesterol; LDL-C: Low density lipoprotein cholesterol; VLDL: Very low density lipoprotein cholesterol; TG: Triglycerides; TL: Total lipids; CVD: Cardiovascular disease; ANOVA: Analysis of variance; NCEP-ATP III: National Cholesterol Education Program's-Adult Treatment Panel.

INTRODUCTION

Changes in lifestyle such as alterations in eating habits and the adoption of a sedentary lifestyle, have contributed substantially to the epidemic growing of chronic diseases such as obesity, diabetes mellitus and hypertension, conditions that frequently occurs with lipid abnormalities, hypercoagulability and increased risk of cardiovascular disease (CVD).[1,2]

A major cause of morbidity and mortality in adults are the atherosclerotic diseases in both developed and developing countries, and dyslipidemia is a primary factor in their emergence.[3-5] The onset of the disease can now be detected in childhood, which is considered the

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most important period in the prevention of these risk factors.[6-8] Keeping this in mind, it becomes necessary to analyze the epidemiological profile for effective prevention and treatment of this disease.

The Brazilian Society of Cardiology (SBC) in 2013, through the V Brazilian guidelines on 'Dyslipidemia and Prevention of Atherosclerosis', establishes and recommends monitoring of the lipid profile as a mean of control and prevention of atherosclerosis, using the following parameters: TG, TC, LDL-C and HDL-C.[9] Currently, LDL-C above 100 mg/dl appear to be related to increased risk of developing cardiovascular events as well as high levels of triglycerides (above 500 mg/dl) generally predict diseases like acute pancreatitis.[6]

Data from the Brazilian Ministry of Health in 2009 show that in Aracaju, the capital of the state of Sergipe, the overall prevalence of dyslipidemia in the population is 20.9%, being 18% in men (one of the largest in the country, losing only to Belém, the state capital of Pará) and 23.3% in women. Currently, it is believed that in Aracaju the rates are close to those described previously.[10]

An analysis by the Brazilian Ministry of Health, in 2010, through a study conducted in nine Brazilian capitals, involving 8,045 subjects (mean age 34.7±9.6 years), showed that serum total cholesterol level was 183±39.8 mg/dl, of which 32.4% of subjects presented levels greater than 200 mg/dl. This amount may represent, in the age group above 50 years, about 19 million Brazilians. Because of this high prevalence of dyslipidemia, it became necessary to stratify patients into different risk groups and develop health policies able to co-opt them for treatment.[6]

Given the impact of lipid disorders for the health of the general population and in view of the high public spending on treating the consequences of dyslipidemia, such as cardiovascular disease, we intend to trace the lipid profile of the population in the state of Sergipe, Brazil. It is the second study, in this perspective, held in the Northeastern region of our country.

METHODS

This is a descriptive, longitudinal, ecological and retrospective study, based on analysis derived from a secondary database of lipid profiles from a Laboratory of Clinical Analysis of Aracaju, Sergipe, Brazil. Data related to gender and age of the patient, as well as serum levels (in mg/dl) of TC, HDL-C, LDL-C, Very-low-density lipoprotein cholesterol (VLDL-C), TG and total lipids (TL) were collected. The measurement of LDL-C was calculated indirectly through the Friedewald equation[11] (LDL-C=TC-HDL-C-TG/5), where TG/5 is cholesterol bound to LDL or VLDL-C. The sample was grouped by year, by gender and age in order to enable comparison and statistical analysis of the different variables in this study. According to the V Brazilian dyslipidemia guidelines (SBC 2013), each lipid parameter can be grouped into different categories, namely: good, desirable, borderline, high, very high and low (Tables 1 and 2).[9]

Lipids	Values (mg/dl)	Categories
TC	<200	Desirable
	200-239	Borderline
	>240	High
LDL-C	<100	Good
	100-129	Desirable
	130-159	Borderline
	160-189	High
	>190	Very high
HDL-C	>60	Desirable
	<40	Low
TG	<150	Desirable
	150-200	Borderline
	200-499	High
	>500	Very high
Non-HDL cholesterol	<130	Good
	130-159	Desirable
	160-189	High
	>190	Very high

Table 1: Reference values of the lipid profile for adults over 20 years according to the V Brazilian dyslipidemia guidelines (SBC).

Lipid Profile		Values (mg/dl)	
	Desirable	Borderline	High
TC	<150	150-169	>170
LDL-C	<100	100-129	>130
HDL-C	>45		
TG	<100	100-129	>130

Table 2: Reference values of the lipid profile for children and adolescents (below 20 years) according to the V Brazilian dyslipidemia guidelines (SBC).

In this study, we included the lipid profiles held in the city of Aracaju/SE, from January 2003 to January 2013, in which contained the sex and age of patients. The tests with incomplete data were excluded.

Data were collected from the files of the laboratory on day and time previously scheduled with the technical managers of the institution, with the permission of the coordinator of the Laboratory. The files, available in electronic format, stored on an external HD or USB Pen Drive were transported to laboratory of the Group of Molecular Anatomy, located in the Department of Morphology of the Federal University of Sergipe, Aracaju, Brazil.

The collected data were tabulated in an electronic spreadsheet, making use of Microsoft Excel® (Microsoft Corporation, Redmond, USA, 2007). The inferential analysis was

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performed by student's *t* test (two variables) and analysis of variance (ANOVA) (with three or more variables), and results were expressed as mean and standard deviation (SD). It was also analyzed partial correlation between time and variables through the Pearson's test for statistical analyzes we used the GraphPad Prism 5.0® (GraphPad Software Inc., USA) software and the significance level (*p*-value) in this study was 0.05.

RESULTS

The sample consisted of 63,396 people, including 24,425 men and 38,971 women with a mean age of 42.02±17.38 years (43.03±17.43 years for women and 40.42±17.18 years for men, $p<0.0001$). The average value of TC, HDL-C, LDL-C, VLDL-C, TG and TL were respectively 193.39±43.62 mg/dl; 48.80±11.24 mg/dl; 118.35±36.75 mg/dl; 26.16±16.46 mg/dl; 131.28±82.21 mg/dl and 565.27±115.88 mg/dl. Between genders, differences were observed for CT (196.59±43.67 mg/dl for women and 188.29±43.06 mg/dl for men, $p<0.0001$), HDL-C (51.21±11.30 mg/dl for women and 44.96±9.99 mg/dl for men, $p<0.0001$), LDL-C (121±37.02 mg/dl for women and 114.11±35.90 mg/dl for men, $p<0.0001$), VLDL-C (24.39±14.24 mg/dl for women and 29.23±19.10 mg/dl for men, $p<0.0001$), TG (121.98±71.18 mg/dl for women and 146.12±95.38 mg/dl for men, $p<0.0001$) and TL (559.05±105.01 mg/dl for women and 575.21±130.75 mg/dl for men, $p<0.0001$) (Figure 1).

In relation to different age groups, we observe the following composition: 7932 persons below 20 years; 21,570 individuals between 21 and 40 years; 24,195 people between 41 and 60 years; 8,944 individuals between 61 and 80 and finally 755 people over 80 years. Comparing the different parameters of lipid profile between the different age groups, we observe statistically significant differences ($p<0.0001$) in all parameters studied (Figure 2). We also observed weak positive correlations between age and TC values (r=0.247, $p<0.001$), LDL-C (r=0.206, $p<0.001$), TG (r=0.159, $p<0.001$) and TL (r=0.203, $p<0.001$) in the adult population (20-59 years) and very small negative correlations between age and the different parameters of lipid profile in the elderly, namely TC (r=-0.075, $p<0.001$), LDL-C (r=-0.069, $p<0.001$), TG (r=-0.038, $p=0.0015$) and TL (r=-0.063, $p<0.001$).

Setting up a time series within the adult age and older, we observed the existence of very small negative correlations between time and all study variables, as follows: CT (r=-0.04392, $p<0.0001$), LDL-C (r=-0.02503, $p<0.0001$), HDL-C (r=-0.009977, $p= 0.018$), TC (r=-0.04984, $p<0.0001$) and LT (r=-0.06164, $p<0.0001$). It was evident high fluctuation in the average values of these variables over the last 10 years (Figure 3). The same goes for the distribution of lipid parameters between the different sexes (Figures 4 and 5).

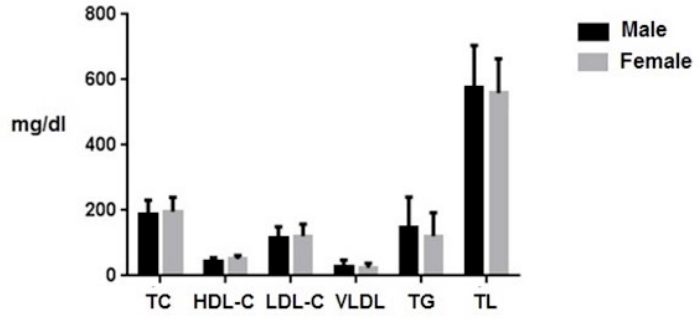

Figure 1: Distribution of the different parameters of the complete lipid profile. We observed statistically significant differences ($p<0.0001$) in all parameters studied.

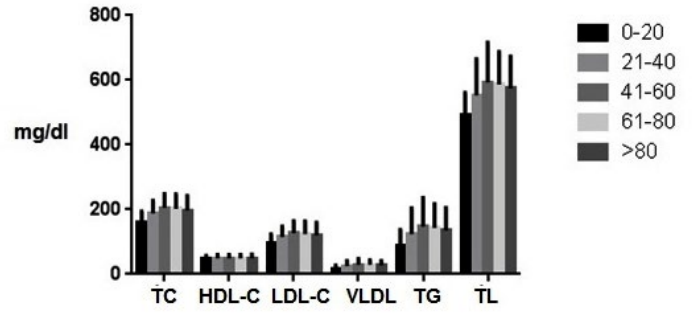

Figure 2: Distribution of the different parameters of the complete lipid profile between the different age groups. We observed statistically significant differences ($p<0.0001$) in all parameters studied.

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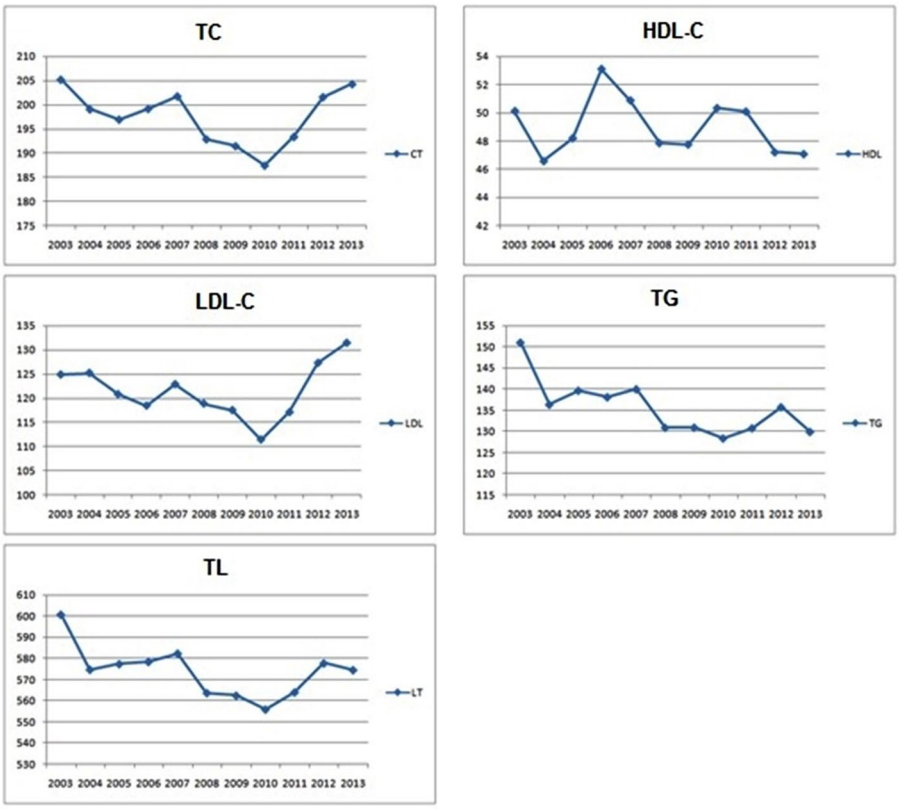

Figure 3: Time series showing the average dosage of the different lipid parameters in a range of 10 years. The data suggest that during the period, the fluctuation of the mean values of serum lipids appear to have been little influenced by time, although there is a slight tendency to decline.

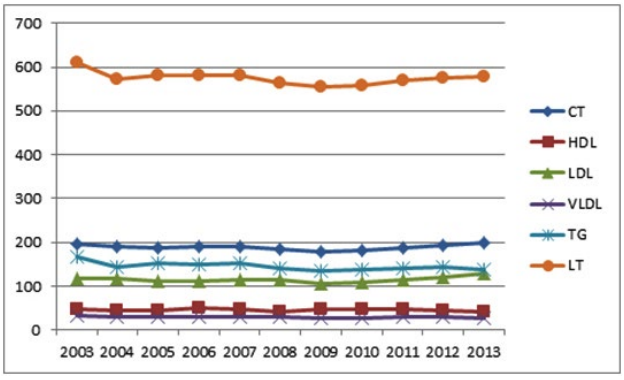

Figure 4: Time series showing the average dosage of the different lipid parameters in a range of 10 years from males.

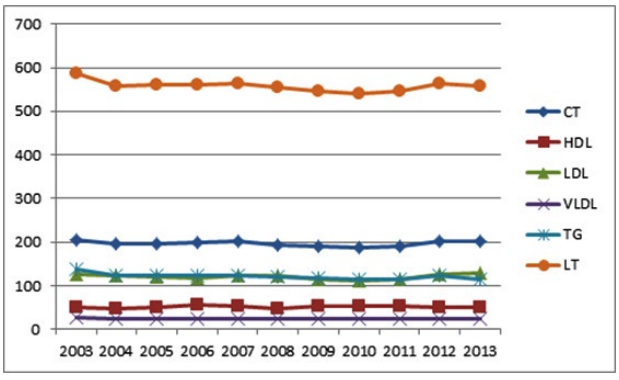

Figure 5: Time series showing the average dosage of the different lipid parameters in a range of 10 years from females.

Regarding the amount of children and adolescents, two groups were formed: group 1 comprised patients 2-12 years (N=3282) and group 2, 13-20 years (N=4650). The Wilcoxon test showed that there were differences among group means in relation to serum levels of LDL-C, VLDL-C, total cholesterol (TC) and triglycerides (TG), with group 1 always presenting lower values comparing to group 2 (Table 3). In comparison of results with reference values proposed by the V Brazilian guidelines, it was observed that the mean lipid fractions were within the desirable range, with the exception of total cholesterol, which showed a significant discrepancy (alpha=0:05, p<0.0001), reaching the average exceeds 10 mg/dl the optimal value.

DISCUSSION

There are few studies in the literature comparing the lipid profile between different age groups.[8,12,13] Some studies have shown direct correlation between increased incidence of cardiovascular disease and total cholesterol levels above 200 mg/dl.[9,14,15] In our study, we observed increased levels of this lipid, reaching a peak in the middle age group (41-60 years) and suffering a slight fall in the age group of the elderly. Recent studies show that cholesterol levels of children in a given geographic region would be directly related to the prevalence of coronary artery disease during adulthood in the same region.[12,16-18] Because of this, since

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	02 to 12	13 to 19	Normal range (desirable)
CT	156.92±30.10 mg/dl	160.68±34.90 mg/dl	<150 mg/dl
HDL-C	46.74±10.14 mg/dl	47.53±10.38 mg/dl	> 45 mg/dl
LDL-C	92.92±26.34 mg/dl	95.32±29.63 mg/dl	<100 mg/dl
VLDL	17.25±8.84 mg/dl	17.85±9.72 mg/dl	<20 mg/dl
TG	86.30±44.20 mg/dl	89.25±48.58 mg/dl	<100 mg/dl
TL	483.47±62.79 mg/dl	490.76±71.84 mg/dl	-

Table 3: Mean values and standard deviations from different parameters of lipid profiles in children and adolescents.

2006, the Brazilian Society of Cardiology (SBC) started recommending cut-off for total cholesterol in children and adolescents in 150 mg/dl and routine supervision from 170 mg cholesterol/dl of blood for prevention cardiovascular diseases.[13]

Studies also show that HDL-C have a protective role in the development of atherogenesis[19,20]; and the increase of its levels would be directly associated with reduced cardiovascular risk.[21,22] In this present study, the behavior was regularly among the different age groups, but was observed between the sexes, significantly higher levels in females, which may explain the lower prevalence of vascular events (CVD and/or stroke) in all ranges age in females compared to males. It is also observed that the presence of high levels of triglycerides associated with low HDL-C, predisposes to the development of acute myocardial infarction during life, in spite of individuals with high levels of triglycerides do not have higher levels of coronary events in relation to population in common.[23-25]

In the present study, it was observed analogously to total cholesterol, triglycerides higher rates in middle-aged population in comparison to the extreme age (young and elderly); and higher rates in male compared to the female population. These observations, together with the epidemiological characteristics related to HDL-C, mentioned in the previous paragraph, infer a higher prevalence of metabolic syndrome in male middle-aged population, according to the National Cholesterol Education Program's-Adult Treatment Panel III (NCEP-ATP III), predisposing them to greater prevalence of cardiovascular events (especially myocardial infarction or ischemic stroke).[26-29] Now, it is known that the analysis of non-fasting triglycerides could provide important information of remnant lipoproteins (RLPs) associated with increased risk of CHD.[9,27]

Despite being taken for a long time as a villain, now-a-days it is known that LDL-C is not a major risk marker for coronary events currently fitting that role to non-HDL cholesterol (which includes the fractions of very low molecular weight-VLDL), especially in cases of hypertriglyceridemia associated with diabetes, metabolic syndrome or renal chronic disease.[9,30,31] However, the most recent consensus is still maintained LDL cholesterol as the primary target for therapy, especially in those patients with triglyceride levels below 200 mg/dl, because at these levels, the ratio between LDL cholesterol and HDL-C is no next.[3,23] These findings were in agreement with our study, which was detected higher rates of LDL-C in females compared to males.

Regarding the historical evolution of the different lipid parameters through 10 years, there has been a slight reduction in all the parameters. This indicates that those factors associated with the onset of dyslipidemia, such as a diet rich in fatty foods and little physical exercises are still present in our population.[10,31] Therefore, public policies are needed to change health habits, reducing the probability of occurrence of cardiovascular diseases.[32,33]

CONCLUSION

We hope that this research contributes to the knowledge of the prevalence of lipid abnormalities in our state and can be used to prevention and control of dyslipidemia in Sergipe and, by extension, in Brazil.[33,34]

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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