

## Study of Lipid profile in a population of university students<sup>1</sup>

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**Objective:** to evaluate the lipid profile in a population of university students. **Methods:** cross-sectional study with 702 students, of both genders enrolled in various courses at a public university in Fortaleza-CE. The demographic data and data on lifestyle habits were collected through a self-administered questionnaire. The blood collection was performed in a clinical laboratory. **Results:** showed a predominantly young population, with a mean age of 21.5 years with more females (62.7%). High levels of triglycerides, total cholesterol and cholesterol associated with low density lipoprotein (LDL-c) were found in 23.0%, 9.7% and 5.9% of students, respectively. The cholesterol associated with high density lipoprotein (HDL-c) was at reduced values in 12.0% of subjects and was significantly associated with smoking ( $p=0.0231$ ) and physical inactivity ( $p=0.0357$ ). **Conclusion:** changes in lipid profile are present in the young population and intervention studies should be encouraged in order to reduce the prevalence of cardiovascular disease in adulthood.

**Descriptors:** Dyslipidemias; Triglycerides; Cholesterol, HDL; Cholesterol, LDL; Young Adult.

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## Introduction

Lipids, represented by phospholipids, cholesterol, triglycerides (TG) and fatty acids, are considered essential to the human body, both by making up of the basic structure of cell membranes (phospholipids), and by acting as a precursor to steroid hormones, bile acids and vitamin D, as well as being a constituent of cell membranes, acting on the fluidity of the latter and in the activation of the enzymes located there (cholesterol) <sup>(1)</sup>.

As for TG, these are formed from three fatty acids bound to a glycerol molecule and constitute one of the most important forms of energy storage in the body, and are deposited in the adipose and muscle tissue. In relation to lipoproteins, it is emphasized that these allow the solubilization and transport of lipids, usually hydrophobic substances, in aqueous plasma. It is important to note that there are four major classes of lipoproteins separated into two groups: a) those that are TG-rich, larger and less dense, represented by chylomicrons, of intestinal origin, and very low density lipoproteins, of hepatic origin, and b) those rich in cholesterol, forming low density (LDL-c) and high density (HDL-c) particles<sup>(1)</sup>.

In many situations, the concentrations of these lipids and/or lipoproteins are not in normal amounts in the human body, in what is known in the scientific literature as dyslipidemia. Studying the lipid profile (total cholesterol biochemical determinations – TC, HDL-c, TG and LDL-c) after fasting for 12 to 14 hours, has been an activity of great value, considering that the research already carried out, and correlation between the morphology of the arteries obtained from autopsies and cardiovascular risk factors, has allowed it to be demonstrated that dyslipidemia is a factor of great importance for the development of atherosclerosis in later life<sup>(2)</sup>, as well as for the development of other health disorders such as metabolic syndrome and type 2 diabetes mellitus<sup>(1)</sup>.

It is known that genetic predisposition has influence on the development of changes in cholesterol levels, however, it is not the determining factor in most cases in which an inappropriate exposure lifestyle is observed<sup>(1)</sup>. It is noteworthy that researchers now have identified the presence of risk factors for chronic diseases in young people, especially adolescents, demonstrating that, on a daily basis, individuals of a young age have shown inappropriate lifestyle<sup>(3)</sup>. It is necessary and very important to evaluate the lifestyle of young adults so that preventive measures can be taken as early as possible<sup>(4)</sup>.

Also with regard to young people, special attention should be given to university students. Among some of the justifications showing the importance of studying this group is the fact that they are subject to special conditions, with their entry into the university system. For many students, entering university corresponds to the first time they will have to take responsibility for their own housing, feed themselves and manage their own finances. The association between difficulty in performing such tasks and psychosocial factors, lifestyle and situations in an academic setting contribute to the exposure of students to inappropriate lifestyle habits, such as skipping meals, consumption of fast food and eating nutritionally unbalanced meals, which can result in risk components for a number of diseases<sup>(5)</sup>.

Studies<sup>(6-7)</sup> show that a large portion of university students had used licit and illicit drugs at least once in life and that many of them consider the consumption of alcohol and smoking as normal and socially acceptable, which means that the consumption of these is increasing, causing ill affects on health. Accordingly, it has been found that university students have distinct risk behaviors that therefore should be investigated.

Individualizing the problem for dyslipidemia, Portuguese authors conducted a survey of 154 university students and found that exposure to university life greatly increased their levels of cholesterol. The authors found that students who had recently entered higher education had lower proportions of dyslipidemia (28.6%), overweight (12.5%) and smoking (0.0%) compared to students exposed to academic life (44.0% – dyslipidemia, 16.3% – overweight and – 19.3% smoking)<sup>(4)</sup>.

Literature data are already demonstrating that although young, many university students already have risk factors for chronic diseases and metabolic diseases<sup>(8)</sup>. In order to check the lipid profile of nutrition students and their relationship with other cardiovascular risk factors, a study in Santa Catarina, Brazil, with 63 university students, whose ages were 17-43 years identified low HDL-c in 47.6% of students and found hypercholesterolemia in 38.1% of them<sup>(9)</sup>.

Another piece of Brazilian research, this time carried out at the Faculty of Medicine of São José do Rio Preto, São Paulo, with 153 university students, aimed to study the lipid profile and its correlation with risk factors for cardiovascular disease and, among its main results, the most important was that altered levels of total cholesterol, LDL-c and TG were detected in 11.8%, 9.8% and 8.5% of the students, respectively, as well as reduced levels of HDL-c in 12.4 % of them<sup>(10)</sup>.

It is important to note that in light of these findings, if no early intervention occurs, these problems will probably perpetuate and continue to negatively impact the health of these individuals<sup>(11-12)</sup>.

Thus, taking into account that the dyslipidemia is present in the young population and that studies involving this population are scarce, especially in Brazil, the objective of this investigation was to study the lipid profile in a population of university students.

## Methodology

This is a cross-sectional study conducted with students, of both genders, at a public university in Fortaleza, Brazil, in the period January-July 2011.

Based on the total number of students enrolled in courses at the university being investigated, the sample was extracted by applying the formula for infinite populations, using  $P=50\%$ ,  $Q=50\%$  significance level of 0.05 and relative sampling error of 8% (absolute error=4%)<sup>(13)</sup>.

The calculation resulted in 702 students who were stratified according to the following areas: Humanities (20.4%), Exact Sciences (16.5%), Agriculture (14.0%), Health (15.1%), Science (18.1%) and Technology (15.9%). The criteria for inclusion were established as follows: age  $\geq 18$  years, be a student of daytime courses attended in person, agree to participate in all stages of data collection, have a landline or cell phone and e-mail contact. We excluded pregnant women and nursing mothers.

Of all daytime courses, we selected two from each area of human knowledge. Students were recruited through calls made by researchers in the classroom and through signs posted by the university.

The social and demographic data and data on lifestyle habits were collected by means of a self-administered questionnaire, which used a theoretical framework appropriate to each of the subjects:

*Sedentary lifestyle* – the following were classified as sedentary: students who said they did not practice regular physical activity at least three times per week and for at least thirty consecutive minutes per exercise activity<sup>(14)</sup>.

*Smoking* – was classified into four categories: daily smokers (those who smoked at least one cigarette per day for at least a month before completing the questionnaire), occasional smokers (those who do not smoke daily), former smokers (those that after having been smokers, had stopped smoking at least one month

before), and nonsmokers (those who had never smoked or had been smoking for less than a month)<sup>(15)</sup>.

*Alcohol Consumption* – the validated version in Brazil of AUDIT (Alcohol Use Disorders Identification Test) was used<sup>(16)</sup> with the following standard procedures.

Regarding the demographic data, it should be made clear that all measurements were performed by a group of duly-trained nurses who followed the following standards rigorously:

*Weight* – was measured with the students barefoot, wearing light clothing and without wearing accessories. For this purpose, we used an electronic anthropometric scale for adults, with 200 kg capacity;

*Height* – inelastic anthropometric tape fixed to a smooth wall was used and respondents were instructed to position themselves erect and motionless, hands flat on their thighs and their heads placed in the Frankfurt plane;

*Body mass index (BMI)* – defined as the ratio of the weight (kg) by the square of the height (m<sup>2</sup>) was calculated and analyzed, taking into account the criteria of the World Health Organization<sup>(17)</sup>, i.e., considered as low if BMI  $< 18.5$  kg/m<sup>2</sup>; normal if  $\geq 18.5$  and  $< 25.0$ , overweight if values between 25.0 and 29.9 kg/m<sup>2</sup>, and obese if BMI  $\geq 30$  kg/m<sup>2</sup>;

*Waist circumference (WC)* – measured at the midpoint between the last rib and the upper border of the iliac crest, measured at the end of the expiratory movement, using an inelastic tape placed on the skin, with the subject in an upright position<sup>(8)</sup>.

*Venous blood was collected* in a clinical laboratory. A vacuum collection system was used, BD Vacutainer® (São Paulo, Brazil), by puncture. For this purpose, the participants in the study went without food for twelve hours, for biochemical determinations of triglycerides, total cholesterol and fractions thereof. The sample was stored in 5 mL tubes without anticoagulant (for dosages of triglycerides, total cholesterol and fractions)

After collection, the samples were processed and centrifuged for twenty minutes in a LS3 CELM Plus® serologic digital centrifuge (São Paulo, Brazil), with maximum g force of 1,700 x g. Then, 1 mL aliquots of serum were separated to perform the biochemical measurements. For evaluating of biochemical parameters, commercial Labtest Diagnostic S/A® (Minas Gerais, Brazil) kits were used, with standard techniques based on enzymatic and colorimetric methods, spectrophotometry, according to the manufacturer's recommendations. The concentrations were determined by use of a Labmax 240® automatic biochemical

analyzer (Minas Gerais, Brazil) and the determinations of LDL-c were calculated using the Friedewald formula. A free snack was offered to all of the participants once the blood samples had been taken.

For the statistical analysis, SPSS software, version 16.0 was used. For the continuous-type sociodemographic and economic variables, we calculated the average and standard deviation. To associate the lipid profile with gender, we used the median of the variables and the Mann-Whitney test. In the association between the mean serum levels of total cholesterol, HDL-c, LDL-c and triglycerides with variables related to lifestyle and demographics, we used the ANOVA variance and then Tukey test. For all crosses those whose *P* value was less than 0.05 were considered significant.

It should be stressed that all students signed the Free and Informed Consent form and the study was approved by the Ethics Committee on Human Research of the Federal University of Ceará, under protocol number 208/10.

## Results

The study included 702 university students. Of these, 62.7% were women, 49.3% "colored" (*pardo*, dark-skinned, mixed-race), 92.0% were single and 53.3% were in the age group 20-24 years. The majority of the participants were students of the Humanities, 20.4%, and freshman, 69.1%.

The average household income was R\$ 3,211.66 (SD=3765.48), distributed with higher proportions of economic classes B and C (79.0%), considered to be average purchasing power by Brazilian standards. In addition, 64.7% were doing nothing other than studying and 70.4% lived with their parents.

Excess weight was detected in 26.4%, with 21.3% and 5.1% for overweight and obesity, respectively. The CC was at high values in 5.4% of students. It was found also that 70.2% were sedentary, 8.5% were using tobacco and 6.6% had harmful alcohol consumption.

Regarding the lipid profile of the university students, high triglyceride, total cholesterol and LDL-c levels were found in 23.0%, 9.7% and 5.9%, respectively. With regard to HDL-c, reduced levels were present in 12.0% of the students.

By associating the lipid profile by gender, it was realized that the men showed the largest median total cholesterol, LDL-c and triglycerides, while females had higher levels of HDL-c. All crosses found statistically significant association as summarized in Table 1.

Table 1 - Median Values for Lipid Profile according to gender. College students. Fortaleza, CE, Brazil, 2011

Lipid Profile (mg/dl)	Female (N=440)	Male (N=262)	Total (N=702)	p Value*
Total Cholesterol				0,0079
Median	146	153	149	
Min-Max	12-1512	89-250	12-1512	
HDL-c				0.0000
Median	56	49	52	
Min-Max	38-124	38-70	38-124	
LDL-c				0.0000
Median	66	79	70	
Min-Max	14-174	12-172	12-174	
Triglycerides				0.0000
Median	125	135	130	
Min-Max	46-220	50-244	46-244	

\*Mann-Whitney Test

Levels of total cholesterol in serum were higher in smokers, those overweight and those who had high waist circumference values. Moreover, they did not vary according to physical activity levels. There was no statistically significant relationship in any of the crosses performed. With regard to HDL-c, it is clear that the variables smoking and but a sedentary lifestyle showed a significant relationship, i.e., students who smoke and were physically inactive had lower mean levels, compared to a nonsmoking students and those who practice physical activities (Table 2).

Table 2 - Association between mean serum levels of total cholesterol, HDL-c, LDL-c and triglycerides and variables related to lifestyle and demographics. University students. Fortaleza, CE, Brazil, 2011

Variable	Total Cholesterol		Low-density lipoprotein (HDL-c)		High-density lipoprotein (LDL-c)		Triglycerides	
	Mean	P*	Mean	P*	Mean	P*	Mean	P*
Smoking		0.5812		0.0231		0.1697		0.0771
Smokers	159		51		80		134	
Non-smokers	154		54		74		126	

(continue...)

Table 2 - (continuation)

Variable	Total Cholesterol		Low-density lipoprotein (HDL-c)		High-density lipoprotein (LDL-c)		Triglycerides	
	Mean	P*	Mean	P*	Mean	P*	Mean	P*
Sedentary Lifestyle		0.9422		0.0357		0.3132		0.1532
Yes	155		52		76		130	
No	155		54		73		126	
IMC		0.5800		0.0751		0.0203		0.1542
Underweight	151		53		73		124	
Normal (healthy) weight	153		54		72		125	
Overweight	160		52		81		132	
Obese	161		51		83		130	
Waist circumference		0.5112		0.4471		0.3638		0.2167
Normal	155		53		74		127	
High	161		54		79		133	

\*Test Used – ANOVA. P<0,05 Considered Significant

The mean LDL-c levels were higher in smokers, those with a sedentary lifestyle, those high waist circumference values, and especially those who are overweight, the latter showing a statistically significant association. The mean triglyceride levels showed no significant relationship with any of the variables studied (Table 2).

Based on the normality of the variables, correlation measures were carried out using the Spearman test. The

correlation between the levels of LDL-c and HDL-c levels was found to be proportional ( $r=0.167$ ) but weak and statistically insignificant ( $p=0.248$ ) (Figure 1). Among nonsmokers, the correlation between the levels of HDL-c was positive ( $r=0.391$ ) and statistically significant ( $p=0.005$ ), i.e. in this group there is an increase in levels of this lipoprotein (Figure 2). With respect to LDL-c, this was not repeated ( $r=- 0.223$ ) and was not statistically significant ( $p=0.122$ ) (Figure 2).

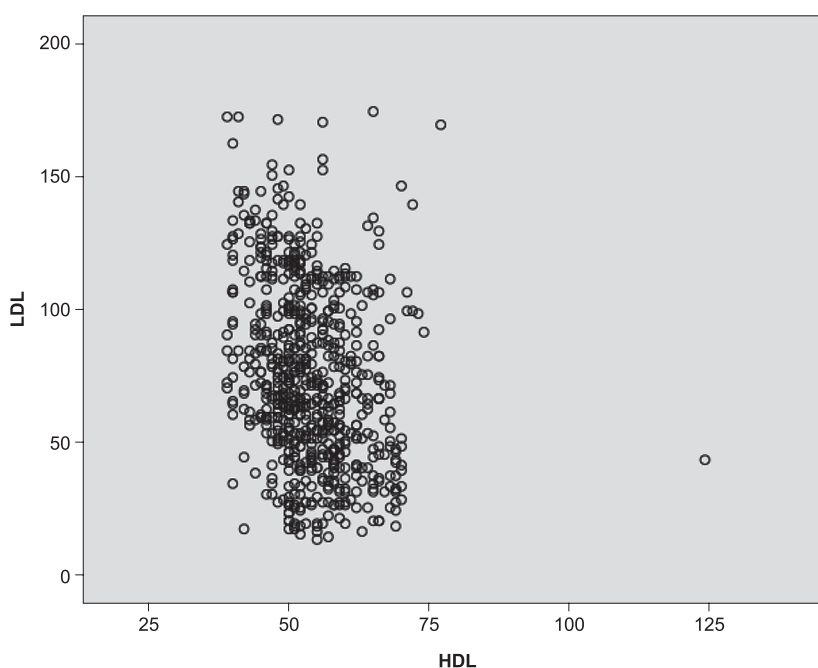


Figure 1 - Correlation between the levels of LDL-c and HDL-c in university students. Fortaleza, CE, Brazil, 2011

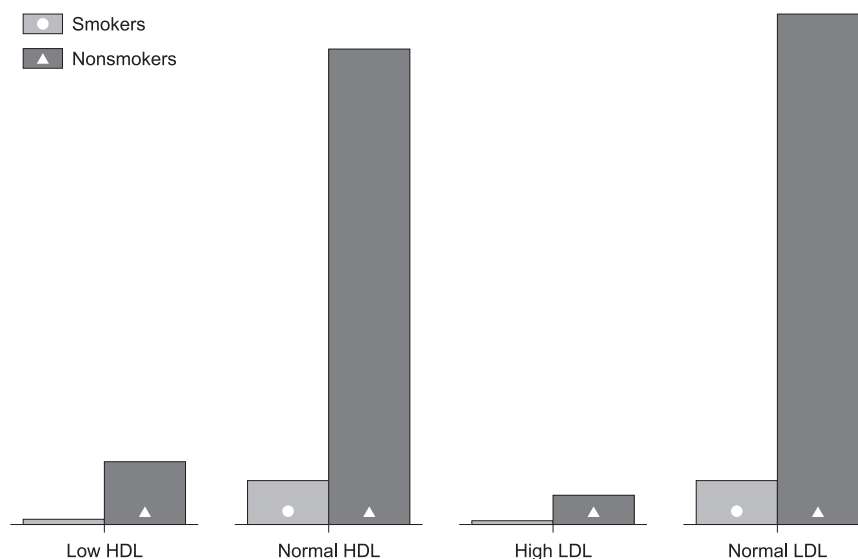


Figure 2 - Correlation between HDL-c and LDL-c levels and smoking in university students. Fortaleza, CE, Brazil, 2011

## Discussion

In the present study, we evaluated 702 university students of both genders. The population was predominantly young, with a mean age of 21.5 years and female. Excess weight, sedentary lifestyle, tobacco and alcohol consumption were present in 26.4%, 70.2%, 8.5%, and 6.6% of the sample, respectively. High levels of triglycerides, total cholesterol and LDL-c were found in 23.0%, 9.7% and 5.9% of students, respectively. The HDL-c values were low in 12.0% of subjects and were significantly associated with smoking and physical inactivity.

The mean age of 21.5 years can be explained by this being the most frequent age to enroll in higher education in Brazil. To prove this assertion, one can point to an investigation conducted in the southwestern state of Minas Gerais, involving 349 students on the delete Nursing, Biological Sciences, Nutrition and Physical Education courses, which found that 45.3% of the sample were aged between 20 and 30 years<sup>(18)</sup>.

As noted, overweight and obesity were present in 21.3% and 5.1%, respectively, higher than the percentage found in university students in Portugal (19), 12.2% and 3.2%, and lower than those found in Chile<sup>(20)</sup>, where excess weight was present in 70.1% of the sample.

Regarding physical activity, the majority of students were classified as sedentary (70.2%). Yet as noted, references that could be compared to this result are virtually unanimous in showing high rates of physical inactivity among students in higher education.

These findings to not just concern Brazil because they are common in other countries, often with a more worrisome prevalence. Nationally, studies have found rates of physical inactivity of 74.7% and 57.9%, respectively<sup>(18,21)</sup>, while internationally, research has found values of 91.5% and 72.5%, respectively<sup>(20,22)</sup>.

Also in relation to lifestyle, smoking and drinking were present in 8.5% and 6.6% of students. As for smoking, Venezuelan scholars, investigating a population of 100 university students, found higher values than the present study, noting that 23.0% of them were using tobacco<sup>(23)</sup>. Other researchers, seeking to investigate risk factors for chronic non-communicable diseases in 120 medical students found prevalence of smoking and alcohol consumption of approximately 34.2% and 68.3% of them, respectively<sup>(22)</sup>.

It was observed that in the study in question, that men were the ones with the biggest changes in CT values ( $p=0.0079$ ), LDL-c ( $p=0.0000$ ) and triglycerides ( $p=0.0000$ ). On the other hand, the women had higher levels of HDL-c ( $p=0.0000$ ). These findings, when compared to the literature, are sometimes similar and sometimes not. For example, a study conducted in Cartagena – Colombia, with 301 students found too, that men were the ones with larger changes in the levels of TC, LDL-c and triglycerides, the latter association being statistically significant<sup>(24)</sup>.

However, the findings of this study do not agree with the results of an investigation carried out in Portugal with 154 students, at the University of Aveiro. The authors also found a statistically significant



association between lipid profile and gender, however, it was the women who had higher mean values of TC (164.1 mg/dL), LDL-c (83.04 mg/dL) and triglycerides (112.69 mg/dL) compared to men<sup>(4)</sup>.

With respect to the cross between lifestyle habits and anthropometric data, with the lipid profile, the present study found that smoking, sedentary, overweight and high waist circumference subjects were those who had dyslipidemia.

For smoking, a statistically significant association with HDL-c ( $p=0.0231$ ) was found. The literature makes it clear that smoking leads to changes in the lipid profile, leading to significantly increases in triglycerides, VLDL and LDL-c, as well as a decrease in HDL-c<sup>(25)</sup>.

A sedentary lifestyle was also associated with HDL-c, and lower average cholesterol was found among those who did not engage in regular physical activity. It is known that physical exercise produces an increase in the metabolism of lipids and carbohydrates. One of the most significant changes is the increase in HDL-c, considered to be the fraction which has a protective effect on atherosclerotic disease<sup>(1)</sup>. These findings, when confronted with the literature, corroborate the strong link between physical exercise and maintaining good health<sup>(26)</sup>.

Excess weight was associated statistically ( $p=0.0203$ ) with an increase in the levels of LDL-c in this study. A study conducted at Tufts University in Boston, United States, with 564 (mean age=19.1 years) students found that 16.2% of the students already were overweight/obese. Furthermore, a strong association was found between overweight and high levels of TC and LDL-c, as well as between physical activity and increased HDL-c and a lowering of triglyceride levels<sup>(26)</sup>.

The waist circumference Classification (WC) in the present study showed no statistically significant relationship with the lipid profile, however, it was found that those students who had a large WC had high mean values of TC, LDL-c and increased TG levels, when compared to those with normal WC. Searches in the literature identified that Brazilian researchers also found similar results and other researchers have observed that individuals with abdominal obesity had a higher prevalence of dyslipidemia, as well as other diseases such as hypertension and diabetes mellitus<sup>(9)</sup>.

Given the above, it is clear that the university students studied showed significant changes in different variables related to health, such as overweight, physical inactivity and dyslipidemia, which demonstrates the

need for routine assessments of this portion of the population. Researchers are already suggesting that there is a need to assess the health, health and the behavior determinants of young people during the transition from school to university<sup>(27)</sup>.

It cannot be denied that young people when they enter the university, are still shaping their habits and are at a critical point in their lives, making lifestyle choices. The transition to adulthood is an ideal time to encourage individuals to adopt healthy lifestyles. Accordingly, the chances of this population of the sticking to the guidelines in relation to a healthier lifestyle are significantly increased<sup>(11-12)</sup>.

## Conclusion

The results of the study indicate that changes to the lipid profile were present in the population studied. High levels of triglycerides, total cholesterol and LDL-c were found in 23.0%, 9.7% and 5.9% of the university students, respectively. HDL-c had diminished values in 12.0% of the subjects and was significantly associated with smoking ( $p=0.0231$ ) and a sedentary lifestyle ( $p=0.0357$ ).

Given these findings, further research should be carried out, either of an epidemiological nature, so that larger samples of university students can be studied in different areas of Brazil, or intervention studies, so that healthy habits are incorporated and developed in the lives of these students.

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