Lipid Profile of Schoolchildren from Recife, PE

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Abstract

Background: The occurrence of dyslipidemia is increasing in pediatric populations. Altered lipid profiles are related to a higher incidence of hypertension and atherosclerotic disease.

Objective: To evaluate the extent of dyslipidemia and investigate its association with overweight and abdominal obesity in adolescent students from Recife, Brazil.

Methods: Personal data, socioeconomic level, anthropometric measurements and lipid profile of 470 adolescents, aged 10 to 14 years, of both sexes, students at the Public School system in the city of Recife, state of Pernambuco, Brazil, were obtained. The statistical analysis was carried out using the Epi-info 6.04 and SPSS 13.0 software. The level of significance was set at 5%.

Results: The majority of the population was dyslipidemic (63.8%; 95%CI: 59.3 - 68.2), with hypoalphalipoproteinemia being the most prevalent dyslipidemia (56%; 95%CI: 51.3 - 60.5). Adolescents who were overweight or who had abdominal obesity presented higher levels of triglycerides and lower levels of HDL-cholesterol (p < 0.05). Levels of total cholesterol and fractions were not different between sexes.

Conclusion: A high incidence of unfavorable lipid profile was shown in this series, demonstrating the necessity to measure the lipid profile as early as this age range. Healthy lifestyle measures should be encouraged in this population. (Arq Bras Cardiol. 2010; [online].ahead print, PP .0-0)

Key words: Dyslipidemias/epidemiology; hypertension; obesity, abdominal; adolescent; life style; Recife; Brazil.

Introduction

Dyslipidemia is a clinical condition characterized by abnormal levels of lipids or lipoproteins in blood that is determined by genetic and environmental factors. Evidence has demonstrated that high levels of total cholesterol (TC), LDL-cholesterol (LDL-c) and triglycerides (TG), as well as decreased levels of HDL-cholesterol (HDL-c) are related to a higher incidence of hypertension and atherosclerotic disease. Atherogenesis starts with the formation of fatty streaks, which are the precursors of atheroma plaques. They start to appear at the aorta as early as three years of age and, in adolescence, they start to affect the coronaries, subsequently progressing at the other phases of the life cycle. The disease has a slow and silent evolution and the clinical manifestations in adult life result in several morbid conditions that affect the circulatory system, which, in turn, culminate in high mortality rates. The literature has demonstrated the start of atherosclerosis as early as in childhood due to the increase in plasma cholesterol levels, which can be potentiated throughout life by obesity and other factors, such as family history, physical inactivity, inadequate diet and arterial hypertension.

Updated publications in our country indicate an increase in the occurrence of dyslipidemia in children and adolescents. The prevalence in this age group varies worldwide between 2.9% and 33%, with a progressive increase along the years. Dyslipidemia is often secondary to childhood obesity and there is a positive association between the incidence of obesity and dyslipidemia in children and adolescents. Studies have shown the association between the anthropometric parameters that classify overweight and abdominal obesity and the altered lipid profile in this group. Considering the increasing number of children and adolescents at risk for the development of cardiovascular diseases and considering the few population–based studies on the prevalence of dyslipidemia in Brazilian adolescents, it is of utmost importance to perform studies to assess the problem at this age range.

Therefore, the present study aimed at assessing the extent of dyslipidemia and investigating the association of the lipid profile with overweight and abdominal obesity in adolescent students from the Public School system in the city of Recife, state of Pernambuco, Brazil.

Methods

An observational, cross-sectional study was carried out in 31 public elementary schools, which belong to the Public...
School system of the city of Recife, state of Pernambuco, from October to December 2007. The population consisted of schoolchildren aged 10 to 14 years, of both sexes, regularly attending these schools in the year 2007.

The sample size was determined based on the dyslipidemia prevalence data of a similar study carried out in Camaragibe, state of Pernambuco, Brazil\(^\text{12}\). The type of dyslipidemia with the lowest percentage (hypertriglyceridemia) was used to calculate the sample size. Therefore, considering a prevalence of 15\%, with an acceptable margin of error of 5\%, reliability of 5\% and a population larger than 9,000 schoolchildren, the sample size was established as 196 students. As the process of sample selection was the polyphase type, of which sample units were the school (1st conglomerate) and the school year (2nd conglomerate), the sample “n” was adjusted by the effect of the study design, using a factor of correction of 2.1, totaling a minimum number of 412 adolescents. To correct eventual losses, 15\% was added to this number, totaling a sample of around 470 students.

The following students were excluded from the study: those with a referred personal history of pathologies (diabetes mellitus type II, hypothyroidism, nephrotic syndrome, chronic renal failure, liver disease, Cushing syndrome, anorexia nervosa and bulimia) or referred use of medications (anti-hypertensive drugs, corticoids, steroids, isotretinoin, protease inhibitors) that could affect the lipid profile.

The information on personal data, socioeconomic level, anthropometric data and blood samples from the participants were obtained at the same time, at the schools and the data were entered in specific formularies.

For the biochemical measurements of TC, LDL-c, HDL-c and TG, approximately 5 ml of blood were collected from each student, after a 12-14-hour fast, in Vacutainer tubes. The tubes were stored in Styrofoam boxes containing recyclable ice were sealed and transported for the sample processing. The serum was separated from the red blood cells by centrifuging the samples at 3,000 rpm for 10 minutes at 4°C up to 2 hours after the venipuncture. The sera was placed in microtubes and stored at -20°C for subsequent lipid fraction measurement. The material was analyzed in a laboratory of clinical analysis stored at -20°C up to 2 hours

The diagnosis of overweight was based on the body mass index (BMI), according to the values indicated by Cole et al,\(^\text{16}\) adjusted for age and sex. The diagnosis of abdominal obesity was carried out by assessing the waist circumference (WC) was measured at the midpoint between the lowest percentage (hypertriglyceridemia) was used to calculate the sample size. Therefore, considering a prevalence of 15\%, with an acceptable margin of error of 5\%, reliability of 5\% and a population larger than 9,000 schoolchildren, the sample size was established as 196 students. As the process of sample selection was the polyphase type, of which sample units were the school (1st conglomerate) and the school year (2nd conglomerate), the sample “n” was adjusted by the effect of the study design, using a factor of correction of 2.1, totaling a minimum number of 412 adolescents. To correct eventual losses, 15\% was added to this number, totaling a sample of around 470 students.

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The construction of the database and the statistical analysis were carried out using the Epi-info Software release 6.04 and SPSS release 13.0 software. The data were entered in duplicate and verified by the Student’s t-test and the Mann Whitney U test was used for those that did not meet the criteria of normality or homoscedasticity. The level of significance was set at 5\% for the rejection of the null hypothesis.
The study was submitted to and approved by the Research Ethics Committee of Instituto Materno Infantil de Pernambuco (Registration # CEP/IMIP 1.024/07). All adolescents that participated in the study were previously informed on the objective of the research, as well as the methods to be employed. All parents or tutors in charge of the adolescents participating in the study signed the Free and Informed Consent Form.

Results

Of the 470 blood samples, a LDL-c and three TC measurements were lost due to technical problems at the analysis of the fractions, whereas three data concerning weight, 11 concerning height and 13 concerning waist circumference were disregarded, as there were inconsistencies between the two performed measurements.

The age median was 11 years (CI: 10 - 12 years) and there were no differences between the sexes. Table 1 shows the characterization of the studied sample. Among the adolescents included in the study, most were females (55.3%; 95%CI: 50.7 - 59.9; p < 0.05). Regarding the socioeconomic class, there was a predominance of students from social class C2 (43.6%; 95%CI: 38.5 - 48.9).

Considering as dyslipidemic the adolescent with alteration in at least one lipid profile fraction, most of the participants (63.8%) were considered as having the pathology (95%CI: 59.3 - 68.2; p < 0.05).

The prevalence of alterations in the different lipid profile measurements are shown in Table 2. There was a low frequency of LDL-c increase. On the other hand, a higher prevalence was observed for HDL-c alteration and hypoalphalipoproteinemia was the most frequent dyslipidemia.

When the occurrence of simultaneous dyslipidemias was analyzed, it was observed that the most frequently observed combination was TG+HDL-c decrease (12.1%) (Table 3). Figure 1 shows the correlation charts between different lipid fractions. Significant correlations (p < 0.01) were observed among all analyzed variables; however, the best correlation was observed between the TG and HLD-c values (r = -0.38).

Table 4 shows the comparisons of lipids and lipoproteins between the sexes and the presence or not of overweight and abdominal obesity.

The levels of the lipid profile as a whole did not differ regarding sex (p ≥ 0.05) and individuals with overweight, according to the BMI, showed higher levels of TG and lower levels of HDL-c. A similar fact was observed among students with abdominal obesity, according to the WC indicator. According to the WHtR indicator, the adolescents with abdominal obesity presented, in addition to higher TG and lower HDL-c levels, higher levels of LHL-c. The TC levels were the only ones that did not differ in relation to this parameter.

Discussion

In Brazil, studies on the prevalence of lipid alterations in the pediatric age range are still scarce. The results obtained in the present study are important, as they demonstrate that dyslipidemia is part of a disturbing reality and must be investigated among the adolescent population of the country.

Additionally, the lack of standardization in the sampling and the methodology, mainly regarding the definition of reference intervals, impairs the comparison of this epidemiological phenomenon in the different states of the country. Many studies use cutoffs recommended by the III Brazilian Guideline on Dyslipidemias9 (III DBSD), which use the values established by the National Cholesterol Education Program for children and adolescents from the United States20. This fact can induce potential biases, as it disregards differences in ethnicity, socioeconomic levels, dietary habits and the physical constitution of the Brazilian population21. Studies carried out in the city of São Paulo with children and adolescents identified reference intervals that were different from the values proposed by the III DBSD22,23. Thus, in 2005, the I Guideline for the Prevention of Atherosclerosis in Childhood and Adolescence (I DPAIA) proposed reference values for lipids and lipoproteins for Brazilian children and adolescents6.

The prevalence of dyslipidemia found in the present study (63.8%) was quite high, which is an alarming fact. Gama et al24, in an investigation carried out in children from the southeast
Lipid profile of schoolchildren

Table 2 - Classification of the lipid profile according to the levels recommended by I Brazilian Guideline for Atherosclerosis Prevention in Infancy and Childhood, in adolescents aged 10 to 14 years from Recife - 2007

<table>
<thead>
<tr>
<th>Lipid</th>
<th>Desirable</th>
<th>Borderline</th>
<th>Altered</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>IC</td>
</tr>
<tr>
<td>TC</td>
<td>298</td>
<td>63.8</td>
<td>59.3 - 68.2</td>
</tr>
<tr>
<td>LDL-c</td>
<td>401</td>
<td>85.5</td>
<td>82.0 - 88.6</td>
</tr>
<tr>
<td>HDL-c</td>
<td>207</td>
<td>44.0</td>
<td>39.5 - 48.7</td>
</tr>
<tr>
<td>TG</td>
<td>304</td>
<td>64.7</td>
<td>60.2 - 69.0</td>
</tr>
</tbody>
</table>

* CI - 95% confidence interval; TC - Total Cholesterol; LDL-c - Low-density lipoprotein; HDL-c - High-density lipoprotein; TG - triglycerides.

Table 3 - Prevalence of mixed dyslipidemias according to the levels recommended by I Brazilian Guideline for Atherosclerosis Prevention in Infancy and Childhood, in adolescents aged 10 to 14 years from Recife - 2007

<table>
<thead>
<tr>
<th>Mixed dyslipidemias</th>
<th>Altered</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
</tr>
<tr>
<td>TC + TG</td>
<td>21</td>
</tr>
<tr>
<td>TC + HDL-c</td>
<td>23</td>
</tr>
<tr>
<td>TG + HDL-c</td>
<td>57</td>
</tr>
<tr>
<td>TC + LDL-c</td>
<td>10</td>
</tr>
<tr>
<td>TG + LDL-c</td>
<td>2</td>
</tr>
<tr>
<td>HDL-c + LDL-c</td>
<td>5</td>
</tr>
<tr>
<td>TC + HDL-c + TG</td>
<td>13</td>
</tr>
<tr>
<td>TC + HDL-c + LDL-c + TG</td>
<td>2</td>
</tr>
</tbody>
</table>

*CI - 95% confidence interval; TC - Total Cholesterol; TG - triglycerides; HDL-c - High-density lipoprotein; LDL-c - Low-density lipoprotein.

region of the country using the cutoffs proposed by the DPAIA, reported a similar prevalence of dyslipidemia (68.4%).

Etiologically, dyslipidemias are classified as primary or secondary. The primary dyslipidemias have a genetic connotation and some of them only manifest only under the influence of environmental factors. Among the prevalence of dyslipidemias, one must consider the homozygous familial hypercholesterolemias, which, albeit rare, are considered severe diseases. Nevertheless, most dyslipidemias in children and adolescents are related to an inadequate lifestyle. Therefore, The maintenance of a nutritionally adequate dietetic model, the control of body weight, the practice of physical exercises and the cessation of smoking are some of the recommendations related to changes in the lifestyle that help prevent alterations in the lipid levels, as well as establish healthy habits into the adult life.

The hypolipidemic diet was the main lipid alteration. This fact is noteworthy, as this is a young population and the HDL-c is an important protective factor against the development of chronic diseases, especially atherosclerosis. Studies by Carvalho et al and Grillo et al with children and adolescents also demonstrated the occurrence of low HDL-c levels as the most frequent dyslipidemia at this age range. On the other hand, in the study by Gama et al, the increase in TC was the most prevalent dyslipidemia and the percentage of alteration in HDL-c levels was lower than the one observed in the present study (35.1% vs 56%).

In a study with a similar methodology, the frequency of increased TG levels was lower than the one found in the present study (3.5% vs 15%); whereas the LDL-c and TC levels were higher (18.6% vs 2.1%; 43.8% vs 11.6%, respectively)24. Other studies have also demonstrated higher percentages of increased TC levels, when considering values > 170 mg/dl1,3,6. On the other hand, our findings are in accordance with those by Scherr et al, who found a lower magnitude of hypercholesterolemia among schoolchildren from public/philanthropic schools (14%).

In the present study, the percentage of increased LDL-c levels was low. However, it is important to mention that there are subclasses of LDL, as one LDL is small and dense (LDL phenotype B) and another, which is larger. The LDL phenotype B, being smaller and denser, more easily cross the endothelial barrier and are more easily oxidizable, which also makes them more atherogenic. Thus, even in individuals with normal LDL-c levels, the lipid profile can be less favorable, given the proportion between the lipoprotein subclasses.

The occurrence of TG levels considered to be increased, together with decreased HDL-c levels, was the type of concomitant dyslipidemia more frequently observed among these adolescents. When the correlations between the lipid variables were analyzed, these fractions were the ones that presented the best correlation. This occurrence must be interpreted carefully, as the TG/HDL-c ratio is directly correlated with the LDL phenotype B in plasma, and thus, it can indicate a more atherogenic lipid profile.

The mean levels of lipids and lipoproteins obtained from the schoolchildren from the public schools in Recife are lower than the ones reported by other studies4,5,6,10,13 except for the ones reported by Moura et al13 and Franca and Alves1 in which TG levels were slightly lower. Although the studies on the influence of the socioeconomic level on the lipid profile are not consensual, studies carried out in Brazil show lower means of TC, TG and LDL in the group from the lowest socioeconomic class. Scherr et al and Giuliano et al compared the lipid profile of students from the public vs. private schools and observed, respectively, higher mean levels of TC and LDL-c and TC and TG among students from private schools. This might be explained by the fact that in Brazil, more overweight or obese children are still found in...
Figure 1 - Correlations between the lipid variables in adolescents aged 10 to 14 years from Recife-2007.
the upper socioeconomic classes, who mostly attend private schools. When we compared the findings of the present study with those observed among students from public schools only, we obtained higher TG and lower HDL-c levels, whereas the TC and LDL-c levels were similar.

The fact that the mean values of the lipid fractions were lower than those observed in studies carried out with Brazilian schoolchildren, might be due to the fact that the students from public schools present a healthier lifestyle in comparison to those from private schools. In general, adolescents from public schools exercise more and have a more balanced diet, as the food offered by the public school cafeteria is prepared according to recommendations by nutritionists and many of these students only eat at school.

Several publications in our country have shown higher levels of most lipoproteins and lipids in female children and adolescents. However, we did not observe a statistically significant difference between the sexes, although the levels were higher among the girls, especially regarding TG levels.

Based on our data and considering the association between the anthropometric parameters that classify overweight and obesity and the altered lipid profile reported by several studies, the mean levels of TG and HDL-c, both from overweight participants and those with abdominal obesity, show to be less favorable. These data corroborate those reported by Suárez et al, who observed significant differences in lipid levels (TG and HDL-c) between the general population and that presenting overweight and obesity. Grillo et al found a significant association between the low HDL-c levels and the presence of obesity, defined by the BMI, in schoolchildren aged 3 to 14 years. Regarding the TG levels, researchers evaluated the lipid profile of adolescents and found higher TG and lower HDL-c levels in the group with overweight, when compared to the levels observed in the group with normal weight, whereas TC and LDL-c levels did not differ between the two groups.

Regarding the CT and LDL-c levels, our findings are partially in agreement with those found by Suárez et al and Silva et al, who did not report differences in LDL-c levels according to the nutritional status. However, they found higher TC levels in overweight and obese schoolchildren, respectively.

Dyslipidemia is frequently secondary to childhood obesity and there is a positive association between the incidence of obesity and dyslipidemia in children and adolescents. The mechanism that explains this association is perhaps the activation of the AMP-dependent kinase pathway, induced
by the increase in insulin and leptin and the decrease in
the activation of adiponectin, which, in turn, increases
the oxidation of fatty acids. In these children, adiponectin has
a positive association with insulin sensitivity and HDL-c levels
and a negative association with TG levels. According to
Santos and Spósito, the main dyslipidemia associated with
obesity is characterized by mild and moderated increases in
TG and decrease in HDL-c levels, which corroborates the
findings of the present study.

The abdominal obesity has shown to be an important
predictor of metabolic complications and adverse health
effects and it is related to an increase in the cardiovascular and
metabolic risk in children and adolescents. The WC and the
WHtR are simple and effective ways to measure abdominal
obesity in children and can be better predictors of the risk of
cardiovascular disease than the BMI.

However, the WC has been criticized as it does not include
in its calculation the differences in body height and the waist-
to-height ratio (WHtR) has been proposed as better predictor
of cardiovascular risk. A study by Schneider et al., carried
out in adult and elderly individuals, verified that the WHtR
can predict the prevalence of dyslipidemia better than the
other anthropometric parameters, respectively WC and BMI.

In the present study, adolescents with overweight and
abdominal obesity (according to the parameter WC) did not
present higher LDL-c levels in comparison with the other
students. This fact was only observed in those classified as
having central obesity, according to the indicator WHtR.
Additionally, the TC levels in the adolescents with central
obesity, according to this same indicator, showed a tendency
toward higher values, when compared to the levels observed
in students without abdominal obesity. These findings can
suggest that WHtR is the best indicator of possible alterations
in the lipid profile.

Conclusion

The percentage of dyslipidemia in adolescents is high,
which demonstrates the need for the measurement of the
lipid profile as early as this age range. Overweight and central
obesity have an effect on the mean values of these fractions.

The data presented here should serve as a warning to the
multidisciplinary team on the need to encourage healthy
lifestyle measures among the aforementioned population,
mainly regarding the practice of physical activities and healthy
dietary habits.

Acknowledgements

To Conselho Nacional de Pesquisa (National Research
Council - CNPq) and the Ministry of Science and Technology
(MCT) for the financial support; to Instituto de Medicina
Integral Prof. Fernando Figueira for the logistic support; and
Emídio Albuquerque for the statistical analysis; and the
scientific initiation fellows Rafaella de Andrade and Emilly
Moreno for typing the data.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was
reported.

Sources of Funding

This study was funded by Ministério de Ciência e Tecnologia
and CNPq.

Study Association

This article is part of the thesis of master submitted by Patrícia
Brazil Pereira, from Universidade Federal de Pernambuco.

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