Associated Factors to Total Cholesterol: School Based Study in Southern Brazil

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Abstract

Background: **Evidence has suggested that a significant proportion of children and adolescents has high levels of total cholesterol.**

Objective: **To estimate the prevalence of hypercholesterolemia and associated factors in 07-12 year-old school children.**

Methods: **School based cross sectional study of a random sample of 1,294 07-12 year-old school children from Caxias do Sul/RS, Brazil. The students answered an interview with information on socioeconomic status, food habits, and physical and leisure activities. Total cholesterol, cardiorespiratory fitness, body mass and height were measured to calculate body mass index. For the data treatment, univariate, bivariate, and multivariate analyzes were used.**

Results: **The multivariate analysis identified that individuals from high socioeconomic level (OR: 1.70; CI: 1.05-2.75), of female gender (OR: 1.32; CI: 1.03-1.67), and overweight (OR: 1.40; IC: 1.10-1.77) had increased chances of having increased total cholesterol (≥ 3rd tercile).**

Conclusion: **High total cholesterol levels on 07-12 year-old school children are associated with high socioeconomic level, female gender, and overweight. Encouraging an active life style and appropriate dietary habits can help control cholesterol levels and reduce risk factors. (Arq Bras Cardiol. 2011; [online].ahead print, PP.0-0)**

Keywords: **Cholesterol; risk factors; child, adolescent; hypercholesterolemia.**

Introduction

Cardiovascular diseases (CVD) are the leading causes of death in developed countries, accounting for thousands of deaths each year[1]. In Brazil, these conditions determine one third of all deaths and are the leading cause of medical spending, thus causing a substantial increase in health expenditures[2].

One of the main risk factors for CVD is hypercholesterolemia. Epidemiological studies show that high concentrations of total cholesterol (TC) increase the likelihood of developing cardiovascular diseases, leveraged throughout life by obesity and a set of other factors such as smoking, hypertension, diet, family history and sedentary lifestyle[3].

Evidence from studies indicate that the deposition of fat on the artery walls begins in childhood and is more likely with higher cholesterol levels in the blood[4]. However, it rarely leads to adverse outcomes in children's health, but its long-term effects can be considerable, since changes in lipid metabolism, present in childhood and adolescence tends to persist into adulthood, contributing to the development of CVD[5].

Evidence from a number of studies shows a high prevalence of hypercholesterolemia in children and adolescents[6-9]. Considering that CVD develops slowly and progressively, starting to act since the first years of life, and that TC is an important player in this process, it becomes important to undertake studies on the prevalence of hypercholesterolemia in children and adolescents. However, it is essential that these studies, in addition to diagnosing the prevalence, are also geared towards identifying the factors associated with hypercholesterolemia. Early detection of this problem can provide tools for creating policies to prevent these factors in pediatric patients and preventing or delaying CVD in adults.

Given the information presented and discussed, this study aimed to estimate the prevalence of hypercholesterolemia among schoolchildren aged 7 to 12 years of age and their potential associations with sociodemographic indicators, lifestyle, and health-related physical fitness (HRPF).

Methods

School-based cross-sectional study was conducted with students aged 7 to 12 years enrolled in private and state schools (day shift) in the city of Caxias do Sul (RS). To calculate the sample size the following criteria were adopted:

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a) population of 33,241 schoolchildren of this age group according to information from the state and municipal offices of education; b) estimated prevalence of hypercholesterolemia in 20%; c) confidence interval 95% (95%CI); d) statistical power of 80%; e) acceptable sampling error of 3%; f) design effect (deff) equal to 1.5 to control confounding factors; and g) adding a further 15% to compensate for possible losses and refusals. With the adoption of these criteria the need to evaluate 1,154 students was estimated. The sampling criterion used was probabilistic sampling by clusters, where each school was considered a conglomerate. All the local schools (153) participated in the draw with the same chances to participate in the study according to the number of students aged 7-12 years. All students aged between 7 and 12 from the eight selected schools were invited to participate in the study. Only those with informed consent signed by an adult and those who expressed willingness to participate in the study were included in the sample. This study was approved by the Ethics Committee of the Institution where the study was conducted (protocol 2006-365H). Data collection occurred from April to August of 2007 by four graduate students (three physical education professionals and one physiotherapist) previously trained to collect data.

Initially, a block-structured interview was performed with each of the individuals who comprised the sample for the evaluation of socio-demographic information, dietary habits and physical activity habits and leisure activities. Information regarding socioeconomic status was stratified according to the classification proposed by Barros and Victora[10], which considers the use of 13 variables to produce the National Economic Indicator.

TC values (dependent variable) were obtained through the portable monitor Accutrend™ GCT (Roche Diagnostics) using the method of photometry of reflection. The collection method followed the instructions recommended by the manufacturer. The measurement intervals were 150-300 mg/dl and the time required for measurement was 180 seconds. Blood was withdrawn by puncture of the volar surface of distal phalanx of the ring finger through the lancing device (softclix pro) and their disposable lancets, graded from 1 to 3 in increasing degree of penetration depth (depth: 1 = smallest; 2 = medium; 3 = largest). To standardize, we used the degree 2 of penetration for all examinations. To initiate the procedure, the finger should be clean and, after puncturing, the individual received a cotton swab to press on the site. The students were not required to be fasting, since the TC shows no significant variation with the individual whether or not fasting[11]. This form of measuring TC (portable monitor Accutrend™ GCT Roche Diagnostics) and this procedure (not fasting) were used in a campaign in Brazil by the Brazilian Society of Cardiology in more than 81,000 individuals[12]. TC was divided into tertiles, and the first (T1) and second tertiles (T2) were grouped and considered as "normal" and the top tercile (T3) was considered "increased."

The following independent variables were considered: a) socioeconomic status (high, middle or low); b) education of household head (≥ 13 years, 9-12 years or ≤ 8 years); c) type of residence (house or flat); d) age (7-9 or 10-12 years); e) gender (male or female); d) dietary habits (breakfast - yes or no; lunch every day - yes or no, repeat meal - yes or no; dinner - yes or no - eating after dinner - yes or no); e) physical activity habits and leisure activities (walking / cycling to school - yes or no, practicing sports at leisure - yes or no, time per day watching television, videogames and computer - ≤ 1 hour, 1-3 hours or ≥ 3 hours); f) cardiorespiratory fitness (adequate or low); g) and nutritional status (normal or overweight). Except for the last two variables described here, the other independent variables were collected by structured interview.

Cardiorespiratory fitness was estimated from the 9-minute run/walk test following the procedures of measurement and evaluation suggested by the Project Esporte Brasil[13]. Nutritional status was estimated from the values of body mass index (BMI), and the students were classified (normal or overweight) according to the cutoffs suggested by the Project Esporte Brasil[13]. To calculate BMI, height and weight measurements were taken following recommended procedures[13].

For data quality control, 5% of assessments were redone via phone at random and double data entry. The data were stored in a database formatted in EpiData. After checking the consistency of data, the database was exported to the program SPSS 13.0, where they were analyzed. Univariate, bivariate and multivariate analyses were performed.

In the univariate analysis, absolute and relative frequencies (proportions) were used in each of the variables followed by CI95%. For the bivariate analyses, chi-square test was used for heterogeneity and chi-square test was used for trend. In this analysis, each independent variable was associated with a dichotomized dependent variable ("normal" or "increased" TC).

In the multivariate analysis, binary logistic regression was used with dichotomized TC as an outcome. Only the variables that presented significance level (p) equal to or smaller than 0.2 in the bivariate analysis were included in the multivariate model. The input of each of the independent variables in the multivariate analysis took place according to the hierarchical theoretical model constructed (Fig. 1). The theoretical model considered three blocks of causal determination (proximal, intermediate and distal). The first block (sociodemographic indicator) included socioeconomic status, education of household head, type of residence, age and sex. The intermediate block (indicators of lifestyle) included dietary and physical activity habits and leisure activities. The last level (HRPF indicators) included cardiorespiratory fitness and nutritional status. The final multivariate model considered as factors associated with increased TC the independent variables that showed p smaller than or equal to 0.05.

Results

Out of the 1,154 children estimated for the study, 1,460 were evaluated. Out of these, 18 were excluded for being outside the age range studied. Out of the 1,442 children with consistent data collected, 1,294 allowed blood collection. Table 1 presents the descriptive results of the variables studied. The TC value that corresponded to the beginning of T3 was 170 mg/dl with 34.4% of the sample with equal or greater value. The high number of children with low cardiorespiratory fitness (62.2%) calls attention.

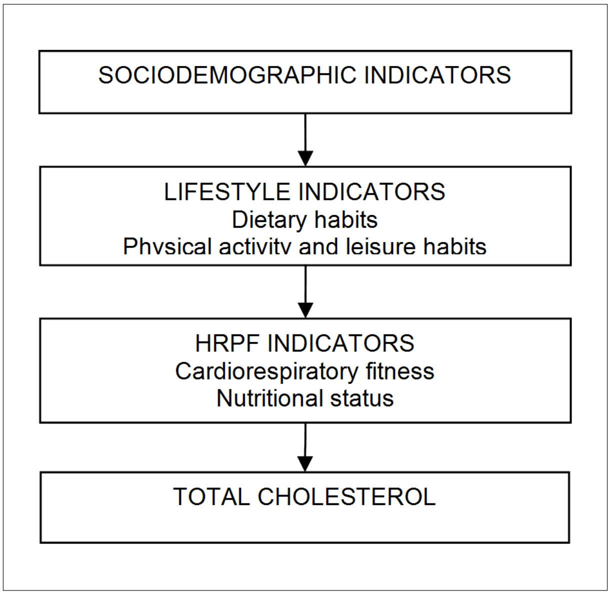

Figure 1 - Hierarchical theoretical model of factors associated with high cholesterol.

Table 1 - Description of results for the variables studied in students aged 7 to 12 years in Caxias do Sul (RS), 2007

Variable	n	% (CI95%)
Dependent		
Total cholesterol		
Normality (< 3ºT)	849	65.6 (63.0-68.2)
Increased (≥ 3ºT)	345	34.4 (32.0-36.8)
Socio-demographic indicators		
Socioeconomic status		
Low	125	10.7 (8.9-12.5)
Intermediate	356	30.4 (27.8-33.0)
High	691	59.0 (56.2-61.8)
Education level of household head		
≥ 13 years	162	13.7 (11.7-15.7)
9 -12 years	368	31.2 (28.5-33.8)
≤ 8 years	651	55.1 (52.3-57.9)
Type of residence		
Home	1,291	89.5 (87.9-91.1)
Apartment	151	10.5 (8.9-12.1)
Age group		
7-9 years	686	47.6 (45.0-50.2)
10-12 years	756	52.4 (49.8-55.0)
Gender		
Male	721	50 (47.4-52.6)
Female	721	50 (47.4-52.6)

Table 1 continuation - Description of results for the variables studied in students aged 7 to 12 years in Caxias do Sul (RS), 2007

Lifestyle indicators		
Dietary habits		
Breakfast		
Yes	1,132	79.2 (77.1-81.3)
No	298	20.8 (18.7-22.9)
Having lunch every day		
Yes	1,372	95.9 (94.9-96.9)
No	298	4.1 (3.1-5.1)
Repeating the meal (lunch)		
Yes	400	28.1 (25.8-30.4)
No	1,021	71.9 (69.6-74.2)
Having dinner		
Yes	1,301	90.9 (89.4-92.4)
No	130	9.1 (7.6-10.6)
Eating after dinner		
Yes	357	26.2 (23.9-28.5)
No	1,004	73.8 (71.5-76.1)
Physical activity habits and leisure		
Walking/cycling to school		
Yes	825	58.2 (55.6-60.8)
No	592	41.8 (39.2-44.4)
Practicing sports at leisure		
Yes	535	38.7 (41.3-36.1)
No	847	61.3 (58.7-63.9)
Daily time with TV. video game and computer		
< 1 hour	403	28.5 (26.1-30.9)
1-3 hours	585	41.3 (38.7-43.9)
> 3 hours	428	30.2 (27.8-32.6)
HRPF indicators		
Cardiorespiratory fitness (9 minutes)		
Proper	530	37.8 (35.3-40.3)
Low	873	62.2 (59.7-64.7)
Nutritional status (BMI)		
Normality	1.039	72.1 (69.8-74.4)
Excess weight	403	27.9 (25.6-30.2)

n - sample number;% - proportion of the sample, CI95% - confidence interval of 95%.

To carry out the associations between TC and the variables that make up the theoretical model proposed (Fig. 1), the chi-square test was used. In this analysis, out of the 15 independent variables studied and associated with the dependent variable, only six had a significance level smaller than or equal to 0.20. Out of the variables that made up the block of sociodemographic indicators, socioeconomic status, age and sex were associated with a significance level that met the criteria previously set to be included in the multivariate model. The results pointed to a high socioeconomic status, younger age group (7-9 years), and female sex associated with high TC level (table 2).

In the block of lifestyle indicators, only the variable 'going to school walking/cycling' had a level of significance enough to be added in the multivariate analysis. Students who reported not walking/cycling to school were associated with high TC levels. In the final block, HRPF indicators, the two variables had significance level values enough to participate in the multivariate analysis. Students with low

Table 2 - **Bivariate analysis between total cholesterol (normality - increased) and the independent variables in schoolchildren in Caxias do Sul (RS), 2007**

Variable		Total cholesterol		
		Increased	Normality	
Socio-demographic indicators	**n (%)**	**% (CI95%)**	**% (CI95%)**	**χ^2(p)**
Socioeconomic status†				
Low	116 (10.9)	24.1 (16.3-31.9)	75.9 (68.1-83.7)	6.041 (0.014)
Intermediate	316 (29.8)	31.3 (26.2-36.4)	68.7 (63.6-73.8)	
High	629 (59.3)	35.5 (31.8-39.2)	64.5 (60.8-68.2)	
Education level of household head†				
≥ 13 years	146 (13.7)	34.2 (26.5-41.9)	65.8 (58.1-73.5)	0.222 (0.637)
9 -11 years	332 (31.2)	34.3 (29.2-39.4)	65.7 (60.6-70.8)	
≤ 8 years	586 (55.1)	32.8 (29.0-36.6)	67.2 (63.4-71.0)	
Type of residence*				
Home	1.157 (89.4)	34.7 (32.0-37.4)	65.3 (62.6-68.0)	0.612 (0.434)
Apartment	137 (10.6)	31.4 (23.6-39.2)	68.6 (60.8-76.4)	
Age group*				
07-09 years	606 (46.8)	36.8 (33.0-40.6)	63.2 (59.4-67.0)	2.932 (0.087)
10-12 years	688 (53.2)	32.3 (28.8-35.8)	67.7 (64.2-71.2)	
Gender*				
Male	652 (50.4)	32.5 (28.9-36.1)	67.5 (63.9-71.1)	2.046 (0.153)
Female	642 (49.6)	36.3 (32.6-40.0)	63.7 (60.0-67.4)	
Lifestyle indicators				
Dietary habits				
Breakfast*				
Yes	1,018 (79.3)	33.9 (31.0-36.8)	64.1 (61.1-67.1)	0.889 (0.346)
No	265 (20.7)	37.0 (31.2-42.8)	63.0 (57.2-68.8)	
Having lunch every day*				
Yes	1,234 (96.1)	34.8 (32.1-37.5)	65.2 (62.5-67.9)	0.937 (0.324)
No	50 (3.9)	28.0 (15.5-40.5)	72.0 (59.5-84.5)	
Repeating the meal (lunch)*				
Yes	907 (31.1)	33.5 (30.4-36.6)	66.5 (63.4-69-6)	0.504 (0.478)
No	368 (28.9)	35.6 (30.7-40.5)	64.4 (59.5-69.3)	
Having dinner*				
Yes	1,168 (91.0)	34.0 (31.3-36.7)	66.0 (63.3-68.7)	1.499 (0.221)
No	116 (9.0)	39.7 (30.8-48.6)	60.3 (51.4-69.2)	
Eating after dinner*				
Yes	895 (73.2)	34.1 (57.1-63.5)	65.9 (62.8-69.0)	0.176 (0.675)
No	328 (26.8)	35.4 (30.2-40.6)	64.6 (59.4-69.8)	

Table 2 continuation - Bivariate analysis between total cholesterol (normality - increased) and the independent variables in schoolchildren in Caxias do Sul (RS), 2007

Physical activity habits and leisure				
Walking/cycling to school*				
Yes	756 (59.4)	31.5 (28.2-34.8)	68.5 (65.2-71.8)	6.825 (0.009)
No	516 (40.6)	38.6 (34.4-42.8)	61.4 (57.2-65.6)	
Practicing sports at leisure*				
Yes	482 (38.8)	32.2 (28.0-36.4)	67.8 (63.6-72.0)	0.937 (0.333)
No	761 (61.2)	34.8 (31.4-38.2)	65.2 (61.8-68.6)	
Daily time with TV. video game and computer†				
< 1 hour	367 (28.9)	34.9 (30.0-39.8)	65.1 (60.2-70.0)	0.416 (0.519)
1-3 hours	526 (41.4)	34.6 (30.5-38.7)	65.4 (61.3-69.5)	
> 3 hours	378 (29.7)	32.8 (28.1-37.5)	67.2 (62.5-71.9)	
HRPF indicators				
Cardiorespiratory fitness (9 minutes)*				
Proper	486 (38.4)	26.3 (22.4-30.2)	73.7 (69.8-77.6)	6.137 (0.013)
Low	779 (61.6)	35.7 (32.3-39.1)	64.3 (60.9-67.7)	
Nutritional status (BMI)*				
Normality	932 (72.0)	32.9 (29.9-35.9)	67.1 (64.1-70.1)	3.103 (0.078)
Excess weight	362 (28.0)	38.1 (33.1-43.1)	61.9 (56.9-66.9)	

*n - sample number; % - proportion of the sample; CI95% - confidence interval 95%; χ^2 - Chi-squared test; p - significance level; *Chi-squared test for heterogeneity; †Chi-squared test for trend.*

cardiorespiratory fitness and overweight were associated with high TC levels (table 2).

To perform the multivariate analysis, the order of entry of factors associated with the model was performed as shown in Table 3, i.e., respecting the hierarchical theoretical model (Fig. 1). Binary logistic regression analyses, in gross odds ratio (OR) values, confirm the results of the Chi-Square analyses. Students from families of middle and high socioeconomic status, younger age groups, females, who do not walk/cycle to school, who have low cardiorespiratory fitness and overweight have increased chances of presenting increased TC. When analyzed together (odds ratio adjusted), some of the variables mentioned above lose statistical significance and do not constitute the final multivariate model. The results of binary logistic regression analysis adjusted indicate that high socioeconomic status, female sex and overweight are associated with increased TC levels in students aged 7 to 12 years of age (table 3, figure 2).

Discussion

The results for increased TC levels in the population studied pointed to a prevalence of 34.4%. Considering that high TC level was defined as values at or above the 3rdT of the distribution and this value was 170 mg/dl, the same value recommended for classification of TC as borderline in individuals aged under 18 years[11], it is possible to compare our results with some studies available in the literature. Similar results were found in different studies[6-9], even in neighboring regions and with similar habits and culture as the population of the study concerned[7]. Moreover, there is evidence suggesting prevalence of hypercholesterolemia still higher than those found in this study[14].

In addition to the results of increased TC, other characteristics of concern were found in the population of this study. The high prevalence of low cardiorespiratory fitness and excess weight are similar to those reported by other studies in different regions of Brazil[15-20]. The concern with these results is due to the association presented by these two characteristics with increased TC, as evidenced in this study and in a series of another study[21-24].

From the bivariate analysis, it was possible to identify the variables, including those used in this study, which were associated with increased TC. Similarly to that found by Gerber and Zielinsky[7], in this study, high socioeconomic status was associated with increased TC. These results deserve attention, since the two studies were conducted in geographically close cities, whose populations have similar cultural characteristics, which may contribute to the similarity of the results. However, as highlighted by Grillo et al[25], even with results that suggest there is no influence of socioeconomic status[9], there is a predominance of studies demonstrating the association between high socioeconomic status and increased TC levels in children and adolescents.

The age group was also associated with TC. The results indicated that younger individuals are associated with increased TC levels. These results are in line with the results of a longitudinal study that found average reductions of 19 mg/dl per year from 9 to 16 years of age[26]. Also indicating that younger

Table 3 - **Gross and adjusted odds ratio for total cholesterol (normality - increased) and associated factors among schoolchildren in Caxias do Sul (RS), 2007**

Variable		Binary logistic regression			
Socio-demographic indicators	**n (%)**	**Gross OR (CI95%)**	**p**	**Adjusted OR (CI95%)**	**p**
Socioeconomic status					
Low	116 (10.9)	1.00	-	1.00	-
Intermediate	316 (29.8)	2.19 (1.72-2.78)	0.000	1.11 (0.82-1.51)	0.464
High	629 (59.3)	3.14 (2.05-4.80)	0.000	1.70 (1.05-2.75)	0.031
Age group					
10-12 years	606 (46.8)	1.00	-	1.00	-
07-09 years	688 (53.2)	2.09 (1.78-2.46)	0.000	1.15 (0.89-1.48)	0.282
Gender					
Male	652 (50.4)	1.00	-	1.00	-
Female	642 (49.6)	2.07 (1.76-2.44)	0.000	1.32 (1.03-1.67)	0.031
Lifestyle indicators					
Physical activity habits and leisure					
Walking/cycling to school					
Yes	756 (59.4)	1.00	-	1.00	-
No	516 (40.6)	2.17 (1.86-2.53)	0.000	1.24 (0.96-1.62)	0.099
HRPF indicators					
Cardiorespiratory fitness (9 minutes)					
Proper	486 (38.4)	1.00	-	1.00	-
Low	779 (61.6)	2.79 (2.02-3.87)	0.000	1.20 (0.78-1.84)	0.399
Nutritional status (BMI)					
Normality	932 (72.0)	1.00	-	1.00	-
Excess weight	362 (28.0)	2.04 (1.78-2.33)	0.000	1.40 (1.10-1.77)	0.005

n - sample number; % - proportion of the sample; CI95% - confidence interval 95%; OR - odds ratio; p - significance level.

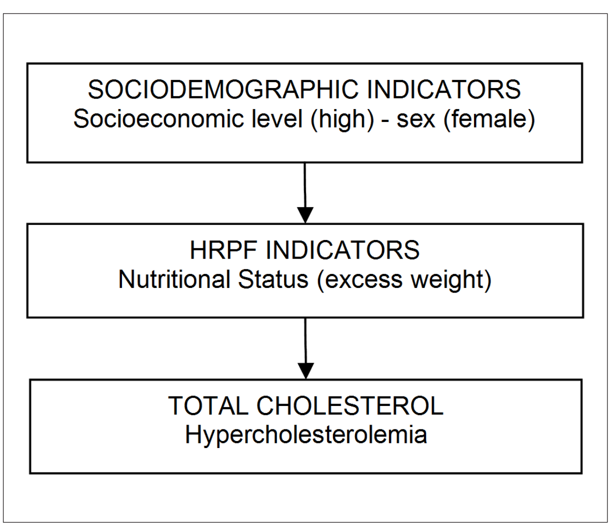

***Figure 2** - Final theoretical model after multivariate analysis between total cholesterol and associated factors among schoolchildren in Caxias do Sul, Brasil, 2007.*

schoolchildren are associated with higher levels of TC, the results of a study conducted in Belo Horizonte (MG) indicated that children (under 11 years) have significantly higher average total cholesterol than adolescents (from 12 to 18 years)[27]. However, even with much of the results of different studies indicating an association between increasing age and a reduction in TC, there is evidence that do not support these findings[8].

Also with respect to the variables that made up the block of sociodemographic indicators, sex was also associated with TC. Just as the two previous variables, where associations with TC are supported in the literature, information regarding sex suggest, as found in this study, that female sex shows an association with increased TC[6,8,18,27-29].

Concerning the variables related to dietary habits and physical activity habits and leisure, considered as indicators of lifestyle, only walking/cycling to school was associated with TC. The results indicated that students who do not walk/cycle to school are associated with increased TC. These results confirm findings of other studies indicating that lower levels of physical activity are associated with higher levels of TC[28,30,31].

Furthermore, it is important to report that some studies have considered the importance of going to school as a major component of the active lifestyle of children and adolescents[32,33].

Unlike what was reported by other studies[34,35], associations between dietary habits and TC were not found. These differences may be related to the way dietary habits were operationalized in this study. In this investigation, the students were asked only about having or not the main meals of the day (breakfast, lunch and dinner) and whether they used to repeat the meals at lunch and have anything to eat after dinner, while in other studies the questions referred to the type of food and nutients[34,35]. This characteristic can be considered a limitation of this study.

With regard to the block of HRPF indicators, the two variables were associated with TC. These findings are similar to those found by a number of other studies[21-24,30,31,36]. These results highlight the need for actions aimed at controlling excess weight, and for the encouragement of physical exercise by children and adolescents, encouraging them to adopt a lifestyle that will help them in the primary prevention of cardiovascular diseases[37,38].

After bivariate analyses, all independent variables that correlated with the dependent variable were part of the multivariate analysis. The results of this analysis found that only socioeconomic status, sex and nutritional status remained in the model. Students belonging to families of high socioeconomic status had 70% more chances to have increased TC than their peers from families of low socioeconomic status (OR = 1.70; 95%CI = 1.05-2.75), reinforcing the information discussed in the literature regarding associations between socioeconomic status and TC[7,25].

Considering the results provided by the multivariate analysis, associations between sex and TC presented and discussed above are reinforced[6,8,18,27-29]. The adjusted odds ratio indicated that female students had 32% more chances to have increased TC than the male students (OR = 1.32, 95%CI = 1.03-1.67).

The last variable to remain in the model after the multivariate analysis was nutritional status. Students classified as overweight had increased chances (40%) to experience high TC levels compared to students classified as normal nutritional status (OR = 1.40; 95%CI = 1.10-1.77). These findings reinforce the well-established association between nutritional status and TC[21-24,30,31].

It is important, however, to emphasize that these results are in line with information from some of the studies described here. Stabeline Neto et al[21] found that even after correcting for BMI, cardiorespiratory fitness remained significantly associated with TC in boys. A study involving prepubertal students on the participation of cardiorespiratory fitness, fat percentage and level of physical activity in determining levels of TC (and other biological risk factors for cardiovascular diseases) indicated that cardiorespiratory fitness has the highest ability to explain the variation of TC results[30]. In turn, the results of multivariate analysis of this study are reinforced by evidence from studies that indicate the nutritional status as a variable more associated with TC than with cardiorespiratory fitness[23].

Prior to presenting the findings, it is necessary to consider some limitations of the study. Besides the previously mentioned limitation on the procedure used to obtain the information regarding dietary habits, other limitations should be highlighted. Although there were significant associations between various independent variables with TC, it is not possible to establish causality, because it is a cross sectional study. Although the determination of TC alone does not require fasting[11] and has already been used as a strategy in other studies[12], this characteristic should be observed, since the reference values were obtained by fasting for 12 hours. In addition, some results are subject to the recall bias of students who, for being children, may have provided misleading information, especially about their lifestyle. Besides this, it is necessary to stress the non-inclusion of family history as one of the independent variables in this study. Some evidence suggests an association of this characteristic with TC levels of children and adolescents[9,39]. Nevertheless, regardless of the limitations, our findings are representative and reinforce the body of knowledge about TC and the variables associated with it in children aged 7-12.

Conclusions

Considering the results found, there is evidence that high total cholesterol levels in 07-12 year-old school children are associated with high socioeconomic level, female gender, and overweight. The results also bring some repercussions. There is a need to establish preventive measures to decrease risk factors in the population in general and among young people in particular. The efficiency of these measures stems from the early identification of risks in the population and implementation of educational programs. Among other possibilities, these educational programs should focus on guidelines about dietary habits, encouraging the regular practice of physical exercises, and encouragement for regular checking of cardiorespiratory fitness and nutritional status in children and adolescents. Such measures may assist in early detection of young individuals with increased chances of presenting risk factors for CVD and thus minimize the chances of developing coronary complications throughout life. In a country the size of Brazil, where there are strong regional and cultural differences, studies like this can contribute to the knowledge of these characteristics.

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