METABOLIC SYNDROME AND ITS ASSOCIATION WITH SOCIO-ECONOMIC LEVEL IN STUDENTS

Síndrome metabólica e associação com nível socioeconômico em escolares

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ABSTRACT

Purpose: to investigate the association between socioeconomic status and the presence of metabolic syndrome (MS) in public schools in the city of Montes Claros-MG. **Methods:** this is a cross-sectional study, analytical. We evaluated 382 children between 10 and 16 years from the cluster sampling. Socioeconomic status was divided into high and low and MS was diagnosed using the criteria of the International Diabetes Federation. For data analysis, we used the chi-square test (p <0.05) and odds ratios (with 95% confidence). **Results:** the students of lower socioeconomic class showed changes in nutritional status and laboratory tests, which contributed to the presence of MS in 8.7% school. **Conclusion:** the low socioeconomic status contributes significantly to opportune diagnosis of MS and also operates in the incidence of this disease, because their belong ingare more exposed to risk factors.

KEYWORDS: Social Class; Nutritional Status; Students; Epidemiology

INTRODUCTION

Socioeconomic status (CSE) is an important variable in the acquisition as well as the maintenance of health and well-being that influence people's behavior, such as easier access to high-calorie foods causing metabolic changes, acquisition of automobiles leading to sedentary lifestyles as well as low level of education that hinders access to prophylactic information[1]. Epidemiological studies have linked socioeconomic characteristics (income, education level and number of family members) with the incidence of chronic diseases [2].

The relationship between CSE and health is not limited to adults; population studies show that children from families of low CSE have a higher risk of developing obesity, hypertension and dyslipidemia causing cardiovascular disease (CVD) compared to children from families with higher purchasing power[2-4].

The combination of factors such as hypertension, dyslipidemia, hyperglycemia, and abdominal obesity is known as metabolic syndrome (MS) and its diagnosis comprises a combination of three or more factors[5]. Its prevalence is rapidly increasing among children and adolescents thus compromising their health as they grow into their adulthood[3,6].

MS became one of the greatest public health challenges due to changes in the characteristics of lifestyle, as children and adolescents are becoming ever more overweight and obese, with attendant high cost to public coffers, and it is becoming a worldwide epidemic[7,8].

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In a cross-sectional study involving 380 Brazilian adolescents from public schools, there was a positive correlation between CSE and the prevalence of MS[9]. Two basic health units in the city of São Paulo - SP were investigated regarding the relationship of MS and CSE, it was found that residents in the neighborhood of those with low economic means have 2.3 times the risk of developing MS[10]. In a population-based study in rural communities, using Jequitinhonha Valley, with 534 individuals with limited socioeconomic resources, it was revealed that women are more prone to the occurrence of chronic diseases because they have higher rates of physical inactivity, obesity and metabolic changes[11].

The relationship between CSE and MS has been little explored in epidemiological investigations, but economic disadvantages are predictive for the incidence of CVD morbidity and mortality [12-14]. Given this gap, the aim of this study was to investigate the possible association between socioeconomic status and the prevalence of metabolic syndrome among school children of the city of Montes Claros - MG.

METHODS

It is an epidemiological and descriptive cross-sectional study.

The study was approved by the Ethics Committee on Human Research of the State University of Montes Claros, with a consolidated No. 152.330/12. Informed consent to participate in the study was signed by the parents and guardians of the students.

Involved sample was selected through cluster sampling. The sampling process was determined through two stages: 1) stratification of primary schools (n = 53,032) and secondary schools (n = 15,505) totaling 68,537 students, and 2) clusters of schools according to the regions: north (n = 10), south (n = 17), east (n = 15), west (n = 13), totaling 55 schools. Thereafter, the drawing of the schools that participated in the study was done, based on the list provided by the institutions with the number and age of students. Four schools were drawn up randomly, one in each region due to logistical difficulties in movement and sufficient number of students to constitute the sample. In stage 2, all students between 10 and 16 years who were present in physical education classes were invited to participate in the research. The calculation of the final sample was established with an error of three percentage points and a confidence interval of 95 %, a design effect of 1.5, plus 10 % for possible losses and or refusals. Thus 421 children were selected from the formula: n = (ZZ) .pqN / ee (N - 1) + pqZZ , where Z = confidence interval P = probability of being rejected 50 % q = probability of being chosen 50 % N population = ee = percentage of error ≤ 0.05 [15].

Of the 421 initially established school, 15 students (12 boys and 3 girls) did not deliver the suit-free consent signed by parents and guardians Of the remaining 406 students, 4 children (3 boys and 1 girl) did not properly fill out the questionnaire, 12 students (3 boys and 9 girls) did not attend the laboratory, resulting in 390 school performed laboratory tests. Through draw, 8 male students were excluded, reaching the final sample of 382 students distributed in the following regions: north (n = 392, 200 and 192), south (n = 412, 246 and 166), east (n = 442, 291 and 151) and west (n = 502, 225 and 277) (primary and secondary school schools, respectively).

The socioeconomic status (CSE) of the sample was characterized by means of a structured questionnaire taking into account the specific educational background of parents, prevalence of skin color and family income. 8 categories were derived namely (A1, A2, B1, B2, C1, C2, D and E). These 8 categories were then further subdivided into high socioeconomic status (CSEA: A1, A2 and B1) as well as low socioeconomic status (CSEB: B2, C1, C2, D and E)[16].

The variables of nutritional status and metabolic syndrome were:

a) Anthropometry - The body mass (BM) and height (H) were measured on a scale of medical platform Filizola (Filizola, Brazil) with a capacity of 150 kg with 100 g precision and range of 2 m with an accuracy of 0,1 cm. The subject stood with arms along the body and the head positioned in the Frankfurt plane. Nutritional status was defined by the Body Mass Index (BMI) with the following classifications: normal weight, overweight and obese[17].

b) Obesity - Obesity has been evaluated from the abdominal circumference (AC) using a metal anthropometric flexible tape, which was inelastic and without Lock (Sanny SN 40-10, Brazil) with a limit of 2 m and an accuracy of 0.1 cm. The measurements were performed with the person being evaluated facing the evaluator, the measure was determined in the horizontal plane specific to each sex. The male was evaluated at the navel line while the female was evaluated just below the last rib, both measures were taken after normal expiration[18].

c) Blood pressure (SBP / DBP) - was measured with the aid of a sphygmomanometer (BD, Brazil) and a stethoscope Rappaport type (Premium, Brazil), which was tested and calibrated before being used. The evaluation took place with the individual in a sitting position after 10 minutes of rest, and the right arm supported at heart level, The clamp unit was put about 3 cm above the ante cubital fossa, centralizing the rubber bag on the humeral artery while the clamp was thereafter deflated with constant velocity. The first Korotkoff sound was considered for systolic blood pressure reading and the last reading for diastolic blood pressure. Care was taken to rest the instrument at five-minute intervals before the next measurement. An average of two measurements was taken to minimize measurement errors[19].

d) Blood dosages - Blood samples were collected for biochemical Laboratory in Santa Clara city of Montes Claros, MG, Brazil, through venipuncture with disposable needles and syringes, after the volunteer had fasted for 12 hours. After puncture, about 10 ml of blood were collected in a tube without anticoagulants to obtain the serum and each tube was identified by a number; each tube was capped and then stored in two coolers Termolar ® brand with a capacity of 200 tubes each. The tubes were placed in a centrifuge at 3500 rpm for 10 minutes. After that, the sample was dehydrated, segmented and placed in different tubes. The tubes were properly identified and stored in a refrigerator at -20°C for later analysis. The concentrations of triglycerides (TG), high density cholesterol (HDL-C) and glucose (Gly) were determined by the calorimetric method oxidase enzyme analyzer processed by Liquiform brand Labtest Diagnostic Kits ®.

The International Diabetes Federation (IDF) defined MS for children and teenagers, dividing them into groups: 6 to <10 years, 10 to < 16 years and > 16 years. In these groups, the AC > p 90° age is essential for the diagnosis of the syndrome. Below 10 years, the diagnosis of MS should not be done, but the child should be counseled about the need for weight loss and a change of lifestyle. For those over 10 years, the MS diagnosis can be conducted and, therefore, there must be abdominal obesity and the presence of two or more of the following factors: TG > 150 mg / dL, HDL < 40 mg / dL, Gly > 100 mg / dL, SBP ≥ 130 and DBP ≥ 85 mmHg [20]. For adolescents older than 16 years, the criteria used were those for adults[5].

All subjects were evaluated by two physical education teachers with minimum experience of 30 ratings, and “r” Pearson intra - raters was 0.975 and between subjects was 0.967. The period of data collection occurred in four days. On the first day the researcher sought each drawn school and presented the objectives of the research to the director, who subsequently informed the physical education teachers about the study procedures. In possession of the identification of age, sex, class, period of study and course work, the students were drawn to participate in the study. On the second day, the researcher presented each student with a suit-free consent form to be completed by parents or guardians, with a commitment to return the form. The next day, being the third day, and now in possession of the consent form, the socioeconomic questionnaires were administered along with hemodynamic and anthropometric evaluation. On the fourth day, the students attended the laboratory for blood sampling after fasting for 12 hours before the exercise.

For data analysis, we used the statistical program Statistical Package for Social Sciences (SPSS 20.0 for Windows ®). Descriptive statistics was done by means of the measures of central tendency mean ± standard deviation (M ± SD). The Kolmogorov Smirnov test of normality was conducted, given the sample size. After the normality test, the chi-square test was equally conducted in order to associate the prevalence of MS with the proposed nutritional status. The magnitude was calculated from the odds ratio (OR), with confidence intervals of 95 % (95% CI).

RESULTS

Table 1 shows the descriptive values of the investigated sample according to the CSE. The CSEA consisted of 37 students, 16 (43.2 %) boys and 21 girls (56.8 %), while CSEB showed a greater amount of 345 school children, 135 (39.1 %) boys and 210 (60.9 %) girls. Most of the population is between 11 and 12 years for CSEA and 11 to 14 for CSEB. The MC and E were higher for CSEA than for CSEB. In observation of nutritional status, 75.4% of students presented as eutrophic (CSEA: 78.4%; CSEB: 75.1%), 17.3% were overweight (CSEA: 16.2%; CSEB: 17.4%) and 7.3% were obese (CSEA: 5.4%; CSEB: 7.5%). Regarding education of the population investigated in both groups, the predominant primary education: 67.6 % in CSEA and 87.5 % in CSEB. The skin color was self-reported, the CSEA consisted of 24 (64.9 %) mixed, 4 (10.8%) blacks and 6 (16.2%) were white, while CSEB gathered in 202 (58.6 %) mixed, 55 (15.9%) blacks and 46 (13.4%) were white.

Table 2 presents the prevalence of students regarding the criteria for diagnosis of MS by CSE. Regarding CA, 8.4% of students from CSEB had values above the established (CI: 0.88 to 0.46, p = 0.067). As for BP, only CSEB showed changes in SBP and 0.6 % (CI: 0.98 to 1, p = 0.642) and 0.3 % with PAD (CI: 0.99 to 1, p = 0.743). The TG 2.6% of students from CSEB is above the reference values (CI: 0.95-0.99, p = 0.320). Only 1.4% of students from CSEB showed hyperglycemia (CI: 0.97-0.99, p = 0.461).

On the levels of HDL-C, 5.4% of students from CSEA and 18.8% of the school CSEB presented below the reference values, which showed a significant association (p = 0.041) indicating that CSEB is less likely to be active than CSEA (OR = 3.48, CI: 0.89 to 13.65). These results demonstrate that those children belonging to the group CSEB changes in more than three criteria thus increasing the chances for diagnosis of MS.

Table 3 shows the diagnosis of MS in 8.7% of CSEB investigated, the prevalence being higher among girls (10.4%) compared to boys (4 %).

Table 1 - Description of the school according to socioeconomic status

Variables	Socioeconomic Classification		
	CSEA	CSEB	Total
Gender			
Male	16 (43,2%)	135 (39,1%)	151 (39,5%)
Female	21 (56,8%)	210 (60,9%)	231 (60,5%)
Age (Years)			
10	4 (10,8%)	29 (8,4%)	33 (8,6%)
11	7 (18,9%)	67 (19,4%)	74 (19,4%)
12	8 (21,6%)	58 (16,8%)	66 (17,3%)
13	2 (5,4%)	66 (19,1%)	68 (17,8%)
14	4 (10,8%)	63 (18,3%)	67 (17,5%)
15	4 (10,8%)	30 (8,7%)	34 (8,9%)
16	8 (21,6%)	32 (9,3%)	40 (10,5%)
Body Mass (Kg)	50,12 ± 11,47	49,35 ± 13,72	49,42 ± 13,51
Stature (m)	1,57 ± 0,11	1,55 ± 0,11	1,55 ± 0,10
BMI (Kg/m²)			
Eutrofic	27 (73%)	254 (73,6%)	281 (73,6%)
Overweight	8 (21,6%)	64 (18,6%)	72 (18,8%)
Obese	2 (5,4%)	27 (7,8%)	29 (7,6%)
Education			
5ª Serie	7 (18,9%)	101 (29,3%)	108 (28,3%)
6ª Serie	10 (27%)	58 (16,8%)	68 (17,8%)
7ª Serie	4 (10,8%)	73 (21,2%)	77 (20,2%)
8ª Serie	4 (10,8%)	70 (20,3%)	74 (19,2%)
1º Year	4 (10,8%)	23 (6,7%)	27 (7,1%)
2º Year	6 (16,2%)	16 (4,6%)	22 (5,8%)
3º Year	2 (5,4%)	4 (1,2%)	6 (1,6%)
Race			
Brown	24 (64,9%)	202 (58,6%)	226 (59,2%)
Black	4 (10,8%)	55 (15,9%)	59 (15,4%)
Mulatto	1 (2,7%)	14 (4,1%)	15 (3,9%)
Indigenous	1(2,7%)	14 (4,1%)	15 (3,9%)
Yellow	1 (2,7%)	14 (4,1%)	15 (3,9%)
White	6 (16,2%)	46 (13,4%)	52 (13,6%)

CSEA: High Socioeconomic Conditions; CSEB: Low Socioeconomic Conditions.

Table 2 - Description of the criteria of the metabolic syndrome and prevalence (%) with 95% confidence according to socioeconomic status

Criteria	Socioeconomic Classification				*p*
	CSEA	CSEB	OR	IC (95%)	
CA (cm)					
Desirable	37 (100%)	316 (91,6%)			
Changed	--	29 (8,4%)	0,91	0,88-0,46	0,067
SBP (mmHg)					
Desirable	37 (100%)	343 (99,4)			
Neighboring	--	2 (0,6)	0,99	0,98-1,00	0,642
DBP (mmHg)					
Desirable	37 (100%)	344 (99,7%)			
Changed	--	1 (0,3)	0,99	0,99-1,00	0,743
TG (mg/dL)					
Desirable	37 (100%)	336 (97,4%)			
Changed	--	9 (2,6%)	0,97	0,95-0,99	0,320
HDL-c (mg/dL)					
Desirable	35 (94,6%)	280 (81,2%)			
Changed	2 (5,4%)	65 (18,8%)	3,48	0,89-13,65	0,041*
GlI (mg/dL)					
Desirable	37	340 (98,6%)			
Changed	--	5 (1,4%)	0,98	0,97-0,99	0,461

CSEA: High socioeconomic status; CSEB: Socioeconomic status Low, OR: Oddsratio; CI: Confidence Interval, P: statistical significance from qui-square Test CA: waist circumference, SBP: systolic blood pressure, DBP: diastolic blood pressure, TG: triglycerides, HDL-C: Cholesterol High Density; Gli: Glucose
*p<0,05

Table 3 - Description of prevalence (%) of the Metabolic Syndrome with 95% confidence according to socioeconomic status

Occurrence	Socioeconomic Classification				*p*
	CSEA	CSEB	OR	IC (95%)	
Metabolic Sindrome					
Without presence	37 (100%)	315 (91,3%)			
Presence	--	30 (8,7%)	0,91	0,88-0,94	0,052

CSEA: High socioeconomic status; CSEB: Socioeconomic status Low, OR: Oddsratio; CI: confidence interval. p: statistical significance from chi-square test.

DISCUSSION

The results show that 90.3 % of the students belong to CSEB, research shows that children with a CSEB are more likely to develop a sedentary lifestyle and this behavior is an important factor in the development of MS 1.2. The age group with the largest representation was between 11 and 12 years for CSEA and 11 to 14 for CSEB. Population studies reveal that American teenagers aged ≥ 12 years have a metabolic disorder, and 9.2 % of these accumulate at least two criteria for the diagnosis MS[21].

In a meta-analysis, involving the MC of newborns with the prevalence of metabolic syndrome, it was confirmed that there is a risk of 2.53 chances of developing into adults born with LBW, since genetic mechanisms influencing factors and MC birth determine environmental changes that culminate in the MS and consequent CVD [22-24].

Investigations involving the MS and E are scarce, a study associating them concluded that short stature is an important indicator of nutritional deprivation in childhood, and a significant predictor of morbidity in adulthood, especially where malnutrition is a public health problem in less-developed countries and consequently in lower classes [25].

The present data demonstrates that students from CSEB are overweight (18.6%) and obese (7.8%), compared with a desk study with 601 adolescents from three different Brazilian cities found that the prevalence of metabolic syndrome is overweight (17.2%) and obese (37.1%). Research also indicates that when the nutritional status is greatly changed, it increases the chance of involvement of MS [26,27]. With regard to education, 85.5% of the sample are in elementary school, studies show an inverse relationship between education and the risk of chance of developing MS 4,7[28]. Race is not characterized as an important factor, since MS is closely linked to obesity and dyslipidemia[29]. Another study however indicates that children and adolescent Hispanics have a higher prevalence of obesity and insulin resistance, which increases the chances of developing MS than in non-Hispanic white children and black[30].

The present study showed that 8,7% of students have change in CA, a study along with 818 Italian children found that this anthropometric measure would be associated with the identification of dyslipidemia and elevated blood pressure[31]. Likewise, a systematic review study cites that children with CA > p90º are likely to have a sedentary lifestyle and present lipid disorders, type 2 diabetes, hypertension, these being the components of the MS.

In this experiment we found a lower prevalence of children with hypertension analyzed separately, DBP and SBP showed no associations with the CSE. Pressure levels are used in the diagnosis of MS and affects between 0.8% and 8.2% of children and adolescents. Cross-sectional studies associate high blood pressure with nutritional status, CA and CSE, since their combination accelerates premature metabolic changes and their evaluation becomes necessary for children whose families are at greater social risk[32-34]. The diagnosis of hypertension and its inclusion as a parameter in MS detection should take into account age, sex and height [19].

The dyslipidemias are disorders in the concentrations of serum lipids, such as an increase in total cholesterol, low density lipoprotein (LDL-C), and TG and reduced HDL- c[5]. Epidemiological studies show an association between high levels of total cholesterol to the incidence of coronary heart disease at any age; these changes usually begin in childhood and occur silently, with atherosclerotic lesion diagnosed only in adulthood[10,12,21]. This same result was observed in cross-sectional study involving 419 adults over 20 years old in Eastern Taiwan, which showed that 19.3% of those affected by MS, developed it during childhood and adolescence [35].

In this study the prevalence of abnormalities to TG and Gly is very small and the CSEB, the most affected people belonging to lower income, are associated with the incidence and CVD mortality, probably because of the accumulation of risk factors (physical inactivity, hypertension, dyslipidemia), overweight being the main factor. In addition, low literacy level limits information pertaining to prophylactic care[1,3,4].

The increased levels of HDL-C decreased the relative risk for CVD, the ability to perform this reverse cholesterol transport and prevent oxidation and aggregation of the particles of LDL-c in the arterial wall, decreasing the potential of this atherogenic lipoprotein[36]. In the studied sample, decreased concentrations of HDL-C occurred in 18.8% of the school in CSEB, a result that is higher than that of the cross-sectional study done among children and adolescent who were born in São Paulo State, which totaled 13.8%[37].

The presence of MS was diagnosed in 8.7% and all of CSEB and studies indicate the prevalence of those affected to be between 4.1% and 17.2% of investigated[11-26]. The relationship between CSE and MS is close because economic disadvantages are predictive for its occurrence among children and adolescents[6,7,13]. Investigations cite this disorder may be initiated due to risk factors exposed to the individual, such as low literacy level, obesity, high-calorie foods, sedentary lifestyle and altered lipid profile[8,9,12].

A limitation of this study was the imbalance of the sample in relation to socioeconomic conditions. Few CSEA schools were obtained because schools or region were not prioritized. The sample was representative of schools in Montes - clarenses due to the sample size calculation that was employed. The results presented here corroborate other investigations. The scarcity of research on the subject was another limiting factor for discussion of the results, which made us to use international benchmarks.

CONCLUSION

The CSE contributes significantly to the prevalence of MS, its presence was diagnosed in 8.7% of the schools in CSEB because they present change in more than three items. There is an increasing incidence of MS among children and adolescents, but there is no consensus on the cutoff points for diagnosis in young populations which makes it more difficult to detect and further treatment. In this context, it becomes necessary to conduct further studies in other cities in the north of Minas since this is the first research carried out in this region.

RESUMO

Objetivo: verificar a associação entre o nível socioeconômico e a presença de síndrome metabólica (SM) em escolares da rede pública da cidade de Montes Claros-MG. **Métodos:** trata-se de estudo transversal, analítico. Foram avaliados 382 escolares entre 10 e 16 anos, a partir da amostragem por conglomerados. A condição socioeconômica foi dividida em alta e baixa e a SM foi diagnosticada utilizando os critérios da *International Diabetes Federation*. Para análise dos dados, utilizou-se o teste qui-quadrado (p < 0,05)e *oddsratio* (com intervalo de 95% de confiança). **Resultados:** os escolares da classe socioeconômica baixa apresentaram alterações no estado nutricional e nos exames laboratoriais, o que contribuiu para presença da SM em 8,7% escolares. **Conclusão:** a condição socioeconômica baixa contribui de forma significante para o diagnótico da SM e atua também na incidência dessa patologia, devido os seus pertencentes estarem mais expostos aos fatores de risco.

DESCRITORES: Classe Social; Estado Nutricional; Estudantes; Epidemiologia

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