ORIGINAL ARTICLE

Factors associated with overweight and body mass index in three schools of Itaúna – MG

Fatores associados ao excesso de peso e ao índice de massa corporal em três escolas de Itaúna – MG

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ABSTRACT

Objective: to verify the prevalence and factors associated with overweight and body mass index (BMI) in schoolchildren. **Methods:** this was a cross-sectional epidemiological study in which 60 children from six to 10 years of age were evaluated in three public schools of Itaúna-MG. They were classified by BMI/age, and their parents answered a questionnaire about demographic data, medical and family history, lifestyle, and semi-quantitative food frequency. The data were evaluated with the aid of the Excel and SPSS software. Statistical tests for logistic and linear multiple regressions were used. **Results:** the prevalence of overweight, eutrophy, and low weight, identified by BMI/age, amounted to 21.6% (p = 13), 76.7% (p = 46), and 1.7% (p = 1), respectively. Overweight was independently associated with maternal obesity (p = 0.004). A direct association was found between BMI and maternal obesity (p = 0.02), intake of breads (p = 0.03) and snacks such as chips (p = 0.08), and an inverse association was observed between BMI and yogurt (p = 0.007) and ice cream (p = 0.09) intake. **Conclusion:** the prevalence of overweight found in the studied population was high demonstrating the importance of more attention to this aspect because it can be associated with potentially modifiable factors, such as dietetics.

Key words: Body Weight; Pediatric Obesity; Body Mass Index; Diet.

RESUMO

Objetivo: *verificar a prevalência e os fatores associados ao excesso de peso e ao índice de massa corporal (IMC) de escolares.* ***Métodos:*** *trata-se de estudo transversal, epidemiológico, no qual foram avaliadas 60 crianças de seis a 10 anos de idade, de três escolas públicas de Itaúna-MG. Elas foram classificadas quanto ao IMC/idade e seus pais responderam a questionário para obtenção de dados demográficos, história familiar e pregressa, estilo de vida e frequência alimentar semiquantitativo. Os dados foram avaliados com auxílio dos softwares Excel e SPSS. Foram usados testes estatísticos de regressão logística múltipla e linear múltipla.* ***Resultados:*** *a prevalência de excesso de peso, eutrofia e baixo peso identificada pelo IMC/idade foi de 21,6% (p=13), 76,7% (p=46) e 1,7% (p=1), respectivamente. O excesso de peso foi independentemente associado à obesidade materna (p=0,004). Foi encontrada associação direta entre IMC e obesidade materna (p=0,02), ingestão de pães (p=0,03) e salgadinhos tipo chips (p=0,08) e associação inversa entre IMC e ingestão de iogurte (p=0,007) e sorvete (p=0,09).* ***Conclusão:*** *a prevalência de excesso de peso encontrada na população estudada foi alta, demonstrando a importância de mais atenção a esse aspecto, uma vez que ele pode estar associado a fatores potencialmente modificáveis, como os dietéticos.*

Palavras-chave: *Sobrepeso; Obesidade Pediátrica; Índice de Massa Corporal; Dieta.*

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INTRODUCTION

Excessive body weight (obesity and overweight) is in an ascending climb in all human populations,[1] and is currently the fifth greatest risk factor for mortality in the world.[2] Obesity rate among young people is growing and a good portion of overweight children become obese adults.[3]

Obesity is multifactorial, including in its causes organic, environmental, behavioral, psychosocial, and socioeconomic factors. The main behavioral cause is sedentariness, characterized by more hours per day in front of a television, computer, and video games as leisure activities coupled with easy access to processed foods that are rich in sugars and fats, and fast foods.[1]

Childhood overweight and obesity contribute to the emergence of several diseases such as Diabetes melittus type 2, hypertension, dyslipidemia, and metabolic syndrome, which increases the risk of heart diseases, osteoporosis, and cancer.[4,5]

The increasing prevalence of childhood obesity has prompted the search for possible associated factors and most effective ways to prevent and combat it. This study aims to identify factors associated with the body mass index (BMI) and overweight in school children attending public schools.

METHODS

This was a cross-sectional study performed in Itaúna (Minas Gerais) with school children in the age group of six to 10 years old, enrolled in three public institutions. Data were collected in the second semester of 2010 on demographic, socioeconomic, previous and family history, lifestyle, dietary, and anthropometric parameters.

We opted for the adoption of excess weight and BMI variables, prioritizing data that possibly could affect these conditions and/or were associated with their highest values.

Children were randomly selected according to statistical criteria. A pilot study was carried out with 25 students to determine the minimum sample size, spanning the ages from six to 10 years old and both genders. The following variables were measured: systemic systolic and diastolic blood pressure (SBP and DBP), total cholesterol and fractions (HDL, LDL), triglycerides, and insulinemia; averages and standard deviation were calculated. The maximum tolerance error permitted for the estimate of population average of each variable was established to not compromise the reliability of results. The respective sample standard deviation as population estimate, at the significance level of 5%, was used for the calculation of minimum sample in each variable.

We decided to take the maximum sample size between the two minimum obtained, insulinemia, which in turn, was the limiting variable for the sampling by presenting the greatest variability. To this sample, 50% were added considering the losses. Stratification was performed by gender and age within each school to maintain the proportions of age and gender. Students were numbered in each series in sequential order upon data obtained from each school. Subsequently, children were selected based on the number in the list established in each series, using a table of random numbers generated in the Excel 2003 software, until the required number of that gender, age, and school to compose the sample was reached.

Children were selected based on the criteria of belonging to the age group between 6 and 10 years old and enrollment in State schools, attending the morning or afternoon shift, and at the introductory level and fourth grade. Teenagers were not included due to bodily changes that occur during this phase.

The study was conducted only with children whose parents authorized their participation by signing the Voluntary Informed Consent Form and who attended data collection. This study was approved by the Research Ethics Committees from the Federal Universities of Minas Gerais and Itaúna, under the ETIC numbers of 0040.0.203.000-10 and 012/10, respectively.

This study was conducted in two phases: in the first, the child attended school with a guardian who responded to a questionnaire related to demographic, socioeconomic, previous and family history, lifestyle, dietary, and anthropometric information.

The socio-economic and family history survey enabled information about the number of people in the household, the number of children, gender, age, weight and height at birth, prematurity, breastfeeding, and parents' obesity.

The dietary evaluation was conducted through the food frequency semi-quantitative questionnaire (QFASQ) and questions regarding the intake of salt and sugar by addition, the number of meals, and habit of eating while watching television. The questionnaire was based on a similar work adapted to children from six to 10 years old.[6] The QFASQ analysis used the re-

sponses classified in portions per month, week, or day, transformed into portions consumed per day.

In the second phase, the measurements of height and weight were conducted. Weight was obtained in a Tanita BF-683 W model digital electronic personal scale with a maximum capacity of 150 kg and accuracy of 0.1 kg. The height measurement was performed using an Alturaexata vertical anthropometer, graduated in centimeters (cm) up to 2.13 meters and accuracy of 0.01 m.

BMI was calculated from the weight and height data. Children were classified according to the BMI/age value through new growth curves recommended by the Ministry of Health and the World Health Organization.[7] Children with BMI/age above 85 and 97 percentiles were classified as overweight and obese, respectively, and those with percentile below three as low weight.

Data were analyzed with the aid of the Microsoft Excel® and Statistical Package for Social Sciences (SPSS)® version 17.0 softwares. Categorical variables were presented in the form of percentages and absolute values. Numerical variables were subjected to the verification of data normality (Kolmogorov-Smirnov test) to decide on data presentation and secondary tests to be carried out. All variables related to food intake by daily rations obtained with the QFASQ showed the normal distribution ($p < 0.05$) and, therefore, were presented as median, minimum, maximum, and quartiles.

The evaluation of factors associated with overweight (BMI/age > 85 percentile) of univariate form was performed through the Chi-square test, Fisher exact test, and Odds Ratio (for categorical variables associated with whether being or not overweight), and Mann-Whitney test and Student's T-test (according to the distribution of numerical variables). The significance level of 5% was adopted for the presentation of variables associated with overweight in the univariate form.

The multivariate analysis was conducted by creating a multiple logistic regression model using those whose p-value in the univariate analysis was less than 0.2 as input criteria of variables in the model. The model was subsequently elaborated according to the stepwise backward method in which variables with the highest p-value were dropped, one by one, until only variables with $p < 0.05$ remained in the model. The Hosmer and Lemeshow test was employed to verify model fitting ($p > 0.05$); only variables independently associated with overweight children were obtained through this method.

The multiple linear regression analysis was also carried out with the aim of discriminating variables associated with BMI values in the studied children. The linear regression model was obtained by the stepwise backward method.

RESULTS

Sixty children between six and 10 years of age and an average age of 8.3 years were evaluated. The general characteristics of the studied children such as gender and the BMI/age classification are presented in Table 1.

Table 1 - Gender and BMI/age classification in the evaluated school children (Itaúna – 2010)

Characteristics	%	N
Gender		
Male	50	30
Female	50	30
BMI/age classification		
Low weight	1.7	1
Eutrophy	76.7	46
Overweight	21.6	13

The average number of household individuals and number of children was 4.35 ± 1.2 and 2.4 ± 1.1, respectively; 20% (n = 12) of the children were the only child. The average weight and height at birth was 3.3 ± 0.6 kg and 50 ± 2.2 cm, respectively; about 5% (n = 3) of the children were born prematurely. The prevalence of children with a birth weight of 2.5 kg or less was 18.3%, and of 4.0 kg or more was 5%.

In relation to breastfeeding, 18% (n = 11) of children were not breastfed. Out of those who were breastfed, the median of exclusive breastfeeding was 5 ± 4.8 months, and the median of non-exclusive breastfeeding was 6.5 ± 9.7 months.

Exclusive breastfeeding was observed in 42% (n = 27) and 58% (n = 36) of children for at least six and four months, respectively. The percentage of children breastfed exclusively until six months, and with complementary feeding until 24 months, according to a statement from the Ministry of Health, was 57 and 10%, respectively.

The median weight in the studied children was 29.3 kg, with the minimum 19 kg, and maximum 70.4 kg. The average height was 134.6 cm. BMI ranged from 12.3 to 37.5 kg/m², with a median of 16.7 kg/m².

The nutritional status of male children was eutrophy and overweight in 70 and 30%, respectively, and eutrophy, overweight, and underweight in 86, 11, and 3%, respectively, in females. A total of 21.6% (n = 13) of children were identified with BMI/age above the 85 percentile; of these, 69% (n = 9) were males and 31% (n = 4) females. Paternal and maternal obesity was observed in 11.6 and 10% of cases, respectively.

The habit of eating watching television was noted in 68.3% (n = 41) of children. The addition of salt and/or sugar to food already prepared was reported by 53.3% (n = 32) of children. In relation to the number of meals per day, 40% (n = 24) had between three and four, and 60% (n = 36) between five or more.

There was only one variable independently associated with statistic significance to child overweight: mother's obesity (p = 0.004). Out of the children of obese mothers, 71.4% were overweight versus 15.1% from non-obese mothers (OR: 14.06; IC: 2.31-85.41).

The final multiple logistic regression model, adjusted by the Hosmer Lemeshow test (p = 0.919), included the variables maternal obesity and average daily intake in portions of fried meat, although the latter remained in the model without statistical significance (Table 2). The model, generated only with the maternal obesity variable could not be adjusted, and therefore, we opted for the choice of the model containing the average daily intake in portions of fried meat, which could correctly predict the overweight child status in 83.3% of the cases.

Considering BMI as a response variable, the multiple linear regression model revealed statistically significant association between the highest BMI values and mother's obesity (p = 0.02), highest average daily intake of servings of breads (p = 0.03), and lowest average daily intake in servings of yogurt (p = 0.007) (Table 3).

However, in this final model, variables that tended to significance (greater average daily intake in portions of snack foods such as chips, p = 0.08, and lower average daily intake in portions of ice cream, p = 0.09) also remained. It is assumed that these variables, somehow, promoted an interaction effect with the others because, if removed from the model, other variables lost significance (except for the maternal obesity variable).

Table 3 - Factors independently associated to BMI values by using the multiple linear regression analysis (Itaúna – MG, 2010)

Variable	Coefficient	P
Maternal obesity	4.07	0.02
Average daily intake in servings of breads	1.46	0.03
Average daily intake in servings of yogurts	-2.86	0.007
Average daily intake in servings of type "chips" snacks	3.77	0.08
Average daily intake in servings of ice cream	-3.35	0.09
Constant	17.12	

DISCUSSION

The prevalence of overweight/obesity found in this study was high (21.6%) compared to data from the Food and Nutrition Monitoring System (SISVAN) for the year 2009 in children over seven years of age (8.7%) in the city of Itaúna-MG.[8] The prevalence of overweight and obesity found by Ribeiro et al.[9] in the "Study of the heart in Belo Horizonte" was 8.4 and 3.1%, respectively. However, another study conducted in the State of Paraná with 356 children from urban regions, aged between six and 10 years old, showed a higher prevalence of overweight/obesity of 27%.[10]

A research conducted with 528 students, from six to 10 years of age, classified overweight and obesity through BMI according to the international pattern and indicators of adiposity. This study concluded that BMI/age is suitable for classifying overweight and obesity in the concerned age group because it was in agreement with indicators of adiposity.[11] Although it was relevant to use cutaneous folds and waistline measurements for the classification of nutritional status, we opted for using the data to classify according to BMI by age and according to Giugliano and Melo.[11]

Table 2 - Factors independently associated to overweight in the evaluated schoolchildren by using the multiple logistic regression analysis (Itaúna – MG, 2010)

Variable	Coefficient	p	*Odds Ratio*	Confidence interval
Maternal Obesity	3.11	0.006	22.5	2.5-203.2
Average daily intake of portions of fried meat	-4.56	0.093	0.011	0.00-2.2
Constant	-1.12			

There was no relationship between excess weight and gender in this study, although the prevalence of overweight in males (30%) was higher than in females (11%). Higher prevalence of overweight among boys than girls was also found in São Paulo; [12] in Pernambuco and Sorocaba the prevalence of overweight was higher in girls.[1,13]

No relationship between excess weight and BMI values was registered in relation to the number of siblings. However, the relationship between overweight children and being the only child is cited in several studies.[14,15,16] In this study, a significant relationship between breastfeeding and overweight was also not detected, which may have suffered interference by difficulties occurring during data collection. When the child was accompanied by the father, for example, there was, for the most part, difficulties in getting a response to correct breastfeeding periods and confusion regarding exclusive breast-feeding and weaning period.

Breastfeeding has many benefits for children including protection against overweight and obesity.[17,18] A study carried out in Recife with 409 preschoolers concluded that children who were breastfed for four months or longer had a lower prevalence of overweight when compared to those with shorter breastfeeding times.[18]

The Ministry of Health[19] recommends that children should be exclusively breastfed and complementary fed until six and 24 months of age, respectively, which was not found in this study because the median time of exclusive breastfeeding was less than five months.

Relationships between birth weight and prematurity and infant and children overweight and BMI values were not evidenced in the evaluated sample. Martins and Carvalho[20] described the relationship between birth weight and overweight in childhood and found that, although most macrosomic children have a high risk of childhood obesity, there are reports that low birth weight may also be associated with childhood obesity.

Prematurity[21] is identified as a risk factor for overweight in children. However, this association was not observed in this study.

Parental obesity was evaluated through the questionnaire in which the person responsible for the child reported the presence or absence of obesity in parents. This variable would be more specific if the anthropometric measurements of parents had been effectively evaluated and their nutritional status evaluated. Such evaluation was not feasible because the presence of both parents at the time of data collection was not possible. Despite the absence of anthropometry for parents, the mother's obesity variable reported by the mother or the child's guardian showed a relationship with the response variable and were in agreement with various studies.[15, 22,23] This may be related to both family genetics and environmental influences because the child living in the same environment with parents is influenced in acquiring similar eating and life habits.[24,25] Maternal obesity may be more related to childhood overweight than paternal, since it is the mother, in general, who chooses and prepares the food, and if she has inadequate feeding habits, the trend pass to the children.[15]

The eating habits of children have suffered several modifications such as a decrease in intake of fruits and vegetables and increase in consumption of sweets and soft drinks, which have contributed to increasing in overweight individuals.[24] In adolescents, the low consumption of fruits and vegetables and high consumption of fats and sweets seem to be associated with the high percentage of overweight individuals (21%).[26]

In this study, an association between greater intake of daily servings of bread and high BMI was observed, which may be related to the amount of carbohydrates present in this food group. Groups of bread (candy, French, light, integrals, etc.) were not differentiated during data collection, which can be considered a limitation. The consumption of carbohydrates is essential because they are important sources of body energy.[27] However,[27,28] it is observed that individuals with a diet rich in energy from carbohydrates of high glycemic indexes (GI) have more chances of developing cardiovascular diseases, obesity, and diabetes mellitus. The intake of whole grains, which are rich in fibers, to the detriment of other sources of carbohydrates can minimize this situation because they have different GI. High GI stimulates lipogenesis, causing the growth of adipocytes while low GI diets inhibit this response.[28]

The higher consumption of snacks such as chips was also associated with high values of BMI in this study. Pierine et al.[29] stressed that in 441 middle and elementary school children, 28% ate snacks in school meals. These foods have low amount of nutrients that are essential to the development of children, high energy density, and excessive amounts of sodium and fat, and may increase the risk of obesity, hypertension, and cardiovascular diseases.[30]

The inverse relationship between BMI and ingestion of yogurt and ice cream found in this research

may be linked to the large amount of calcium available in these foods. Santos et al.[31] found a negative association between calcium intake and BMI in adolescents of middle socioeconomic level in the city of Ouro Preto (Minas Gerais). Crisóstomo et al.[32] concluded that the intake of calcium and dairy products can contribute to metabolic changes that help controlling weight, body fat, and insulin resistance; and point out that the influence of calcium intake on obesity needs to be further studied.

One of the limitations found in this study was the absence of some data that would be important such as, for example, parents ' education, socioeconomic factors, and level of physical activity in children, factors already identified as associated with overweight children.[33]

This study identified high prevalence of overweight in schoolchildren from six to 10 years of age; and suggests that this result can be related to the mother's obesity, high intake of breads and snacks, and inversely proportional to the ingestion of yogurt and ice cream.

This study is not conclusive because the sample does not characterize the school children population and has limitations in data collection, however, it alerts to the value of healthy nutritional habits and encourages the quest for more knowledge to characterize better the nutritional status of schoolchildren and promote nutritional intervention measures.

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