Growth and nutritional status of adolescents of public education system

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Abstract

Introduction: The prevalence of obesity in children and adults has increased worldwide exponentially over the past two decades, becoming an important issue of global public health.

Objective: To describe the growth and nutritional status of adolescents of public schools.

Methods: Epidemiological, cross-sectional study, a representative sample of students aged 10 to 14 years of the public schools of the Metropolitan Region of Grande Vitória (MRGV), State of Espírito Santo, Brazil. Data on gender, age, skin colour/race, pubertal stage, socioeconomic class, weight and height were obtained. In the nutritional evaluation, the Height/Age (H/A) and Body Mass Index/Age (BMI/A) indexes, in z-score, of the WHO reference (2007) were considered. For statistical analysis, we used the Qui-square test and Student’s t test (Mann-Whitney test for non-normal distribution), and significance level of p < 0.05. Study approved by the Institutional Research Ethics Committee.

Results: There were assessed 818 adolescents, with average age of 12.8 ± 1.1 years, female predominance (58.3%), mixed skin colour/race (41.7%), post-pubertal stage (53.4%) and socioeconomic class C (59.5%). It was identified very low stature in 0.4% and low stature in 1.8% of adolescents. Overweight was diagnosed in 227 (27.7%) students, represented by overweight (18.7%), obesity (8.4%) and severe obesity (0.6%); While 0.2% presented severe thinness and 2.7% thinness. The mean z-score of girls’ height (p = 0.024) was higher than the WHO reference, as well as the BMI z-score of girls (p = 0.0001) and boys (p = 0.0002).

Conclusion: Adolescents of public schools of MRGBV achieve adequate growth, even higher, on average, proposed by WHO (2007). However, they also present a high prevalence of overweight, indicating that the region is at an advanced stage of nutritional transition.

Keywords: growth, nutritional status, adolescent, nutritional transition.

INTRODUCTION

The prevalence of obesity in children and adults has increased exponentially over the past two decades, becoming an important issue of global public health¹. In this sense, the association of obesity with chronic non-communicable diseases is also concerned as this may lead to an increase in cardiovascular risk and metabolic syndrome in the early stages of life, resulting in substantial risks for alterations in glycolipid metabolism, arterial

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hypertension, diabetes mellitus type 2 and premature cardiovascular disease. The rapidity as these changes occurring has been attributed to the nutritional transition that is characterized by recent changes in lifestyle and food patterns of the population, resulting from industrialization, urbanization, economic development, and globalization. In general, this process is characterized by the almost absence of severe energy-protein malnutrition, presence of short stature (possible sequel of chronic malnutrition in the first years of life) and by the increase of overweight and obesity at alarming population scales, which progressively reach the lower socioeconomic strata.

Brazil, following the world trend, has shown significant increase in the prevalence of overweight and obesity in the last four decades, including the young population, however, their values are not well defined by state or metropolitan areas, especially among younger adolescents, because of the limited number of population studies in this age group. National studies have shown a high prevalence of overweight in adolescents, varying between 15.3% and 30.6%, with a reduction in the prevalence of short stature, but in general, they evaluate different populations and not always with the same criteria and diagnoses. Thus, the objective of this study is to describe the growth and nutritional status of school adolescents.

**METHODS**

This is a cross-sectional, epidemiological study in a probabilistic and representative sample of the population, consisting of adolescents between 10 and 14 years of age, of both genders, attending public schools located in an urban area of the Metropolitan Region of Grande Vitória (MRGV), Espírito Santo State, Brazil, carried out in the period of August 2012 and October 2013. The MRGV is composed of the municipalities of Cariacica, Fundão, Guarapari, Serra, Viana, Vila Velha and Vitória, with 48% of the total population of the state, with a population of 3,514,952 inhabitants, with urbanization rate of 98.3%.

The sample size calculation was based on error margin of 3%, confidence interval of 95% and overweight prevalence of 20%. The sample size of 822 subjects was calculated from the equation proposed by Triola, having as reference 27,787 adolescents matriculated in 5th to the 8th grades in the public schools of MRGV, Espírito Santo, Brazil.

The adolescents were selected by random sampling, stratified by conglomerates of unequal sizes, in two stages, with the school being the primary unit and the school class the secondary unit. Inclusion criteria was as follows Students aged 10 to 14 years with no physical disability to interfere anthropometric evaluation, with no secondary obesity, acute or chronic inflammatory diseases or corticosteroid and/or anti-inflammatory use. The weight of the adolescents (barefoot and wearing light clothes) was obtained using a portable electronic scale Tanita® A-080 (Arlington Heights, Illinois, USA) with a maximum capacity of 150 kg and graduation of 100 g. Height was measured with a portable stadiometer Alturaexata® (Belo Horizonte, Minas Gerais, Brazil), with maximum length of 214 cm and precision of 1 mm. The procedures for obtaining the anthropometric measurements were performed as recommended by the World Health Organization. For the nutritional status were considered the body mass index for age (BMI/A), z-score, the reference of the WHO, using the WHO software AnthroPlus version 1.0. 3.

The self-assessment of sexual maturation was applied showing the participants specific frames for sex (breasts and pubic hair for girls, genitals and pubic hair for boys) of different pubertal stages of Tanner, the individual had to indicate his current stage of sexual maturation.

Socioeconomic data were obtained considering the Economic Classification Standard Criteria Brazil through a scoring system associated with the consumption capacity of a household and cut offs of socioeconomic classes segmentation (A1, A2, B1, B2, C1, C2, D, E), also it was used the classification system proposed by IBGE, employs five categories of “colour” or “race” (white, black, yellow, brown or indigenous).

For statistical analysis, we used comparisons and/or associations with Qui-square test (χ²) and Student’s t test (Mann-Whitney test for non-normal distribution). Significance was set at p <0.05. This study was approved by the Research Ethics Committee of the Federal University of Minas Gerais (protocol CAAE - 0301.0.203.000-11) and the Hospital Nossa Senhora da Glória de Vitória (Protocol 41/2012).

**RESULTS**

Out of 822 eligible adolescents, a total of 818 answered (99.5%), from 13 schools of the public school system of MRGV, Espírito Santo, Brazil. The mean age of the sample was 12.8 ± 1.1 years (median of 12.9 years and range of 10 to 14.9 years), with a predominance of females (58.3%). Demographic variables and growth and nutritional status ratings are presented in Tables 1 and 2, respectively.

Overall, the adolescents had an average H/A z-score of 0.092, higher than the mean of reference (p = 0.0121) and an average z-score of BMI of 0.2821, also above the value of reference (p < 0.0001).

Figures 1 and 2 show that the z-score values for height and body mass index of adolescents as a whole, have higher frequencies, compared to the expected value reference of the WHO, values to the left of the median, are the highest z scores.

There was no significant difference in median age and mean z-score of H/A and BMI/A between genders (Table 3). It was noted also that the average z-score for H/A for girls (p=0.024) was higher than the WHO reference as well as the average z - score of BMI/A for girls (p=0.0001) and boys (p=0.0002).

**DISCUSSION**

The prevalence of very low stature and low stature was, respectively, 0.4% and 1.8% (Table 2) in a
Table 1: Distribution of the demographic variables of 818 adolescents, MRGV, Espírito Santo, Brazil, 2014

<table>
<thead>
<tr>
<th>Variables</th>
<th>Absolute Frequency (n)</th>
<th>Relative Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>477</td>
<td>58.3</td>
</tr>
<tr>
<td>Male</td>
<td>341</td>
<td>41.7</td>
</tr>
<tr>
<td>2. Skin colour/race*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>232</td>
<td>245</td>
</tr>
<tr>
<td>Black</td>
<td>341</td>
<td>28.4</td>
</tr>
<tr>
<td>Mixed</td>
<td>29.9</td>
<td>41.7</td>
</tr>
<tr>
<td>3. Pubertal Stage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-puberty</td>
<td>27</td>
<td>3.3</td>
</tr>
<tr>
<td>Puberty</td>
<td>354</td>
<td>43.3</td>
</tr>
<tr>
<td>Post puberty</td>
<td>437</td>
<td>53.4</td>
</tr>
<tr>
<td>4. Socioeconomic class**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>275</td>
<td>33.6</td>
</tr>
<tr>
<td>B</td>
<td>467</td>
<td>59.5</td>
</tr>
<tr>
<td>C</td>
<td>48</td>
<td>5.9</td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Unidentified adolescents yellow skin colour or indigenous race; **Unidentified adolescents of the socioeconomic class E.

Table 2: Distribution of adolescents according to growth achieved and nutritional status, MRGV, Espírito Santo, Brazil, 2014

<table>
<thead>
<tr>
<th>Variables</th>
<th>Absolute Frequency (n)</th>
<th>Relative Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. H/A Index*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very low height</td>
<td>03</td>
<td>0.4</td>
</tr>
<tr>
<td>Low height</td>
<td>15</td>
<td>1.8</td>
</tr>
<tr>
<td>Adequate height</td>
<td>800</td>
<td>97.8</td>
</tr>
<tr>
<td>2. BMI/A Index**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe Thinness</td>
<td>02</td>
<td>0.2</td>
</tr>
<tr>
<td>Thinness</td>
<td>22</td>
<td>2.7</td>
</tr>
<tr>
<td>Eutrophic</td>
<td>153</td>
<td>18.7</td>
</tr>
<tr>
<td>Overweight</td>
<td>69</td>
<td>8.4</td>
</tr>
<tr>
<td>Obesity</td>
<td>05</td>
<td>0.6</td>
</tr>
<tr>
<td>Severe obesity</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*H/A: height for age index; **IMC/I: body mass index for age index.

Figure 1: Frequency Distribution curve of the of 818 adolescents according to height-for-age z score, MRGV, Espírito Santo, Brazil, 2014.
Growth and nutritional status of adolescents of public education system

Table 3: Median of age and z-score media of height and Z score of BMI of adolescents, according to gender, MRGV, Espírito Santo, Brazil, 2014

<table>
<thead>
<tr>
<th>Variables</th>
<th>Girls (n = 477)</th>
<th>Boys (n = 371)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age* in years</td>
<td>12.9 (12.0 a 13.8)</td>
<td>12.8 (12.6 a 12.9)</td>
<td>0.164</td>
</tr>
<tr>
<td>Height z-score**</td>
<td>0.10 (±0.967)</td>
<td>0.08 (±1.154)</td>
<td>0.823</td>
</tr>
<tr>
<td>BMI z-score**</td>
<td>0.30 (±1.175)</td>
<td>0.26 (±1.285)</td>
<td>0.597</td>
</tr>
</tbody>
</table>

*Median (p25 to p75); **mean (±standard deviation).

The mean of the girls’ H/A z-score was 0.10 (± 0.967) and the boys’ z-score was 0.08 (± 1.154), with no significant difference between the genders (p=0.823) (Table 3). The distribution of adolescents, according z-score of H/A shows that the group, as a whole was over than expected growth, with a median of H/A higher values of the WHO reference, mainly in females (p = 0.024).

The relevance of these results is that stature growth, especially in developing countries, may represent an advance in the health conditions of children and young people, since it is one of the indicators of quality of life in a country. This secular trend of growth has been observed in some regions of Brazil since the end of the 1990s, and can be interpreted from the perspective of improving the social determinants of health and can also integrate the process of nutritional transition, including outside the major metropolitan areas.

Amorim et al. evaluated the growth of 13,216 adolescents aged 10 to 18 years, enrolled in the public schools of Paraná, Brazil, and found low prevalence of deficit for the total school by gender, represented by 1.3% and 1.4% higher than the 2.3% expected in the reference population for girls and boys, respectively, with normal distribution of the values of z-score H/A, for both genders (p> 0.2).

In the evaluation of nutritional status, overweight was diagnosed in 227 (27.7%) students, represented by overweight (18.7%), obesity (8.4%) and severe obesity (0.6%) (Table 2). In this study, the prevalence of 27.7% of overweight is higher than that reported for the country (25.4%) and identified in another study with adolescents from five geographic regions of Brazil (20.1%), but it is below the range observed by Cabrera et al. (30.6%). International studies confirm this result, considering criteria for similar nutritional diagnosis.

Globally, the studies report high prevalence of overweight among young populations, with results ranging between 14.7% and 38.6%. This discrepancy in prevalence can be explained by the use of different criteria for nutritional diagnosis, sample size, broad age range, and social and environmental characteristics of the studied groups, limiting, therefore, the comparison of the results found here.

These data are alarming, since obesity in childhood and adolescence tends to remain in adulthood, and the consequences of overweight are associated with a higher risk of dyslipidemia, insulin resistance, hypertension, cardiovascular diseases, syndromes metabolic and...
In the present study, the mean Z-score of BMI/A for girls was 0.30 (± 1.175) and for boys was 0.26 (± 1.285), with no significant difference between the genders (p=0.597) (Table 3). The distribution of students according to Z-score of BMI/A, shows weight gain than expected, with a median BMI/A shifted toward higher values of the WHO reference in girls (p=0.0001) as in boys (p=0.0002).

There was a low prevalence of severe thinness (0.2%) and thinness (2.7%) in this sample, with a rate similar to that reported for the Southeast Region (3.0%) and lower than the national average (3.4%)\(^6\), thus indicating exiguous frequency current frames of severe protein-energy malnutrition in the adolescent population MRGB, Espírito Santo, Brazil.

Findings show that this region is at an advanced stage of nutritional transition, characterized by changes in lifestyle and dietary patterns of the population, with progressive reduction of physical activity, increased consumption of saturated fats, sugars and refined foods as a consequence of industrialization, urbanization, economic development and globalization. These changes are reflected in nutritional outcomes such as changes in mean height, body composition, morbidity and, in particular, a significant reduction in severe protein-energy malnutrition and short stature, and an increase in the prevalence of overweight and obesity at scales alarming population, which, progressively, also affects the lower socioeconomic strata\(^1\).

The study presents as a limitation the evaluation of only adolescents frequenting public schools located in urban areas (93.1% coverage of schools state-wide public administration\(^13\), which hinders extrapolation of the results to the Brazilian population. However, these findings lead to reflections on the need to be a growth surveillance policy and about the nutritional status, being a periodic and continuous evaluation tool of living conditions, welfare and nutrition of a population\(^12,33\). In addition, the study presents epidemiological data not yet analysed in the region, which may be useful in the formulation of public policies for the prevention and control of obesity, and also contribute to a rational and less costly reduction of the incidence of chronic non-communicable diseases in adult life.

In conclusion, adolescents of elementary schools of public education system in the Metropolitan Region of Grande Vitória, Espírito Santo, Brazil, have already achieved adequate growth. However, they also present a high prevalence of overweight, diagnosed in 27.7% of the sample, thus indicating that the young population of the Region is at an advanced stage of nutritional transition.

REFERENCES


Resumo

Introdução: A prevalência de obesidade em crianças e adultos tem aumentando de modo exponencial nas últimas duas décadas, configurando-se como importante problema de saúde pública global.

Objetivo: Descrever o crescimento e o estado nutricional de adolescentes frequentadores de escolas públicas.


Resultados: Avaliados 818 adolescentes, média de idade da amostra de 12,8 ± 1,1 anos, predomínio do sexo feminino (58,3%), cor/raça parda (41,7%), estádio pós-púbere (53,4%) e classe socioeconômica C (59,5%). Identificou-se muito baixa estatura em 0,4% e baixa estatura em 1,8% dos adolescentes. O excesso de peso foi diagnosticado em 227 (27,7%) estudantes, representado por sobrepeso (18,7%), obesidade (8,4%) e obesidade grave (0,6%); enquanto 0,2% e 2,7% deles apresentaram magreza acentuada e magreza, respectivamente. A média do escore z de estatura das meninas (p = 0,024) foi superior ao referencial da OMS, assim como a do escore z do IMC das meninas (p=0,0001) e dos meninos (p = 0,0002).

Conclusão: Os adolescentes da rede pública estadual da RMGV já alcançam um crescimento adequado, inclusive superior, em média, ao proposto pela OMS (2007). Contudo, também apresentam prevalência elevada de excesso de peso, indicando que a Região está em fase avançada de transição nutricional.

Palavras-chave: crescimento, estado nutricional, adolescente, transição nutricional.