

Growth and nutritional status of adolescents of public education system

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DOI:<http://dx.doi.org/10.7322/jhgd.127651>

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 MRGV 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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Trabalho baseado na tese intitulada "Prevalência de excesso de peso e sua associação com os fatores de risco cardiovascular e síndrome metabólica em adolescentes da rede pública estadual de ensino da Região Metropolitana da Grande Vitória – ES", apresentada por Janine Pereira da Silva ao Programa de Pós-Graduação em Ciências da Saúde, Área de Concentração em Saúde da Criança e do Adolescente, da Faculdade de Medicina da Universidade Federal de Minas Gerais (UFMG), em 2014.

Suggested citation: Silva JP, Silva VR, Almeida PCD, Pinasco GS, Bernardes TP, Sasso JGRJ, et al. Growth and nutritional status of adolescents of public education system. *J Hum Growth Dev.* 2017; 27(1): 42-48. DOI:<http://dx.doi.org/10.7322/jhgd.127651>

Manuscript submitted in 2016, accepted for publication in Sep 2016.

hypertension, diabetes *mellitus* type 2 and premature cardiovascular disease²⁻⁴.

The rapidity as these changes are 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 strata⁵.

Brazil, following the world trend, has shown significant increase in the prevalence of overweight and obesity in the last four decades, including the young population⁶, 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 diagnoses⁷⁻¹⁰. 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%¹¹.

The sample size calculation was based on error margin of 3%, confidence interval of 95% and overweight prevalence of 20%⁶. The sample size of 822 subjects was calculated from the equation proposed by Triola¹², having as reference 27,787 adolescents matriculated in 5th to the 8th grades in the public schools of MRGV, Espírito Santo, Brazil¹³.

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 Organization¹⁴. For the nutritional status were considered the body mass index for age (BMI/A) and height for age (H/A), z-score, the reference of the WHO¹⁵, using the *WHO software AnthroPlus* version 1.0.3¹⁶.

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 Tanner¹⁷, the individual had to indicate his current stage of sexual maturation.

Socioeconomic data were obtained considering the Economic Classification Standard Criteria Brazil¹⁸ 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 IBGE¹⁹, 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 (χ^2) 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 WHO¹⁵, values to the left of the median, this 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 reference¹⁵ 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

	Variables	Absolut Frequency (n)	Relative Frequency (%)
1. Gender	Female	477	58.3
	Male	341	41.7
2. Skin colour/race*	White	232	245
	Black	341	28.4
	Mixed	29.9	41.7
3. Pubertal Stage	Pre-puberty	27	3.3
	Puberty	354	43.3
	Post puberty	437	53.4
4. Socioeconomic class**		08	1.0
	A	275	33.6
	B	487	59.5
	C	48	5.9
	D		

*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

	Variables	Absolut Frequency (n)	Relative Frequency (%)
1. H/A Index*	Very low height	03	0.4
	Low height	15	1.8
	Adequate height	800	97.8
2. BMI/A Index**		02	0.2
	Severe Thinness	22	2.7
	Thinness	567	69.3
	Eutrophic	153	18.7
	Overweight	69	8.4
	Obesity	05	0.6
	Severe obesity		

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

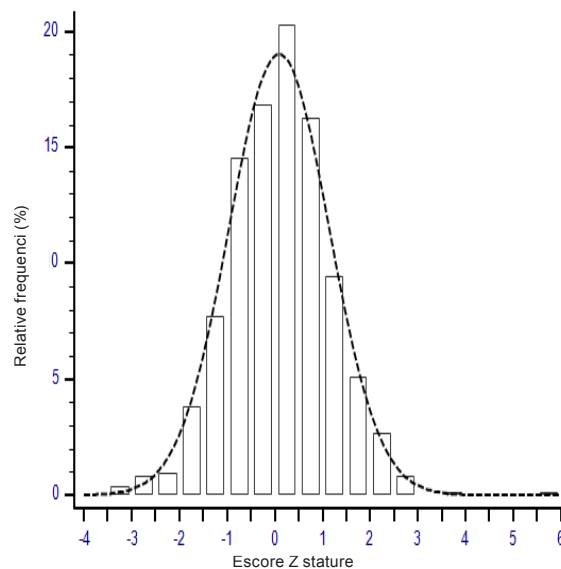


Figure 1: Frequency Distribution curve of the of 818 adolescents according to height-for-age z score,MRGV, Espírito Santo, Brazil, 2014.

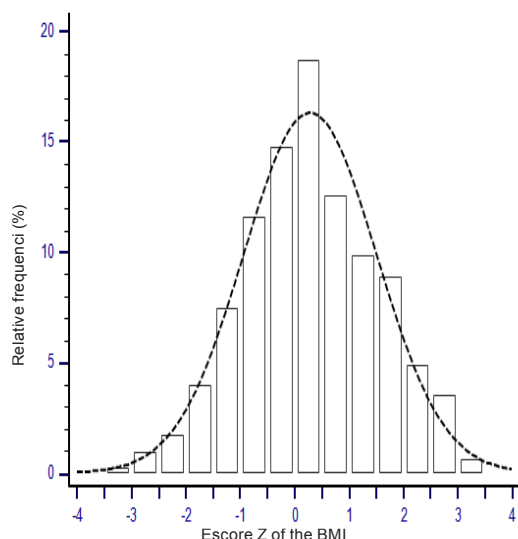


Figure 2: Frequency distribution of the 818 adolescents according to the z-score of the BMI-for-age, MRGV, Espírito Santo, Brazil, 2014.

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

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

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

probabilistic and representative sample of adolescents, from 10 to 14 years of age, attending public schools of MRGV, Espírito Santo, Brazil. These results show that the young population in the region already reached adequate growth, regardless of the socioeconomic level, since 65.4% of this population belongs to classes C and D (Table 1).

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 WHO¹⁵ 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 areas²⁰.

Amorim *et al.*²¹ 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 population²² 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%)⁶ and identified in another study with adolescents from five geographic regions of Brazil (20.1%)⁷, but it is below the range observed by Cabrera *et al.*¹⁰ (30.6%). International studies confirm this result²³⁻²⁵, 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%^{7-10,26-29}. 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

maintenance of chronic non-communicable diseases³⁰⁻³¹.

In the present study, the mean Z-score of BMI/A for girls was 0.30 (\pm 1.175) and for boys was 0.26 (\pm 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 reference¹⁵ 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 MRGV, 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 strata⁵.

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 administration¹³), 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^{32,33}. 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.

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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.

Método: Estudo epidemiológico, transversal, com amostra representativa de estudantes (dez a 14 anos) da rede pública estadual da Região Metropolitana da Grande Vitória (RMGV), ES, Brasil. Obtidos dados referentes ao sexo, idade, cor/raça, estágio puberal, classe socioeconômica, peso e estatura. Na avaliação nutricional, foram considerados os índices de estatura para idade (E/I) e índice de massa corporal para idade (IMC/I), em escore z, do referencial da OMS (2007). Para análise estatística, utilizou-se o teste Qui-quadrado e t de Student (Mann-Whitney para distribuição não normal), e nível de significância de $p < 0,05$. Estudo aprovado pelo Comitê de Ética em Pesquisa Institucional.

Resultados: Avaliados 818 adolescentes, média de idade da amostra de $12,8 \pm 1,1$ anos, predomínio do sexo feminino (58,3%), cor/raça parda (41,7%), estágio 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.