



Original

The prevalence of overweight and obesity in adolescents in Bahia, Brazil

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Abstract

Aim: A cross-sectional study was conducted with 1,477 middle school students enrolled in the public school network in Salvador, Bahia, Brazil to assess the prevalence of overweight and obesity.

Methods: The sample was determined using a two-stage cluster sampling technique for selecting schools and classes. A posteriori error was estimated. The students were classified as overweight or obese according to the World Health Organization's 2007 classifications. They were also classified according to age, stage of sexual maturity, socioeconomic class and the presence of abdominal obesity.

Results: Overall, 9.3% of the students were overweight and 6.4% were obese; therefore, 15.7% of the students were considered to have excess weight (obesity + overweight), at a 95% confidence interval. Abdominal obesity was found in 12.9% of all students and in 13% of those of normal weight. An association was found between excess weight and age < 14 years ($p = 0.030$) and abdominal obesity ($p = 0.001$).

Conclusions: Intervention programs should be implemented to prevent and treat obesity in childhood and adolescence. In addition, professionals working with individuals in this age group should be sensitized to this problem. The need to standardize the anthropometric indicators used in the different studies is also emphasized.

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LA PREVALENCIA DE SOBREPESO Y OBESIDAD EN ADOLESCENTES DE BAHÍA, BRASIL

Resumen

Objetivo: Un estudio transversal se llevó a cabo con 1477 estudiantes de primaria matriculados en las escuelas públicas de Salvador, Bahía, Brasil, para evaluar la prevalencia del sobrepeso y la obesidad.

Métodos: La muestra se determinó por la técnica de muestreo por conglomerados en dos etapas para la selección de escuelas y clases. Más tarde, *posteriori error* se calculó. Los estudiantes fueron clasificados como sobrepeso u obesos de acuerdo con la clasificación de la Organización Mundial de la Salud, 2007. Ellos también fueron clasificados de acuerdo a la edad, la etapa de maduración sexual, y la presencia de obesidad abdominal.

Resultados: En general, el 9,3% de los estudiantes tenían sobrepeso y el 6,4% eran obesos, por lo tanto, el 15,7% de los alumnos se considera que tienen exceso de peso (sobrepeso + obesidad), con un intervalo de confianza del 95%. De la población total estudiada el 12,9% presentaron obesidad abdominal, esta condición se observa en el 13% de su peso normal. Se encontró asociación entre el sobrepeso y la edad < 14 años ($p = 0,030$) y obesidad abdominal ($p = 0,001$).

Conclusiones: Los programas de intervención deben ser implementados para prevenir y tratar la obesidad en la infancia y la adolescencia. Además, los profesionales que trabajan con las personas en este grupo de edad deben ser sensibles a este problema. La necesidad de estandarizar los indicadores antropométricos utilizados en los diferentes estudios se enfatiza también.

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Palabras clave: Obesidad. Sobrepeso. Adolescentes. Pediatría. Estudiantes.

Abbreviations

WHO: World Health Organization.

POF: Brazilian Family Income Survey.

BMI: Body mass index.

Kg: Kilograms.

SPSS: Statistical Package for the Social Sciences.

CI: Confidence intervals.

SD: Standard deviation.

FNDE: National Foundation for Educational Development.

FAPESB: Bahia Foundation for the Support of Research.

CNPq: National Council for Scientific and Technological Development.

Introduction

According to the World Health Organization (WHO), obesity is the principal cause of preventable chronic disease. It reduces life expectancy and is associated with various comorbidities.¹⁻³ Obesity is the most common cause of insulin resistance in children⁴ and is also associated with dyslipidemia,⁵ musculoskeletal abnormalities,⁶ diabetes mellitus,⁷ cardiovascular complications, non-alcoholic fatty liver disease⁸ and cancer.⁶ Obesity also inflicts psychosocial consequences on the emotional development of the child or adolescent through discrimination and stigmatization.⁹

The WHO has recognized that obesity is fast becoming an epidemic, constituting a growing concern in view of the high rates of overweight and obesity that range from 10% to 40% in developed countries. More recently, increasing rates have also been observed in developing countries.¹⁰ Comparing data from the 1974-75 Brazilian Family Income Survey (POF) with the more recent 2008-9 data, the prevalence of excess weight in adolescents increased from 3.7% to 21.7% in boys and from 7.6% to 19.4% in girls.¹¹ In Europe, Spain has the highest rates of childhood obesity today.¹²

Evidence shows that child obesity is the principal risk factor for adult obesity.¹³ Overweight adolescents are 70% more likely to become overweight or obese adults, this percentage increasing to 80% if the father and/or mother are also obese.¹⁴ Child obesity is a condition that is difficult to treat. If comorbidities are present, the treatment of obesity must be more aggressive and individualized to ensure a more rapid weight loss.¹⁵

Since the school represents an ideal location in which to provide education on nutrition and to transmit appropriate information to the students, their families and their teachers, the objective of the present study was to determine the prevalence of overweight and obesity in adolescent schoolchildren, using current reference standards.

Materials and methods

A cross-sectional, observational study was conducted with a sample population composed of male and female

schoolchildren of 10 to 17 years of age enrolled in the 6th, 7th and 8th grades in state schools in Salvador, Bahia, Brazil. Any pregnant or breastfeeding girls were excluded from the study, as well as any students in whom anthropometric measurements could not be taken and those who refused to participate. According to the Education Department's 2008 school register, there were 207 state schools in the city, with 81,380 students enrolled in the middle school grades defined in the study protocol. Sample size was established by a simple random technique without replacement. Students were selected using a two-stage cluster sampling technique, the first stage consisting of the selection of schools and the second the selection of classes. In each class selected, all the students who agreed to participate and who signed an informed consent form were evaluated. Twenty-three schools were randomly selected, making a total of 69 classes (three classes in each school) and 1,477 students. Eighty-one students refused to participate; therefore, the final sample size consisted of 1,396 students. This sample originally formed part of a larger study involving children enrolled in public schools. Considering that the sample size was not calculated with the specific objective of evaluating the prevalence of excess weight, the *a posteriori* sample error was calculated based on the prevalence of excess weight found (15.7%). The previously adopted sample size permitted the prevalence of this endpoint to be determined with an error of 1.9%. The purpose and objectives of the study were explained to the directors, teachers, parents and students involved.

Standardized anthropometric measurements were collected at the schools in accordance with the Anthropometric Standardization Reference Manual and the World Health Organization (WHO) (1995). The equipment was calibrated immediately prior to starting data collection and then checked periodically. The measurements were taken by two investigators, with variations of 100 grams for weight, 0.1 cm for height and 0.5 cm for waist circumference considered acceptable. Whenever the difference between the two measurements was greater than the variation permitted, a third measurement was taken and the mean of the three measurements constituted the final value. Weight was measured using electronic scales with weighing capacity of 199.95 kg and accuracy of 50 grams. The weight of the child's school uniform was subtracted from his/her total weight. Height was measured to the nearest 0.1 cm using a stadiometer. The child was measured standing upright with no shoes and no accessories of any kind. Body mass index (BMI), or the Quetelet index, defined as the ratio between weight in kilograms (kg) and height in square meters (m²), was used to evaluate the anthropometric status of the students. A BMI-for-age curve was used to classify the nutritional status of the students in accordance with the WHO growth charts (2007). Anthropometric status was defined as leanness when BMI was under the 3rd percentile, normal when BMI was between the 3rd and 85th percentiles, overweight when BMI was between the 85th and 97th percentiles, and obese when

BMI was at or above the 97th percentile. Waist circumference was measured with the student standing upright with his/her feet together. The midpoint between the last rib and the iliac crest was marked and a non-elastic, fibreglass measuring tape with a thickness of 0.5 cm was used to measure waist circumference at the midwaist. Measurement was rounded up to the nearest millimetre. Waist circumference measurements were evaluated and classified in percentiles. Abdominal obesity was defined as waist circumference above the 80th percentile in accordance with the cut-offs proposed by Taylor et al.¹⁶.

Stage of sexual maturity was evaluated privately by the student him/herself in accordance with images provided. The adolescents were grouped according to the characteristics of staging defined in the Tanner stages.¹⁷ In the girls, the occurrence of menarche was also investigated.

The socioeconomic profile of the families was classified according to the Brazilian Criteria of Economic Classification¹⁸. Since none of the students belonged to socioeconomic classes A1, A2 or B1 and very few individuals were classified as belonging to classes B2, C1 or C2, socioeconomic classes were redistributed into three categories: B2/C1/C2, D or E.

The data were analyzed using the Statistical Package for the Social Sciences, version 17 (SPSS, 2008). In the descriptive analysis, categorical variables are presented as frequencies and continuous variables as measures of central tendency and dispersion. Proportions were calculated to estimate prevalence rates, and confidence intervals (CI) were determined. The difference between proportions was established using Pearson's chi-square test and values were considered statistically significant when p-values were $\leq 5\%$.

The study protocol was approved by the Internal Review Board of the School of Nutrition, Federal University of Bahia. The parents or guardians who agreed to allow their children to participate in the study signed an informed consent form. The patients identified as being overweight or obese were referred to the Paediatric Gastroenterology Outpatient Department at the Federal University of Bahia, where they are being followed up.

Results

Overall, 15.7% of the students were found to be overweight or obese (9.3% overweight and 6.4% obese). When evaluated according to waist circumference, abdominal obesity was found in 12.9% of the adolescents. One girl refused to allow herself to be weighed and three students did not allow their waist circumference to be measured. The mean age of the students was 14.27 ± 1.54 years [mean \pm standard deviation (SD)]. The mean weight of the 1,395 students evaluated was 51.96 ± 12.02 kg (range 26.45-112.90 kg). Mean height was 161.77 ± 8.94 cm (range 134.25-193.70 cm). The characteristics of this sample are shown in table I.

Table II shows the prevalence of excess weight in the adolescents according to gender, age, stage of

Table I
Characteristics of adolescents aged 10 to 17 years in state public schools of the city of Salvador, Bahia-Brazil, 2009

Variable	N	%	IC 95%
<i>Sex</i>			
Male	604	43.3	43-43.5
Female	792	56.7	56.6-56.8
<i>Age (years)</i>			
< 14	627	45.0	44.8-45.2
≥ 14	767	55.0	54.9-55.1
<i>Sexual maturation Stage</i>			
Prepubertal	119	8.5	8.0-8.9
Pubertal	307	22.0	21.7-22.3
Postpubertal	967	69.4	69.3-69.5
<i>Economic class</i>			
B2/C1/C2	67	5.3	4.6-5.9
D	579	45.5	45.3-45.7
E	626	49.2	49.0-49.4

N = Number students assessed; IC = Confidence Interval.

sexual maturity, socioeconomic level and waist circumference. There was a positive and statistically significant association between excess weight and being under 14 years of age and having waist circumference above the 80th percentile (abdominal obesity).

The prevalence of abdominal obesity (waist circumference at or above the 80th percentile) was 12.8% in the adolescents of normal weight.

Table II
Overweight by gender, age, sexual maturation stage, socioeconomic status, and waist circumference in adolescents (10-17 years) of the state public schools of the city of Salvador, Bahia-Brazil, 2009

Variable	Overweight		
	N	%	P ^a
<i>Sex</i>			
Male	98	16.2	0.68
Female	122	15.4	
<i>Age (years)</i>			
< 14	119	19.0	0.03
≥ 14	101	13.2	
<i>Sexual Maturation Stage</i>			
Pre and postpubertal	18	15.1	0.50
Púbere	42	13.7	
<i>Socioeconomic Status</i>			
B2/C1/C2	14	20.9	0.14
D	100	17.3	
E	87	13.9	
<i>CC</i>			
Obesity abdominal (\geq P80)	156	87.2	< 0.0001
Normal (< P80)	62	5.10	< 0.0001

BMI = Body Mass Index; N = Number students assessed; CC = Waist circumference.
^aChi-Square.

Table III
Brasilian studies on the prevalence of overweight among public school students between 2007 and 2010, with the evaluation criteria and population studied anthropometric

<i>Author/Local/Year</i>	<i>Age group</i>	<i>N</i>	<i>Assessment anthropometric</i>	<i>Prevalence of excess weight</i>
Campos LA et al. 2007, Fortaleza-CE ³³	10-19 years	571	Must et al.	18%
Suñé FR et al., 2007, Município de Capão da Canoa-RS ²²	11-13 years	719	Cole et al.	24,8%
Vilma R et al., 2008, Anapólis, GO ³⁴	7-14 years	346	OMS 2007	19,9%
Vanzelli et al. 2008, Jundiá, SP ²³	10-18 years	662	CDC 2001	25,5%
Tassitano RM et al., 2009, Recife-PE ³⁴	14-19 years	4,210	Cole et al.	13,9%
Mendonça MRT et al., 2010, Maceió-AL ²⁶	7-17 years	986	CDC 2001	13,8%
Marques CDF et al., 2010, Salvador Bahia (este estudo)	10-17 years	1,396	OMS 2007	15,6%

Discussion

Regional, national and international studies have revealed a steady increase in child obesity in recent years. In the present study, the new WHO 2007 curves for weight, height and BMI were used, this being the second study conducted in Brazil to use these parameters. The prevalence of excess weight in the present study was 15.7% in adolescents of 10-17 years of age (9.3% overweight and 6.4% obesity). These rates are lower than those reported for adolescents of 12-17 years of age in the United States, with the Third National Health and Nutrition Examination Survey reporting rates of 21.7% and 10.8% for overweight and obesity, respectively¹⁹. A study conducted in Spain using data from NHS (National Health Survey) between 2006 and 2007 throughout Spain with a sample of 6,139 children defined as obese or overweight by the cutoff points proposed by the International Task Force (IOTF) showed a prevalence of excess weight of 29.1%, 18.8% of overweight and obesity of 10.3%, also higher than that found in this study.¹²

Socioeconomic differences between populations may explain the slightly lower prevalence of excess weight in this region compared with rates from other countries, as well as differences associated with the dietary habits and routine activities of the Brazilian population; however, a steady increase in adult and child obesity has also been reported here. Various studies conducted in Brazil to determine the prevalence rates of obesity in children and adolescents have reported some differences in prevalence, probably due to variations in the anthropometric diagnostic criteria used and regional differences, with higher prevalence rates in the more affluent regions of the south and southeast. Table III shows the most recent population-based studies carried out in Brazil, including the criteria used for anthropometric evaluation, the

number of individuals analyzed and the findings of excess weight in adolescents.

Neutzling et al.²⁰ reported a prevalence of overweight and obesity of 4.5% in young people in the northeast of Brazil, a rate that is lower than that reported for the south and southeast and lower than the rate found in the present, more recent study, conducted with students in an urban area, in which the increasing epidemic of obesity has also been documented. The findings of this study, which was conducted with an expressive number of schoolchildren in the capital city of the state of Bahia, Brazil, were compared with results from previous studies such as that carried out in 2001 by Albano and Souza,²¹ who reported a prevalence of overweight of 10.5% in male and female adolescents of 11-17 years of age in a public school in São Paulo. However, their sample size was small and therefore not very representative of the target population.

The prevalence of obesity in the present study differed from rates reported in studies conducted in regions with higher socioeconomic levels, according to the findings of Suñé et al. in 2007²² and Vanzelli et al. in 2008²³ (prevalence rates of obesity of 3.5% and 9%, respectively, versus 6.4% in the present study). In a study carried out in Jundiá, São Paulo, Rezende et al.²⁴ reported prevalence rates very close to that found in the present study. Although that study was conducted in a region that is more socioeconomically privileged compared to Bahia, it was the only study to use the same reference values for nutritional evaluation (WHO 2007). This fact suggests that, despite regional differences, the new reference curves may have succeeded in improving standardization of the nutritional evaluation of children and adolescents, thus facilitating comparison between the various studies, since findings vary greatly and are based on a range of diverse criteria.

The prevalence of overweight found in the present study was lower than that reported in a study conducted with children studying at private schools in the northeast of the country, with a prevalence of overweight of 26.2%.²⁵ The fact may perhaps be explained by the greater access of these individuals to high-calorie foods, a hypothesis that gained strength in a study comparing children from public and private schools in which a multivariate analysis was conducted to evaluate whether students in private schools are more likely to be overweight or obese.²⁶ That study showed a significant association between being overweight and studying in a private school, perhaps also due to a more sedentary lifestyle with computers, electronic games and television.²⁶

In the present sample, no association was found between excess weight and gender, sexual maturity or socioeconomic level. In Goiânia, a study conducted in 2000 with a sample of 243 children in 5th to 8th grades found a prevalence of overweight of 7.3% in boys and 8.0% in girls, with rates of obesity of 4.2% in boys and 3.0% in girls.²⁷ In this study, the prevalence of excess weight (overweight + obesity) was higher in boys; however, the difference was not statistically significant. It has to be admitted that girls are generally more concerned with body image than boys in this age group. Other studies conducted in Brazil and other countries like Spain have shown a higher prevalence of overweight and obesity in boys.^{12,21,26-30}

Adolescents of both sexes within the same age group may be at different phases of puberty, with differences in events being associated with growth.²⁸ This fact may explain the result found in the present study of a higher prevalence of excess weight in younger age groups (< 14 years), with a positive association between age < 14 years and excess weight. The prevalence of excess weight was higher in the initial phase of adolescence, possibly suggesting that the growth spurt at puberty may protect against weight gain. This finding may be important when planning future intervention programs in schools. The different stages of adolescence, each with its own individual characteristics, have to be taken into consideration, including how each stage should be managed within these intervention programs. In agreement with the findings of the present study, Abrantes et al.³¹ investigated youths in the northeast of Brazil and reported a higher prevalence of obesity in children of 10-14 years of age compared to older age groups. This aspect may reflect perception of self-image, with older adolescents, often pressured by the communication media, becoming increasingly aware and more critical of their appearance.

In the present study, the prevalence of abdominal obesity (waist circumference at or above the 80th percentile) was 12.9% and there was a positive association between abdominal obesity and excess weight, showing that these two variables were dependent in the anthropometric evaluation of the students in this sample. The data found are in agreement with current reports in the literature. Pinto et al.³² reported a prevalence of abdominal obesity of 14.9% (95% CI: 13.1-

16.9) in schoolchildren of 10 to 14 years of age in public and private schools in Recife, Pernambuco, Brazil, using the same criteria for the measurement of waist circumference used in the present study and showed a strong correlation between BMI and waist circumference. The association between the prevalence of abdominal obesity and the presence or absence of excess weight was evaluated, with 12.8% of individuals of normal weight being found to have a waist circumference above the 80th percentile, showing that abdominal obesity is an important marker of central obesity and cardiovascular risk even in students who are not overweight. This aspect should be emphasized to paediatricians, who are in a position to detect an increase in waist circumference at an early stage in children with a tendency to develop excess weight.

The trend towards increasing rates of overweight and obesity in children and adolescents is a fact today all over the world, including Brazil and this northeastern region of the country. This fact demands urgent multidisciplinary and governmental measures of prevention and treatment over the short and long-term, as well as educational programs for healthcare professionals. Clear guidance and clarification should be provided to the population by the medical teams and healthcare professionals involved. In addition, media advertising should be regulated, emphasizing healthy dietary habits and regular physical activity in order to minimize and avoid the severe consequences of overweight and obesity in children, adolescents and adults.

Cross-sectional studies involve some methodological limitations and conclusions should only be extrapolated to populations with similar characteristics. Biases in selection, data collection and analysis were rigorously evaluated and measures were taken to avoid them.

The findings of the present study show that excess weight continues to represent an increasing problem in all age groups and in all regions of Brazil. There is a need to standardize the use of current anthropometric indicators, this being the second study conducted in the country with the use of these methods. The anthropometric evaluation criteria still vary between the studies conducted in different geographical areas, and this fact hampers the comparison of some of the data. In the sample studied, the prevalence rates of overweight and obesity were similar to those found in publications resulting from studies conducted in Brazil in regions with a similar socioeconomic level. Although slightly lower, figures were close to those reported in more developed areas, suggesting an increase in the problem even in less affluent regions of the country. The prevalence of excess weight was higher in the initial phase of adolescence and was similar for both genders, for the different stages of sexual maturity and for the different social classes. The association between excess weight and abdominal obesity (waist circumference at or above the 80th percentile), a finding described as a predictor of early cardiovascular risk, is noteworthy. Abdominal obesity should be investigated in all patients, even in individuals

of normal weight, since this anthropometric measurement has been shown to be capable of evaluating central adiposity irrespective of body weight, a factor that should be assessed in children who would benefit from early therapeutic intervention.

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