



ORIGINAL ARTICLE

Overweight and obesity prevalence among children and adolescents from Northeast and Southeast regions of Brazil

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Abstract

Objective: to study the prevalence of obesity and overweight among children and adolescents from Northeast and Southeast regions of Brazil.

Methods: data was collected from Life Pattern Research conducted by the Brazilian Institute of Geography and Statistics (IBGE) in 1997. A sample of 3,317 children and 3,943 adolescents was studied according to age groups. Overweight (adolescents) and obesity (adolescents and children) were defined according to World Health Organization recommendations. Z-test was used to compare prevalence among age groups, sex and geographic region. The cut-off point for statistical significance was 0.05.

Results: overweight prevalence in adolescents was 1.7% in Northeast and 4.2% in Southeast. Obesity prevalence in adolescents was 6.6% and 8.4% in children and 8.2% and 11.9% in Northeast and Southeast, respectively. Considering both regions prevalence of obese female children was 10.3%, the rate of obese adolescents was 9.3% and overweight adolescents represented 3.0%. Among males prevalence was 9.2%, 7.3% and 2.6%, respectively.

Conclusions: obesity prevalence is lower in Northeast than Southeast among children with age from 2 to 17 years old. Overweight prevalence among adolescents was also lower in Northeast than in Southeast. The prevalence of obesity among younger than 2 and older than 18 years old was the same. Obesity prevalence is higher among breast-fed females. Among other age groups prevalence of obesity and overweight was the same for males and females. It is difficult to compare these results with other studies, since there are few populational studies and the criteria used to define overweight and obesity in children and adolescents varies in each study.

J Pediatr (Rio J) 2002; 78 (4): 335-40: obesity, overweight, childhood, adolescence.

Introduction

In developed countries, obesity is considered an important public health issue; the World Health Organization (WHO) considers it a global epidemic.¹ The increase in the

prevalence of obesity in developing countries, especially in Latin America, has also been studied. In countries such as India and China, a 1% increase in the prevalence of obesity generates 20 million new cases.² Obesity is associated with arterial hypertension, cardiac disorders, osteoarthritis, type II diabetes and some types of cancer, and its impact is more intense on morbidity than on mortality rates.¹⁻³ Obese people, especially children and adolescents, usually present low self-esteem, affecting their relationships and school performance.

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Manuscript received Dec 13 2001. Accepted for publication May 08 2002.

The prevalence of obesity has also been growing intensely in child and teenage populations, tending to continue throughout adult life: approximately 50% of the children who are obese by the sixth month of age, and 80% of those who are obese by the age of five will remain obese.^{4,5} In addition, scientific evidence has revealed that atherosclerosis and arterial hypertension are pathologic processes with onset in childhood, and that it is during this period that eating habits and physical activity patterns are established.⁶⁻⁸ Thus, the concern about prevention, diagnosis and treatment of obesity has now been shifted towards the child population.

Anthropometry is considered to be the most useful method for tracing obesity, since it is inexpensive, noninvasive, universally applicable, and well accepted by this population.^{1,9} Anthropometric indices are obtained through the combination of two or more basic anthropometric data (weight, sex, age, height).¹ The use of the Body Mass Index (BMI) to identify adults who are overweight is consensual, and its use in the nutritional assessment of children and adolescents began to be more common after the study published by Must *et al.*,^{10,11} who presented percentile values according to age and sex. These values are considered to be referential by the WHO, being used to identify overweight and obesity only among adolescents; children must be evaluated through the weight/height index.¹

Brazilian data in relation to childhood obesity are still scarce; many authors study specific age groups (children or adolescents separately), often with samples that are not representative of the target population.¹² In the present study, we evaluated the prevalence of overweight and obesity in children and adolescents of the Southeast and Northeast regions of Brazil.

Methodology

For the present study, we used research data about life standards gathered in 1997 by the Brazilian Institute for Geography and Statistics (IBGE), in association with the World Bank. This research evaluated housing conditions, demographic tendencies (migration, fecundity and history of births), access to health and education services, nutrition, and living conditions of the Brazilian population, in addition to height and weight data.¹³ The sample included 19,409 adults and children living in 5,000 households, distributed among 554 census zones in northeastern and southeastern towns. The sampling process was divided into two stages of selection, with stratification of primary units - sectors of the geographical base in the 1991 demographic census - and selection proportional to a size measure, and random selection of units of secondary households. Anthropometric measurements were performed using Danish precision scales, Seca model 890, calibrated to up to 150 kg, with 1g increments. Height measurements of all evaluated subjects were performed with wooden anthropometers, with 1mm

increments; the entire measuring process was performed in accordance with the training adopted by the Brazilian National Research on Health and Nutrition.¹³ Data obtained were made available in CD-ROM by IBGE.

Information with regard to weight, height and sex were extracted from the IBGE database and stored in a secondary database, using Epi-Info software, version 6.04.¹⁴

Among the 4,313 adolescents studied by IBGE, 370 (8.6%) did not present height and/or weight information. The same occurred with 440 children (11.7%) out of the initial 3,757. Thus, the final sample of the present study included 7,260 subjects, out of which 3,317 were children and 3,943 were adolescents.

The definition of obesity used in the present study followed the recommendations of the WHO.¹ Children were considered obese when the z score for the weight/height ratio, calculated with Epi-Info software, was higher than 2. For adolescents, we used the BMI, which was calculated using the weight/(height x 2) formula, according to the values proposed by Must *et al.*^{11,12} We considered *overweight* a BMI equal to or above the 85th and under the 95th percentile, and *obese* a BMI equal to or above the 95th percentile. For this purpose, we developed a program, using the Epi-Info software, which grouped adolescents according to sex and age.

The variable age, calculated in months, was obtained through the difference between the date of the anthropometric exam and the date of birth. Then, children and adolescents were placed in different age groups, according to the parameters currently used in the medical literature: infants (0 to 1 year); preschool children (2 to 6 years); school-age children (7 to 9 years); early adolescents (10 to 14 years); mid-adolescents (15 to 17 years) and late adolescents (18 to 19 years).¹⁵

Using the z test, which is equivalent to the chi-square test,¹⁶ the overall prevalence of obesity (males and females combined) in the Northeastern region was compared to the overall prevalence in the Southeast, for each age group, in order to verify whether the difference between geographic regions was statistically significant. We also compared the overall prevalence of obesity (Northeast and Southeast combined) in order to verify whether there is a statistically significant difference between male and female prevalence. Significance level was established at $P < 0.05$.¹⁶

Results

With regard to gender, 50.4% of the children were male and 49.6% female. The age of children averaged 122.9 months (standard deviation = 68 months), and median of 126 months. The number of children and adolescents in each group, distributed according to age (year by year), gender and geographic region, was practically the same.

The prevalence of overweight or obese children and adolescents was lower in the Northeastern region. The prevalence of obesity was higher among children (Table 1).

Table 1 - Prevalence of overweight and obesity in children and adolescents from Northeast and Southeast regions of Brazil, 1997

	Overweight		Obesity	
	Southeast	Northeast	Southeast	Northeast
Children*	–	–	11.9%	8.2%
Adolescents	10.4%	6.6%	1.7%	4.2%

* WHO does not present definition of overweight for children.

By analyzing the data of the two regions jointly, we observe that the prevalence of overweight and obesity was higher among females (Table 2).

Table 2 - Prevalence of overweight and obesity in children and adolescents, classified according to gender, from Northeast and Southeast regions of Brazil, 1997

	Overweight		Obesity	
	Female	Male	Female	Male
Children*	–	–	10.3%	9.2%
Adolescents	9.3%	7.3%	3.0%	2.6%

* WHO does not present definition of overweight for children.

The prevalence of obesity was higher in the Southeastern region when compared to Northeast, with a statistically significant difference for the following age groups: preschool children ($P<0.01$), school-age children ($P<0.01$), early adolescence ($P<0.01$), and mid-adolescence ($P<0.05$). The prevalence of overweight was also higher in the Southeastern region, showing a statistically significant difference among adolescents ($P<0.05$) (Table 3).

By comparing the prevalence of obesity among males and females in Brazil (Northeast and Southeast regions combined), we verify a higher prevalence among females, with a statistically significant difference only for infants ($P<0.01$). Among school age children, the P value was 0.07. The difference between the prevalence of obesity and overweight among female and male adolescents was not statistically significant (Table 4 and Figure 1).

Table 3 - Prevalence (percentage) of overweight and obesity in children and adolescents, classified according to geographical regions, from Northeast and Southeast regions of Brazil, 1997

	Overweight		Obesity	
	Northeast	Southeast	Northeast	Southeast
Infant [†]	–	–	13.4	15.5
Preschool child [†]	–	–	7.8	10.1*
School age child [†]	–	–	5.6	12.4*
Early	6.9	12.2*	2.4	7.2*
Moderate	6.3	9.3*	1.3	2.8*
Late	6.8	9.4*	0.8	1.5

* $P<0.05$ † WHO does not present definition of overweight for children.

Discussion

Although the WHO recommends the use of weight/height ratio for the nutritional assessment of children, this parameter is not unanimously accepted; since the study published by Must et al.,^{10,11} several authors have presented new BMI curves, which are already being used for the nutritional assessment of both children and adolescents.¹⁷ Due to this diversity of applied criteria (different BMI values), some authors consider that an international estimate of the prevalence and secular tendency towards pediatric obesity, as well as a comparison among prevalence studies, is not possible.¹⁸ Another study demonstrated that results for the prevalence of overweight and obesity in studies based on the values proposed by Cole et al. and Must et al. can be compared.¹⁹

Table 4 - Prevalence (percentage) of overweight and obesity according to gender in children and adolescents, classified according to age group, from Northeast and Southeast regions of Brazil, 1997

	Overweight		Obesity	
	Female	Male	Female	Male
Infant [‡]	–	–	19.0	10.2*
Preschool child [‡]	–	–	8.9	8.7
School age child [‡]	–	–	7.3	9.3 †
Early	10.4	8.0	4.6	4.3
Moderate	7.9	7.4	2.4	1.5
Late	10.6	5.7*	1.2	1.1

* $P<0.05$ † $P = 0.07$

‡ WHO does not present definition of overweight for children.

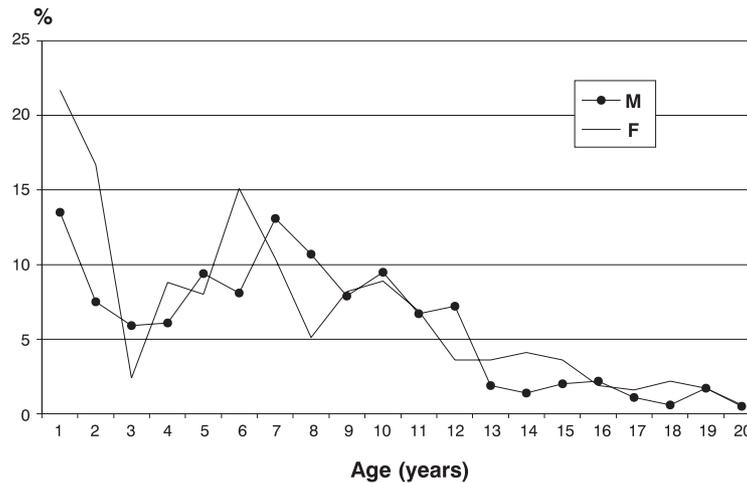


Figure 1 - Prevalence of obesity according to gender and age

Brazilian data concerning childhood obesity are still limited, and the absence of a unanimous definition of obesity for this age group leads to some difficulties in comparing prevalence rates reported in different studies about this subject.^{12,20} Another fact that limits the comparison is that most part of national studies are based on samples with students or at outpatient settings, which are not representative of this population. In addition, few studies have jointly analyzed children and adolescents. Since the sample of the present study is representative of the Northeast and Southeast regions, by presenting an adequate sample size, we can infer these results for the population of children and adolescents of these two geographical regions of Brazil, comparing them with other national studies.

The prevalence of obesity in children observed in the present study was higher than that of previous reports for other Brazilian states. In the city of São Paulo, a 3.8% prevalence of obesity was found in a study with 1,280 children from zero to five years of age.²¹ In Pelotas, the prevalence of obesity in 1,564 children with 12 months of age was three times lower (6.7%)²² the prevalence among children (0-10 years), as described in a slum in Maceió (1.6%), was five times lower.²³ The prevalence rates of obesity among adolescents in the present study were similar to the prevalence described in Belo Horizonte (2.1%),²³ and lower than the prevalence described by other Brazilian studies, which varied from 5.2% to 11.2%.²³⁻²⁵

Prevalence rates of overweight among adolescents found in this study were similar to those found in other studies: in Pelotas (11.2%),²² Belo Horizonte (5.7%-6.3%)²⁴

and Rio de Janeiro (9.3%-10.9%).²⁵ A similar study carried out in Curitiba presented a lower prevalence (4.4%).²⁶

With regard to gender, some authors describe a higher prevalence of overweight and obesity among adolescent females,²⁶ although the opposite has also been described.¹² In the present study, obesity was more prevalent in females only among infants, while the prevalence of overweight was higher among female adolescents.

Comparison with international studies is also made difficult by the gathering of data in different age groups, as well as for the use of different BMI curves. Prevalence reported in the present study was lower than the prevalence described in Australian and American studies.^{28,29}

Some authors state that the onset of obesity and overweight occurs around the ages of 5-6, especially among girls.²⁹ In Saudi Arabia, the highest prevalence of overweight and obesity was described between the ages of 6-10.³⁰ In China, the highest prevalence of overweight and obesity among teenagers is reported between the ages of 11-12.³⁰ In the present study, the highest prevalence of obesity was seen among infants, with another peak in preschool children, showing a progressive reduction after this age (Figure 1).

In the present study, prevalence of obesity among children was always higher than among adolescents (Figure 1). This difference could be explained by the use of different anthropometric indices: weight/height for children, BMI for adolescents.

Another explanation could be the different stages of regular development in children and adolescents. The

higher prevalence of obesity in infants may be explained by the fact that repletion occurs during this stage, mainly between zero and nine months of age, and due to the fact that this stage is characterized by a slower growth speed. Repletion is marked by a proportionally higher increase of weight than height, also showing an increase of subcutaneous deposits, reflecting fat storage. Repletion also occurs in early adolescence, possibly leading to complaints of underdeveloped genitalia, due to the accumulation of fat in the area immediately under the pubis.³¹

The medical literature also describes that preschool children present two different growth stages: rapid growth, between the ages of two and five, and slow growth, between the ages of five and seven (by observing the graph, we identify that the prevalence of obesity was higher at the second stage). Among school-age children, up to the beginning of adolescence, the prevalence of obesity remained practically stabilized. The behavior of prevalence rates of obesity is in accordance with the age when a rapid growth begins to be observed: 10 years for girls, and 12 years for boys.¹⁵

We concluded that the prevalence of overweight among adolescents is higher for females. The prevalence of obesity is lower in the Northeast region for children and adolescents with ages ranging between 2-17. Two age groups, children under two and adolescents above 18 years of age, did not show a statistically significant difference as to the prevalence rates reported for the Northeast and Southeast regions. Comparison of results observed in this study with other studies is difficult due to the scarcity of national population-based studies and due to the diversity of the criteria applied.

References

- World Health Organization. Physical status: the use and interpretation of anthropometry. Geneva: WHO; 1995.
- Vischer TL, Seidell JC. The public health impact of obesity. *Annu Rev Public Health* 2001;22:355-75.
- Eckersley RM. Losing the battle of the bulge: causes and consequences of increasing obesity. *Med J Aust* 2001;174:590-2.
- Troiano RP, Flegal KM, Kukzmarski RJ, Campbell SM, Johnson CL. Overweight prevalence and trends for children and adolescents – The National and Nutrition Examination Surveys, 1963 to 1991. *Arch Pediatr Adolesc Med* 1995;149:1085-91.
- Gortmaker SL, Dietz WH, Sobol AM, Wehler CA. Increasing pediatric obesity in the United States. *Am J Dis Child* 1987; 141:535-40.
- Mc Namara JJ, Malot MA, Stremple JF, Cutting RT. Coronary artery disease in combat casualties in Vietnam. *JAMA* 1971;216:1185-7.
- Francischi RPP, Pereira LO, Freitas CS, Klopfer MM, Santos RC, Vieira P, et al. Obesidade: atualização sobre sua etiologia, morbidade e tratamento. *Revista Nutrição* 2000;13:17-28.
- Story M, Evans M, Fabsitz RR, Clay TE, Rock BH, Broussard B. The epidemic of obesity in American Indian communities and the need for childhood obesity-prevention programs. *Am J Clin Nutr* 1999;69 Supl 4:747-54.
- Goulart EMA, Corrêa EJ, Leão E. Avaliação do crescimento. In: Leão E, Corrêa E, Viana MB, Mota JAC, editores. *Pediatria Ambulatorial*. 3rd ed. Belo Horizonte: Coopmed; 1998.p.71-94.
- Must A, Dallal GE, Dietz WH. Reference data for obesity: 85th and 95th percentiles of body mass index (wt/ht²) and triceps skinfold thickness. *Am J Clin Nutr* 1991;53:839-46.
- Must A, Dallal GE, Dietz WH. Reference data for obesity: 85th and 95th percentiles of body mass index (wt/ht²) and triceps skinfold thickness – a correction. *Am J Clin Nutr* 1991;54:773.
- Balaban G, Silva GAP. Prevalência de sobrepeso e obesidade em crianças e adolescentes de uma escola da rede privada de Recife. *J Pediatr (Rio J)* 2001;77:96-100.
- Ministério do Planejamento, Orçamento e Gestão. Pesquisa sobre Padrões de Vida 1996-1997. 2nd ed. Rio de Janeiro: IBGE; 1999.
- Dean AG, Dean JA, Coloumbier D, Burton AH, Brendel KA, Smith DC. Epi Info, version 6.04: a word processing, database, and statistics program for public health on microcomputers. Centers for Disease Control and Prevention – World Health Organization; 1996.
- Ferreira RA, Romanini MAV, Miranda SM, Beirão MMV. Adolescente: particularidades de seu atendimento. In: Leão E, Corrêa EJ, Viana MB, Mota JAC, editores. *Pediatria Ambulatorial*. 3rd ed. Belo Horizonte: Coopmed; 1998.p.49-56.
- Soares JF, Siqueira AL. Introdução à Estatística Médica. 1ª ed. Belo Horizonte: Departamento de Estatística – UFMG; 1999.
- Abrantes MM, Lamounier JA, Colosimo EA. Índice de massa corporal para identificar obesidade na infância e adolescência: indicações e controvérsias. *Revista Médica de Minas Gerais*. No prelo.
- Guillaume M. Defining obesity in childhood: current practice. *Am J Clin Nutr* 1999;7 Supl 1:126-30.
- Abrantes MM, Lamounier JA, Colosimo EA. IMC na obesidade: recomendações da OMS X tendências atuais. *Anais do III World Congress of Pediatric Nutrition*; 2001 jul 6-9; São Paulo, SP. São Paulo; 2001.p.29-30.
- Monteiro CA, Conde WL. Tendência secular da desnutrição e da obesidade na infância na cidade de São Paulo (1974-1996). *Rev Saude Publica* 2000;34 Supl 6:8-12.
- Post CL, Victora CG, Barros FC, Horta BL, Guimarães PRV. Desnutrição e obesidade infantis em duas coortes de base populacional no Sul do Brasil: tendências e diferenciais. *Cad Saude Publica* 1996;12 Supl 1:49-57.
- Florêncio TMMT, Ferreira HS, França APT, Cavalcante JC, Sawaya AL. Obesity and undernutrition in a very-low-income population in the city of Maceió, northeastern Brazil. *Br J Nutr* 2001;86:277-83.
- Ribeiro RQC, Oliveira RG, Colosimo EA, Bogutchi TF, Laomunier JA. Prevalência da obesidade em escolares adolescentes na cidade de Belo Horizonte. Resultados parciais do II Estudo Epidemiológico. *Anais do Simpósio: Obesidade e anemia carencial na adolescência*. Instituto Danone; 2000 jun 8-9; Salvador, BA. Salvador; 2000.p.237-38.
- Castro IRR, Engstrom EM, Anjos LA, Azevedo AM, Silva CS. Perfil nutricional dos alunos da rede municipal de educação da cidade do Rio de Janeiro. *Anais do Simpósio: Obesidade e anemia carencial na adolescência*. Instituto Danone; 2000 jun 8-9; Salvador, BA. Salvador; 2000.p.231-32.
- Von der Heyde MED, Amorim STSP, Lang RMF, Von der Heyde R. Perfil nutricional de adolescentes da cidade de Curitiba. *Anais do Simpósio: Obesidade e anemia carencial na adolescência*. Instituto Danone; 2000 jun 8-9; Salvador, BA. Salvador; 2000. p.227.

26. Mokhtar N, Elati J, Chabib R, Bour A, Elkaki K, Schlossman NP, et al. Diet culture and obesity in northern Africa. *J Nutr* 2001;131 Supl 3:887-92.
27. Al-Shammari SA, Khoja T, Gad A. Community-based study of obesity among children and adults in Riyadh, Saudi Arabia. *Food and Nutrition Bulletin* 2001;22:178-83.
28. Booth ML, Wake M, Armstrong T, Chey T, Hesketh K, Mathur S. The epidemiology of overweight and obesity among Australian children and adolescents, 1995-97. *Aust N Z J Public Health* 2001;25:162-9.
29. Hanley AJG, Harris SB, Gittelsohn J, Wolever TMS, Saksvig B, Zinman B. Overweight among children and adolescents in a Native Canadian community: prevalence and associated factors. *Am J Clin Nutr* 2000;71:693-700.
30. Chunning C. Fat intake and nutritional status of children in China. *Am J Clin Nutr* 2000;72 Supl 5:1368-72.
31. Longui CA. Crescimento normal. In: Monte O, Longui CA, Calliari LEP, editores. *Endocrinologia para o pediatra*. 2nd ed. São Paulo: Atheneu; 1998.p.3-10.

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