

# Prevalence of overweight/obesity and economical status of schoolchildren

*Prevalência de sobrepeso/obesidade e nível econômico de escolares*

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## ABSTRACT

**Objective:** To associate the nutritional status of elementary schoolchildren with their gender, age group, and economic status based on a cross-sectional study carried out at public schools in the municipality of Cruzeiro do Oeste, Southern Brazil.

**Methods:** The study was performed in 2010 including 939 schoolchildren aged six to ten years-old. The economical status of the families was classified based on a socioeconomic ranking questionnaire (Brazilian Association of Survey Companies), and the body mass index was calculated. Data were analyzed by descriptive statistics, and differences between independent groups were verified by Mann-Whitney and Kruskal-Wallis tests, while possible associations were verified by the chi-square test, being significant  $p < 0.05$ .

**Results:** The prevalence of obesity in the sample was 8.0%, and overweight, 16.4%. No association was found between the socioeconomic and nutritional status or between the nutritional status and gender.

**Conclusions:** A high prevalence of overweight and obesity was found in this study, indicating that children of both genders are affected regardless of their economical status and age.

**Key-words:** overweight; obesity; children.

## RESUMO

**Objetivo:** Associar o estado nutricional com sexo, grupo etário e nível econômico de escolares do ensino fundamental por meio de um estudo transversal nas escolas municipais do município de Cruzeiro do Oeste, Paraná, Brasil.

**Métodos:** A pesquisa foi realizada em 2010 com 939 alunos com idades entre seis e dez anos. Para tanto, realizou-se a classificação do nível econômico das famílias por meio do questionário de *ranking* econômico (Associação Brasileira de Empresas de Pesquisa) e foi calculado o índice de massa corpórea. A análise dos dados foi realizada por estatística descritiva, e a verificação de diferenças entre grupos independentes pelos testes de Mann-Whitney e Kruskal-Wallis, bem como possíveis associações foram verificadas pelo teste do qui-quadrado. Para todos os procedimentos adotou-se o nível de significância de  $p < 0,05$ .

**Resultados:** A prevalência de obesidade na amostra estudada foi de 8,0% e de sobrepeso, 16,4%. Não houve associação entre nível econômico e estado nutricional, assim como entre estado nutricional e sexo.

**Conclusões:** A prevalência de sobrepeso e obesidade foi considerada alta, evidenciando que crianças de ambos os sexos são afetadas, independentemente de seus níveis econômicos e grupo etário.

**Palavras-chave:** sobrepeso; obesidade; crianças.

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## RESUMEN

**Objetivo:** asociar el estado nutricional con el sexo, la franja de edad y el nivel socioeconómico de escolares de la enseñanza primaria, mediante estudio transversal en las escuelas municipales de la ciudad de Cruzeiro do Oeste (Paraná, Brasil).

**Métodos:** La investigación fue realizada en 2010, con 939 alumnos entre seis y diez años. Para eso, se realizó la clasificación del nivel económico de las familias mediante cuestionario de clasificación económica (Asociación Brasileña de Empresas de Investigación - ABEP) y se calculó el índice de masa corporal. El tratamiento estadístico se realizó por medio de los recursos de la estadística descriptiva y la verificación de diferencias entre grupos independientes por las Pruebas de Mann-Whitney y Kruskal-Wallis, así como posibles asociaciones fueron verificadas por la prueba de chi-cuadrado. Para todos los procedimientos se adoptó el nivel de significancia de  $p < 0,05$ .

**Resultados:** La prevalencia de obesidad en la muestra estudiada fue de 8,0% y la de sobrepeso fue de 16,4%. No hubo asociación entre nivel económico y estado nutricional, así como entre estado nutricional y sexo.

**Conclusiones:** La prevalencia de sobrepeso y obesidad fue considerada alta, evidenciando que niños de ambos sexos son afectados, independiente de su nivel económico y franja de edad.

**Palabras clave:** sobrepeso; obesidad; niños.

## Introduction

Obesity has increased at an alarming rate, and it is considered a worldwide epidemic that affects different age groups<sup>(1)</sup>, social classes, genders, and particularly, children. In Brazil, data from the Brazilian Institute of Geography and Statistics indicate that, among children aged 5 to 9 years, one in three is overweight, and 14.3% are obese. According to the WHO (World Health Organization)<sup>(2)</sup>, obesity is a chronic disease, defined as excess body fat<sup>(3)</sup>, accumulated in the adipose tissue, with implications for health and which occurs concomitantly with genetic and environmental risk factors<sup>(4)</sup>.

Childhood obesity is considered a public health problem by the WHO due to its physiological consequences (type II diabetes, heart disease, hypertension, stroke, etc.), emotional damage (children are faced with prejudice and discrimination), harmful behaviors, such as isolation<sup>(5-7)</sup>, deleterious

effects on quality of life<sup>(8)</sup>, and due to its psychological effects (depression and anxiety) that hinder acquisition of a healthy lifestyle with better eating habits, and regular physical activity<sup>(9)</sup>, since many of these adverse effects persist in adulthood<sup>(10)</sup>. Since obesity is associated with complications as well as higher mortality rates, the greater the amount of time an individual is exposed to obesity, the greater the chances of complications<sup>(11)</sup>.

The increased prevalence of childhood obesity is worrying because of the risk that children have of becoming adults with metabolic disorders and comorbidities. Accordingly, several longitudinal studies show that childhood obesity is a predictor of obesity in adult life<sup>(7,9,11)</sup>, since three stages of growth seem to be particularly crucial in this evolution: the prenatal period, the period between 4 to 8 years, and adolescence<sup>(12)</sup>.

Obesity is presented as a multicausal disease, and may be classified as exogenous or endogenous. Only 5% of cases can be attributed to endogenous causes, while exogenous causes are more frequent, accounting for approximately 95% of obese children<sup>(9)</sup>. Therefore, it is essential to study the factors that contribute to or even determine the development of obesity in childhood, particularly the socioeconomic level and nutritional status<sup>(9,10,12)</sup>, and then establish actions to reduce this scenario. There are undeniable social benefits and health improvement provided by increased family income, but this is not always accompanied by positive changes only, since a higher socioeconomic status may lead to increased consumption of foods with high energy content and low nutritional value, causing a significant increase in obesity<sup>(13,14)</sup>. For instance, in the recent years, England recorded a significant increase in childhood obesity and overweight among school children, however, this finding was more evident in the higher economic strata<sup>(15)</sup>.

In this sense, considering the relevance of the topic, this article aimed to evaluate the prevalence of overweight and obesity associating nutritional status with sex, socioeconomic status, and age group of school children by means of a cross-sectional study in municipal schools of Cruzeiro do Oeste, state of Paraná.

## Method

This is a descriptive cross-sectional study to assess the prevalence of overweight and obesity in children from 6 to 10 years old attending municipal elementary schools in Cruzeiro do Oeste, state of Paraná. The city is located in the

northwest of the state, and has about 22,000 inhabitants and, according to the Atlas of Human Development in Brazil, presents a Human Development Index (HDI) of 0.751 and Gini Index of 0.57, with an economy based on agriculture<sup>(16)</sup>.

The age range of the study was chosen and all schools were invited to participate. The state system schools (n=4) did not meet the age range and the private system (n=1) did not accept to participate in the study. Thus, with the exclusion of the state and private schools, municipal schools, six in number, were included and the sample was selected through the signature of an informed consent form by parents and/or guardians. The students (n=1,224) in this age group were invited to participate in the study. On the day of the assessment, only those who had parental permission were included; those who did not return the signed consent form and those whose information on economic level and date of birth were incomplete were excluded. Data were collected in October and November 2010 and the final sample consisted of 939 students (76.7% of students enrolled in the academic year of 2009) from the first to the fourth year, aged from 6 to 10 years. The researchers responsible for data collection were trained by the Group for the Study and Research on Obesity – Grupo de Estudos e Pesquisa de Obesidade (GREPO).

The equipment used were: Tanita electronic scale (Model 2202) with a capacity of 136kg and precision of 100g and a SECA stadiometer (Bodimeter 206). The socioeconomic status was defined through a questionnaire of economic classification by the Brazilian Association of Research Companies – Associação Brasileira de Empresas de Pesquisa, ABEP<sup>(17)</sup>, completed by parents or guardians. This classification is based

on items such as ownership of goods (television, radio, car, vacuum cleaner, VCR and/or DVD player, fridge, freezer and washing machine), services (housemaid), household characteristics (number of bathrooms) and educational level of the head of the household. The total score for each item results in the classification of respondents into seven strata identified as “social classes” A1, A2, B1, B2, C, D, and E<sup>(17)</sup>. For analysis purposes, the eight economic levels, proposed by ABEP, were regrouped and named as follows: A1, A2, and B1 in High Economic Level (H); B2, C1 and C2 in Medium Economic Level (M) and, D and E in Low Economic Level (L).

The school children had body mass (kg) and height (cm) measured, and the BMI calculated was used for classification of nutritional status according to the cutoff points proposed by Cole<sup>(18)</sup>. It was also considered the excess weight as an outcome for the study, obtained from the group of children with overweight and obesity. The independent variables considered were sex, age group, and income. The anthropometric measures were collected by researchers at school during class time. Data were organized in Excel for Windows. Statistical analysis was performed using the Statistical Package for Social Sciences - SPSS 13 for Windows. Data were organized using the resources of descriptive statistics such as frequency, percentage, and average. The normality distribution of data was verified by the Kolmogorov-Smirnov test. The verification of differences between independent groups was performed using the Mann-Whitney and Kruskal-Wallis tests and possible associations were assessed using the chi-square test. For all procedures the level of statistical significance was set at 5% ( $p < 0.05$ ).

**Table 1** - Distribution and mean values of nutritional status according to sex in school children from 6–10 years from Cruzeiro do Oeste, state of Paraná

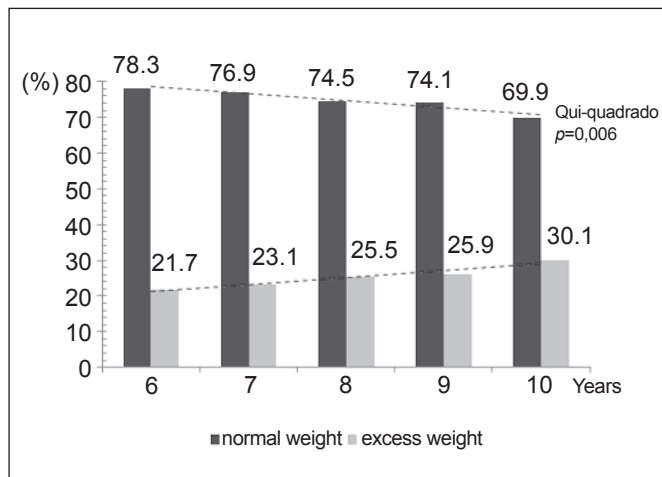
Nutritional status	Male		Female		p	Total	
	% (n)	BMI Average (Min–Max)	% (n)	BMI Average (Min–Max)		% (n)	BMI Average (Min–Max)
Normal	78.3 (357)	16.8 (11.8–20)	73.0 (353)	16.9 (10.1–20.3)	0.114	75.6 (710)	16.4 (10.1–20.3)
Overweight	14.7 (67)	20.5 (17.7–24.4)	18 (87)	21.1 (17.6–25.2)	0.471	16.4 (154)	21 (17.6–25.2)
Obese	7 (32)	25.7 (20.9–31.6)	9 (43)	24.8 (20.3–33.0)	0.075	8 (75)	25.2 (20.3–33.0)
Excess weight*	21.7 (99)	17.9 (17.7–31.6)	27 (130)	22.3 (17.6–33.0)	0.937	24.4 (229)	22.3 (17.6–33.0)
Total	48.6 (456)	17.5 (11.8–31.6)	51.4 (483)	17.7 (10.1–33.0)	0.725	100 (939)	17.6 (10.1–33.0)

\*Excess weight=overweight (O)+obese(O); Min: minimum; Max: maximum; BMI: body mass index.

**Table 2** - Distribution and mean values of nutritional status in school children from 6 to 10 years from Cruzeiro do Oeste, state of Paraná, according to the economic level

Nutritional status	Economic Level						p**	p***
	Low		Medium		High			
	% (n)	Average BMI (Min~Max)	% (n)	Average BMI (Min~Max)	% (n)	Average BMI (Min~Max)		
Normal	75.4 (144)	16.1 (12.3~20)	73.9 (531)	16.5 (10.1~20.3)	79.3 (23)	16.3 (13.7~17.1)	0.329	0.198
Overweight	15.7 (30)	20.8 (18.6~23.9)	16.6 (119)	20.4 (17.6~25.2)	17.2 (5)	21.0 (0~0)	0.262	0.111
Obese	8.9 (17)	25.5 (21.6~31.2)	9.6 (69)	21.8 (20.3~33)	3.4 (1)	24.1 (21.7~24.1)	0.419	0.916
Excess Weight*	24.6 (47)	17.7 (18.6~31.2)	26.1 (188)	17.8 (17.6~33)	20.7 (6)	17.4 (21.7~24.1)	0.784	0.061
Total	20.3 (191)	17.7 (12.3~31.2)	76.6 (719)	17.8 (10.1~33)	3.1 (29)	17.4 (13.7~24.1)	0.108	0.805

\*Excess weight=overweight(O)+obese(O); \*\*Kruskal-Wallis Test for average body mass index (BMI) between economic levels; \*\*\*Chi-square test for nutritional status between economic levels; Min: minimum; Max: maximum.



**Figure 1** - Prevalence and association of overweight and age scores in children from the city of Cruzeiro do Oeste, state of Paraná. \*Chi-square test for linear trend  $p < 0.05$  (linear trend of increasing overweight with increasing age group  $p = 0.006$ ).

The study followed the ethical principles for research involving human subjects and was approved by the Research Ethics Committee of Universidade Estadual de Maringá (Opinion n. 556/2009).

## Results

The study assessed 939 school children, 456 (48.6%) male and 483 (51.4%) female, with a mean age of  $8.3 \pm 1.46$  years. A percentage of 75.6 of school children presented

normal BMI, being 357 male and 353 female, with mean value of BMI of  $16.4 \pm 6.2 \text{ kg/m}^2$ . The classification of nutritional status based on BMI indicated that 24.4% of students were overweight, being 16.4% overweight and 8% obese (Table 1).

When criteria by Cole<sup>(18)</sup> were used, no significant differences were observed between mean BMI and sex.

Table 2 shows the distribution of students according to nutritional status and economic level. There was a predominance of students in the medium economic status. According to the economic classification adopted, 20.3% of children were in the low level, 76.6% in the medium level, and 3.1% in high level. It was verified that the prevalence of excess weight was of 24.6%, 26.1%, and 20.7% for the low, medium, and high levels, respectively, considering the total number of students at each level (Table 2). It appears, therefore, that the groups have similar values of mean BMI in different economic strata, with no significant associations between socioeconomic status and nutritional status ( $p = 0.108$ ). When the proportions of students within each economic level were compared according to their nutritional status, no associations were found between variables ( $p = 0.805$ ).

Figure 1 shows the distribution of students according to nutritional status and age groups. It is observed a linear trend of increasing prevalence of overweight according to age ( $p = 0.006$ ). The percentage of overweight is increasing with increasing age and, on the other hand, there is an inverse relationship in this association with normal weight.

## Discussion

The prevalence of excess weight in children is worrying in Brazil<sup>(19)</sup> and, accordingly, it is important to assess nutritional status through the measurement of body weight and height, to calculate the Body Mass Index (BMI), considering that anthropometric data enable the diagnosis of nutritional status in a simple, economical, and easy way to interpret, as reported Salomons<sup>(20)</sup>.

Thus, the prevalence of excess weight verified in this study was of 24.4%, higher than that found in a study conducted in Maringá, state of Paraná, (22.1%) with school children from 6 to 8 years<sup>(14)</sup>. It was also higher than the prevalence observed in children younger than 10.9 years from the Northeast and Southeast regions of Brazil, where the authors found excess weight in 18.1% of the sample<sup>(21)</sup>. The values observed in this study were also higher than those observed in school children from 6 to 10 in the city of Brasília, where the prevalence of overweight among children was 20.1%<sup>(22)</sup>. When compared to the findings of Guedes<sup>(21)</sup> who investigated school children in Londrina, state of Paraná, and found 24.5% of children with excess weight in the age group from 7 to 10 years, the values obtained in this study were quite similar (24.4%). Pelegrini *et al*<sup>(23)</sup> also observed a high prevalence in the South (24.3%), when compared to other regions. One possible explanation for the higher prevalence observed in the southern region is related to the easy access to fast-foods, passive travel (car use), sedentary behavior (computer, videogames), directly associated with increase in excess body weight.

In Brazil, according to data from ABEP<sup>(17)</sup>, most families belong to the medium economic status, similarly to the results of this study. The children most affected by obesity belong to the highest economic levels according to several studies<sup>(14,17,20)</sup>. This fact can be attributed to greater economic access to consumer goods and services, which also enables the increase in food consumption, especially high-calorie foods, as well as larger facilities provided by technological advances, leading to a decrease in the practice of physical activities. In school children from Cruzeiro do Oeste, economic status proved to be dissociated from overweight rates, regardless of sex, corroborating the results obtained in other studies<sup>(19)</sup>. Despite evidence that overweight and obesity are more prevalent in high economic levels<sup>(14,20,22,24)</sup>, there is a trend for changes in this profile, with the progressive increase in overweight and obesity rates in lower classes<sup>(5)</sup>.

The results demonstrate that the problem of excess weight permeates all economic levels, demonstrating the current phase of nutritional transition in Brazil, i.e., the simultaneous prevalence of overweight among the highest and lowest economic levels<sup>(23)</sup>. In this perspective, intensive changes in the panorama of Brazilian health are revealed, such as better life conditions, greater health care coverage, and fertility decline, which helped the reduction in malnutrition in the country. In contrast, urbanization and its impact on dietary and physical activity patterns have contributed to the development of overweight and, therefore, to changes in nutritional indicators<sup>(12)</sup>. This inversion, in a relatively short period of time, puts obesity as one of the key issues for public health in Brazil<sup>(11,25)</sup>.

The prevalence of overweight and obesity among school children was similar for both sexes. There was a gradual increase in the prevalence of overweight according to the age groups, and the percentage of overweight students increased as age increased, a worrying fact since being overweight in childhood is strongly related to obesity in adult life. The obese child is more likely to keep this condition in adolescence and adulthood, which confirms some findings<sup>(11,12,20,24)</sup> that indicate gradual increase in rates of overweight and obesity among children from 2 to 10 years old and extends from childhood until adult life. In the study conducted by Krinski *et al*<sup>(25)</sup> with children in the city of Vilhena, state of Rondônia, there was a linear increase in the prevalence of overweight according to age, from 9.7% at 6 years to 27.7% at 11.

In a study by Harvard Growth with adolescents who were followed during 55 years, it was verified that 52% of individuals who presented excess weight when adolescents remained in this nutritional state after 55 years. The study also found that the relative risk of death from all causes and from coronary heart disease were approximately two times higher in these individuals<sup>(26)</sup>.

It should be remarked that this study has limitations, particularly regarding the cross-sectional design of the study. The results, despite showing consistency, could be enriched with studies of longitudinal design, consolidating the trend of increasing overweight and obesity in this age group. The fact that the private schools were not investigated may have prevented an important comparison to the results of this study.

It can be concluded that, in this study, both sexes were indiscriminately affected by excess weight and there was no

association of overweight with economic level. Evidence of differences in the prevalence of overweight with increasing age was observed in both sexes. The prevalence of overweight and obesity in this study was high, and it should be understood as an emerging and worrying issue. Therefore, this

finding highlights the need for emergency measures that lead to changes in behavior and lifestyle of children in this age group, such as verifying the extent of the problem and supplying subsidies to strategies for prevention and control, with deployment of individual and collective actions.

## References

- Lopes HF, Egan BM. Autonomic dysregulation and the metabolic syndrome: pathologic partners in an emerging global pandemic. *Arq Bras Cardiol* 2006;87:538-47.
- Brasil. Instituto Brasileiro de Geografia e Estatística. Pesquisa de Orçamentos Familiares 2008-2009: antropometria e análise do estado nutricional de crianças e adolescentes no Brasil. Rio de Janeiro: IBGE; 2010.
- Zlochevsky ER. Obesidade na infância e adolescência. *Rev Paul Pediatr* 1996;14:124-33.
- Dietz WH. Health consequences of obesity in youth: childhood predictors of adult disease. *Pediatrics* 1998;101:518-25.
- Friedman R, Alves BS. *Endocrinologia e diabetes*. 2ª ed. Rio de Janeiro: Medbook; 2009.
- Kanashiro LC, Sarubbi JR. Tratamento psicológico. Psicoterapia. In: Setian N, Damiani D, Manna TD, Dichtchekian V, Cardoso AL, editors. *Obesidade na criança e no adolescente: buscando caminhos desde o nascimento*. São Paulo: Roca; 2007.
- Melo VL, Serra PJ, Cunha CF. Childhood obesity – psychosocial impacts. *Rev Med Minas Gerais* 2010;20:367-70.
- Laitinen J, Power C, Järvelin MR. Family social class, maternal body mass index, childhood body mass index, and age at menarche as predictors of adult obesity. *Am J Clin Nutr* 2001;74:287-94.
- Araújo CQ, Teixeira JV, Coutinho LC, Silva AT. Obesidade infantil versus modernização: uma revisão de literatura. *Tema* 2009;8:120-7.
- Kiess W, Reich A, Müller G, Galler A, Kapellen T, Raile K *et al*. Obesity in childhood and adolescence: clinical diagnosis and management. *J Pediatr Endocrinol Metab* 2001;14 (Suppl 6):1431-40.
- Balaban G, Silva GA. Protective effect of breastfeeding against childhood obesity. *J Pediatr (Rio J)* 2004;80:7-16.
- Cordinhã AC, Paúl A, Fernandes L. Childhood obesity and arterial hypertension – a reality in preschool-aged children. *Acta Pediatr Port* 2009;40:145-9.
- Ferreira VA, Magalhães R. Obesity and poverty: the apparent paradox. A study among women from the Rocinha slum, Rio de Janeiro, Brazil. *Cad Saude Publica* 2005;21:1792-800.
- Netto-Oliveira ER, Oliveira AA, Nakashima AT, Rosaneli CF, Filho AO, Rechenchosky L *et al*. Overweight and obesity in children of different socioeconomic levels. *Rev Bras Cineantropom Desempenho Hum* 2010;12:83-9.
- Stamatakis E, Wardle J, Cole TJ. Childhood obesity and overweight prevalence trends in England: evidence for growing socioeconomic disparities. *Int J Obes (Lond)* 2010;34:41-7.
- Programa das Nações Unidas para o Desenvolvimento [homepage on the Internet]. Atlas do Desenvolvimento Humano no Brasil [cited 2011 Aug 26]. Available from: <http://www.pnud.org.br/Atlas.aspx?view=atlas>
- Associação Brasileira de Empresa de Pesquisa [homepage on the Internet]. CCEB. Critério de Classificação Econômica Brasil, 2008 [cited 2011 Jul 30]. Available from: <http://www.abep.org.br>
- Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ* 2000;320:1240-3.
- Antunes JL. Socioeconomic status and health: a discussion of two paradigms. *Rev Saude Publica* 2008;42:562-7.
- Salomons E, Rech CR, Loch MR. Nutritional status of six to ten-year-old schoolchildren in the municipal education system of Arapoti, Paraná, Brasil. *Rev Bras Cineantropom Desempenho Hum* 2007;9:244-9.
- Guedes DP, Paula IG, Guedes JE, Stanganelli LC. Prevalência de sobrepeso e obesidade em crianças e adolescentes: estimativas relacionadas ao sexo, à idade e à classe socioeconômica. *Rev Bras Educ Fis Esp* 2006;20:151-63.
- Giugliano R, Melo AL. Diagnosis of overweight and obesity in schoolchildren: utilization of the body mass index international standard. *J Pediatr (Rio J)* 2004;80:129-34.
- Pelegri A, Silva DA, Petroski EL, Gaya AC. Overweight and obesity in seven to nine-year-old Brazilian students: data from the Brazilian sports project. *Rev Paul Pediatr* 2010;28:290-5.
- Vanzelli AS, Castro CT, Pinto MS, Passos SD. Prevalence of overweight and obesity among children of public schools in the city of Jundiaí, São Paulo, Brazil. *Rev Paul Pediatr* 2008;26:48-53.
- Krinski K, Elsangedy HM, Hora S, Rech CR, Legnani E, Santos BV *et al*. Nutritional status and association of overweight with gender and age in children and adolescents. *Rev Bras Cineantropom Desempenho Hum* 2011;13:29-35.
- Must A, Jacques PF, Dallal GE, Bajema CJ, Dietz WH. Long-term morbidity and mortality of overweight adolescents: a follow-up of the Harvard Growth Study 1922 to 1935. *N Engl J Med* 1992;327:1350-5.