

## Prevalence of overweight and obesity in schoolchildren: relationship with socioeconomic status, gender and age

### *Prevalência de sobrepeso e obesidade em estudantes: relações com nível socioeconômico, sexo e idade*

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**Abstract** – Overweight and obesity in childhood and adolescence have reached alarming rates in Brazil. The aim of this study was to analyze the prevalence rates of overweight and obesity according to socioeconomic status, gender and age in schoolchildren from 11 towns around the Itaipu Lake, western Paraná. The sample consisted of 5,962 subjects (3,024 girls) aged 6 to 17 years. Overweight and obesity were identified based on body mass index, adopting the cut-off values for age and gender suggested by the International Obesity Task Force. The prevalence rates according to different strata (gender, age and socioeconomic status) were compared by means of logistic regression using odds ratios. The prevalence of overweight and obesity was 14.8% and 5.8% among boys, respectively, and 15.2% and 4.5% among girls. The prevalence rates decreased with increasing age. Considering socioeconomic status, the prevalence of overweight and obesity was significantly higher in schoolchildren from high-income families. The prevalence rates indicate a trend similar to that observed for the highest prevalence reported in surveys conducted in other cities and regions of Brazil. The present results suggest the need for interventions of the public health system and of society, seeking alternatives to alleviate this problem and its consequences.

**Key words:** Body mass index; Obesity; Overweight; Prevalence; Schoolchildren.

**Resumo** – O sobrepeso e a obesidade na infância e adolescência têm alcançado índices preocupantes no Brasil. O objetivo deste estudo foi analisar os valores de prevalência de sobrepeso e obesidade separados por nível socioeconômico, sexo e idade em estudantes de 11 municípios do entorno do lago de Itaipu, no oeste do Paraná. A amostra foi constituída por 5.962 sujeitos, sendo 3.024 do sexo feminino, com idades entre seis e 17 anos. O sobrepeso e a obesidade foram identificados pelo Índice de Massa Corporal, adotando-se pontos de corte para sexo e idade sugeridos pela International Obesity Task Force. As prevalências nos diferentes estratos (sexo, idade e classe socioeconômica) foram comparadas por intermédio do cálculo de regressão logística, utilizando-se “odds ratios”. No masculino, as prevalências de sobrepeso e obesidade encontradas foram de 14,8% e 5,8%, respectivamente, e no sexo feminino foi de 15,2% e 4,5%. As prevalências diminuíram com o avanço da idade. Considerando o nível socioeconômico, as prevalências de sobrepeso e obesidade foram consideravelmente maiores nos estudantes que pertencem às famílias de maior poder aquisitivo. Os valores observados indicam que existe um comportamento parecido com as mais altas prevalências observadas em pesquisas desenvolvidas em outras cidades e regiões do país. As informações obtidas neste estudo sugerem a necessidade de intervenções do sistema público de saúde e da sociedade, buscando alternativas para amenizar este problema e suas consequências.

**Palavras-chave:** Estudantes; Índice de massa corporal; Obesidade; Prevalência; Sobrepeso.

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## INTRODUCTION

Excess body weight has long ceased to be merely a matter of esthetics. Studies highlight the damage to human health caused by this condition, such as the development of diabetes, cardiovascular diseases, hypertension, osteoarthritis and some types of cancer, among other chronic-degenerative disorders<sup>1-3</sup>, as well as low self-esteem<sup>4</sup>, musculoskeletal pain, fractures, and mobility difficulties<sup>5</sup>.

In Brazil, there has been a constant increase in excess body weight, particularly over the last 30 years. In 1975, the National Survey of Household Spending (Estudo Nacional de Despesa Familiar - ENDEF) showed a rate of excess weight of 18.6% in men and of 28.6% in women. The Household Budget Survey (Pesquisa de Orçamentos Familiares - POF) conducted in 2003 indicated a significant increase in this prevalence, which reached 41% among men and 39.8% among women. In 2006, the Brazilian Ministry of Health conducted a telephone survey of Risk and Protective Factors for Chronic Diseases (Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico - VIGITEL), which confirmed the growing trends in excess weight in the country. In 2008, the prevalence of excess weight among adults was 43.3%, with a rate of 47.3% in men and of 39.5% in women<sup>6</sup>.

A similar trend is observed in childhood and adolescence. According to the 1975 ENDEF, the prevalence of excess weight in the age group of 10 to 19 years was 7.5% among girls and 3.9% among boys. The National Survey on Health and Nutrition (Pesquisa Nacional sobre Saúde e Nutrição - PNSN) conducted in 1989 indicated an increase to 13.2 and 8.3%, respectively. After a period of 14 years, the 2003 POF reported a new increase in the prevalence of excess weight, which was 18% among boys and 15.4% among girls<sup>6</sup>. This growing trend is a matter of concern considering the fact that a significant proportion of these obese children and adolescents will become obese adults<sup>7-9</sup>.

In view of the above considerations, it becomes important to know the current extent of this problem and to identify possible indicators associated with these prevalence rates in order to provide substantive information for future intervention programs. Therefore, the objective of the present study was to analyze the prevalence of overweight and obesity according to gender, age and socioeconomic status in schoolchildren aged 6 to 17 years from towns around the Itaipu lake, westernmost region of Paraná state.

## METHODOLOGICAL PROCEDURES

This was a cross-sectional study involving the population of schoolchildren from the following 11 towns located around the Itaipu lake: Foz do Iguaçu, Santa Terezinha de Itaipu, São Miguel do Iguaçu, Itaipulândia, Missal, Santa Helena, Entre Rios do Oeste, Pato Bragado, Marechal Cândido Rondon, Mercedes, and Guaíra. All intervention procedures were approved by the

Ethics Committee of the School of Medical Sciences, State University of Campinas (Universidade Estadual de Campinas) (Protocol 370/2011), and were conducted according to Resolution 196/96 of the National Health Council.

A survey was conducted specifically for this study to determine the total number of schools and schoolchildren in each participating municipality, in collaboration with the State Department of Education and Municipal Secretariats of Education. The population under study comprised 58,003 schoolchildren. The sample size was calculated using a probabilistic sampling method and was stratified by gender and age group as follows:  $SCC = SN/N$  and  $n = SCC \times SN$ , where  $SCC$  = sample calculation coefficient,  $SN$  = sub-universe,  $N$  = universe, and  $n$  = calculated sample size. The minimum sample size estimated was 5,243 subjects. Considering losses and refusals, an arbitrary number of 6,500 schoolchildren were chosen. At the end, 538 subjects were excluded because they met one or more of the following exclusion criteria: age younger than 6 years or older than 17 years; presence of diseases or other conditions; failure to provide the free informed consent form signed by the parent or legal guardian; non-attendance on the day of data collection, and incorrectly answered questionnaires. Thus, the final sample consisted of 5,962 subjects of both genders.

Thirty-four schools were randomly selected. The sample of each town was established after a randomized study considering the proportionality of subjects. The classes were chosen by drawing lots. The chronological age of the subjects was determined as decimal age using the date of birth and date of data collection according to previously established criteria<sup>10</sup>.

Height and body weight were measured according to international recommendations<sup>11</sup>. Overweight and obesity were defined based on the body mass index (BMI) according to World Health Organization criteria<sup>1</sup>. The cut-off values suggested by the International Obesity Task Force (IOTF) were adopted<sup>12</sup>. The prevalence of overweight and obesity was determined separately for gender, chronological age and socioeconomic status. For the purpose of analysis, three age groups were established: 6 to 10 years, 11 to 14 years and 15 to 17 years, hereinafter referred to as age groups I, II and III, respectively.

Socioeconomic status was evaluated using the questionnaire proposed by the Brazilian Association of Research Companies (Associação Brasileira de Empresas de Pesquisa – ABEP)<sup>13</sup>. Scores were attributed to each item and the socioeconomic status (SES) was thus defined as A (highest), B, C, D and E (lowest). In the present study, strata A1 and A2, B1 and B2 and C1 and C2 were analyzed together as A, B and C, respectively.

The data were collected by a previously trained team in order to standardize the protocols and to minimize errors during data collection.

The SPSS for Windows<sup>®</sup> 15.0 program was used for creation of the database and statistical analysis. The Kolmogorov-Smirnov test showed a normal distribution of the body weight, height and BMI data. The variables studied were characterized using descriptive statistics (mean

and standard deviation) and by two-way analysis of variance using the classification criteria gender and age. Scheffé's post-hoc test was used to identify specific differences. The prevalence of overweight and obesity was established based on the proportions of relative and absolute frequency. The prevalence according to gender, age group and socioeconomic status was determined by logistic regression calculating odds ratios (OR) and 95% confidence intervals.

## RESULTS

Table 1 shows the composition of the sample considering age group, gender and socioeconomic status.

**Table 1.** Composition of the sample studied considering age group, gender and socioeconomic status (n=5,962).

Age group (years)	Socioeconomic status											
	Boys						Girls					
	A	B	C	D	E	Total	A	B	C	D	E	Total
6-10 (I)	37	520	469	27	1	1,054	29	464	448	23	0	964
11-14 (II)	48	569	535	30	2	1,184	38	580	650	34	1	1,303
15-17 (III)	37	347	298	18	0	700	14	360	359	24	0	757
Total	122	1,436	1,302	75	3	2,938	81	1,404	1,457	81	1	3,024

Table 2 shows the mean, standard deviation and F statistics of height, body weight and BMI.

**Table 2.** Height, body weight and body mass index according to age and gender.

Age (years)	Height (cm)		Body weight (kg)		BMI (kg/m <sup>2</sup> )	
	Boys	Girls	Boys	Girls	Boys	Girls
6	120.6 <sup>a,b</sup> ±5.4	119.4 <sup>a,b</sup> ±5.3	22.8 <sup>b</sup> ±4.2	22.5 <sup>b</sup> ±4.4	15.6±2.0	15.7±2.1
7	125.8 <sup>a,b</sup> ±5.6	124.0 <sup>a,b</sup> ±5.8	25.9 <sup>b</sup> ±5.5	25.4 <sup>b</sup> ±6.1	16.3±2.5	16.3±2.8
8	131.0 <sup>b</sup> ±6.8	130.2 <sup>b</sup> ±6.7	25.9±7.1	29.1±7.4	16.6±2.9	17.0±3.1
9	137.2 <sup>b</sup> ±6.8	136.3 <sup>b</sup> ±7.1	33.7 <sup>a,b</sup> ±7.8	31.8 <sup>a,b</sup> ±7.0	17.7 <sup>a</sup> ±3.1	17.0 <sup>a,b</sup> ±3.0
10	141.5 <sup>b</sup> ±7.7	142.0 <sup>b</sup> ±7.2	37.2 <sup>b</sup> ±10.9	36.5 <sup>b</sup> ±9.4	18.3±4.0	17.9 <sup>b</sup> ±3.4
11	145.8 <sup>a,b</sup> ±6.9	147.7 <sup>a,b</sup> ±7.5	39.9±10.7	41.0 <sup>b</sup> ±10.3	18.6±3.9	18.6±3.7
12	151.3 <sup>a,b</sup> ±7.9	153.2 <sup>a,b</sup> ±7.2	44.6 <sup>b</sup> ±10.6	45.6 <sup>b</sup> ±10.8	19.3 <sup>b</sup> ±3.7	19.3±3.8
13	158.9 <sup>a,b</sup> ±9.4	157.4 <sup>a</sup> ±6.3	51.4 <sup>b</sup> ±13.2	49.9 <sup>b</sup> ±11.6	20.2 <sup>b</sup> ±3.9	20.0±4.0
14	164.7 <sup>a,b</sup> ±8.7	159.6 <sup>a</sup> ±5.6	52.2 <sup>a,b</sup> ±12.8	52.8 <sup>a</sup> ±10.5	20.2±3.7	20.7±3.8
15	169.7 <sup>a,b</sup> ±8.4	161.8 <sup>a</sup> ±6.0	59.6 <sup>a,b</sup> ±13.7	55.0 <sup>a</sup> ±10.6	20.6±3.8	21.0±3.6
16	173.9 <sup>a</sup> ±7.3	162.5 <sup>a</sup> ±6.8	63.8 <sup>a,b</sup> ±13.4	55.7 <sup>a</sup> ±9.8	21.3±4.1	21.2±3.7
17	175.3 <sup>a</sup> ±7.5	162.1 <sup>a</sup> ±6.5	68.5 <sup>a,b</sup> ±14.4	57.0 <sup>a</sup> ±10.1	22.2±4.1	21.7±3.7
F <sub>gender*age</sub>	56.770 (p<0.000)		15.332 (p<0.000)		1.311 (p>0.05)	

Values are the mean ± standard deviation. BMI: body mass index. Superscript letters indicate significant differences (p < 0.05): a, between genders; b, between ages.

The prevalence of overweight and obesity, as well as the OR and their respective confidence intervals, is shown in Table 3.

**Table 3.** Prevalence and odds ratios with 95% confidence intervals of overweight and obesity according to gender, age group and socioeconomic status.

		Overweight		Obesity	
		Prevalence	OR (95%CI)	Prevalence	OR (95%CI)
Gender	Boys	14.8% (n=436)	1.00	5.8% (n=171)	1.00
	Girls	15.2% (n=459)	0.97 (0.85-1.12)	4.5% (n=136)	1.31 (1.04-1.65)
Age group	6-10 years (I)	14.4% (n=291)	1.00	6.2% (n=126)	1.00
	11-14 years (II)	16.7% (n=416)	1.34 (1.10-1.62)	4.0% (n=124)	1.30 (1.00-1.69)
	15-17 years (III)	12.9% (n=188)	0.90 (0.76-1.05)	3.9% (n=57)	1.24 (0.88-1.73)
SES	D	11.5% (n=18)	1.00	5.1% (n=8)	1.00
	C	14.2% (n=391)	1.14 (0.98-1.32)	4.9% (n=134)	0.90 (0.47-1.73)
	B	15.8% (n=449)	1.19 (0.82-1.72)	5.5% (n=155)	1.13 (0.89-1.43)
	A	18.2% (n=37)	1.27 (0.77-2.09)	4.9% (n=10)	0.94 (0.45-1.96)

OR: odds ratio; 95%CI: 95% confidence interval; SES: socioeconomic status.

The prevalence of overweight was 14.8% among boys and 15.2% among girls, while the prevalence of obesity was 5.8% and 4.5%, respectively. The results of logistic regression showed that girls were 31% more likely to be obese than boys (OR=1.31; 95%CI=1.04-1.65).

Analysis according to age group showed a higher prevalence of overweight in age group II. This group had a 34% higher risk of overweight than group I (OR=1.34; 95%CI=1.10-1.62). On the other hand, the prevalence of obesity gradually decreased with increasing age. The risk of obesity was 30% higher in group II (OR=1.30; 95%CI=1.00-1.69) and 24% higher in group III (OR=1.24; 95%CI=0.88-1.73).

With respect to socioeconomic status, a progressive increase in the prevalence of overweight was observed, indicating that the higher the socioeconomic status, the higher the prevalence of overweight. The risk of overweight was 27% higher among schoolchildren from high-income families (SES A) compared to SES D (OR=1.27; 95%CI=0.77-2.09). The prevalence of obesity was higher in SES B and lower in SES D. Furthermore, SES B was associated with a 13% higher risk of obesity (OR=1.13; 95%CI=0.89-1.43).

Considering the possible existence of differences between genders, the variables were analyzed separately (Table 4). With respect to age group, similar prevalence rates were observed in the two genders. The highest prevalence rates were identified in age group II and the lowest in group III. Differences in the risk of overweight were observed between genders. In boys, group II had a 51% higher risk (OR=1.51; 95%CI=1.14-1.99), while the risk was significantly lower, only 19%, in girls (OR=1.19; 95%CI=1.10-1.62). The prevalence of obesity decreased with increasing age in both genders. The highest risk of obesity (42%) was identified in girls of group II (OR=1.42; 95%CI=0.96-2.11).

In schoolchildren belonging to families of higher socioeconomic status, overweight tended to increase gradually and this trend was similar in the two genders. SES A was associated with a 48% higher risk of overweight in boys (OR=1.48; 95%CI=0.69-3.27) and with a 16% higher risk in girls (OR=1.16; 95%CI=0.64-2.09) when compared to SES D.

**Table 4.** Prevalence and odds ratios with 95% confidence intervals of overweight and obesity according to age group and socioeconomic status in boys and girls from towns around the Itaipu lake, western Paraná.

		Overweight		Obesity	
		Prevalence	OR (95%CI)	Prevalence	OR (95%CI)
Boys					
Age group	6-10 years (I)	14.1% (n=149)	1.00	6.3% (n=66)	1.00
	11-14 years (II)	16.9% (n=200)	1.51 (1.14-1.99)	6.1% (n=72)	0.98 (0.67-1.47)
	15-17 years (III)	12.4% (n=87)	0.77 (0.77-0.97)	4.7% (n=33)	0.89 (0.54-1.07)
SES	D	9.3% (n=7)	1.00	6.7% (n=5)	1.00
	C	13.2% (n=17(3))	1.19 (0.74-1.92)	5.7% (n=74)	0.84 (0.33-2.15)
	B	16.3% (n=234)	1.28 (1.03-1.58)	6.8% (n=82)	1.01 (0.73-1.39)
	A	18.9% (n=23)	1.48 (0.69-3.27)	8.2% (n=10)	1.47 (0.74-2.92)
Girls					
Age group	6-10 years (I)	14.7% (n=142)	1.00	6.2% (n=60)	1.00
	11-14 years (II)	16.6% (n=216)	1.19 (1.10-1.62)	4.0% (n=52)	1.42 (0.96-2.11)
	15-17 years (III)	13.3% (n=101)	0.94 (0.83-1.30)	3.2% (n=24)	1.29 (0.77-2.15)
SES	D	13.6% (n=11)	1.00	3.7% (n=3)	1.00
	C	15.0% (n=219)	1.03 (0.59-2.16)	4.1% (n=60)	1.06 (1.04-1.07)
	B	15.3% (n=215)	1.07 (0.83-1.25)	5.2% (n=73)	1.28 (0.90-1.81)
	A	17.3% (n=14)	1.16 (0.64-2.09)	0.0% (n=0)	

OR: odds ratio; 95%CI: 95% confidence interval; SES: socioeconomic status.

The highest prevalence observed was 8.2% in boys of SES A and 5.2% in girls of SES B. The results of logistic regression showed that, in boys, SES A was associated with a 47% increase in the risk of obesity compared to SES D (OR=1.47; 95%CI=0.74-2.92). In girls, the highest risk (28%) of obesity was observed in SES B (OR=1.28; 95%CI=0.90-1.81).

## DISCUSSION

An expressive number of studies have been conducted in Brazil over the last decade in an attempt to identify the prevalence of obesity in children and adolescents, but these studies have used different criteria for the identification and classification of obesity, a fact showing the lack of consensus and impairing large comparisons. However, we found epidemiological studies conducted in Brazil that used similar criteria: age, BMI and IOTF. Prevalence rates of overweight<sup>14-17</sup> and obesity<sup>14,15,17-19</sup> similar to those observed here have been identified in at least one of the genders. When the prevalence estimates of overweight and obesity were summed to determine the total prevalence of excess weight, some studies<sup>14,15,17,19</sup> reported values exceeding 20%, as observed in the present study.

Corso et al.<sup>20</sup> studied schoolchildren from eight towns in Santa Catarina. The age of these children corresponded to age group I. The prevalence rates of overweight (15.4%) and obesity (6.1%) were similar to those observed in the present study (14.4% and 6.2%, respectively). For age group II, two studies conducted in Pelotas<sup>21</sup> and Capão da Canoa<sup>22</sup>, Rio Grande do Sul, reported a prevalence of excess weight of 24.8%, while a slightly lower rate

(20.7%) was observed in the present study, with the highest values in boys. A lower prevalence of excess weight was observed in age group III (16.8%). A similar trend has been reported in other studies<sup>23-25</sup>.

In the present study, the prevalence of overweight and obesity followed a similar trend in the two genders, decreasing gradually with increasing age. This trend has also been reported in another study<sup>16</sup>.

With respect to the risk of obesity, girls showed a greater predisposition, especially in age group II. In boys, a higher risk of overweight was also identified in age group II. Similar results have been reported by Guedes et al.<sup>19</sup>.

Schoolchildren of both genders from high-income families were more predisposed to develop overweight. No pattern was observed for the prevalence of obesity, which was similar in SES D and B in boys and the highest prevalence of this study (8.2%) was observed in SES A. In girls, the prevalence of obesity was higher in SES D, C and B, and no case of obesity was observed in SES A.

A markedly higher risk of both overweight and obesity (close to 50%) was observed in boys of SES A. Similar trends, but at lower percentages, were seen in girls. These values obtained by logistic regression were considerably lower than those reported in another study<sup>19</sup> conducted in 2006, with the identification of situations of double and even triple the risk of developing overweight and obesity.

The results of the present study suggest the need for intervention programs designed to combat the constant increase in overweight and obesity in Brazil, which requires the joint effort of families, schools, society, and public authorities. Physical education professionals play a key role in this process, especially those working in schools since they have the opportunity to help change this reality.

One limitation of this study is the lack of detailed information about the eating habits and physical activity of the schoolchildren, which would permit a more thorough discussion of this subject.

## CONCLUSIONS

The present study shows that overweight and obesity in children and adolescents have reached considerably high rates in the towns located around the Itaipu lake, irrespective of gender and age. Considering the socioeconomic status, higher prevalence rates of overweight and obesity were observed in schoolchildren from high-income families. The prevalence rates indicate a trend similar to that observed for the highest prevalence reported in surveys conducted in other cities and regions of Brazil. It is expected that these data become a matter of concern for the public health system and society, seeking alternatives to alleviate this problem and its future consequences.

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