

# Risk factors associated with overweight among adolescents from Western São Paulo state\*

FATORES DE RISCO ASSOCIADOS AO EXCESSO DE PESO ENTRE ADOLESCENTES DA REGIÃO OESTE PAULISTA

FACTORES DE RIESGO ASOCIADOS AL EXCESO DE PESO ENTRE ADOLESCENTES DE LA REGIÓN OESTE PAULISTA

Rômulo Araújo Fernandes<sup>1</sup>, Igor Conterato<sup>2</sup>, Kelly Patrícia Messias<sup>3</sup>, Diego Giuliano Destro Christofaro<sup>4</sup>, Arli Ramos de Oliveira<sup>5</sup>, Ismael Forte Freitas Júnior<sup>6</sup>

## ABSTRACT

The objective of this study was to analyze the association between being overweight and family risk factors in adolescents from Western Sao Paulo state. This cross-sectional study involved 1779 adolescents of both genders and with ages ranging between 11 and 17 years. The participants' body mass index was calculated, and the family risk factors were analyzed through a questionnaire. Excessive weight was associated with the male gender (OR=1.55 [1.22-1.97]), studying in a private school (OR=2.14 [1.56-2.94]) and mother's higher education (OR=0.52 [0.33-0.83]). There is a need to implement initiatives to fight obesity in the school environment and reach the whole family structure, taking gender-related specificities into consideration.

## KEY WORDS

Obesity.  
Adolescents.  
Risk factors.  
Cross-sectional studies.

## RESUMO

Analisar a associação entre excesso de peso e diferentes fatores de risco familiares em adolescentes da região oeste do estado de São Paulo. Estudo transversal com 1779 adolescentes de ambos os sexos, e idade compreendida entre 11 e 17 anos. Calculou-se o índice de massa corporal e os fatores de risco familiares foram analisados por meio de questionário. O excesso de peso foi associado com o sexo masculino (OR=1,55 [1,22-1,97]), estudar em escola particular (OR=2,14 [1,56-2,94]) e maior escolaridade materna (OR=0,52 [0,33-0,83]). Iniciativas de combate à obesidade devem ser instauradas em meio escolar e atingir toda a estrutura familiar, bem como levar em consideração particularidades decorrentes do sexo.

## DESCRIPTORIOS

Obesidade.  
Adolescentes.  
Fatores de risco.  
Estudos transversais.

## RESUMEN

Analizar la asociación entre exceso de peso y diferentes factores de riesgo familiares en adolescentes de la región oeste del estado de São Paulo. Estudio transversal con 1779 adolescentes de ambos sexos, y edad comprendida entre 11 y 17 años. Se calculó el índice de masa corporal; los factores de riesgo familiares fueron analizados por medio de cuestionario. El exceso de peso fue asociado con: sexo masculino (OR=1,55 [1,22-1,97]), estudiar en escuela particular (OR=2,14 [1,56-2,94]), y mayor escolaridad materna (OR=0,52 [0,33-0,83]). Iniciativas de combate a la obesidad deben ser instauradas en el medio escolar y alcanzar a toda la estructura familiar, así como llevar en consideración particularidades provenientes del sexo.

## DESCRIPTORIOS

Obesidad.  
Adolescentes.  
Factores de riesgo.  
Estudios transversales.

\* Extracted from the thesis "Fatores de risco para o desenvolvimento do sobrepeso e obesidade em adolescentes de diferentes condições socioeconômicas", Physical Education Graduate Program, Londrina State University, Paraná, 2007. <sup>1</sup>M.Sc.. Professor at Physical Education Department at Universidade Estadual Paulista "Júlio de Mesquita Filho", Presidente Prudente, SP, Brazil. romulo\_ef@yahoo.com.br <sup>2</sup>Degree in Physical Education. Physical Education Department, Universidade Estadual Paulista, "Júlio de Mesquita Filho", Presidente Prudente, SP, Brazil. igorconterato@hotmail.com <sup>3</sup>Physical Education undergraduate. Physical Education Department at Universidade Estadual Paulista, "Júlio de Mesquita Filho", Presidente Prudente, SP, Brazil. kelly\_messias@hotmail.com <sup>4</sup>Physical Education Graduate. Physical Education Center at Londrina State University, Londrina, PR, Brazil. ddcleite@yahoo.com.br <sup>5</sup>Ph.D.. Professor at Physical Education Center, Londrina State University, Londrina, PR, Brazil. arli@uel.br <sup>6</sup>Ph.D.. Professor at Physical Education Department, Universidade Estadual Paulista, "Júlio de Mesquita Filho", Presidente Prudente, SP, Brazil. ismael@fct.unesp.br

## INTRODUCTION

Overweight and obesity (O/O) are considered serious public health issues across the world because of their strong associations with various risk factors for developing non-transmissible chronic diseases<sup>(1-2)</sup>.

Studies show that Brazilian children and adolescents, though being in the early phases of human development, already have a high adipose tissue accumulation that is directly related with increased systolic and diastolic arterial blood pressure values<sup>(2)</sup>. The reported increase is apparently based on the decisive role that excessive fat in the blood stream has in forming fat deposit on blood vessel walls (atheroma) in these youths.

Although there are no similar reports in the literature concerning the Brazilian pediatric population, studies with North-American populations of the same age show that there has been a significant increase in the number of patients with diseases associated to O/O, such as *diabetes mellitus* and gallbladder problems, seen at health systems in the referred country over a 20-year period (1979-1999)<sup>(1)</sup>.

There is an increasing prevalence of O/O among pediatric populations, especially in developing countries, which is the case of Brazil. Three large population surveys performed between 1974 and 1997 show that the referred phenomenon increased by more than 200%<sup>(3)</sup>. In Brazil, this increase in the occurrence of O/O accompanied the significant changes brought about in family structure and society over the last three decades.

These changes in the structure of Brazilian families include significant changes in eating habits and in the practice of physical activities. Hence, families adopt habits/behaviors associated with O/O (e.g.: skipping important meals; less physical activities; more sedentary behaviors). This has been observed among adolescents living in Southern Brazil<sup>(4-6)</sup>.

Despite the impossibility to fully distinguish the burden of genetics and the environment in children, the relationship between the family environment and the development of O/O is strongly influenced by socioeconomic variables, such as family income, the education level of parents or tutors, smaller family structures, and attending a private school. Furthermore, these variables are associated with the increase in O/O prevalence<sup>(4-6)</sup>.

Despite the various indicators of the significant power the family environment has on avoiding/developing O/O, there are still many gaps in the literature to be filled.

In addition, few study centers have performed large surveys that analyze the occurrence of O/O and its interaction with various risk factors. Therefore, there is a significant limitation to construct a broader view about this major

problem in the country, since socioeconomic characteristics change from region to region.

Some municipalities, such as those located in Western São Paulo state, despite high indicators of O/O prevalence among their youth<sup>(7)</sup>, lack information in this respect and, therefore, face several difficulties to structure efficient initiatives for the prevention of / battle against O/O. For this reason, it is essential for health professionals from various areas to obtain information about O/O if they are interested in performing intervention strategies for treatment and prevention.

## OBJECTIVE

The objective of the present study was to analyze the association between O/O and different family risk factors among adolescents living in the city of Presidente Prudente, São Paulo state.

## METHOD

This cross-sectional study has descriptive and analytical characteristics, and was performed in the second semester of 2007 in the city of Presidente Prudente, São Paulo state. Sample size was determined through an equation to estimate population parameters. A sample of 1,779 students was necessary to detect an estimated O/O prevalence of 28.6%<sup>(7)</sup>, with a sample error of 2.1%, power of 80%, and statistical significance of 5%. Based on information obtained in a previous study, which reported a 12.5% sample loss, the present study aimed to interview at least 2,001 male and female students. After excluding individuals with any kind of irregularity in the collected data (questionnaires left blank or completed inappropriately; absence on the evaluation days), the sample consisted of 1,779 students, with ages ranging between 11 and 17 years, and regularly enrolled in state or private schools in the referred city.

The first step to select the sample was to obtain data regarding the total amount of schools (n= 118) and the number of students in each. The data showed there were 36 schools for the age group considered in the present study (11-17 years). In agreement with the proportion of students in the two school systems (approximately 30% in private schools), six schools (four state and two private) were randomly selected.

Before data collection, all students from the six selected schools were invited to participate in the study. A consent term was sent to their parents or tutors asking permission for the subjects' participation in the study. The inclusion criteria were based on the following information: (a) be a regular student enrolled in one of the six studied schools; (b) not have any diagnosed metabolism disease or special need that could affect the result, or be pregnant; (c) return

In Brazil, this increase in the occurrence of O/O accompanied the significant changes brought about in family structure and society over the last three decades.

the consent term signed by a parent or tutor. The present study was performed in agreement with all guidelines and regulations for studies involving human beings (decree 196/96) and was approved by the Ethics Committee for Research Involving Human Beings at *Universidade Estadual Paulista – UNESP (Presidente Prudente Campus)* [Registration number 087/2006].

All anthropometric measurements were performed at each school, in a room reserved and prepared specifically for this purpose<sup>(8)</sup>. The students' body mass was measured using a mechanic scale (Filizola<sup>®</sup>), with a 0.1kg precision and maximum capacity of 150kg. The students' height was measured using a metal stadiometer fixed to the wall with a precision of 0.1cm and maximum height of 2 meters. The students' body mass index (BMI) was obtained using their weight and height data. Knowing the students' BMI values and using specific critical reference values according to age and gender<sup>(9)</sup>, subjects were classified according to their respective nutritional status: eutrophy, overweight or obesity.

Students completed the questionnaire in the classroom, receiving help from the same evaluator, who provided a brief explanation about the correct way of completing the forms and answered any questions the students had. Students were not allowed to talk while completing the questionnaires. The students' parents also completed a questionnaire, but at home and without any supervision by the researcher.

The families' economic condition (EC) was determined according to the *Brazil Economic condition Classification Criteria* (ABEP – Brazilian Association for Population Studies- abbreviation in Portuguese)<sup>(10)</sup>. Students also completed this specific questionnaire in the classroom with the help of the evaluator. This instrument takes into consideration the parents' level of education, the existence/number of certain rooms and appliances at home, and establishes an EC classification (between A [highest] and E [lowest]). After categorizing the subjects using the EC instrument, the sample was divided once again as follows: high economic condition (HEC; category A); average economic condition (AEC; category B); low economic condition (LEC; categories C, D and E). This questionnaire also provided data concerning the number of TV sets the adolescents had at home. The students' parents were invited to complete a questionnaire with information about their education and about the number of siblings living in the same house as the studied adolescent.

With the purpose of evaluating the consistency of the information provided in all questionnaires, two weeks after data collection, a small portion of the sample (170 students and 30 parents) was randomly selected to answer the questionnaires again, and agreement levels (*Kappa [k]* index) between the answers (CE [ $k=0.87$ ]) and parents' data ( $k=1.00$ ) were analyzed.

The *Kolmogorov-Smirnov* test showed that non-parametric statistics were necessary to analyze the numerical variables. *k* indicated the agreement of categorical data. The chi-square ( $\chi^2$ ) test analyzed the association between the variables and also compared ratios. Binary regression logistics, represented by odds ratio (OR) and a 95% confidence interval (CI95%), in the univariate and in the adjusted model (eliminate any confounding variables), indicated the magnitude of the associations between O/O (outcome) and the different family factors analyzed. Values (*p*) below 5% were considered significant and the statistical analysis was performed using *SPSS 13.0*.

## RESULTS

The analyzed sample consisted of 46.3% boys and 53.7% girls ( $p=0.002$ ). There was no statistical difference between both genders in terms of age (male: median= 13.8 [interquartile range - IR= 3.2] and, female: median= 13.7 [IR= 2.8];  $p=0.817$ ) and BMI (b: median= 20.1 [IR= 5.1] and, female: median= 19.7 [IR= 4.8];  $p=0.139$ ). However, male adolescents were taller (median= 1.65 [IR= 0.20]) and heavier (median= 54.7 [IR= 21.2]) than female adolescents (median= 1.59 [IR= 0.10] and median= 49.5 [IR= 14.1], respectively; both with  $p=0.001$ ).

The total O/O occurrence among the studied adolescents was 22.9% (overweight= 16.8% and obesity = 6.1%) and it was associated with the gender, school environment (attending private school), smaller number of siblings and better economic condition (Table 1). No statistically significant association was found between O/O and the number of TV sets in the household and the parents' education level.

In the univariate model, the logistic regression showed that male adolescents (OR= 1.49 [1.19-1.86]) had greater chances of becoming O/O, as well as students attending private schools (OR= 2.00 [1.58-2.54]). In addition, students with better economic conditions have more chances of becoming overweight (Table 2).

**Table 1** – Association between overweight and family risk factors - Presidente Prudente, São Paulo - 2007

Family Factors		Eutrophy %	O/O %	$\chi^2$	p
Gender	Female	80.4	19.6	12.005	0.001
	Male	73.3	26.7		
School	Public	80.6	19.4	32.881	0.001
	Private	67.4	32.6		
TV sets	TV $\leq$ 1	79.7	20.3	1.730	0.188
	TV $\geq$ 2	76.4	23.6		
EC	Low	83.3	16.7	10.823	0.001
	Average	76.2	23.8		
	High	73.7	26.3		
HE	None	77.6	22.4	1.215	0.270
	Father	75.5	24.5		
	Mother	81.1	18.9		
	Both	72.4	27.6		
Siblings	None	73.1	26.9	4.698	0.030
	1-2	76.7	23.3		
	2-3	81.6	18.4		
	$\geq$ 4	80.9	19.1		

O/O= overweight and obesity; EC= economic condition; HE= higher education.

**Table 2** – Association between overweight and different family risk factors among adolescents of both genders, using a univariate and multivariate model - Presidente Prudente, São Paulo- 2007

Risk Factors	O/O %	O/O among Adolescents	
		Univariate model OR (CI95%)	Multivariate model OR (CI95%)
Gender	Female	19.6	1.00
	Male	26.7	1.49 (1.19-1.86)
School	Public	19.4	1.00
	Private	32.6	2.00 (1.58-2.54)
TV Sets	TV $\leq$ 1	20.3	1.00
	TV $\geq$ 2	23.6	1.21 (0.92-1.59)
EC	Low	16.7	1.00
	Average	23.8	1.55 (1.14-2.11)
	High	26.3	1.77 (1.27-2.47)
HE	None	22.4	1.00
	Father	24.5	1.12 (0.76-1.65)
	Mother	18.9	0.80 (0.52-1.22)
	Both	27.6	1.31 (0.95-1.81)
Siblings	None	26.9	1.00
	1-2	23.3	0.82 (0.59-1.15)
	2-3	18.4	0.61 (0.39-0.95)
	$\geq$ 4	19.1	0.64 (0.32-1.26)

O/O= overweight and obesity; EC= economic condition; HE= higher education; OR= odds ratio; CI95%= 95% confidence interval.

In the multivariate analysis model (Table 2), risk factors were grouped in one single mathematical model, aiming to eliminate any effects from possible confounding variables. In this model, it was found that the variable *higher economic condition* lost its statistical significance. In addition, it was observed that a higher education level among mothers was a significant protection factor associated to O/O (reduction of 48%).

## DISCUSSION

The prevalence of O/O in the studied sample was 22.9%, which is similar to the rates of 25.9%<sup>(5)</sup> and 24.8%<sup>(6)</sup> observed in a recent study performed among adolescents from the state of Rio Grande do Sul. These prevalence rates are much higher than the 12.6% observed in the 1990's<sup>(3)</sup> and they reflect the critical situation of nutritional transition (from nutritional deficiency to being overweight) the young population of Brazil has been experiencing over the last decades<sup>(3)</sup>.

Brazilian studies have indicated a close relationship between O/O and EC, with higher rates observed in wealthier economic strata, regardless of the region being analyzed<sup>(3,11-12)</sup>. This positive association between overweight and EC is apparently based on the easier access these youths have to obesogenic food or sedentary behaviors<sup>(12)</sup>. The present study found a statistically significant association between EC and O/O, which is in agreement with the aforementioned studies. However, that association did not remain significant in the multivariate model, showing that it can be mediated by other factors associated with EC, such as school environment.

In fact, in terms of school environment, several studies have shown there is an association between attending private school and having greater risks for being overweight<sup>(5,11-12)</sup>, higher cholesterol levels and, consequently, more occurrences of hypercholesterolemia<sup>(13)</sup>. There is still no consensus in the literature about the explanations for this phenomenon. In a recent study<sup>(11)</sup>, however, it was observed that private school students consumed more high-calorie foods while at school, such as: soft drinks, fried foods, and candies. Nonetheless, in another line of thought, but also considering the effect of school environment on the development of O/O, there is evidence<sup>(14)</sup> that well-structured campaigns can significantly reduce O/O prevalence and physical inactivity among those students.

Therefore, considering the importance of school environment for the students' development of life habits and values, it should be emphasized that schools are important allies in this battle, provided that well-structured campaigns against O/O are held. On the other hand, when such campaigns are not present, schools are characterized as significant diffusion agents of health-threatening habits among these youth.

In the present study, the gender differences observed (higher O/O occurrence among males) are similar to those found for adolescents living in Capão da Canoa, Ro Grande do Sul state<sup>(6)</sup>, but differ from the information found for adolescents living in Fortaleza, Ceará state<sup>(12)</sup>. In fact, in Brazil, there is no clear tendency about the association between gender and overweight. This knowledge gap is possibly influenced by associations observed between the many family / sociocultural variables and risk factors for the development of O/O.

A clear example of the referred influence was evidenced in a study on adolescents living in the city of Pelotas, Rio Grande do Sul state<sup>(15)</sup>, which found that male youths have more family support to engage in physical activities. In addition, as previously observed in New Zealand adolescents<sup>(16)</sup>, female youths apparently liked fruits and vegetables more than their male peers, though no clear reason was found for this distinction. Therefore, in the search for more effective results, there is a need to implement campaigns to fight obesity, taking gender differences into consideration, as well as performing more studies to analyze those differences.

In addition to the aforementioned controversial themes, it is worth stating the association observed between mothers' higher education level and lower O/O occurrence. This finding evidences a possible protection factor probably triggered by greater access to quality information. Previous studies have indicated risk associations between these variables (only in the univariate model), or did not even detect that such association existed<sup>(5-6)</sup>. On the other hand, there are studies that indicate a strong influence of both parents or the mother alone on the development of O/O<sup>(17-18)</sup>.

## CONCLUSIONS

The school environment, represented as attending private school, and mothers' higher education level were variables associated to overweight among the studied adolescents. In addition, despite the inability to state the cause, gender is also an important factor associated to overweight. These data stress the importance of implementing initiatives to fight O/O at schools, considering gender differences and the need to reach the family structure where these youth live.

The main limitation of this study is its cross-sectional design. This characteristic makes it possible to analyze associations but impedes the establishment of causal relationships between the analyzed variables. In this sense, inferences about the associations observed in this study should be made with caution and further temporal studies should be performed with this sample, as well as in other regions of Brazil.

## REFERENCES

1. Wang G, Dietz WH. Economic burden of obesity in youths aged 6 to 17 years: 1979-1999. *Pediatrics*. 2002;109(5):E81-1.
2. Araújo TL, Lopes MV, Cavalcante TF, Gudes NG, Moreira RP, Chaves ES, et al. Análise de indicadores de risco para hipertensão arterial em crianças e adolescentes. *Rev Esc Enferm USP*. 2008;42(1):120-6.
3. Wang Y, Monteiro C, Popkin BM. Trends of obesity and underweight in older children and adolescents in the United States, Brazil, China, and Russia. *Am J Clin Nutr*. 2002;75(6):971-7.
4. Mendes MJ, Alves JG, Alves AV, Siqueira PP, Freire EF. Associação de fatores de risco para doenças cardiovasculares em adolescentes e seus pais. *Rev Bras Saude Matern Infant*. 2006;6(1Supl):549-54.
5. Terres NG, Pinheiro RT, Horta BL, Pinheiro KA, Horta LL. Prevalence and factors associated to overweight and obesity in adolescents. *Rev Saúde Pública*. 2006;40(4):627-33.
6. Suñé FR, Dias-da-Costa JS, Olinto MT, Pattussi MP. Prevalência e fatores associados para sobrepeso e obesidade em escolares de uma cidade no Sul do Brasil. *Cad Saúde Pública*. 2007;23(6):1361-71.
7. Fernandes RA, Kawaguti SS, Agostini L, Oliveira AR, Ronque ER, Freitas Júnior IF. Prevalência de sobrepeso e obesidade em alunos de escolas privadas do município de Presidente Prudente-SP. *Rev Bras Cineantropom Desempenho Hum*. 2007;9(1):21-7.
8. Gordon CC, Chumlea WC, Roche AF. Stature, recumbent length and weight. In: Lohman TG, Roche AF, Martorel R, editors. *Anthropometric standardization reference manual*. Champaign: Human Kinetics Books; 1988. p. 3-8.
9. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ*. 2000;320(7244):1240-3.
10. Instituto Brasileiro de Opinião Pública e Estatística. Levantamento sócio econômico-2000-IBOPE [texto na Internet]. Rio de Janeiro; 2001. [citado 2003 fev. 02]. Disponível em: [http://www.abep.org/codigosguias/ABEP\\_CCEB.pdf](http://www.abep.org/codigosguias/ABEP_CCEB.pdf)
11. Nunes MMA, Figueroa JN, Alves JGB. Excesso de peso, atividade física e hábitos alimentares entre adolescentes de diferentes classes econômicas em Campina Grande (PB). *Rev Assoc Med Bras*. 2007;53(1):130-34.
12. Brasil LM, Fisberg M, Maranhão HS. Excesso de peso de escolares em região do Nordeste Brasileiro: contraste entre as redes de ensino pública e privada. *Rev Bras Saude Mater Infant*. 2007;7(4):405-12.
13. Scherr C, Magalhães CK, Malheiros W. Lipid profile analysis in school children. *Arq Bras Cardiol*. 2007;89(1):73-8.
14. Veugelers PJ, Fitzgerald AL. Effectiveness of school programs in preventing childhood obesity: a multilevel comparison. *Am J Public Health*. 2005;95(3):432-5.
15. Gonçalves H, Hallal PC, Amorim TC, Araújo CL, Menezes AM. Fatores socioculturais e nível de atividade física no início da adolescência. *Rev Panam Salud Publica*. 2007;22(4):246-53.
16. Bere E, Brug J, Klepp KI. Why do boys eat less fruit and vegetables than girls? *Public Health Nutr*. 2008;11(3):321-5.
17. Ortega FB, Ruiz JR, Sjostrom M. Physical activity, overweight and central adiposity in Swedish children and adolescents: the European Youth Heart Study. *Int J Behav Nutr Phys Act*. 2007;4:61.
18. Marins VM, Almeida RM, Pereira RA, Azevedo Barros MB. The relationship between parental nutritional status and overweight children/adolescents in Rio de Janeiro, Brazil. *Public Health*. 2004;118(1):43-9.

### Funding

Research partially funded by CAPES through a study grant between July and December 2007.