

## ORIGINAL ARTICLE

# Factors associated with overweight among school adolescents



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## Abstract

**Introduction:** Overweight has been reported as a public health problem. Consequently, this suggests epidemiological studies for nutritional surveillance.

**Objective:** To analyze the prevalence and factors associated with overweight among high school students in Capital of the Brazilian Western Amazon.

**Methods:** Cross-sectional study of 2694 adolescents from public and private schools. They collected demographic, socioeconomic and sedentary behavior through self-responded questionnaire. Overweight rating followed the recommendations of the World Health Organization (2007). The prevalence rates were calculated, odds ratio and their confidence intervals were calculated at 95%. They identified the factors associated with excess weight by multiple binary logistic regression.

**Results:** The overall prevalence of overweight was 24.2% and 26.3% for males and 22.4% for females. After adjustment factors associated with overweight were economic class A / B (OR = 1.30, 95% CI 1.02 to 1.45), private school type (OR = 1.21, 95% CI 1,02-1.46) and poor health perception (OR = 1.27, 95% CI 1.03 to 1.58). It was concluded that excess weight showed high prevalence in economy class adolescents and B and private schools in Porto Velho, RO, Brazil.

**Conclusion:** Therefore, the practice of physical activity associated with a diet should be encouraged, in addition to reducing sedentary behavior, to prevent the development of overweight and obesity.

**Keywords:** students, adolescents, overweight, physical activity

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## ■ INTRODUCTION

Excess weight (overweight and obesity) in children and adolescents is considered a public health problem in many countries, regardless of their level of development; more recent surveys show prevalence of around 18% in children in the 11-year age group considered as obese in England, the reasons for this phenomenon are several factors such as high calorie food, low levels of physical activity and family influence<sup>1</sup>.

A sedentary lifestyle and a poor standard of food can contribute to excess weight gain among adolescents, considered a risk factor for diseases such as respiratory problems, diabetes mellitus, hypertension and dyslipidemia<sup>2</sup>, accounting for a large share of spending on public health<sup>3</sup>.

In Brazil, data from surveys conducted by the Brazilian Institute of Statistical Geography (IBGE) showed that overweight boys aged 10 to 19 years increased from 3.7% (1974-75) to 21.7% (2008-09). Among girls, in the same period, the growth in overweight was 7.6% to 19.4%<sup>4</sup>. A study of Cardiovascular Risk in Adolescents (ERICA)<sup>5</sup> with an estimated population of 73,399 people

found an overall prevalence of overweight and obesity of 17.6% and 7.6% for girls, and for boys 16.6% and 9.2%, being lower in the Northern region, girls 15.5% and 5.6%, boys 15.1% and 7.6%, and higher in the Southern region where girls showed 20.3% and 9.8%, boys 17.0% and 12.4%, respectively. The national prevalence of overweight and obesity in adolescents seems to be higher in the population of southern Brazil than in other regions.

Adolescence represents a critical period in relation to excess body weight due to rapid linear growth, hormonal, cognitive and emotional changes that can influence the amount of body fat. Teenagers who are overweight tend to become obese adults<sup>6</sup>. Thus, evaluating the nutritional status of adolescents has been recommended, allowing the identification of the subgroups with the highest frequency of exposure to this outcome.

Thus, the objective of this study is to analyse the prevalence and factors associated with overweight among high school students in the capital of the Brazilian Western Amazon.

## ■ METHODS

A cross-sectional descriptive study was conducted in the city of Porto Velho, capital of the state of Rondônia (RO), located in the northern region of Brazil. In 2010, the municipality had an estimated population of 428,527 inhabitants and a Human Development Index (HDI) of 0.756.

The characterization of the population studied was based on a file provided by the State Department of Education (SEDUC/RO), based on the 2010 school census, where the total number of students enrolled in high school was 14,706, distributed in the age group of 14 to 18 years of age of both sexes.

The sample size calculation was based on a 50% prevalence of overweight, a sampling error of two percentage points with confidence interval (CI 97%), resulting in 2,450 children enrolled in public and private schools. For the stratification of the schools by the number of students, the technique of simple randomization by parity proportionality among students of public and private schools 1,452 (59.27%) and 998 (40.73%) was used, was adjusted for losses and refusals 10%, finalized with 2,694, 1,598 (59.32%) and 1,096 (40.68%) respectively, with a response rate of 100%.

The selection process of the students was carried out in three stages: a stratified sampling was initially made proportional to the number of schools per stratum (north, south, east and west) of the city; in a second stage: selection of schools by strata through the proportional process in each stratum and a third stage: draw of the series/classes, from which all the selected students participated in the study. This sampling process allowed each student to be equally likely to be selected.

The study totalled 44 schools (31 public and 13 private). After the selection process, 15 schools (9 public and 6 private) were drawn.

The data collection period was carried out between August 2013 and June 2014. The team responsible for the collection, was composed of professionals and academics of the Physical Education, Nursing and Medicine course of the Federal University of Rondônia (UNIR), they were trained in anthropometric evaluation and also in the application of the questionnaire.

The procedure for applying the questionnaire was in the classroom in the presence of the researchers and the classroom teacher. The printed questionnaire was read and explained by the interviewer, and during the completion of the questionnaire, any doubts were clarified, with an average completion time of 20 minutes.

The questionnaire to collect the variables was a translated version of a self-administered questionnaire, previously tested by the Global School-based Student Health Survey (GSHS), proposed by the World Health Organization (WHO) (available at the website: [www.who.int/chp/GSHS/en](http://www.who.int/chp/GSHS/en)). Based on self-reported measures of weight and body height, the body mass index (BMI) was determined by scholars. The classification of the nutritional status of adolescents, from the BMI, was based on the criteria proposed by the World Health Organization<sup>7</sup>. The cutoff point adopted was “BMI > +1.0 z-score” overweight (overweight and obesity)<sup>8</sup>.

The independent variables were all self-reported. For analysis purposes, they were divided into demographic variables: sex (male and female), age group (14-16 and 17-18 years of age), economic class (A, B and C/D/E), parents' education (primary, secondary and higher), type of school (public and private) and number of persons living at home ( $\leq 2$  members of the household and  $\geq 3$  members of the household); behavioural variables: Time watching television/computer ( $\leq 2$ h/day, 3-4h/day and  $> 4$ h/day), health perception (satisfactory and unsatisfactory),

physical activity levels (active and inactive) frequency and time of physical activity practice of moderate to vigorous intensity in a typical adolescent week were considered in order to derive a measure of the level of physical activity. Subjects who reported participating in at least 60 minutes of moderate to vigorous physical activity for five or more days per week were classified as physically active.

The time in front of the television and computer were considered together for week days and weekends, categorized as watching television: less than two hours, two to four hours and more than four hours daily.

Statistical analysis of the data was performed using the program Stata 12. The prevalence for overweight by sex and age was calculated. The odds ratio was obtained by

multiple binary logistic regressions. The factors associated with overweight were those with a p-value equal to or below 0.05, after adjusting for sex and age.

Data were analysed with the Statistical Package for the Social Sciences version 16.0 and Stata 12.

The data collection was conducted through the authorization and signing of the Term of Free and Informed Consent (TCLE) by the school board, parents or guardians, and the Term of Free and Informed Assent (TFIA) by the students. The Committee of Ethics in Research with Human Subjects of the Federal University of Rondônia (UNIR) approved the study (Certificate of Presentation for Ethical Assessment/CAAE – n.14190113.30000.5300, opinion n.431.027).

## RESULTS

In this study, variables collected from 2,694 high school students from Porto Velho, Rondônia, were analysed. Of these, 45% (1,212) were male and 55% female (1,482), divided into age groups, 1,529 between 14 and 16 years (56.8%) and 1,165 aged between 17 and 18 years (43.2%).

The overall prevalence of overweight was 24.2%. The male sex presented a higher prevalence of overweight (26.3%) in contrast to the female sex (22.4%). Specifically

in males, the highest prevalence of overweight was observed in students of private schools (30.5%), in households with few members (30.1%) of A/B economic classes. While in the female sex the highest prevalence of overweight was identified in adolescents with unsatisfactory health perception (27.4%), aged between 17 and 18 years (24.1%), and with parents who had an intermediate education level (24.1%).

**Table 1:** Prevalence of overweight, socioeconomic variables, sedentary behaviour and health perception by sex. Porto Velho, Rondônia, Brazil, 2013 and 2014.

Variables	Male		Female	
	n	%	n	%
BMI				
Excess weight	1212	26.3	1482	22.4
Age group				
14 – 16 years	660	29.8	869	21.2
17 – 18 years	552	22.1	613	24.1
Economic class				
A/B	910	27.2	1032	23.8
C/D/E	302	22.1	450	19.3
Parents' education				
Elementary	358	23.4	489	21.0
High	342	26.0	447	24.1
Higher	512	28.5	546	22.3
Type of school				
Public	685	23.0	913	22.1
Private	527	30.5	569	23.0
Household members				
= < 2 members	116	30.1	182	23.0
= > 3 members	1096	25.9	1300	22.3
Physical activity				
Active	832	26.6	798	22.1
Inactive	380	25.5	684	22.8
Travel				
Walk/bicycle	257	22.9	247	21.8
Bus/car/motorcycle	955	27.2	1235	22.5
Time in front of TV/Computer				

< 2 daily hours	628	24.8	882	21.8
= > 2 daily hours	584	27.9	600	23.3
Health perception				
Satisfactory	1015	26.1	1143	21.0
Unsatisfactory	197	27.4	339	27.4

Table 2 shows that males were 1.23 times more likely to be overweight than females, with a statistical significance of 0.02. Between the ages of 14-16 years and 17-18 years there was no statistically significant

difference. In the unadjusted logistic regression analysis, the following variables of p-values were found to be close to or below 0.05: gender, economic class, school type and health perception .

**Table 2:** Gross prevalence and odds ratio of overweight of schoolchildren by demographic, socioeconomic variables, sedentary behaviour and health perception. Porto Velho, Rondônia, 2013 and 2014.

	n	%	OR	CI 95%	p
Sex					
Female	1482	22.4	1		
Male	1212	26.3	1.23	(1.03-1.47)	0.020
Age					
14-16 years	1529	24.9	1		
17-18 years	1165	23.1	0.90	(0.75-1.08)	0.278
Economic class					
A/B	1942	25.6	1.33	(1.09-1.64)	0.005
C/D/E	752	25.6	1		
Parents education					
Elementary	847	22.0	1		
Intermediate	789	24.9	1.17	(0.93-1.47)	0.168
High	1058	25.3	1.19	(0.96-1.48)	0.098
Type of school					
Public	1598	22.5	1		
Private	1096	26.6	1.24	(1.04-1.49)	0.014
Household members					
= < 2 members	298	25.8	1		
= > 3 members	2396	24.0	0.90	(0.68-1.19)	0.484
Physical activity					
Active	1630	24.4	1		
Inactive	1064	23.7	0.96	(0.80-1.15)	0.678
Travel					
Walk/bicycle	504	22.4	1		
Bus/car/motorcycle	2190	24.6	1.12	(0.89-1.42)	0.301
Time in front of TV/Computer					
< 2 daily hours	1510	23.1	1		
= > 2 daily hours	1184	25.5	1.14	(0.95-1.36)	0.136
Health perception					
Satisfactory	2158	23.4	1		
Unsatisfactory	536	27.4	1.23	(0.99-1.53)	0.052

OR= gross odds ratio; CI95%: confidence interval of 95%.

Table 3 presents the factors associated with overweight after adjusting for gender and age variables. The students belonging to the economic classes A/B had a 1.30 higher chance of being overweight compared to those of classes C/D/E. It was also found that students in private

schools were 1.21 times more likely to be overweight than those of public schools. The report of unsatisfactory health perception had a magnitude of association of 1.27 (1.03 – 1.58) with overweight .

**Table 3:** Factors associated with overweight in students. Porto Velho, Rondônia, Brazil 2013 and 2014.

	OR	CI 95%	p
Economic class			
A/B	1.30	(1.02-1.45)	0.029
C/D/E	1		
Type of school			
Public	1		
Private	1.21	(1.02-1.46)	0.036
Health perception			
Satisfactory	1		
Unsatisfactory	1.27	(1.03-1.58)	0.025

OR= odds ratio adjusted for age and sex; CI95%: confidence interval of 95%.

## DISCUSSION

The gross and adjusted analysis of the present study showed that the prevalence of overweight and obesity was higher among male adolescents, of economic classes A and B, from private school with a poor health perception. The general prevalence of overweight of 24.2% was considered high, being approximate to that described in other studies. The findings of the latest international data, reported in a systematic review by Chung *et al.*<sup>9</sup>, show that excess weight (overweight and obesity) in children and adolescents (2-18 years old), from mid-2000, gradually increased without indication of reducing the peak. This fact has also been reported by other studies<sup>10-12</sup>.

In the USA, obesity in children and adolescents has increased markedly since 1980<sup>7</sup>. A study of a population of blacks and Hispanic white schoolchildren in Atlanta (USA) in the years 1999, 2001, 2003, 2004, 2005 and 2007, revealed that the prevalence of overweight increased by 30%<sup>13</sup>.

In Brazil, two studies in Northern Brazil, in 2012 and 2011 by Farias *et al.*<sup>14</sup> and Krinski *et al.*<sup>15</sup> in the city of Rio Branco, Acre State, found a prevalence of overweight in schoolchildren from private schools of 26.9%, while in the city of Vilhena, Rondônia State, it was 19.3% in public schools. The findings of both studies confirm the high prevalence of overweight among school children in that geographical region, confirming studies in the northeast<sup>16</sup> and southeast<sup>17</sup> of Brazil, indicating overweight prevalence consistently above 22%, similar to this study, and that the southern region almost always showed a higher prevalence of above 30% in adolescents<sup>18</sup>.

In Porto Velho, male adolescents showed a higher prevalence of overweight in contrast to adult males. A similar trend was observed in Rio Branco students<sup>19</sup>. However, controversy exists regarding the highest differences between boys and girls, with lower socioeconomic status, impoverished by several factors of society and between less developed regions and more developed ones<sup>12</sup>. This variability by gender and age has also been observed in several countries and, in parallel to the increase of the magnitude in genetically stable populations, reaffirms the influence of dietary habits, sedentary lifestyles and socioeconomic conditions on obesity<sup>20</sup>.

Other studies corroborating the findings of the

present one showed higher prevalence of overweight among male adolescents<sup>21,22</sup>. In the United States (USA) the prevalence of obesity in adolescents has increased dramatically from 5% to 13% for males and 5% to 9% in females between 1966 and 1970 and from 1988 to 1991<sup>3</sup>. Similarly, in Rio Branco, it was evidenced in research carried out in elementary and middle schools that boys had higher prevalence of overweight and obesity compared to girls<sup>21,22</sup>.

In Brazil<sup>4</sup>, the share of boys 10-19 years old with overweight increased from 3.7% (1974-75) to 21.7% (2008-09), while among girls, excess weight growth ratio was 7.6% to 19.4%. Recent research by the Study of Cardiovascular Risk in Adolescents (ERICA) found an overall prevalence of excess weight (overweight and obesity) stratified by Brazilian regions of 25.8% for boys and 25.2% for girls<sup>5</sup>.

The results of this study (Northern region) were approximated to the ERICA<sup>5</sup> research, being 22.7% of overweight for boys and 21.1% for girls. In other regions for both sexes, the prevalence was as follows: Northeast regions 24.0% and 24.5%, Central West 25% and 22.3%, Southeast 26.3% and 25.6% and South 29.4% and 30.1%, this shows a difference between sexes in the North, Midwest and Southeast where the boys predominated with higher prevalence, whereas in the Northeast and South regions the girls showed a higher overweight prevalence, particularly in the south of Brazil, already confirmed in other studies<sup>3,17,20</sup>.

In less developed regions or states, the proportion of overweight rises with higher economic class, in this study, overweight was significantly higher in the classes A and B. These results confirm the findings of other studies, that indicate that smaller and less economically favoured regions have a higher prevalence of overweight<sup>5,17</sup>. In developed countries the situation is reversed, with lower classes being more affected by being overweight<sup>1,2</sup>. The aforementioned authors try to explain this problem by the lower prevalence of overweight in the less favoured economic classes in the developing countries, by the lack of foods for a balanced diet of nutrients, associated to a greater energy expenditure during the day, in the higher income classes the frequency of excess weight becomes

greater because of the easy access to processed foods and sedentary behaviours (television, computer, video games and others).

The gross and adjusted analysis showed a significant association of the prevalence of overweight with private schools  $OR_b$  1.24 ( $CI_{95\%}$ : 1.04 to 1.49) and 1.21  $OR_{aj}$  ( $CI_{95\%}$ : 1.02 – 1.46), studies show an association between studying in the private network and presenting greater risks of being overweight. Campos *et al.*<sup>23</sup> found a prevalence of 23.9% in private schools and 18.0% in public schools in Fortaleza, Ceará, Brazil. The study of Benedet *et al.*<sup>24</sup> found a prevalence of 30.12% overweight in private schools and 22.03% in public schools, and after crude analysis private school remained associated with excess weight in adolescent males  $OR_b$  1.52 ( $CI_{95\%}$ : 1.05 – 2.20).

This positive association between overweight, private school and higher socioeconomic classes is apparently supported by these adolescents in the greater access to hypercaloric foods and sedentary behaviors<sup>25</sup>.

In this study, adolescents with excess weight had  $OR_{aj}$  1.27 ( $CI_{95\%}$ : 1.03 to 1.58) more likely to perceive their health unsatisfactorily. These results are similar to those found in other studies<sup>25,26</sup>.

Excess weight is associated with various adverse health outcomes caused by physical, social and emotional problems<sup>27</sup>. Thus, it is speculated that adolescents with excess body weight would already perceive negative implications on their health produced by this nutritional problem through their own perception of body image influenced by several negative factors, such as school, television, place of residence, where these environmental factors are favoured considered negative by bullying culture, caused by low esteem, unbalanced high-calorie diet, poor motivation for physical activity, compulsive electronic devices (television, computer, mobile phone, video games and others), making these adolescents adopt a sedentary behaviour, bringing as consequences widespread diseases such as obesity, dyslipidemia, hypertension, diabetes mellitus and others<sup>28,29</sup>.

As a result, adolescents with overweight may be

more likely to self-assess their health status negatively, because during the adolescent period they become more aware of their body appearance. In tropical countries like Brazil, teens who deviate from the socially determined “standard”, are more vulnerable to dissatisfaction with their body shape, perceiving themselves as having a poor quality of health<sup>25</sup>.

Regarding the limitations of the study, the transversal design made it impossible to identify the temporal relationship between the independent variables and excess weight. Another limitation is the use of self-reported information collected through a questionnaire.

Considering the results, it is recommended to implement guidance and intervention programmes to reduce sedentary lifestyles, and it is necessary to assist in planning preventive actions in relation to excess weight in public and private schools<sup>21</sup>.

The practice of physical activity associated with a healthy diet should be promoted, in addition to reducing sedentary behaviour, to prevent the development of overweight and obesity.

## CONCLUSION

The practice of physical activity associated with a diet should be encouraged, in addition to reducing sedentary behavior, to prevent the development of overweight and obesity.

## Authors' contributions

ES Farias participated in all stages of the article. JP Santos and MM Soares participated in all stages of the data collection of the research project, collaborated with the theoretical revision and writing of the article. KFA Moreira, IFB Gemelli and LGO Gonçalves participated in all stages of data collection of the research project, the critical review of the article and final approval to be published. OF Souza collaborated in the analysis and interpretation of the data and approval of the final version to be published.

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## Resumo

**Introdução:** O excesso de peso tem sido reportado como um problema de saúde pública. Por consequência, essa situação sugere a realização de estudos epidemiológicos voltados para a vigilância nutricional.

**Objetivo:** Analisar a prevalência e fatores associados ao excesso de peso entre escolares do ensino médio em Capital da Amazônia Ocidental Brasileira.

**Método:** Estudo descritivo transversal com 2694 adolescentes de escolas públicas e privadas. Foram coletadas informações demográficas, socioeconômica e comportamento sedentário por meio de questionário auto respondido. A classificação de excesso de peso seguiu as recomendações da Organização Mundial da Saúde (2007). Foram calculadas as prevalências, razão de chance e seus respectivos intervalos de confiança em 95%. Identificaram-se os fatores associados ao excesso de peso por regressão logística binária múltipla.

**Resultados:** A prevalência geral de excesso de peso foi 24,2%, sendo 26,3% para o sexo masculino e 22,4% para o feminino. Após análise ajustada os fatores associados ao excesso de peso foram classe econômica A/B (OR = 1,30; IC95%=1,02 – 1,45), tipo de escola privada (OR = 1,21; IC95%=1,02 – 1,46) e percepção de saúde insatisfatória (OR = 1,27; IC95%= 1,03 – 1,58). Concluiu-se que excesso de peso apresentou elevada prevalência em adolescentes de classe econômica A e B e escolas privadas de Porto Velho, RO, Brasil.

**Conclusão:** Portanto, a prática de atividade física associada uma dieta alimentar deve ser estimulada, além da redução ao comportamento sedentário, para prevenir o desenvolvimento de sobrepeso e obesidade.

**Palavras-chave:** estudantes, adolescentes, sobrepeso, atividade física

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