

Prevalence and factors associated with excess body weight in adolescents

Prevalência e fatores associados ao excesso de peso corporal em adolescentes

Prevalencia y factores asociados al exceso de peso corporal en adolescentes

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Keywords

Overweight; Obesity; Adolescent; Risk factors; Prevalence

Descritores

Sobrepeso; Obesidade; Adolescente; Fatores de risco; Prevalência

Descriptores

Sobrepeso; Obesidad; Adolescente; Factores de riesgo; Prevalencia

Subject

September 10, 2018

Accepted

June 4, 2019

Abstract

Objective: Analyze the prevalence of excess body weight in adolescents and associated factors.

Methods: Cross-sectional study involving 635 adolescents, male and female, between 10 and 16 years of age, in state-owned public schools. A multidisciplinary team collected the data in the second semester of 2016. Data on demographics, family history, pubertal development and behavioral habits were collected. The adolescents were classified by their nutritional status. Bivariate analysis and Poisson hierarchical multiple regression were applied, which revealed the association and the prevalence ratio between excess body weight and the other variables.

Results: The prevalence of excess weight was 32.8% of the adolescents, associated with a family history of dyslipidemia ($p=0.003$; $PR=1.474$; $95\%CI=1.139-1.907$) and alcohol consumption ($p=0.044$; $PR=1.430$; $95\%CI=1.009-2.028$). The remaining variables in this research were not associated with excess body weight.

Conclusion: High prevalence rates of excess body weight were found among the adolescents, associated with a family history of dyslipidemia and alcohol consumption.

Resumo

Objetivo: Analisar a prevalência de excesso de peso corporal em adolescentes e fatores associados.

Métodos: Estudo transversal conduzido com 635 adolescentes de ambos os sexos, com idade entre 10 e 16 anos, em escolas públicas estaduais. A coleta de dados foi realizada no segundo semestre de 2016 por uma equipe multidisciplinar. Coletou-se dados demográficos, da história familiar, desenvolvimento púbere e hábitos comportamentais. Foi feita a classificação dos adolescentes, conforme o estado nutricional. Utilizou-se a análise bivariada e a regressão múltipla hierarquizada de Poisson, o que possibilitou verificar a associação do excesso de peso corporal com as demais variáveis, bem como a razão de prevalência entre elas.

Resultados: A prevalência de excesso de peso foi de 32,8% dos adolescentes, associada a história familiar de dislipidemia ($p=0,003$; $RP=1,474$; $IC95\%= 1,139-1,907$) e a ingestão de álcool ($p=0,044$; $RP=1,430$; $IC95\%= 1,009-2,028$). As demais variáveis neste estudo não foram associadas ao EPC.

Conclusão: Verificou-se altas prevalências de excesso de peso corporal entre os adolescentes, associadas à história familiar de dislipidemia e ingestão de álcool.

Resumen

Objetivo: analizar la prevalencia del exceso de peso corporal en adolescentes y factores asociados.

Métodos: estudio transversal realizado con 635 adolescentes de ambos sexos, entre 10 y 16 años de edad, en escuelas públicas provinciales/ departamentales. La recolección de datos fue realizada en el segundo semestre de 2016 por un equipo multidisciplinario. Se recolectaron datos demográficos, antecedentes familiares, desarrollo de la pubertad y hábitos de comportamiento. Los adolescentes fueron clasificados según su estado nutricional. Se utilizó el análisis bivariado y la regresión múltiple jerárquica de Poisson, lo que permitió verificar la asociación del exceso de peso corporal con las demás variables, así como el motivo de prevalencia.

Resultados: se observó la prevalencia del exceso de peso en el 32,8% de los adolescentes, asociada a los antecedentes familiares de dislipidemia ($p=0,003$; $RP=1,474$; $IC95\%= 1,139-1,907$) y a la ingesta de alcohol ($p=0,044$; $RP=1,430$; $IC95\%= 1,009-2,028$). Las demás variables de este estudio no fueron asociadas al EPC.

Conclusión: se verificó una alta prevalencia de exceso de peso corporal entre los adolescentes, relacionada con antecedentes familiares de dislipidemia e ingesta de alcohol.

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DOI

<http://dx.doi.org/10.1590/1982-0194201900068>



How to cite:

Barbosa IA, Lopes JR, Camargos Filho MC, Dangelo MF, Pinho L, Brito MF, et al. Prevalence and factors associated with excess body weight in adolescents. Acta Paul Enferm. 2019;32(5):485-92.

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Interest conflicts: none to declare.

Introduction

Obesity is characterized by the atypical and excessive accumulation of body fat, damaging people's health and quality of life as it is related to higher early morbidity and mortality.⁽¹⁾ It is currently a relevant global public health concern and, amidst this scenario, the prevalence of excess body weight (EBW) in children and adolescents is also increasing, entailing health risks.⁽²⁾

In view of this reality, we found that adolescents with EBW are more prone to systemic arterial hypertension (SAH), dyslipidemias, metabolic syndrome, diabetes (DM), depression, low self-esteem, low academic performance and low quality of life. Likewise, these adolescents may become overweight adults with increased chances of morbidity and mortality due to cardiovascular diseases (CVD) and some types of cancer.⁽³⁾

In the United States, 17% of young people were obese in 2011-2014. The prevalence of obesity among children (6-11 years) amounted to 17.5% and among adolescents (12-19 years) 20.5%.⁽⁴⁾ In Sri Lanka, the prevalence of overweight among adolescents was 11.0% and obesity 2.4%; in India, 19.0% of overweight and, in Pakistan, 11.0% of obesity.⁽⁵⁾ In Brazil, approximately 23.7% of adolescents suffered from EBW, and 8.3% of male and 3% of female adolescents were obese.⁽⁶⁾ In the Brazilian Southeast, in a recent systematic review of overweight and obesity rates in children and adolescents in the Brazilian macro-regions, the prevalence was 41.3%, lower only than in the South (43.8%).⁽⁷⁾

The EBW is notorious for its multifactorial etiology, and seems to be more strongly associated with behavioral than biological factors,⁽⁸⁾ suggesting lifestyle as a determinant factor of health status,^(8,9) as well as the family, social and school environments.⁽¹⁰⁾ Considering that children and adolescents between the ages of 7 and 14 should be in a school environment,⁽¹¹⁾ a considerable part of their time is spent in school, which makes it an attractive place to investigate EBW. In view of the above, this study aims to analyze the prevalence of EBW in adolescents and associated factors.

Methods

This cross-sectional study was carried out with adolescents, male and female (10 and 16 years old), enrolled in basic (5th to 9th grade) and secondary education (1st and 2nd year) in the city of Montes Claros, Minas Gerais, Brazil. The city has a total of 77,833 students enrolled in basic and secondary education.⁽¹²⁾ The sample size aimed to reach an estimate of population parameters with a prevalence of 0.50, and consequently, a larger sample size. A confidence level of 95% was adopted, with a 5% significance level 5%. The corrections for finite populations and for the design effect were executed, with design effect equal to 1.5. A 10% increase was also established to minimize possible losses and refusals. A sample of 634 adolescents was estimated.

A two-stage cluster sampling process was adopted. In the first stage, five schools were selected to represent the four regions of the city (North, South, East and West), by sampling proportional to the size. The eligibility criteria of the schools were: (i) state-owned public, (ii) basic and secondary school level, (iii) not currently participating in any physical or health activity intervention. In the second stage, adolescents were drawn in all classes of the selected schools, based on the attendance list, by simple random sampling. Teens who were absent during the draw were replaced by others who preceded or followed them on the school attendance list and who agreed to participate in the survey.

Adolescents who reported important significant inflammatory and infectious kidney disease, liver and hematological disease, using drugs that affect the metabolic and hemodynamic profile, pregnant adolescents and those who did not attend for data collection were excluded from the study. According to the established criteria, the final sample consisted of 635 adolescents with proportionality for sex and age and representative of the population, net of losses.

The directors of the selected schools received information about the study and agreed to participate in the research. Parents and / or guardians and

adolescents signed consent and informed consent forms, respectively, to participate in the survey. A multidisciplinary team collected the data at the schools in the second half of 2016.

The team was trained and calibrated. The results were submitted to the kappa coefficient, showing satisfactory levels of intra and inter-rater agreement ($Kappa \geq 0.60$), beyond chance.

The weight of the adolescents was measured using portable digital scales with capacity of 150kg, precision of 0.1kg (Body complete model, with 8 electrodes and interface model BF 100 - Beurer). To measure height, we used a portable stadiometer with a folding measuring rod and support tripod, measuring capacity from 115cm to 210cm, tolerance: ± 2 mm at 210cm, and resolution in millimeters (Sanny professional model). Height (cm) and weight (kg) measures were used to calculate BMI (weight (kg) / height (m^2)). In order to classify the adolescents in terms of EBW, WHO parameters (score $Z \geq 1$) for age and sex were used.⁽¹³⁾

To evaluate the metabolic parameters for total cholesterol (TC), low density lipoprotein (LDL), high density lipoprotein (HDL) and triglycerides (TG), the adolescents fasted for 12 hours, after which specialized technicians of a reference laboratory took peripheral venous blood samples. The biochemical tests were performed using the Labtest® Labmax Laben® automatic analyzer. The enzyme kit - Trinder was used to measure the levels of CT, TG and HDL. LDL was calculated using the Friedewald equation: $LDL = \text{total cholesterol} - (\text{HDL} + \text{triglyceride}/5)$, and enzymatic colorimetric method. The cut-off points used to evaluate the serum levels of these components followed recommendations in the current literature:^(14,15) for individuals 0-19 years old - CT: desirable <170 mg/dL; borderline 170-199mg/dL; high > 200 mg/dL; LDL: desirable <110 mg/dL; borderline 110-129mg/dL; high > 130 mg/dL; HDL: desirable > 45 mg/dL; borderline 40-45mg/dL; TG: desirable <90 mg/dL; borderline 90-129mg/dL; high > 150 mg/dL. In this study, the parameters of CT, LDL and TG were categorized as desirable and undesirable (borderline

and high) and HDL as desirable and undesirable (borderline).

A previously tested questionnaire was applied to collect information among the adolescents, containing self-reported questions about:

- Demographics: sex (male/ female) and age (10 to 13 years / 14 to 16 years);
- Family history: obesity and dyslipidemia (yes / no);
- Pubertal development: sexual maturation assessed through the following questions (a) Have you already got your first period?; (b) Has your voice already deepened? (yes / no);
- Behavioral habits: alcohol consumption (yes / no); food consumption assessed by means of questions adapted from the Ministry of Health "Food test":⁽¹⁶⁾ "Consumption of sweets (sweets of any kind, filled cakes with icing and sweet cookies, soft drinks and processed juices) more than twice per week (yes / no); consumption of ultra-processed foods (fried foods, fried snacks or crisps, salted meats, hamburgers, hams and sausages) more than twice per week (yes / no); physical exercise assessed by means of the International Physical Activity Questionnaire (IPAQ) short version, classified as sedentary, insufficiently active A, insufficiently active B, active, highly active, ranked in this study as sedentary (sedentary, insufficiently active A, insufficiently active B) and active (active, highly active).

The dependent research variable was EBW and the independent variables were organized as follows:

1. Demographic characteristics: sex, age;
2. Family history: obesity and dyslipidemia;
3. Pubertal development: sexual maturation;
4. Lipid profile: CT, LDL, HDL, TG;
5. Behavioral habits: alcohol consumption, food consumption and physical exercise.

Based on the organization of the variables into levels, the following hierarchical model was raised for this study (Figure 1).

The descriptive analysis of the independent variables was carried out using simple and relative frequencies. Then, the bivariate analyses were performed between the outcome variable (EBW)

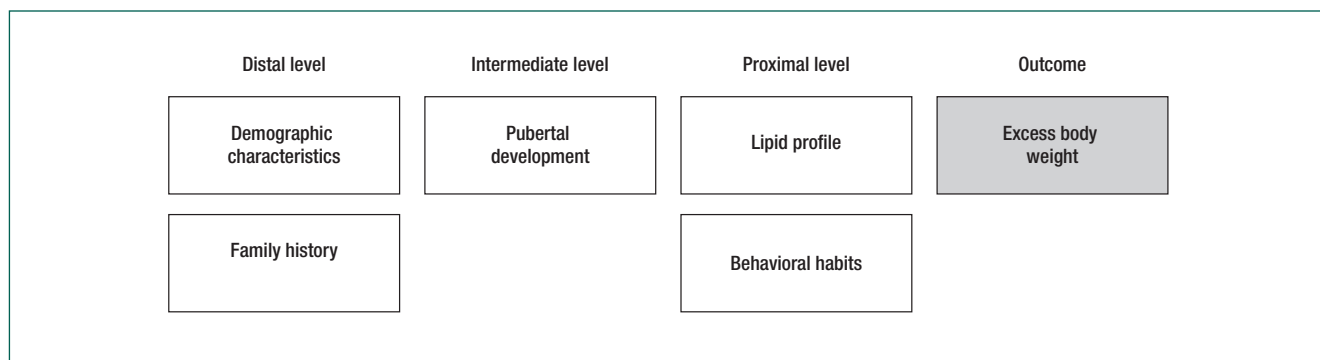


Figure 1. Hierarchized model of determinants of excess body weight in adolescents

and each independent variable (demographic characteristics, family history, pubertal development, behavioral habits, lipid profile), adopting the Poisson hierarchical multiple regression model with robust variance. The crude prevalence ratios (PR) were estimated with their respective 95% confidence intervals. Variables that presented descriptive level (*p*-value) of up to 20% were selected for multiple analysis. In this analysis, the hierarchical Poisson regression model was used. For this model, the scheme presented in Figure 1 was composed of blocks of variables at the distal (demographic variables and family history), intermediate (pubertal development) and proximal (behavioral habits and lipid profile) levels. The design effect was corrected.

The distal-level blocks were the first to be included in the model, remaining as an adjustment factors for the intermediate and proximal determinants. Subsequently, the variables of the intermediate level were included, remaining as adjustment factor for the variables of the proximal level. Finally, the variables of the proximal level were included. At all levels, only those variables with a descriptive level of $p < 0.05$ remained in the model, after adjusting for the variables of the previous levels. Adjusted prevalence ratios (PR) with their respective 95% confidence intervals were estimated. The statistical program used in the analyses was the Statistical Package for the Social Sciences (SPSS version 20.0). This study received approval from the research ethics committee of the State University of Montes Claros under number 1.503.680.

Results

In total, 635 adolescents participated in the study, the majority being female (60.9%), with a mean age of 13.8 (SD = ± 1.7) years. A family history of obesity and dyslipidemia was reported by 33.8% and 15.3% of respondents, respectively. Among the adolescents, 74.3% reported sexual maturation. As for the lipid profile, 50.9% presented undesirable CT. Regarding behavioral habits, 72.0% confirmed the consumption of sweets and 85.3% of ultra-processed foods (Table 1). The prevalence of EBW among adolescents was 32.8%.

In the bivariate analysis of demographic characteristics, there was a statistical association at 20% of EBW for the variables: sex ($p = 0.065$), family history of obesity ($p = 0.163$) and dyslipidemia ($p = 0.002$). The following characteristic of pubertal development was statistically associated with the outcome variable: sexual maturation ($p = 0.074$). Regarding the lipid profile, LDL ($p = 0.050$) and HDL ($p = 0.050$) parameters were associated with the outcome. Regarding the variables related to behavioral habits, the association between EBW and alcohol consumption remained significant ($p = 0.030$) (Table 1).

When the effect of the independent variables was analyzed using Poisson hierarchical multiple regression over EBW, the association with a family history of dyslipidemia ($p=0.003$; PR=1.474; 95%CI=1.139-1.907) and alcohol consumption ($p=0.044$; PR=1.430; 95%CI=1.009-2.028).

Table 1. Descriptive and bivariate analysis between excess body weight and demographic characteristics, family history, pubertal development, lipid profile, behavioral habits of adolescents between 10 and 16 years of age from state-owned public schools in Montes Claros, Minas Gerais, Brazil, 2016 (N = 635).

Variables	Total n(%'a)	EBW n(%'b)	PR	95% CI	p-value
Distal Level					
<i>Demographic characteristics</i>					
Sex					0,065
Male	253(39.1)	72(27.8)	1		
Female	382(60.9)	136(35.0)	1.258	0.986-1.604	
Age					0,659
10 to 13 years	261(40.8)	89(31.5)	1		
14 to 16 years	374(59.2)	119(33.2)	0.949	0.754-1.195	
<i>Family history</i>					
Obesity					0,163
No	408(66.2)	125(30.2)	1		
Yes	222(33.8)	80(35.6)	1.180	0.935-1.490	
Dyslipidemia					0,002
No	531(84.7)	161(29.7)	1		
Yes	99(15.3)	44(44.7)	1.505	1.162-1.949	
Intermediate Level					
<i>Pubertal development</i>					
Sexual maturation					0,074
No	161(25.7)	43(26.3)	1		
Yes	473(74.3)	165(34.3)	1.302	0.975-1.740	
Proximal Level					
<i>Lipid profile</i>					
CT					0,219
Desirable	307(49.1)	92(29.8)	1		
Undesirable	228(50.9)	116(34.4)	1.155	0.918-1.454	
LDL					0,050
Desirable	376(59.2)	136(31.9)	1		
Undesirable	259(40.8)	72(33.0)	0.784	0.615-1.000	
HDL					0,050
Desirable	376(59.2)	136(35.3)	1		
Undesirable	259(40.8)	72(27.7)	0.784	0.615-1.000	
TG					0,541
Desirable	418(65.9)	141(33.0)	1		
Undesirable	217(34.1)	67(30.6)	0.926	0.725-1.184	
<i>Behavioral habits</i>					
Physical activity					0,978
Active	292(46.2)	94(32.2)	1		
Sedentary	343(53.8)	114(32.1)	0.997	0.793-1.253	
Alcohol consumption					0,030
No	589(93.5)	187(31.2)	1		
Yes	41(6.5)	19(46.2)	1.485	1.040-2.120	
Consumption of sweets					0,225
No	171(28.0)	49(28.2)	1		
Yes	452(72.0)	154(33.5)	1.186	0.901-1.561	
Consumption of ultra-processed foods					0,263
No	93(14.7)	25(26.8)	1		
Yes	529(85.3)	178(33.0)	1.230	0.856-1.766	

PR – Prevalence Ratio; CI – Confidence Interval; † – percentage corrected by design effect; a – percentage totaling 100% in column; b – percentage totaling 100% in line

Discussion

As verified, 32.8% of the adolescents presented excess body weight, associated with a family history of dyslipidemia and alcohol intake. The other variables in this study were not associated to EBW.

In the United States, higher prevalence rates of EBW were found in the United States in the states of Arkansas (37.5%), Mississippi (44.5%) and Georgia (37.3%),⁽¹⁷⁾ as well as in China, 33.2%.⁽¹⁸⁾ This prevalence rate corresponded to 27% in Australia,⁽¹⁹⁾ 14 to 28% in Europe,⁽²⁰⁾ and 18.9% of overweight and 8.6% of obesity in Syria for populations of adolescents.⁽²¹⁾

In Brazil, it was observed that excess weight rates among adolescents have increased uninterruptedly in the last 34 years. Among adolescent males, the presence of overweight increased from 3.7% (1974-75) to 21.7% (2008-09); in female adolescents, from 7.6% to 19.4% in the same age group. The same was observed for obesity, from 0.4% to 5.9% in the male adolescents and from 0.7% to 4.0% in the female adolescents when comparing the same periods.⁽⁶⁾ In another study also carried out with adolescents from municipal schools in the city of Montes Claros, it was observed that 18.5% of the surveyed individuals presented EBW.⁽²²⁾ Research found 29.5% of EBW in Rio Branco-AC,⁽²³⁾ 27.6% in Porto Alegre-RS,⁽²⁴⁾ 21.2% in Goiânia-GO,⁽²⁵⁾ 20.8% in João Pessoa-PB.⁽²⁶⁾ Given the multifactorial genesis of obesity, in that not only genetic factors, but also environmental and behavioral variables seem to influence its onset, the variable observed prevalence between different regions can probably be justified.⁽²⁷⁾

In this study, the association of sex with EBW was not observed. In the literature, however, it is reported that the increase in EBW in female adolescents may be due to the fact that they are close to puberty⁽²⁸⁾ and accumulate a much higher percentage of fat and less lean mass than male adolescents.⁽²⁹⁾

The presence of a family history of dyslipidemia in this study was significantly associated with EBW. Particularities of the domestic environment have been referred to as being relevant in the etiology

of chronic diseases, as they may influence healthy or unhealthy lifestyles.⁽³⁰⁾ Full independence is still a future expectation for most adolescents and the guidance received from the parents tends to influence the way they perceive themselves.⁽³¹⁾

According to the literature, the sole fact that adolescents suffer from EBW favors the adverse lipid profile.⁽³²⁾ If they present family members with a family history of hypercholesterolemia and / or premature coronary artery disease (men <55 years or women <65 years) and the adolescents suffer, among others, from SAH, DM, smoking, obesity or atherosclerotic disease, they become candidates for the screening for familial hypercholesterolemia as a preventive measure for atherosclerosis.⁽¹⁶⁾ Thus, paying attention to the lipid profile of adolescents and their relatives becomes justifiable. There are few studies that evaluate these conditions together though.

The lipid profile of the adolescents was not associated with EBW in this research. A study with adolescents from Paraná did not find a significant association either between the lipid parameters of adolescents classified as overweight.⁽³³⁾

An association between physical activity and EBW was expected, which was not confirmed in this study. Research conducted with Portuguese students found that overweight and obese students are relatively un-active. Body weight is related to physical fitness rates, so that overweight and obese individuals are more likely to be unfit.⁽³⁴⁾ In this study, the IPAQ short version was used to evaluate the physical activity. Authors argue that this instrument still needs adjustments for the sake of application to younger adolescents in order to improve the validity indicators.⁽³⁵⁾ Nevertheless, IPAQ has the advantage of being widely used in studies, which permits the comparability of the data.

Alcohol consumption was associated with EBW among the adolescents surveyed. The most common age among adolescents to test alcohol is around the age of 12.⁽³⁶⁾ In this period of life, alcohol consumption tends to increase due to the intensification of group activities. Considering the physiological peculiarities of adolescence and the fact that these youngsters are in school, any amount of alcohol in-

take, however small, will constitute a threat to the adolescents' balance and good health.⁽³⁸⁾ Alcoholic beverages are highly caloric and can interfere with appetite and weight gain.

The food consumption of sweets and ultra-processed foods was not associated with EBW. The eating habits of adolescents, high in fat, sugar and sodium and low in vitamins and minerals, may contribute to the increase of chronic noncommunicable diseases such as overweight and obesity.^(1,22) The diverging results may be due to the measuring of food consumption data.

The different methodologies and classifications of variables related to family history, pubertal development, lipid profile and behavioral habits may have influenced the comparison of the results.

This study should be interpreted in the light of some limitations. The sample was obtained with schoolchildren from the public network, so the results should be viewed with caution for the purpose of extrapolation to other groups of adolescents in different contexts, although in the same region. The data for the variable sexual maturation were obtained without physical evaluation of the adolescents; the information about alcohol consumption and eating habits was based on self-report, which may have generated bias due to inaccurate information, embarrassment, and memory. It should be noted, however, that this study used a representative sample of the population, obtained in a probabilistic way.

Actions to prevent EBW and associated factors are desirable. In this sense, nursing plays an important role because they are close to the health service users, including adolescents, and can implement actions involving this clientele for the purpose of prevention of weight control and alcohol intake and screening for family history of dyslipidemias.

The nurse can engage in individual or collective educational activities on behavioral habits in adolescence in Primary Health Care (PHC). Nursing consultations with adolescents in PHC should be prioritized and should consider the sociocultural, behavioral and family context in the prevention and control of excess weight.

Conclusion

These findings alert to the high prevalence rates of EBW among adolescents in the state-owned public education network in Montes Claros, associated with the family antecedents of dyslipidemia and alcohol consumption.

Collaborations

Barbosa IA, Lopes JR, Camargos Filho MCO, Dangelo MFSV, Pinho L, Brito MFSE, Barbosa DA and Silva CSO were responsible for the project design, writing of the article, data analysis and interpretation, relevant critical review of the intellectual content and contributed to the final approval of the version for publication. They assume responsibility for the entire study, guaranteeing its precision and integrity.

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