Artículo Original / Original Article

The omission of meals is associated with excess weight in adolescents

La omisión de comidas está asociada al exceso de peso en adolescentes

ABSTRACT

The aim of this study was to investigate the association between skipping meals and excess weight in adolescents. This study used a secondary database based on cross-sectional research. Weight and height were measured for the classification of nutritional status and the omission of meals was determined from the 24-hour food record. Statistical analyses were performed on a sample stratified by age from 10 to 13 years and 14 to 19 years. There was a high prevalence of excess weight (overweight and obesity) in the sample and a high frequency of meal omission among adolescents. The omission of lunch and dinner among adolescents between 14 and 19 years and those between 10 to 13 years, respectively, was directly associated with excess weight.
Keywords: Adolescent; Meals; Obesity; Overweight.

RESUMEN

El objetivo de este estudio fue investigar la asociación entre omisión de comidas y condición de exceso de peso en adolescentes. Este es un estudio con datos secundarios de una investigación transversal. El peso y la altura se midieron para clasificar el estado nutricional y la omisión de las comidas se determinó a partir del registro de alimentos de 24 horas. Los análisis estadísticos se realizaron en una muestra estratificada por edad de 10 a 13 años y de 14 a 19 años. Hubo una alta prevalencia de exceso de peso en la muestra y una alta frecuencia de omisión de comidas entre los adolescentes. La omisión del almuerzo y la cena, en los rangos de 14 a 19 años y de 10 a 13 años, respectivamente, se asoció directamente con el exceso de peso.
Palabras clave: Adolescentes; Comidas; Obesidad; Sobrepeso.

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INTRODUCTION

Globally, the number of obese children and adolescents grew more than ten times, from 11 million in 1975 to 124 million in 2016, in addition to another 213 million children with overweight. These data were presented in a study of approximately 31.5 million children and adolescents aged 5 to 19 years, in which Body Mass Index (BMI) and obesity was evaluated in the last four decades[1].

In Brazil, analyses of adolescent nutritional status in the Family Budget Surveys (POFs) from 2002 to 2003[2] and 2008 to 2009[3] showed that the prevalence of excess weight (overweight and obesity) increased from 16.7 to 20.5% and that of obesity, from 2.3 to 4.9%. In 2015, according to the National School Health Survey, the prevalence of excess weight was 23.7%, which corresponds to an estimated total of 3 million students aged 13 to 17 years[4].

Excessive weight gain in adolescence is a significant risk factor for overweight and obesity in adulthood[5], in

addition to being associated with early onset of chronic non-communicable diseases such as hypertension, cancer and type 2 diabetes[6,7].

Adolescence is a transition phase between childhood and adulthood, where intense biopsychosocial changes occur so that excess weight may be related to common behavioral factors in this age group, such as inappropriate eating practices[8].

Maintaining main meals has been shown to have a protective effect for excess weight regardless of sociodemographic variables[9]. In contrast, most research has focused only on studying the omission of breakfast and neglecting other main meals, such as lunch and dinner[10,11].

Adolescents are an important demographic group to search for strategies that favor early prevention and intervention against excess weight. As a result, this study aimed to investigate the association between skipping meals and excess weight among adolescents in the city of Fortaleza, Ceará/Brazil.

MATERIALS AND METHODS

This is a study with secondary data based on cross-sectional research, carried out in the municipal schools of Fortaleza – Ceará in 2015.

The school population was stratified as to the local division of health services into six regions called "Regional Executive Secretary " (RES),, from I to VI. The sample was calculated using a formula for a finite population[12], considering a sampling error of 3% and a significance level of 5%. The outcome used was from the original research considering a prevalence of 15% dyslipidemia among students. The initial sample consisted of 1022 students and 812 satisfactorily completed data collection.

Adolescents of both sexes, aged 10 to 19 years, who were at school on the day of collection and who brought the informed consent signed by a guardian were included. Adolescents who did not answer any questions or did not complete data collection and adolescents with disabilities (physical or mental) and infectious diseases were excluded from the study.

Two previously trained nutritionists collected the data. Anthropometric measurements were taken in the morning. Body weight was measured on a calibrated electronic scale (Sanny®), with a maximum capacity of 150 kg, and a sensitivity of 100 g. Adolescents were instructed to stand on the center of the platform and remain in an orthostatic position, barefoot, and wearing light clothes.

Height was measured by a rigid stadiometer, with the adolescent in an orthostatic position with feet together, barefoot, in inspiratory apnea and with the head oriented at 90° according to the Frankfurt plane, remaining with the heel surfaces,

pelvic girdle, scapular girdle, and occipital region in contact with the device.

Excess weight (overweight plus obesity) was determined based on Body Mass Index (BMI) values, adopting the growth curves of the World Health Organization[13] with a cutoff point for overweight of BMI z-score for age ≥1.

The consumption or omission of meals was determined from the 24-hour food recall collected per meal: breakfast, morning snack, lunch, afternoon snack, dinner, and supper, where the individual informed whether or not each meal had been eaten. The absence of food during breakfast, lunch, and dinner was considered an omission of the meal. Sociodemographic variables were not investigated.

Statistical analyses were performed on a sample stratified by age from 10 to 13 years and 14 to 19 years, using the median, 13 (12-14) years, as the cutoff point. The Shapiro-Wilk test verified the normality of the data. The Pearson's chi-square test was utilized to analyze associations between sex, excess weight and skipping meals stratified by age. To analyze the association between skipping meals (breakfast, lunch, and dinner) and excess weight, crude and sex -adjusted Poisson regression was used. Values of $p <0.05$ were considered statistically significant. Analyses were performed using Stata® version 13.

The research is part of a project called "Dyslipidemia and eating practices in adolescents in Fortaleza", which was approved by the Ethics Committee of Hospital Infantil Albert Sabin, number 327851. The authorization for data collection was provided through the signature of the person responsible for the adolescent in the Free and Informed Consent Form, which detailed the stages of the study, as well as its objectives, risks and benefits.

RESULTS

The primary sample contained 812 adolescents, and 56.8% were girls. The group had a median age of 13 (12-14) years, with 62.9% were 10 to 13 years of age. Excess weight was observed in 32% of adolescents, which was higher between 10-13 years (p= 0.001) and did not differ by sex (p = 0.297). The meal that was most frequently omitted was breakfast (42.6%), followed by dinner (13.7%), and finally lunch (9.6%) (Table 1).

Table 2 shows the crude and sex-adjusted Poisson regression analysis. Between 10 and 13 years old, adolescents who skipped dinner showed a higher prevalence of excess weight, even after adjusting for sex (PR= 1.1; 95% CI: 1.01-1.20; p = 0.034). In the group 14 to 19 years old, the association occurred with the omission of lunch. Adolescents who omitted this meal presented a 1.15 times higher prevalence of excess weight compared to those who consumed lunch (PR= 1.15; 95% CI: 1.01-1.31; p= 0.037).

Table 1. Sex distribution, excess weight and omission of meals, stratified by adolescent age group. Municipal Schools of Fortaleza, CE, 2015.

Variables	Total sample (N= 812)		10 to 13 years (N= 511)		14 to 19 years (N= 301)		
	N	%	N	%	N	%	p
Sex							
Female	461	56.8	283	55.4	178	59.1	0.297
Male	351	43.2	228	44.6	123	40.9	
Excess weight							
Without excess	552	68.0	326	63.8	226	75.1	0.001*
With excess	260	32.0	185	36.2	75	24.9	
Omission of meals							
Breakfast							
Consumed	466	57.4	294	57.5	172	57.1	0.913
Omitted	346	42.6	217	42.5	129	42.9	
Lunch							
Consumed	734	90.4	462	90.4	272	90.4	0.983
Omitted	78	9.6	49	9.6	29	9.6	
Dinner							
Consumed	701	86.3	448	87.7	253	84.1	
Omitted	111	13.7	63	12.3	48	16.0	0.147

N: frequency of participants; %: percentage; p: p-value ($p<0.05$). Pearson's chi square test.

Table 2. Association, crude and adjusted by sex, between meal omission and excess weight among adolescents. Municipal Schools of Fortaleza, CE, 2015.

Meals		Excess Weight			
		10 to 13 years		14 to 19 years	
		Crude	Adjusted	Crude	Adjusted
Breakfast					
Consumed		Ref.	Ref.	Ref.	Ref.
Omitted	p	0.116	0.088	0.969	0.788
	PR	1.05	1.05	1.00	0.99
	CI 95%	0.99-1.12	0.99-1.12	0.91-1.09	0.91-1.07
Lunch					
Consumed		Ref.	Ref.	Ref.	Ref.
Omitted	p	0.694	0.962	0.031	0.037*
	PR	1.01	1.00	1.08	1.15
	CI 95%	0.96-1.06	0.91-1.11	1.00-1.17	1.01-1.31
Dinner					
Consumed		Ref.	Ref.	Ref.	Ref.
	p	0.044	0.034*	0.149	0.112
Omitted	PR	1.06	1.10	0.94	0.92
	CI 95%	1.00-1.11	1.01-1.20	0.87-1.01	0.83-1.02

Ref.: Reference; p: p-value ($p<0.05$); PR: Prevalence Ratio; CI: Confidence Interval. Poisson's Regression analysis was used with robust variance estimation.

DISCUSSION

The results of the present study showed a high prevalence of excess weight (32%) in adolescents, higher than that found in the Macro-regions of Brazil: North (20.7%), Northeast (19.1%), Southeast (23.5%), South (25.6%) and Midwest (22.8%), according to data from the National School Health Survey (2015)[4]. According to Santos and collaborators[14], changes in the pattern of eating and sedentary behavior, resulting from the epidemiological and nutritional transition, resulted in an accelerated increase in overweight and obesity among Brazilian adolescents.

The practice of skipping meals was higher during breakfast, followed by dinner and lunch. Estima et al.[15] found similar results, and the prevalence of excess weight among adolescents was higher in the stratum with unsatisfactory meal consumption patterns, that is, in those who omitted more meals throughout the week.

The prevalence of omission of lunch was less than 10%; however, in the group aged 14 to 19 years, it was directly associated with excess weight. Although it is one of the main meals, there are few studies investigating its omission and association with nutritional status. This is probably due to the low prevalence found[15,16,17].

At dinner, omission was the second biggest, and in the 10 to 13 age group, skipping lunch was associated with excess weight. A study carried out in Belgium found the same association[18]. A study with Iranian teenagers found that skipping dinner increased the chance for cardiovascular risk factors, such as excess weight and abdominal obesity, which remained significant after adjusting for sex, age, socioeconomic status, physical activity and smoking[19]. Dinner consumption is often neglected, and few studies have investigated its omission concerning other variables.

It is possible that some teenagers eat small meals that they do not recognize as dinner. Teixeira and other authors[20] found a high prevalence of substituting dinner for snacks in obese adolescents. Most of the substitutes had a high energy density and low nutritional value.

According to Leal et al.[17], the omission of lunch and dinner can compromise the adequate intake of iron, since the foods present in the groups of beans and meats, commonly consumed in these meals are important sources of iron, and would not be eaten at other times of the day.

Excess weight contributes to iron deficiency due to the circulating increase in hepcidin levels that restricts the intestinal absorption of iron and its release by macrophages[21].

In adolescence, there is an increased need for iron, and its deficiency causes short and long-term damage to neuropsychomotor development, learning capacity, appetite, growth, in addition to compromising immune system response[22].

In the present study, a high percentage (42.6%) of breakfast omission stands out, higher than that found in other cities in Brazil[15,17,23,24,25,26,27], but it is worth mentioning that no studies have been conducted in the North and Northeast regions.

A study using data from the National School Health Survey (2012) found that 38% of adolescents did not eat breakfast regularly, which was associated with a higher likelihood of having other inappropriate eating habits, such as a diet low in fruits and vegetables and rich in sugars and fried foods[28]. Worldwide, as shown in a review of 39 studies with 286.804 children and adolescents from 33 countries, the prevalence of breakfast omission ranged from 10 to 30%, with an increasing trend in adolescents[29].

Regarding the contribution of energy and nutrients, breakfast is irrefutably important[30]. Regular breakfast consumption is associated with an increased likelihood of ingesting key food groups, such as fruits, dairy products, and dietary fiber, which are usually eaten for breakfast; besides, they are more likely to meet recommendations for micronutrients and have other positive health-related behaviors, such as physical activity and sleeping more than 8 hours/night[30,31,32].

In the present study, no association was found between breakfast omission and excess weight. According to Affenito[33], the relationship between breakfast and BMI may vary according to the methodology used in each study. Analyses adjusted for lifestyle and food habits, in addition to multiple measurements of food consumption, are necessary to investigate this association further. Breakfast can be composed of food of low nutritional quality and can be consumed by overweight adolescents. According to the 2017-2018 Family Budget Survey[34], the consumption of fruits, vegetables and dairy products in our region is deficient and therefore breakfast consumption may not provide a protective effect. This cross-sectional study aimed at relating meal omission to excess weight does not allow us to state the causes of the associations investigated.

The present study has as limitations the impossibility of establishing a causal relationship due to the cross-sectional nature of the design. A single food record was used, but that did not weaken the study, given the large sample size and dietary qualitative analysis. No other socioeconomic and lifestyle variables were investigated, however models were adjusted for sex and age, which are directly associated with food consumption.

Finally, the study made a significant contribution to elucidating the eating profiles of adolescents in Northeast Brazil, demonstrating the importance of large meals such as lunch and dinner and their influence on excess weight for this population.

CONCLUSIONS

There was a high prevalence of excess weight in the sample and a high frequency of omission of meals among adolescents. The omission of lunch and dinner among

adolescents 14-19 years and 10-13 years, respectively, was directly associated with excess weight.

REFERENCES

1. NCD Risk Factor Collaboration. Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128.9 million children, adolescents, and adults. Lancet 2017; 390: 2627-2642.
2. Brazil. Brazilian Institute of Geography and Statistics. Family Budget Survey 2002-2003: anthropometry and analysis of the nutritional status of children and adolescents in Brazil. Rio de Janeiro, 2006.
3. Brazil. Brazilian Institute of Geography and Statistics. Family Budget Survey 2008-2009: anthropometry and nutritional status of children, adolescents and adults in Brazil. Rio de Janeiro, 2010.
4. Brazil. Brazilian Institute of Geography and Statistics. National School Health Survey: 2015. Rio de Janeiro, 2016.
5. Singh AS, Mulder C, Twisk JW, Van Mechelen W, Chinapaw MJ. Tracking of childhood overweight into adulthood: a systematic review of the literature. Obes Rev. 2008; 9: 474-88.
6. Abdullah A, Wolfe R, Stoelwinder JU, Courten M, Stevenson C, Walls HL, et al. The number of years lived with obesity and the risk of all-cause and cause-specific mortality. Int J Epidemiol. 2011; 40: 985-96.
7. Park MH, Falconer C, Viner RM, Kinra S. The impact of childhood obesity on morbidity and mortality in adulthood: a systematic review. Obes Rev. 2012; 13: 985-1000.
8. Cardoso LO, Engstrom EM, Leite IC, Castro IRR. Socioeconomic, demographic, environmental and behavioral factors associated with overweight in adolescents: a systematic review of the literature. Rev Bras Epidemiol. 2009; 12: 378-403.
9. Benedet J, Assis MAA, Calvo MCM, Andrade DF. Excess weight in adolescents: exploring potential risk factors. Rev Paul Pediatr. 2013; 31: 172-181.
10. Pendergast FJ, Livingstone KM, Worsley A, McNaughton SA. Correlates of meal skipping in young adults: a systematic review. Int J Behav Nutr Phys Act. 2016; 13: 125.
11. Adolphus K, Bellissimo N, Lawton CL, Ford NA, Rains TM, Totosy de Zepetnek J, et al. Methodological challenges in studies examining the effects of breakfast on cognitive performance and appetite in children and adolescents. Adv Nutr. 2017; 8: 184S-196S.
12. Casella G, Berger RL. Statistical Inference. Cengage Learning, São Paulo, 2010.
13. World Health Organization. Growth reference 5-19 years. Available in: https://www.who.int/growthref/who2007_bmi_for_age
14. Santos DS, Carneiro MS, Silva SCME, Aires CN, Carvalho LJS, Costa LCB. Nutritional transition in adolescence: an approach of the last 10 years. REAS/ EJCH 2019; 20: e477.
15. Estima CCP, Costa RS, Sichieri R, Pereira RA, Veiga GV. Meal consumption patterns and anthropometric measurements in adolescents from a low socioeconomic neighborhood in the metropolitan area of Rio de Janeiro, Brazil. Appetite 2009; 52: 735-739.
16. Berta EE, Leaks VA, Walz F, Martinelli MI. Nutritional status of school children and its relationship to breakfast habit and quality. Rev Chil Nutr. 2015; 42: 45-52.
17. Leal GVS, Philippi ST, Matsudo SMM, Toassa EC. Food consumption and meal patterns of adolescents, São Paulo, Brazil. Rev Bras Epidemiol. 2010; 13: 457-467.
18. Vanderhulst E, Faik A, Vansintejan J, Van Rossem I, Devroey D. Association of dietary habits and interest for food and science versus weight status in children aged 8 to 18 years. J Obes. 2018; 2018: 1-7.
19. Azadbakht L, Akbari F, Qorbani M, Esmaeil Motlagh M, Ardalan G, Heshmat R, et al. Dinner consumption and cardiovascular disease risk factors among a nationally representative sample of Iranian adolescents: the CASPIAN-III Study. J Cardiovasc Thorac Res. 2019; 11: 138-146.
20. Teixeira AS, Philippi ST, Leal GV, Araki EL, Estima CC, Guerreiro RE. Replacement of meals with snacks in teenagers. Rev Paul Pediatr. 2012; 30: 330-337.
21. Hutchinson C. A review of iron studies in overweight and obese children and adolescents: a double burden in the young? Eur J Nutr. 2016; 55: 2179-2197.
22. MP Guaranteed, Pitta TS, JDA Sheep. Iron deficiency in adolescence. Rev Bras Hematol Hemoter. 2010; 32: 45-48.
23. Costa MCD, Junior LC, Matsuo T. Eating habit of teenage schoolchildren in a western Paraná municipality. Rev Nutr. 2007; 20: 461-471.
24. Silva FA, Candiá SM, Pequeno MS, Sartorelli DS, Mendes LL, Oliveira RMS, et al. Frequency of daily meals and associated variables in children and adolescents. J Pediatr. 2017; 93: 79-86.
25. Fiuza RFP, Muraro AP, Rodrigues PRM, Sena SEM, Ferreira MG. Skipping breakfast and associated factors among Brazilian adolescents. Rev Nutr. 2017; 30: 615-626.
26. Marchioni DML, Gorgulho BM, Teixeira JA, Verly Junior E, Fisberg RM. Prevalence of breakfast omission and its associated factors in adolescents in São Paulo: ISA-Capital study. Nutrire 2015; 40: 10-20.
27. Brevidelli MM, Coutinho RMC, Costa LFV, Costa LC. Prevalence and factors associated with overweight and obesity among adolescents in a public school. Rev Bras Promoç Saúde 2015; 28: 379-386.
28. Ferreira NL, Claro RM, Mingoti SA, Lopes ACS. Coexistence of risk behaviors for being overweight among Brazilian adolescents. Prev Med. 2017; 100: 135-142.
29. Monzani A, Ricotti R, Caputo M, Solito A, Archero F, Bellone S, et al. Systematic review of the association of skipping breakfast with weight and cardiometabolic risk factors in children and adolescents. What should we better investigate in the future? Nutrients 2019; 11.
30. Ask AS, Hernes S, Aarek I, Johannessen G, Haugen M. Changes in dietary pattern in 15 years old adolescents following a 4 month dietary intervention with school breakfast - a pilot study. Nutr J. 2006; 5: 33.
31. Affenito SG, Thompson D, Dorazio A, Albertson AM, Loew A, Holschuh NM. Ready-to-eat cereal consumption and the School Breakfast Program: Relationship to nutrient intake and weight. J Sch Health 2013; 83: 28-35.
32. Pontigo Lues K, Castillo-Durán C. Eating and sleeping schedules in Chilean adolescents from San Antonio, V Region: Their association with obesity and body fat distribution. Rev Chil Nutr. 2016; 43: 124-130.
33. Affenito SG. Breakfast: a missed opportunity. J Am Diet Assoc. 2007; 107: 565-569.
34. Brazil. Brazilian Institute of Geography and Statistics. Family Budget Survey 2017-2018: Analysis of personal food consumption in Brazil. Rio de Janeiro, 2020.