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Changes in meal frequency among adolescents living in a socially vulnerable area of the Rio de Janeiro metropolitan region, Brazil

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Abstract *This study described changes in meal frequency over a 5-year period among adolescents living in the Rio de Janeiro metropolitan region. The data used were from two cross-sectional, population-based studies conducted by home visits. In 2005 the final sample was 1089 households with 511 adolescents (aged 12 to 18 years) and in 2010, 1121 households with 314 adolescents. Meal frequency was obtained through self-administered questionnaire and the adolescents were assessed for appropriate weight by BMI cut-off points, by sex and age group. Increasingly, traditional daily lunch was replaced by snacks (from 3.7% to 13.7%) and traditional dinner was eaten (62.9% to 72.0%). Overweight adolescents ate breakfast less often than those not overweight (in 2005, 68.3% and 79.3%, p=0.02 and, in 2010, 59.5% and 77.4%, p=0.03). Traditional daily lunch was increasingly replaced by snacks and consumption of traditional dinner increased over the 5-year period. Also, eating breakfast every day was associated with BMI classification at both study times: those who were overweight consumed breakfast less frequently.*

Key words *Meal frequency, Adolescents, BMI classification*

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Introduction

Certain particular features which are observed in adolescence, such as modifications in diet and eating patterns and in lifestyle[1,2], can affect young people's health and linger on into adult life[3,4]. These modifications cause concern, because they have been associated with the current epidemiological situation of substantially increased overweight and obesity in adolescents worldwide[5,6], including in Brazil[7,8] and with the development of chronic non communicable diseases in this age group[4].

Adolescents' diets characteristically contain excessive quantities of the fast-food type of hypercaloric and industrialised foods, sugary soft drinks and sweets[2,9,10], and are low in foods that are sources of fibre, such as fruits and vegetables[11,12]. Missing main meals, particularly breakfast[13,14] or replacing them with snacks that are often rich in calories, carbohydrates and sodium[12,15] are other common traits of adolescents' eating habits.

In that context, habitually not missing meals has proven to be a protective factor against overweight and obesity[16,17], while these health problems have been associated with missing main meals[18,19]. Adolescents' consumption of foods considered important for their health and development is thus low. These include calcium-rich foods, which are mostly present at breakfast[20,21], and marker foods of healthy eating present at lunch and dinner, such as beans, vegetables or greens and fruits[12], which are unlikely to be eaten at any other time of day.

Studies of adolescents' meals have observed that breakfast is the meal most missed, and more often by girls than by boys[15,22,23]. It has also been found that lunch is eaten more often than dinner[18,24]. Nonetheless, there are few reports of how these practices have been changing over time and how they may be associated with overweight and obesity, particularly in Brazil.

In 2005 Estima *et al.*[25], in a cross-sectional study of adolescents living in a region whose population is predominantly lower class, observed that girls missed breakfast more often than boys (12.4% and 4.5%, respectively) and that an unsatisfactory meal pattern (when the three main meals – breakfast, lunch and dinner – were not eaten daily) was highly frequent, in around one third of the adolescents. They also observed an association between this unsatisfactory meal pattern and higher mean body mass indices (BMI), particularly in the boys.

In 2010 another cross-sectional study in the same location collected data on meal frequency, making it possible to investigate changes in these practices over time. Given the increased prevalence in overweight observed in the period between the two studies[26], the hypothesis here is that the adolescents may have been missing meals increasingly in the period investigated and that this behaviour may be associated with overweight. Accordingly, the objective of this study was to describe the changes in meal frequency over time and to learn how that practice associated with the adolescents' socioeconomic, demographic and weight profile variables over the five-year period.

Methods

Sampling

This study used data from two cross-sectional, population-based studies conducted by way of home visits to investigate residents of Campos Elíseos, Duque de Caxias, in Rio de Janeiro State, Brazil. At the time of the second study (2010), Campos Elíseos had a predominantly urban population, estimated at 855,048, which corresponded to 5.34% of the population of the state[27]. In 2005, it was notable for being one of the districts with the lowest per capita income in the municipality of Duque de Caxias, with only 26.8% of families receiving per capita income of more than one minimum wage, while about 83% of families were in social classes C and D by the ABIPEME classification and 52.3% of heads of families had not completed lower secondary school[28].

The study population comprised the adolescents from 12 to 18.9 years old who formed part of the set of families resident in permanent private households in Campos Elíseos on the reference dates of each study (2005 and 2010).

In 2005 the final sample was 1088 households and 561 eligible adolescents, who were interviewed. Fifty adolescents were excluded for discrepancies in completion of the questionnaires, so that the data for 511 adolescents were considered (91.0% response rate). In the second study, conducted in 2010, the final sample was 1121 households, where all 314 adolescents considered eligible were interviewed. In the two studies, adolescents were considered eligible if they were from 12 to 18.9 years old, had no physical disability that would prevent anthropometric evaluation and/or their responding to the ques-

tionnaire and were not pregnant. The home interviews and measurements were made after a free and informed consent form was signed by the person responsible for the household and only adolescents who agreed to participate were evaluated. Further details of the sampling criteria have been described in other articles published by Salles-Costa *et al.*[28] and Santana *et al.*[26].

Data collection

In both study periods, data were collected between April and December 2005 (the first study) and between April and December 2010 (the second study) by a team of interviewers specifically trained for the purpose.

The questionnaires applied in 2005 and 2010 were developed for these specific studies using questions established previously in similar studies. Both were divided into modules and were similar so as to assure the data would be comparable. The study reported here used the identification and control module, with items 1 to 6 to characterise the household; the module on adolescents, with 24 questions about living habits and demographics, of which those relating to the adolescents' meal frequency and race were used; the anthropometrics module, of which the body mass and height measurements were used; and the household module, with 6 topics, of which the questions used were on sociodemographic data, such as monthly per capita family income and head of household's schooling. In 2005 the schooling of the adult who answered the questionnaire was recorded. In 2010 the schooling of the head of household was assessed, because that position was required in order to be the questionnaire respondent. The difference in method is not believed to have biased the results, because most of the questionnaire respondents in 2005 were heads of household.

With a view to refining the data collection instrument, the questionnaires underwent pre-testing and a pilot study with individuals similar to the study participants, but who did not take part in the study. The questionnaires applied by the interviewers were reviewed by a supervisor shortly after the interviews were conducted. In the event of doubt as to whether or not a question had been responded to correctly, the resident was contacted by telephone for clarification. If that contact was not possible, the interviewer returned to the household to check the response.

Meal frequency was investigated by means of the following questions: in 2005 "How often do you usually eat the following meals?"; in 2010 "How many times a week do you eat the following meals?". These questions referred to the main meals: traditional breakfast, lunch and dinner and lunch or dinner replaced by snacks. The response options were: a) daily, b) 3 to 6 times a week, c) once or twice a week and d) never or nearly never.

For the anthropometric assessment, in both studies, all individuals were assessed wearing light clothing and barefoot. Weight was measured with a portable digital scales with capacity of 150 kilograms and graduations of 50 grams. Height was measured using a portable stadiometer, with graduations of 0.1 centimetres (cm), with which two measurements were made, allowing a maximum variation of 0.5 cm between them, and their mean was calculated. Weight and height were obtained following the techniques proposed by Gordon *et al.*[29]. BMI was calculated as weight in kilograms divided by weight in metres squared.

The sociodemographic variables investigated were sex, age, skin colour, monthly per capita family income (total earnings divided by the number of members of the family), expressed in multiples of a minimum wage (R$ 300.00 in 2005 and R$ 510.00 in 2010) and schooling of an adult in the family who responded to the questionnaire (generally the head of the house in 2005) and the head of the house in 2010.

Data analysis

The data were analysed using the Statistical Program for the Social Sciences, version 19.0 (SPSS, Chicago, IL), by applying the Complex Sample procedure for complex samples and data expansion.

Meal frequency was calculated as the percentage of adolescents who ate breakfast, lunch and dinner (traditional lunch and dinner if a meal was eaten or snack-lunch and snack-dinner). The categories used in the descriptive analyses were daily, 3 to 6 times a week, once or twice a week, never or nearly never. In the analyses of association, frequencies were grouped as more often (daily and 3 to 6 times a week) and less often (once or twice a week and never or nearly never).

Meal pattern was evaluated as a dichotomous variable (satisfactory or unsatisfactory) calculated by scoring the frequency with which the adolescents ate a meal at breakfast, lunch and dinner (daily=0; 3 to 6 times a week=1; once or twice a week=2; never or nearly never=3). As a

result, scores ranged from zero to nine (the sum of scores for eating a meal at breakfast, lunch and dinner). The meal pattern was considered to be satisfactory when the sum was zero or one, as in Estima *et al.*[25].

The appropriateness of the adolescents' weight was calculated on the basis of BMI cut off points, by sex and age group, following World Health Organisation criteria[30]. The underweight and appropriate weight categories were grouped as "Not overweight" and overweight and obesity, as "Overweight". Sex (male and female), age (12 to 14.9 years and 15 to 18.9 years) and skin colour (white and black/brown) were analysed as binary variables. In the descriptive analyses, per capita income was categorised as up to ½ minimum wage, ½ to 1 minimum wage and more than 1 minimum wage. In the analyses of association, this variable was considered binary (up to ½ minimum wage and greater than ½ minimum wage). In the descriptive analyses, the schooling of an adult in the family (2005) and the head of house (2010) was categorised as: A) Illiterate/ lower secondary, first stage incomplete; B) lower secondary, first stage complete/second stage incomplete; C) lower secondary, second stage complete/upper secondary incomplete; and D) upper secondary incomplete/higher incomplete and complete. In the analyses of association, this variable was considered to be binary and grouped as <8 years' schooling (grouping categories A and B) and ≥8 years' schooling (grouping categories C and D).

First a descriptive analysis of the study variables was performed, for the frequencies and 95% confidence intervals (95%CI), at the two stages (2005 and 2010). The chi-squared test was used to compare frequencies between the studies. Associations between the dependent variables (eating meals at breakfast, lunch, dinner, snack-lunch and snack-dinner and meal pattern) and the independent variables (per capita income, head of household's schooling, sex, age, skin colour and weight profile) were ascertained using the chi-squared test at each study date (2005 and 2010), accepting a p-value of < 0.05 for statistical significance. The magnitudes of the associations between the study data at 2005 and 2010 were evaluated by odds ratio (OR) and 95%CI and these ORs were compared using the method described by Altman and Bland[31].

Results

Table 1 shows the adolescents' distribution by sociodemographic characteristics and weight classification in 2005 and 2010. Weight classification differed significantly (p=0.03) between the years: percentage underweight decreased (4.5% to 0.9%) and overweight increased (16.3% to 22.8%).

As regards meal frequency (Table 2), frequency of eating a snack-lunch every day increased from 3.7% (2005) to 13.7% (2010) and eating one never or nearly never decreased from 81.7% to 68.1% (p=0.005). Eating a meal for dinner increased from 62.9% (2005) to 72.0 % (2010) (p=0.002).

Also, in both 2005 and 2010, eating breakfast every day was associated with weight classification: prevalence was greater among adolescents who were not overweight than among those who were. In 2005 eating a meal at lunch every day was more prevalent among the younger participants than among the older ones (91.1% and 84.1%, p=0.04) (Table 3).

Also in 2005 eating a meal for dinner every day was associated with age: it was more prevalent in those <15 years old (69.5% and 57.6%, p=0.005). In 2010 older adolescents (>15 years old), those with more income (>½ minimum wage) and those not overweight were approximately twice as likely to eat a meal for dinner daily as in 2005 (Table 3).

Satisfactory meal pattern was associated with sex and age in 2005: it was more prevalent in boys (72% and 62.2%, p=0.04) and in adolescents <15 years old (73.6% and 61.7%, p=0.02). In 2010 it was associated with weight classification: it was more prevalent among those who were not overweight (75.4% and 54.4%, p=0.007) (Table 3).

Discussion

Prominent among the main results, over the five-year period, were the increase in replacing a traditional daily lunch with a snack and in eating a traditional dinner. An association as also noted, at both points in the study, between eating breakfast every day and weight classification: those who were overweight ate breakfast less frequently that those who were not. That association was

Table 1. Sociodemographic characteristics and weight classification on the basis of adolescents' BMI. Campos Elíseos, Duque de Caxias-RJ, 2005 and 2010.

	2005		2010		Var.	p-value[1]
	n*	% (95%IC)	n*	% (95%IC)	(%)	
Sex	511		314			0.668
Male		49.3 (44.5-54.1)		51.0 (44.3-57.7)	+ 1.7	
Female		50.7 (45.9-55.5)		49.0 (42.3-55.7)	- 1.7	
Age (years)	511		314			0.178
12-14.9		44.9 (39.3-50.6)		50.3 (42.7-57.9)	+ 5.4	
15-18.9		55.1 (49.4-60.7)		49.7 (42.1-57.3)	- 5.4	
Skin colour	510		308			0.572
Black/pardo		81.2 (76.7-85.0)		78.9 (70.9-85.1)	- 2.3	
White		18.8 (15.0-23.3)		21.1 (14.9-29.1)	+ 2.3	
Per capita income**	503		304			0.470
Up to ½ minimum wage		47.7 (41.2-54.3)		50.5 (40.7-60.2)	+ 2.8	
½-1 minimum wage		42.3 (36.8-47.9)		36.5 (28.5-45.3)	- 5.8	
>1 minimum wage		10.1 (7.1-14.1)		13.1 (7.4–22.1)	+ 3.0	
Schooling***	509		309			0.10
Illiterate/first stage lower secondary incomplete		18.5 (14.9-22.8)		13.3(8.0-21.3)	-5.2	
First stage lower secondary complete and second stage incomplete		30.7 (26.2-35.7)		26.8(19.9-35.1)	-3.9	
Lower secondary complete and upper secondary incomplete		24.5 (19.2-30.6)		36.1(27.9-45.1)	+11.6	
Upper secondary complete and higher incomplete and complete		26.3 (21.6-31.5)		23.8 (16.9-32.4)	-2.5	
BMI classification	511		301			0.033
Underweight		4.5# (2.7-7.2)		0.9 (0.3-2.8)	- 3.6	
Appropriate weight		72.2 (66.9-76.9)		68.2 (60.5-74.9)	- 4.0	
Overweight		16.3 (12.7-20.6)		22.8# (17.3-29.5)	+ 6.5	
Obesity		7.1 (4.8-10.5)		8.1 (5.1-12.8)	+ 1.0	

*The amounts differ due to losses on each variable. **Value of minimum wage: 2005=R$ 300; 2010=R$ 510. ***Schooling of an adult in the family. [1] Chi-square test. [#] Partitioned chi-square test <0.05.

Source: Authors.

also evident in 2010 and an unsatisfactory meal pattern was more frequent in those who were overweight.

As regards meals eaten, most of the studies found in the literature evaluated only breakfast[13,14]. This study found that breakfast was eaten more often by those who were not overweight. The same was observed by Legarrea *et al.*[32] with 21,385 adolescent students in Chile, where eating breakfast every day was more common among individuals with appropriate weight (62%) and less so among individuals who were overweight (56.3%) or obese (51.8%). Storey *et al.*[19], in a study of Canadian adolescents, observed that those who were not overweight ate breakfast with greater frequency than the students who were overweight or obese.

Satisfactory meal pattern was also associated with weight classification in 2010: it was more frequent in those who were not overweight, similarly to what was found in the same population in 2005 by Estima *et al.*[25]. They observed that boys whose meal pattern was unsatisfactory (regularly omitting at least one of the three main meals) displayed higher mean BMI and waist circumference than those whose meal pattern was satisfactory. The same was observed by Cnop *et al.*[33] in students at public and private schools: irregular meal habits were associated with overweight. In that connection, it was observed in this study that

Table 2. Adolescents' meal frequency and meal patterns. Campos Elíseos, Duque de Caxias-RJ, 2005 and 2010.

Meals	2005		2010		Var. (%)	p-value[1]
	n*	%	n*	%		
Breakfast	509		304			0.08
Every day		76.7(71.8-81.0)		72.0(62.7-79.7)	- 4.7	
3 to 6 times a week		7.1(4.6-10.7)		14.3(8.9-22.1)	+7.2	
Once or twice a week		7.1(4.8-10.2)		3.9(1.5-10.0)	- 3.2	
Never or nearly never		9.2(6.4-13.1)		9.8(6.4-15.0)	+ 0.6	
Lunch (meal)	509		305			0.44
Every day		87.2(83.4-90.3)		86.7(80.2-91.3)	- 0.5	
3 to 6 times a week		8.6(6.1-12.1)		8.6(5.2-13.9)	0	
Once or twice a week		3.0(1.7-5.0)		1.6 (0.5-4.8)	- 1.4	
Never or nearly never		1.2(0.5-3.0)		3.1(1.0-9.5)	+ 1.9	
Snack-lunch	507		287			0.005
Every day		3.7(2.2-6.3)		13.7(7.5-23.7)	+ 10.0	
3 to 6 times a week		3.6(2.0-6.2)		7.1(3.7-13.2)	+ 3.5	
Once or twice a week		11.0(7.8-15.2)		11.1 (5.7-20.5)	+ 0.1	
Never or nearly never		81.7(76.8-85.8)		68.1(57.6-77.0)	- 13.6	
Snack-dinner	505		285			0.29
Every day		7.3(5.0-10.5)		15.5(10.2-22.8)	+ 8.2	
3 to 6 times a week		8.3(5.8-11.9)		5.0(2.4-9.9)	- 3.3	
Once or twice a week		22.8(18.1-28.3)		18.1(11.7-27.0)	- 4.7	
Never or nearly never		61.6(55.1-67.8)		61.4(51.2-70.7)	+ 0.2	
Dinner (meal)	509		303			0.002
Every day		62.9(57.0-68.5)		72.0(64.6-78.4)	+ 9.1	
3 to 6 times a week		20.3(16.1-25.2)		17.9(12.7-24.7)	- 2.4	
Once or twice a week		7.8(5.2-11.5)		0.2(0.1-0.9)	- 7.6	
Never or nearly never		9.0(6.2-12.9)		9.8(6.1-15.4)	+ 0.8	
Meal pattern	509		300			0.68
Satisfactory		67.0 (61.8-71.9)		69.0(60.7-76.3)	+ 2.0	
Unsatisfactory		33.0 (28.1-38.2)		31.0 (23.7-39.3)	- 2.0	

*The amounts differ due to losses on each variable. [1] Chi-square test.

Source: Authors.

missing the main meals (breakfast, lunch and dinner) – and not just breakfast – may be related to overweight and obesity.

The increase found in this study, in eating a snack every day instead of a traditional lunch, agrees with other authors' reports. Teixeira *et al.*[15] noted that a third of the 106 students at a technical school in São Paulo replaced lunch with a snack. A similar result was found by Araki *et al.*[24] in a cross-sectional study of 71 adolescents in upper secondary schools in São Paulo, which found that 29% replaced lunch with snacks and, of these, 17% did so once or twice a week. A study by Leal *et al.*[23] with 228 adolescents in São Paulo found that 30.8% also replaced lunch or dinner with a snack. Replacing lunch by snacks frequently probably results from factors connected with changes in adolescents' lifestyles, media influences[34] and possibly disorganised eating habits, which may lead to main meals being eaten less often[35].

Also, in the first study, lunch in the form of a traditional meal was associated with age: it was eaten every day more frequently by the younger adolescents (12 to 14.9 years old). This may perhaps be due to the influence that the family still exerts over the younger adolescents[12]. There was also an increase in eating a traditional meal at dinner. This may be related to the increase in eating a snack instead of lunch, resulting in less

Table 3. Association between meals eaten every day and sociodemographic characteristics, odds ratios and 95% confidence intervals (95%CI) for the magnitude of the associations. Rio de Janeiro, Brazil, 2005 and 2010.

Variables	2005			2010			Var.	Odds ratio
	n*	%	p¹	n*	%	p¹	(%)	(95%CI)
Breakfast								
Sex			0.10			0.13		
Male	250	80.7		156	76.0		- 4.7	0.76 (0.41-1.38)
Female	258	72.8		147	67.6		- 5.2	0.78 (0.46-1.30)
Age (years)			0.35			0.22		
12-14.9	228	79.1		152	66.9		- 12.2	0.53 (0.28-0.99)
15-18.9	280	74.7		151	77.1		+ 2.4	1.13 (0.63-2.05)
Per capita income**			0.43			0.81		
≤½ minimum wage	238	78.1		149	72.7		- 5.4	0.74 (0.45-1.23)
>½ minimum wage	262	75.2		144	70.9		- 4.3	0.80 (0.40-1.58)
Schooling***			0.86			0.66		
<8 years	251	77.2		121	69.2		- 8.0	0.66 (0.29-1.48)
≥8 years	256	76.4		178	73.4		- 3.0	0.85 (0.46-1.56)
BMI classification			0.02			0.03		
Not overweight	389	79.3		204	77.4		- 1.9	0.89 (0.54-1.46)
Overweight	119	68.3		90	59.5		- 8.8	0.68 (0.30-1.53)
Snack-lunch								
Sex			0.83			0.66		
Male	250	3.5		147	12.6		+ 9.1	3.93 (1.27-12.20)
Female	256	4.0		140	14.9		+ 10.9	4.23 (1.13-13.57)
Age (years)			0.57			0.55		
12-14.9	228	4.4		142	18.6		+ 14.2	4.97 (1.59-15.48)
15-18.9	278	3.2		145	8.9		+ 5.7	2.93 (0.87-9.89)
Per capita income**			0.76			0.31		
≤½ minimum wage	237	4.2		146	17.8		+ 13.6	4.96 (1.60-15.40)
>½ minimum wage	262	3.5		131	10.7		+ 7.2	3.12 (0.73-13.36)
Schooling***			0.48			0.17		
<8 years	249	4.5		118	10.0		+ 5.5	2.37 (0.84-6.70)
≥8 years	256	3.1		165	16.7		+ 13.6	6.33 (1.97-20.36)
BMI classification			0.70			0.83		
Not overweight	387	4.0		187	12.4		+ 8.4	3.41 (1.19-9.75)
Overweight	119	3.0		89	13.5		+ 10.5	4.96 (1.03-23.77)

it continues

traditional food being eaten in the course of the day, leading to an increase in eating a meal at dinner to compensate for the poor daytime diet.

As already seen in the literature, girls ate the main meals less frequently than boys, corroborating the findings of Maia *et al.*[11], in which unhealthy meal patterns were associated with the female adolescents. Similarly, Teixeira *et al.*[15] observed that more girls were in the habit of replacing meals by snacks. Vieira *et al.*[36] observed that missing dinner was also about three times more prevalent among the girls.

Unsatisfactory meal patterns were also more frequent among the girls in 2005 and that association continued in 2010, although it was not significant (p=0.06). This may be related to the fact that girls show more concern with their bodies, with body image and losing weight than boys[37], particularly in early adolescence. As a result of that excessive concern, they introduce inappro-

Table 3. Association between meals eaten every day and sociodemographic characteristics, odds ratios and 95% confidence intervals (95%CI) for the magnitude of the associations. Rio de Janeiro, Brazil, 2005 and 2010.

Variables	2005			2010			Var. (%)	Odds ratio (95%CI)
	n*	%	p[1]	n*	%	p[1]		
Lunch (meal)								
Sex			0.24			0.24		
Male	250	88.9		158	89.6		+ 0.7	1.07 (0.43-2.6)
Female	258	85.6		146	83.6		- 2.0	0.85 (0.40-1.80)
Age (years)			0.04			0.97		
12-14.9	228	91.1		154	86.7		- 4.4	0.63 (0.26-1.5)
15-18.9	280	84.1		151	86.8		+ 2.7	1.24 (0.60-2.57)
Per capita income**			0.13			0.65		
≤½ minimum wage	238	89.8		149	88.3		- 1.5	0.85 (0.33-2.21)
>½ minimum wage	262	84.5		146	85.8		+ 1.3	1.11 (0.49-2.49)
Schooling***			0.98			0.32		
<8 years	250	87.2		121	83.3		- 3.9	0.73 (0.31-1.68)
≥8 years	256	87.2		180	88.7		+ 1.5	1.16 (0.50-2.69)
BMI classification			0.54			0.61		
Not overweight	389	86.6		204	87.3		+ 0.7	1.05 (0.50-2.19)
Overweight	119	89.1		90	84.2		- 4.9	0.64 (0.21-1.91)
Snack-dinner								
Sex			0.28			0.48		
Male	249	8.6		146	17.5		+ 8.9	2.23 (0.97-5.15)
Female	256	5.9		138	13.4		+ 7.5	2.45 (1.01-5.90)
Age (years)			0.14			0.66		
12-14.9	227	5.1		141	14.2		+ 9.1	3.10 (1.14-8.4)
15-18.9	277	9.1		143	16.7		+ 7.6	2.01 (0.95-4.24)
Per capita income**			0.29			0.75		
≤½ minimum wage	236	8.8		144	14.9		+ 6.1	1.82 (0.72-4.59)
>½ minimum wage	260	5.8		130	17.3		+ 11.5	3.36 (1.35-8.33)
Schooling***			0.69			0.69		
<8 years	248	7.8		116	14.4		+ 6.6	1.97 (0.84-4.65)
≥8 years	255	6.7		164	16.7		+ 10.0	2.78 (1.09-7.06)
BMI classification			0.59			0.29		
Not overweight	386	6.9		187	12.2		+ 5.3	1.87(0.93-3.77)
Overweight	118	8.5		87	17.3		+ 8.8	2.26 (0.80-6.36)

it continues

priate weight control practices, which may be even more harmful to health[38]. Also notable is that missing one or more meals may be harmful and lead to excessive eating at other meals or to compulsive eating[39,40].

In this study, no significant associations were found between meal frequency and the sociodemographic variables skin colour, income and schooling. However, that investigation is justified, given that the social and economic status of the population of this area is at odds with the wealth generated in the municipality, underlining the unequal distribution of income and access to goods and services as a result of social exclusion. That situation may undermine diet[28] and may result in unfavourable health outcomes for adolescents residing in that municipality.

The findings of this study should be evaluated in view of its limitations and strong points. As it was conducted on the basis of two cross-sectional studies, it could not determine causal relations in the associations between the study variables. It is believed that future longitudinal studies will contribute to clarifying those associations. Another

Table 3. Association between meals eaten every day and sociodemographic characteristics, odds ratios and 95% confidence intervals (95%CI) for the magnitude of the associations. Rio de Janeiro, Brazil, 2005 and 2010.

Variables	2005			2010			Var. (%)	Odds ratio (95%CI)
	n*	%	p[1]	n*	%	p[1]		
Dinner (meal)								
Sex			0.12			0.55		
Male	250	67.0		158	74.2		+ 7.2	1.41 (0.78-2.55)
Female	258	59.0		144	69.7		+ 10.7	1.59 (0.87-2.90)
Age (years)			0.005			0.73		
12-14.9	228	69.5		154	73.3		+ 3.8	1.20 (0.65-2.20)
15-18.9	280	57.6		148	70.7		+ 13.1	1.78 (1.04-3.04)
Per capita income**			0.83			0.19		
≤½ minimum wage	238	63.4		147	68.0		+ 4.6	1.22 (0.69-2.17)
>½ minimum wage	262	62.2		146	76.4		+ 14.2	1.96 (1.10-3.50)
Schooling***			0.77			0.57		
<8 years	250	63.9		119	69.6		+ 5.7	1.29 (0.74-2.25)
≥8 years	256	62.2		180	73.2		+ 11.0	1.66 (0.91-3.01)
BMI classification			0.78			0.07		
Not overweight	389	63.3		201	76.9		+ 13.6	1.92 (1.10-3.37)
Overweight	119	61.7		91	60.8		- 0.9	0.96 (0.43-2.10)
Satisfactory meal pattern								
Sex			0.04			0.06		
Male	250	72.0		156	75.7		+ 3.7	1.21 (0.62-2.35)
Female	258	62.2		143	61.8		- 0.4	0.98 (0.56-1.70)
Age (years)			0.02			0.52		
12-14.9	228	73.6		152	66.4		- 7.2	0.71 (0.36-1.39)
15-18.9	280	61.7		148	71.7		+ 10.0	1.57 (0.88-2.78)
Per capita income**			0.41			0.29		
≤½ minimum wage	238	68.9		145	73.0		+ 4.1	1.21 (0.66-2.21)
>½ minimum wage	262	65.1		144	64.5		- 0.6	0.97 (0.51-1.85)
Schooling***			0.63			0.92		
<8 years	250	66.0		117	68.1		+ 2.1	1.10 (0.51-2.36)
≥8 years	256	68.2		178	69.0		+ 0.8	1.03 (0.56-1.89)
BMI classification			0.53			0.007		
Not overweight	389	67.9		201	75.4		+ 7.5	1.44 (0.85-2.46)
Overweight	119	64.3		89	54.4		- 9.9	0.66 (0.33-1.30)

*The amounts differ due to losses on each variable. **Value of minimum wage: 2005=R$ 300; 2010=R$ 510. ***Schooling of an adult in the family. [1] Chi-square test.

Source: Authors.

limitation is that the nutrient composition of the snacks used to replace meals was not investigated and thus it could not be determined whether or not these were healthy alternatives. One of the study's strong points is that it evaluated the change in meal frequency over time. Another differential in comparison other studies on this subject among adolescents was that it evaluated frequency of all meals, and not just breakfast. The fact that this assessment was conducted in the context of a socially highly vulnerable population is another strong point, because there are few studies in such contexts.

It was concluded that replacing a traditional lunch with a snack every day increased over the five-year period, as did eating a traditional dinner. Also, eating breakfast every day was associated with weight classification at both points in the study: overweight adolescents ate breakfast less frequently. These findings show the adolescents'

need for guidance on the health risks of missing meals, as well as more encouragement for eating regular meals, so as to prevent their nutritional profile from deteriorating and avert the risks attendant on those alterations.

Collaborations

RA Maravalhas participated in the study conception, statistical analyses and drafting of the article. DD Santana participated in the study conception, statistical analyses and drafting of the article. R Salles-Costa participated in the study conception and final drafting of the article. GV Veiga participated in the study conception, statistical analyses and final drafting of the article.

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