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Beverages characterize the nutritional profile of Brazilian adolescents' breakfast

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Abstract

Background: The breakfast is the most important meal of the day, and its quality is essential for children and adolescents to maintain proper health condition. However, the nutritional composition of breakfast remains poorly studied. The aim of this study was to characterize the nutritional quality of Brazilian adolescents' breakfast.

Methods: This is a cross-sectional study, conducted in 2005, including 1133 students from public schools, between 10 and 14 years old, in Niterói, Brazil. Information regarding breakfast consumption was obtained using 24-h dietary recall. Cluster analysis was applied to characterize the breakfast nutritional profiles.

Results: Of the sample, 16 % did not have breakfast on the survey day, and skipping breakfast was more frequent among overweight than among of normal-weight individuals (20 vs. 15 %; $P = 0.04$) as well as among those studying in the morning shift compared to adolescents studying in the afternoon shift (18 vs. 10 %; $P < 0.01$). The mean daily energy, macronutrient, calcium, and vitamin A intakes were significantly higher among individuals who had breakfast compared with those who did not. The breakfast contribution to the daily energy intake was, on average, of 18 %. The food profile analysis showed that breakfast could be characterized by the type of beverage consumed in the meal, and five eating profiles were identified: "Coffee or tea," "Milk or milk-based beverages," "Sugar-sweetened beverages," "No beverage consumption," and "More than one type of beverage".

Conclusions: The dietary breakfast choices were related with the daily energy and nutrient intake and the type of beverage characterized the breakfast food selection among Brazilian adolescents.

Keywords: Meal intake, Breakfast, Dietary intake, Dietary patterns, Sugar-sweetened beverages, Adolescents

Background

The Brazilian adolescents' diet has been characterized by excessive amounts of high energy-dense foods; sugar, fat, and salt; and low amounts of fruits, vegetables, and dairy products [1, 2]. This condition may pose a significant risk of dietary inadequacy, excessive weight gain, and metabolic disorders [3–6].

Additionally, dietary habits, like the pattern of meal consumption, have been associated with adverse health outcomes [7–10]. Breakfast has been considered the most important meal of the day [11], and its regular consumption has been associated with a satisfactory energy intake, adequate micronutrient intake, and healthy dietary choices [12–15]. Having breakfast on a regular basis is also positively associated with body weight control [16–18] and inversely associated with body mass index (BMI), waist circumference, body fat percentage [13, 19, 20], and smoking and alcohol consumption [15]. It has been suggested that breakfast quality is essential for children and adolescents to reach or maintain proper health condition [15, 21]. In Brazil, studies addressing breakfast habits, usually evaluate how often this meal is skipped [8, 10] and the results indicate that breakfast is not a regular habit to 8.5 to 28.4 % of the Brazilian adolescents [9, 10, 22]. Moreover, studies regarding breakfast composition of Brazilian adolescents showed that "coffee with milk" and "bread with butter or margarine" are the foods most frequently included in this meal [23, 24], whereas fresh fruits or squeezed fruit juices are scarcely consumed [25].

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However, the nutritional composition of breakfast remains poorly studied in Brazil. The aim of this study was to characterize the breakfast of Brazilian adolescents to identify their nutritional and dietary profiles.

Methods

Study design and sample size

This study is a secondary analysis of an intervention study carried out in 2005 with 10–14 years old adolescents from public schools of Niterói, Brazil. Data were obtained in the baseline survey. The main study aimed to evaluate the efficacy of an intervention program for preventing excess weight gain by reducing soft drink consumption [26]. Thus, for the main study, the sample size was calculated for a cluster randomized controlled trial and was based on previous data from a study performed in 2003 [27] in the same geographic region, in which the standard deviation for consumption of sugar-sweetened beverages was 1.49 glasses per day. The sample size needs to detect a difference of 0.5 glasses of a sugar-sweetened beverage between the two studied groups (intervention and control) with a power of 80 %, and a significance level of 95 % was 140 students per group. Considering the cluster design (classes) and anticipating a participation rate of 80 %, the plan consisted of recruiting 600 students. Meanwhile, schools, instead of classes, were randomized to reduce the possibility of interventional contamination. Thus, 1435 students from 47 classes and 22 schools were invited to participate in the study. Further details can be found elsewhere [26].

The study was approved by the Research Ethics Committee of the Institute of Social Medicine at Rio de Janeiro State University and funded by the National Council for Scientific and Technological Development (CNPq—process number 50.5629/2004-6). The students' parents or guardians signed informed consent forms.

Measurement of socio-demographic and anthropometric characteristics

Information on socio-demographic variables (sex, age, and study shift (morning or afternoon)) were obtained with structured questionnaire applied during in-person interviews. Weight and height were measured by trained nutritionists using procedures recommended by Lohman et al. [28]. Stature was measured using a portable stadiometer to the nearest 0.1 cm (Seca, model Body Metter 208) with children wearing no shoes, and weight was measured using a portable digital scale to the nearest 0.1 kg (Tanita, model BC 533 Inner Scan) with children wearing light clothes. Age- and gender-specific BMI (weight/stature^2) *z*-score cutoffs were used to classify children in overweight (≥+1 *z*-score) or non-overweight (<+1 *z*-score) according to the World Health Organization curves [29].

Measurement of food intake and evaluation of the nutritional characteristics of breakfast

Data on food consumption was obtained by means of one 24-h dietary recall (24hR) administered through individual interviews conducted by five trained nutritionists and following standardized procedures. Breakfast food consumption was ascertained by the question "What did you eat/drink for breakfast?" If the adolescent did not report any food intake at the breakfast, the meal was registered as absent.

To estimate the nutritional composition of foods cited in 24-h dietary recall, the quantities reported in portion sizes were converted into mass and volume measurements based on specific literature [30]. The food composition was estimated using the NutWin software (Departamento de Informática em Saúde, Universidade Federal de São Paulo, Brazil) [31]. For foods that were not available in the software, the nutritional composition was obtained from Brazilian food composition tables [30, 32, 33].

Daily and breakfast energy, macronutrients, cholesterol, calcium, iron, and sodium intake was estimated. Mean breakfast percentage contribution to the daily intake of energy and nutrients was also estimated. Nutrients intake was adjusted for total energy intake using the nutrient-density method (by 1000 kcal). For daily dietary intake, the analysis was performed for the whole sample and for the sample stratified for those having and skipping breakfast. Food and nutrient intake at the breakfast was estimated only for those reporting this meal in the 24hR. The intake of energy and nutrients at the breakfast was also estimated for adolescents stratified according to the breakfast eating profile.

Identification of breakfast eating profiles

The adolescents reported having 141 different food items for breakfast, which were grouped into 15 food groups based on their nutritional characteristics (Table 1). Some foods were kept isolated if their incorporation into any food group was not appropriate (e.g., eggs), or if they seemed representative of a particular food pattern (e.g., cheese), or if they were frequently consumed (e.g., milk, chocolate milk, bread).

Cluster analysis was applied to identify breakfast eating patterns. Cluster analysis is a method used to identify dietary patterns by clustering individuals according to regularities in their food intake. Thus, individuals are assigned to subgroups (or clusters) in which food consumption is relatively homogeneous; the intra-individual variability inside the cluster is supposedly small, while the between-groups variability is important because of the differences in food intake among subgroups [34].

For this analysis, the amount consumed from each food group was considered and the k-means procedure was used with a maximum of 20 iterations and three

Table 1 Food groups used in cluster analysis reported in the breakfast by adolescents from public schools. Niterói, Brazil, 2005

Groups	Foods included
Sugar and sweets	Sugar, candies, chewing gum, jelly, jam, peanut candy, ice cream, chocolate
Eggs	Fried egg
Breads	French bread, corn bread, sliced bread, sweet rolls, hamburger or hot dog bun
Cookies and crackers	Chocolate sandwich cookie, strawberry sandwich cookie, sweet biscuits, crackers
Fruits and vegetables	Avocado, banana, ambarella, mango, orange, apple, tangerine, strawberry, pear, açaí, lettuce, tomato
Sugar-sweetened beverages	Sugar sweetened fruit drinks, unsweetened fruit drinks, guaraná refreshment, cola and no cola sodas
Milk and milk-based beverages	Chocolate milk, whole milk, semi-skimmed milk, skim milk, yogurt, fruit smoothies with milk
Chocolate and other flavored milk powder	Chocolate powder and other artificially flavored milk powder
Butter or margarine	Butter, margarine, mayonnaise
Cakes	Homemade and processed cakes, tapioca cake, filled frosted cake
Processed and canned meat	Ham, bologna, salami, canned tuna
Cereals	Oatmeal, breakfast cereals, porridge, popcorn, salted and sweetened popcorn
Cheese	Cream cheese, white cheese (queso fresco), mozzarella, American cheese
Coffee and tea	Coffee with milk, instant coffee, sugar sweetened coffee, tea
Snacks and sandwiches	Pancake, pizza, sfiha, hot dogs, cheese sandwich, ham sandwich, hamburger

clusters. The k-means procedure is a method of non-hierarchical clustering that classifies individuals in a predefined number of clusters from the Euclidean distance between the terms in order to allow the distances between observations within a cluster that are minimized relative to the distances between clusters. F statistic values were taken into account to identify the food items that contributed most to solving the clusters. Variables with high *F* values have higher intake differences between clusters. Considering similar analysis performed by Siega-Riz et al. [35], foods included in each identified patterns were examined to define the profile of food consumption at the breakfast.

Statistical analysis

Data were analyzed using the software Statistical Package for the Social Sciences—SPSS, version 21. Student's *t* tests were used to assess the differences in energy and nutrients intake between adolescents that reported having or skipping breakfast and according to sex, school shift, and weight status. The ANOVA test was used to assess the differences between means of energy and nutrient intake according to breakfast eating profiles.

Results

From the 1435 students eligible for the original intervention study, 1409 were examined in the baseline survey (98 %), of which 94 were excluded for this analysis because they were under 10 years old and 182 did not answer the 24hR interview. Therefore, the study included 1133 adolescents: 52 % were female, 77 % attended school in the morning shift, and 30 % were overweight. The average participant age was 11 years (standard deviation = 1 year).

Breakfast skipping was observed for 16 % ($n = 180$) of the adolescents, and this was more frequent among those studying in the morning shift compared to those studying in the afternoon shift (18 vs. 10 %; $P < 0.01$) as well as among adolescents who were overweight compared to the non-overweight adolescents (20 vs. 15 %; $P = 0.04$). No significant difference in breakfast skipping proportion was found between boys (14 %) and girls (18 %) ($P = 0.07$).

The mean daily energy intake was lower in the group skipping breakfast compared with the group that reported having breakfast (2040 vs. 2370 kcal/day; $P < 0.01$). Mean energy-adjusted calcium intake was higher among adolescents who had breakfast compared to those that skipped this meal (286 vs. 214 mg/1000 kcal; $P < 0.01$) (see Additional file 1: Table S1).

Among adolescents who skipped breakfast ($n = 953$), compared with those studying in the afternoon shift, those studying in the morning shift had lower energy, carbohydrate, and protein intake at breakfast and lower percentage contribution of breakfast to the daily intake of energy, cholesterol, calcium, iron, sodium, and vitamin A. Girls had lower intake of energy, carbohydrates, proteins, fat, and sodium for breakfast than boys (Table 2). The most frequently consumed foods at breakfast were bread (64 %), "sugar and sweets" (58 %), "butter or margarine" (50 %), "milk and milk-based beverages" (49 %), "chocolate milk" (37 %), and "coffee and tea" (34 %); in contrast, fruits were only consumed by 4 % of the students (Fig. 1).

Cluster analysis enabled the identification of three eating patterns at breakfast. The first one, consumed by 14 % of

Table 2 Energy and nutrients provided by the breakfast (mean and standard deviation (SD)) of adolescents who reported breakfast consumption from public schools ($n = 953$) according to sex and the school shift. Niterói, Brazil, 2005

	Total ($n = 953$)		Sex					School shift				
			Girl ($n = 481$)		Boy ($n = 472$)		p value*	Morning ($n = 716$)		Afternoon ($n = 237$)		p value*
	Mean	SD	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Energy (kcal)	411	257	374	200	448	301	**<0.01**	403	260	432	247	**0.03**
% total daily kcal	18	10	18	10	19	10	0.31	18	9	21	11	**<0.01**
Carbohydrate (g)	63	40	58	31	68	46	**<0.01**	61	40	66	39	**0.02**
% breakfast kcal	62	12	63	13	61	12	**0.02**	62	12	63	13	0.49
% total daily kcal	11	6	11	6	11	6	0.92	11	6	13	7	**<0.01**
Protein (g)	11.8	7.8	10.6	6.5	13.1	8.9	**<0.01**	11.6	7.6	12.7	8.5	**0.04**
% breakfast kcal	11.6	4.2	11.4	4.4	11.9	4.1	0.09	11.6	4.2	11.6	4.3	0.91
% total daily kcal	2.1	1.3	2.1	1.3	2.2	1.4	0.07	2.1	1.2	2.4	1.6	**<0.01**
Lipid (g)	13	10	11	8	14	12	**<0.01**	13	10	13	10	0.14
% breakfast kcal	27	9	26	9	28	9	**<0.01**	27	9	26	9	0.14
% total daily kcal	5	4	5	4	5	3	**0.02**	5	3	6	4	**<0.01**
Cholesterol (mg/1000 kcal)	58	77	54	60	63	91	0.51	58	79	59	72	0.49
% total daily cholesterol	15	19	15	20	15	19	0.84	14	18	18	21	**0.03**
Calcium (mg/1000 kcal)	638	392	625	415	652	368	0.20	643	409	623	337	0.85
% total daily calcium	39	22	39	23	40	21	0.71	38	22	42	23	**0.04**
Iron (mg/1000 kcal)	4.3	3.8	4.2	4.4	4.4	3.2	0.05	4	4	4	3	0.40
% total daily iron	10	11	10	11	11	11	0.34	10	10	13	13	**<0.01**
Sodium (mg/1000 kcal)	918	597	878	621	959	569	**<0.01**	913	596	931	600	0.71
% total daily sodium	19	16	19	17	20	15	0.06	18	15	23	19	**<0.01**
Vitamin A (Eq. RE[a])	502	474	520	503	483	443	0.85	503	488	497	432	0.66
% total daily vitamin A	34	29	35	31	34	27	0.43	33	29	39	31	**<0.01**

[a]Retinol equivalents

*p value for Mann-Whitney test

The Bold data were just to indicate significant differences

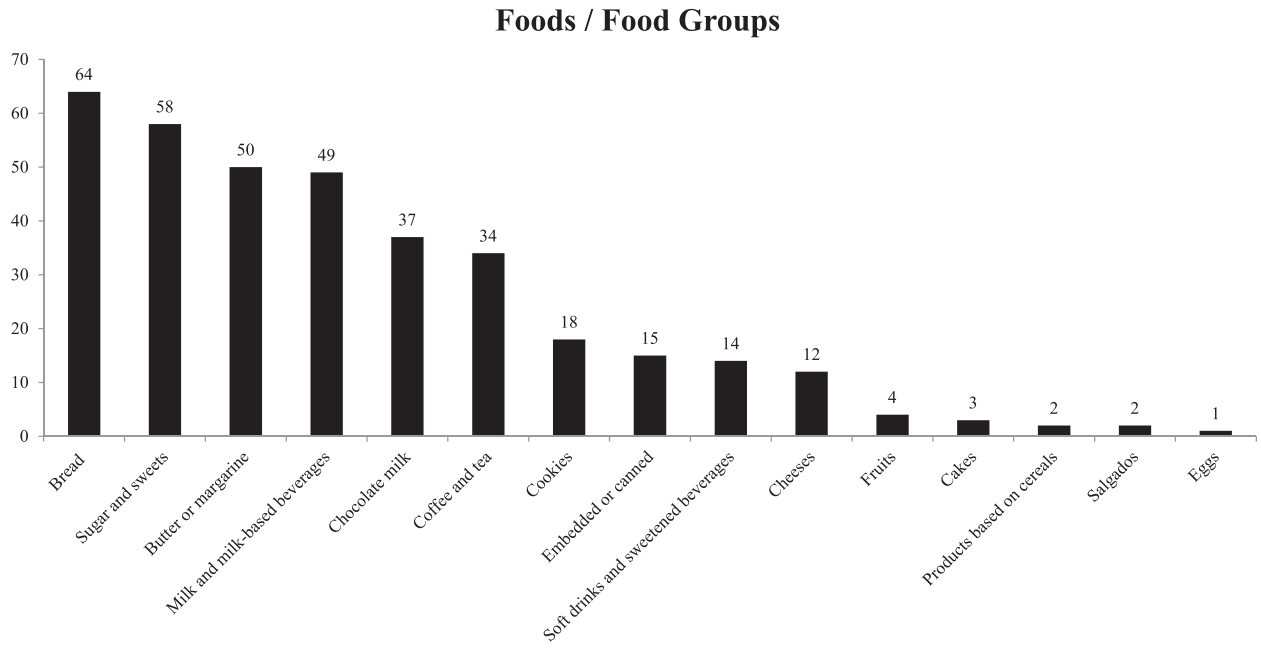

Fig. 1 Foods/food groups consumed in the breakfast by adolescents from public schools in the city of Niterói (RJ), 2005

the adolescents, was characterized by the intake of "Sugar-sweetened beverages", "cookies and crackers", "snacks and sandwiches", and "sausages/canned food" and the second pattern, consumed by 45 % of the adolescents, included milk, "milk-based beverages", and "chocolate milk". The third pattern, reported by 41 % of the adolescents, was characterized by the intake of "Coffee or tea" and "sugar and sweets". All three eating patterns contained bread, butter, cheese, fruits, eggs, cereals, and cakes in similar proportions (Table 3).

Beverages were the food item that marked the differences between the breakfast patterns. Based on this information, the adolescents were grouped into five breakfast eating profiles: (1) "Milk or milk-based beverages" (46 %), (2) "Coffee or tea" (31 %), (3) "Sugar-sweetened beverages" (13 %), (4) "No beverage consumption for breakfast" (6 %), and (5) "More than one type of beverage for breakfast" (4 %).

A greater proportion of adolescents classified in the "Coffee or tea" profile reported the consumption of bread, "sugars and sweets", and "butter and margarine" when compared with the other four profiles. Adolescents in the "Sugar-sweetened beverages" profile reported more frequently the consumption of "snacks and sandwiches" and processed and canned meat than adolescents in the other four profiles. Compared to adolescents in the other profiles, those in the "No beverage consumption for breakfast" profile reported the consumption of fruits and cereals (Table 4).

There were no differences in breakfast nutritional composition among the different dietary profiles (Table 5). However, significant differences were observed for the intake of added sugar. While adolescents adopting the "Sugar-sweetened beverages" profile presented the higher mean intake of added sugar in the breakfast (38 g), those with the "More than one type of beverage" (31 g) and "Milk or milk-based beverages" (29 g) profiles presented intermediate mean values of added sugar intake in the meal. Finally, those having the "Coffee or tea" (18 g) and "No beverage consumption" (12 g) had the lowest mean intake of added sugar in the breakfast. There were no differences in the consumption of breakfast profiles according to age, sex, or weight status (data not shown).

Nevertheless, the daily dietary intake varied according to the breakfast profile. Adolescents consuming "Sugar-sweetened beverages" had higher intake of energy and carbohydrate during the day, while adolescents consuming "Milk or milk-based beverages" had higher daily intake of proteins, fat, calcium, vitamin A, and cholesterol (Table 5).

Discussion

This study indicated that, among adolescents from public schools in Niterói-RJ, beverages are important markers of breakfast eating profiles and that breakfast food choices are related to the daily intake of energy and nutrients, possibly because adolescents adopt similar food choices for the remaining meals.

The results suggest that adolescents adopting the breakfast profile based on "Sugar-sweetened beverages" had a poor-quality diet compared to adolescents who consumed other beverages for breakfast. This finding is in agreement

Table 3 Eating patterns and means of food groups consumption in the breakfast of adolescents from public schools ($n = 953$). Niterói, Brazil, 2005

Food/food groups consumed at breakfast		Breakfast eating patterns			*F*	*p* value[a]
		Sugar-sweetened beverages ($n = 130$)	Milk and milk-based beverages ($n = 429$)	Coffee and tea ($n = 394$)		
		Mean (g or ml)				
Food groups included in the breakfast eating patterns	Sugar-sweetened beverages	**293.8**	2.0	0.6	1334.5	**<0.01**
	Cookies and crackers	**21.4**	9.6	7.1	8.7	**<0.01**
	Snacks and sandwiches	**7.2**	1.2	0.7	10.4	**<0.01**
	Processed and canned meat	**6.5**	3.6	2.5	5.6	**<0.01**
	Milk and milk-based beverages	4.8	**266.1**	5.3	2060.9	**<0.01**
	Chocolate and other flavored milk powder	0.3	**19.5**	0.7	400.8	**<0.01**
	Coffee and tea	3.3	2.0	**161.3**	585.6	**<0.01**
	Sugar and sweets	8.2	9.4	**12.3**	6.4	**<0.01**
Food groups not related to breakfast eating patterns	Butter or margarine	3.0	3.0	3.7	2.4	0.09
	Cheese	4.2	3.0	2.1	2.4	0.10
	Breads	41.9	36.1	40.9	2.3	0.10
	Fruits and vegetables	2.9	3.6	8.5	1.6	0.20
	Eggs	1.4	0.4	0.4	1.6	0.21
	Cereals	0.4	1.0	1.9	0.9	0.40
	Cakes	1.9	3.3	4.4	0.6	0.53

[a]Analysis of variance (ANOVA)
The Bold data were just to indicate significant differences

with data other study showing that the consumption of sugar-sweetened beverages is related with a poor-quality diet and the consumption of unhealthy foods [36].

It is noteworthy that adolescents in the profile "No beverage consumption for breakfast" had significantly higher fruit consumption. Consuming fruits instead of fruit juices and refreshments seems to be healthier because the energy and sugar contents are lower and the fiber content is higher in solid than in liquefied fruits [37].

In the present study, the proportion of adolescents who did not have breakfast on the day of the survey was comparable to that observed in similar studies performed in Brazil and other countries. The frequency of breakfast skipping in Brazil varied between 8.5 and 28.4 % [9, 22] and 20–31.5 % in other countries [14, 38]. In this study, breakfast skipping in 1 day of 24hR was more common among girls, as previously reported by Estima et al. [10] of Brazilian adolescents and Nicklas et al. [39] of American adolescents.

Similarly to findings from studies conducted both in Brazil and in other countries, a higher frequency of breakfast omission was observed among overweight children and adolescents compared to those with normal-weight [14, 38–40]. Breakfast omission has been identified as a risk factor for weight gain [17, 41]. Rampersaud et al. [42] suggested that adolescents who do not have breakfast regularly do not increase their energy intake during the day but still tend to gain more weight than those eating breakfast on a regular basis. According to Horikawa et al. [43], during prolonged fasting, the levels of circulating insulin are higher, which can cause an increase in fat storage and, consequently, weight gain.

The higher frequency of breakfast skipping in adolescents studying in the morning shift can be explained by the fact that these students may rush to leave home in the morning and wait to take their first meal of the day during the school recess, as classes usually begin around 7:00 AM. In Brazilian public schools, the school meal program provides free meals [44]. It has been suggested that lack of time is a possible justification or a risk factor for meal omissions [8, 43].

A possible limitation of this study refers to the use of a single 24-h recall. However, a single 24-h recall allows a trustful estimation of population means [45]. The assessment of breakfast consumption can also be considered a limitation because the question asked could influence the answer, inducing the participants to report positively the consumption of breakfast. However, it is necessary to clarify that such question was chosen after a pre-test to facilitate the understanding of the 24hR, since the study included very young adolescents. It is unlikely that this limitation introduced any bias to the study, as the results obtained were compatible with the findings from similar studies, not only concerning the proportion of adolescents who skipped breakfast, which was more frequent among girls and overweight adolescents, but

Table 4 Frequency (%) of food groups consumption according to the breakfast eating profile of adolescents from public schools in Niterói, Brazil, 2005

Food groups consumed at breakfast	Breakfast eating profile					*p* value*
	Coffee and tea (*n* = 296)	Milk and milk-based beverages (*n* = 437)	Sugar-sweetened beverages (*n* = 127)	No beverage consumption for breakfast (*n* = 60)	More than one type of beverage for breakfast (*n* = 33)	
	%					
Chocolate and other flavored milk powder	0[a]	79[b]	0[a]	3[a, d]	9[c]	**<0.01**
Sugar and sweets	83[a]	51[b]	39[b]	8[a, c]	76[a]	**<0.01**
Milk and milk-based beverages	0[a]	100[b]	0[a]	0[a]	94[c]	**<0.01**
Coffee and tea	100[a]	0[b]	0[b]	0[b]	91[a]	**<0.01**
Cookies and crackers	15	17	25	25	24	0.3
Cakes	2	3	2	8	6	0.1
Processed and canned meat	14	14	23[a]	5[b]	12	**0.02**
Fruits and vegetables	1[a]	3[a]	2[a]	18[b]	6	**<0.01**
Butter or margarine	59[a]	48[b, d]	45[a, d]	20[c]	55[a]	**<0.01**
Eggs	1	0.5	3	0	0	0.07
Breads	75[a]	61[b]	65[a, b]	35[c]	61	**<0.01**
Cereals	0[a]	3[b]	0.8	8[b]	3	**<0.01**
Cheese	9	12	19	8	12	0.06
Sugar-sweetened beverages	0[a]	0[a]	100[b]	0[a]	21[c]	**<0.01**
Snacks and sandwiches	0.3[a]	0.9[a]	6[b]	5	0	**<0.01**

Means followed by the same letter show statistically significant difference
[a]Comparing the group of consumption "Coffee or Tea" with other groups
[b]Comparing the group of consumption " Milk or milk-based beverages" with other groups
[c]Comparing the group "No beverage consumption for breakfast" with other groups
[d]Comparing the group of consumption "Sugar-sweetened beverages" with other groups
**p* value for chi-square test
The Bold data were just to indicate significant differences

Table 5 Daily and breakfast energy and nutrients intake according to breakfast eating profiles of adolescents ($n = 953$) from public schools in Niterói, Brazil, 2005

Energy and nutrients	Profile dietary intake of breakfast										*p* value*
	Coffee or tea ($n = 296$)		Milk or milk-based beverages ($n = 437$)		Sugar-sweetened beverages ($n = 127$)		No beverage consumption for breakfast ($n = 60$)		More than one type of beverage for breakfast ($n = 33$)		
	Mean										
Energy											
Daily total (kcal)	2196[a]	870	2464[b]	962	2544[c]	1115	2124[a, b, c, d]	887	2476[a, b, c, d]	1252	**<0.01**
Breakfast (kcal)	401	275	420	251	406	274	386	168	426	247	1.0
% breakfast/daily total	18	10	19	10	18	9	18	8	17	7	1.0
Carbohydrate											
Daily total (g)	339[a]	135	367[a, b]	152	395[b]	171	316[a]	137	386[a, b]	204	**<0.01**
% kcal daily total	62[a]	7	59[b]	7	63[a]	7	60[a, b]	8	62[a, b]	7	**<0.01**
Breakfast (g)	62	43	64	38	61	43	58	25	68	43	1.0
% kcal breakfast	63	13	62	12	61	12	61	12	66	14	0.5
% kcal breakfast/kcal daily total	11	6	12	6	11	5	11	7	11	5	1.0
Protein											
Daily total (g)	87[a, b]	37	95[a]	38	89[a, b]	39	79[b]	34	91[a, b]	42	**0.03**
% kcal daily total	16[a]	4	16[a]	4	14[b]	4	15[a, b]	4	15[a, b]	4	**<0.01**
Breakfast (g)	11	8	12	8	12	8	12	6	11	7	1.0
% kcal breakfast	11	4	12	4	12	4	12	5	10	4	0.05
% kcal breakfast/kcal daily total	2	1	2	1	2	1	2	1	2	1	0.3
Lipid											
Daily total (g)	56[a]	30	70[b]	34	69[b]	41	59[a, b]	28	66[a, b]	37	**<0.01**
% kcal daily total	23[a]	6	25[b]	6	24[a, c]	6	25[b, c]	6	24[a, b, c]	6	**<0.01**
Breakfast (g)	12	10	13	10	13	11	12	7	12	9	1.0
% kcal breakfast	27	10	28	9	28	10	27	10	24	8	0.2
% kcal breakfast/kcal daily total	5	3	5	4	5	4	5	2	4	3	0.7
Cholesterol											
Daily total (mg/1000 kcal)	77[a]	61	92[b]	59	77[a, b]	55	83[a, b]	59	95[a, b]	70	**0.01**
Breakfast (mg/1000 kcal)	54	62	62	86	57	65	70	105	33	40	0.2
% cholesterol daily total	14	17	16	19	15	20	18	23	11	21	0.9
Calcium											
Daily total (mg/1000 kcal)	257[a]	111	341[b]	122	203[c, e]	98	197[d, e]	120	308[a, b]	104	**<0.01**
Breakfast (mg/1000 kcal)	626	399	642	382	660	401	698	437	516	330	0.3
% calcium daily total	39	23	40	22	40	20	39	21	36	22	1.0

Table 5 Daily and breakfast energy and nutrients intake according to breakfast eating profiles of adolescents ($n = 953$) from public schools in Niterói, Brazil, 2005 *(Continued)*

Iron											
Daily total (mg/1000 kcal)	18	84	11	43	24	115	18	75	8	4	0.5
Breakfast (mg/1000 kcal)	5	5	4	3	4	4	4	3	4	3	1.0
% iron daily total (%)	2	12	10	11	10	10	10	14	9	8	1.0
Sodium											
Daily total (mg/1000 kcal)	968	410	931	386	962	320	954	376	959	314	1.0
Breakfast (mg/1000 kcal)	930	605	924	589	906	634	897	558	808	572	1.0
% sodium daily total	19	16	21	17	17	15	18	14	15	13	0.3
Vitamin A											
Daily total (Retinol equivalents/ 1000 kcal)	368[a, b]	904	460[a]	599	231[b]	456	393[a, b]	745	365[a, b]	630	**0.01**
Breakfast (retinol equivalents/ 1000 kcal)	497	480	483	452	559	533	587	468	417	476	1.0
% vitamin A daily total	34	29	34	30	36	28	33	26	31	29	1.0

Means followed by different letters show statistically significant difference
*p value for Mann-Whitney test
[a]Comparing the group of consumption "Coffee or Tea" with other groups
[b]Comparing the group of consumption " Milk or milk-based beverages" with other groups
[c]Comparing the group of consumption "Sugar-sweetened beverages" with other groups
[d]Comparing the group "No beverage consumption for breakfast" with other groups
[e]Comparing the group "More than one type of beverage for breakfast" with other groups
The Bold data were just to indicate significant differences

also concerning to the findings related to the mean energy intake in this meal.

Finally, this study represents an advancement in the knowledge about breakfast habits of adolescents, describing the most consumed foods and dietary patterns practiced at this meal, in addition of reporting the nutritional characteristics associated with breakfast eating profile. It is worthwhile to note that the Brazilian Dietary Guidelines [46] recommends to have three main meals daily (breakfast, lunch, and dinner), which should be based on fresh or minimally processed foods and provide about 90 % of total calories consumed throughout the day. Thus, the issue of meal consumption should definitely be part of proposals aiming to promote a healthy lifestyle and adequate eating habits. While characterizing the eating pattern at breakfast, this study provides important information to support intervention programs to promote healthy eating among adolescents.

Conclusions

This study showed that the breakfast quality is associated with the type of beverage included in the meal. The consumption of sugar-sweetened beverages in the breakfast was linked to the consumption of foods with high content of fat and sugar, considered typical of a low-quality diet. The consumption of milk or milk-based beverages was related with an increased intake of calcium and vitamin A throughout the day. It is also worth noting that adolescents from public schools in Niterói-RJ have a high frequency of foods high in sugar for breakfast and low consumption of fruits in the breakfast. These findings can support initiatives to promote healthy eating and discourage the consumption of sugar-sweetened beverages, which are known to play a crucial role in the worldwide epidemic of overweight and obesity.

Additional file

Additional file 1: Table S1. Mean (and standard deviation (SD)) of the daily intake of energy and nutrients of adolescents from public schools according breakfast consumption. Niterói, Rio de Janeiro, Brazil, 2005. (DOC 54 kb)

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

The authors' contributions were as follows: ASC was involved in the conception of the study, statistical analysis and interpretation of data, and manuscript drafting and final revision. PRMR participated in the statistical analysis and interpretation of the data and manuscript final revision. LSM was involved in the study conception, statistical analysis, and manuscript final revision. RAGS participated in the study conception, data analysis and interpretation, and manuscript conception and final revision. RS and RAP were involved in the study conception, statistical analysis and interpretation of data, and manuscript conception, writing, and final revision. All authors read and approved the final version.

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