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ORIGINAL ARTICLE

Prevalence of consumption and nutritional content of breakfast meal among adolescents from the Brazilian National Dietary Survey☆

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KEYWORDS
Breakfast;
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Abstract
Objective: To estimate the prevalence of breakfast consumption and describe the foods and nutrients consumed at this meal and throughout the day by Brazilian adolescents.
Method: A total of 7276 adolescents aged 10–19 years were evaluated in the Brazilian National Dietary Survey 2008–9, a population-based cross-sectional study. Individuals' information was collected at home. Dietary data were obtained by two food records. Breakfast was defined as the first eating occasion of the day that occurred between 6 and 9:59 am. Differences between breakfast consumers, occasional consumers, and skippers were tested through Pearson's chi-squared test or *F*-test of regression analysis.
Results: Breakfast was consumed by 93% of adolescents and it was associated with age, income, geographic region and household area. The most frequently consumed foods at breakfast were white bread, coffee, butter/margarine, refined cookies and crackers, and whole milk. The mean daily intakes of total energy, sugar, and calcium were higher among occasional consumers and skippers. Breakfast consumers had higher intake of vitamins B12, C, and D. Breakfast contributed more to total intake of calcium, phosphorus, thiamin, riboflavin, and vitamins A, B6, and D (17–32%), trans fat and sodium (about 30%) and less to folate, vitamin C, iron, zinc, and fiber (8–12%) and energy intake (16%).

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Conclusions: Although the prevalence of breakfast consumption among Brazilian adolescents was high, the overall nutritional quality of this meal is suboptimal, highlighting the need to support adolescents and their families to make more nutrient-dense food choices.

PALAVRAS-CHAVE
Café da manhã;
Adolescente;
Ingestão de alimentos;
Necessidades nutricionais;
Brasil

Prevalência de consumo e teor nutricional da refeição do café da manhã entre adolescentes da Pesquisa Nacional de Consumo Alimentar

Resumo

Objetivo: Estimar a prevalência de consumo de café da manhã e descrever os alimentos e nutrientes consumidos nessa refeição e durante todo o dia por adolescentes brasileiros.
Método: Foram avaliados 7.276 adolescentes entre 10-19 anos no Inquérito Nacional de Alimentação 2008-2009, um estudo transversal de base populacional. As informações dos indivíduos foram coletadas nos domicilios. Os dados alimentares foram obtidos por dois registros alimentares. O café da manhã foi definido como a primeira refeição do dia entre 6h00 e 9h59. As diferenças entre os consumidores de café da manhã, consumidores ocasionais e aqueles que não tomam café da manhã foram testadas por meio do teste de qui-quadrado ou teste F para análise de regressão.
Resultados: O café da manhã foi consumido por 93% dos adolescentes e seu consumo foi associado à idade, renda, região geográfica e área residencial. Os alimentos mais frequentemente consumidos foram pão branco, café, manteiga/margarina, biscoitos e bolachas refinados e leite integral. A ingestão média diária de energia total, açúcar e cálcio foi maior entre os consumidores ocasionais e aqueles que não tomam café da manhã. Aqueles que tomam café da manhã apresentam maior ingestão de vitaminas B12, C e D. O café da manhã contribuiu mais para a ingestão total de cálcio, fósforo, tiamina, riboflavina e vitaminas A, B6 e D (17%-32%), gordura trans e sódio (cerca de 30%) e menos para a ingestão de ácido fólico, vitamina C, ferro, zinco e fibras (8%-12%) e energia (16%).
Conclusões: Apesar de a prevalência de consumo de café da manhã entre os adolescentes brasileiros ter sido alta, a qualidade nutricional dessa refeição está abaixo do ideal, destaca a necessidade de apoio aos adolescentes e suas famílias para possibilitar a escolha de alimentos mais densos em nutrientes.

Introduction

Regular consumption of breakfast has been associated with several nutritional and health benefits.[1–3] Evidence shows that breakfast consumers have higher daily nutrient intake, are more likely to reach nutritional recommendations, and have better overall diet quality when compared with those who do not consume this meal.[1,4–6] Skipping breakfast has been identified as a potentially harmful behavior in pediatric populations, as it has been associated with increased body fat[3] and other negative cardiometabolic risk factors, such as higher waist circumference, unfavorable lipid profile, and increased fasting glucose levels.[7,8] In addition to the physiological benefits, there may be positive effects of breakfast consumption on school performance and attendance, attention, memory, and mental health,[9,10] but more research is needed due to inconsistent findings and methodological limitations of studies.[9]

The Brazilian Dietary Guidelines recommend the consumption of breakfast as one of the three main daily meals, and give examples of a quality breakfast according to Brazilian habits. They recommend the consumption of natural or minimally processed foods, such as fruits, coffee, and milk, and culinary preparations based on cereals or tubers, such as tapioca pancakes, couscous, and cassava cake.[11] The Brazilian National School Food Program (Programa Nacional de Alimentação Escolar [PNAE]), designed to offer school meals for all students enrolled in basic education of public schools of Brazil,[12] presents several recommendations regarding the nutritional content of the school meals; however, it does not propose specific guidelines for breakfast.[12]

Despite the potential nutritional and health benefits of breakfast, studies show that young people are more likely to skip breakfast than other meals.[1] Nonetheless, breakfast skipping estimations present large variation. The estimates of breakfast skipping ranged from 4% in Australians aged 2–16 years,[13] to 23% and 27% among boys and girls aged 12–19 years in the United States, respectively.[14] An international network across 31 countries from Europe and North America reported that daily breakfast consumption in adolescents aged 11–15 years ranged between 37.8% (Slovenia) to 72.6% (Netherlands).[15]

Data from the Brazilian National Survey of Schoolchildren's Health (Pesquisa Nacional de Saúde do Escolar [PeNSE]), conducted in 2012 with 109,104 students from all Brazilian capitals, showed that 61.9% of adolescents (most

aged 11–14 years) reported eating breakfast at least five days per week. Breakfast consumption was positively correlated with a healthier diet; however, the relationship between the nutritional content of breakfast and overall diet quality was not investigated.[16]

The objective of the present study was to assess the prevalence of breakfast consumption and estimate the food and nutrients consumed at this meal and throughout the day by Brazilian adolescents using nationally representative data.

Methods

Study sample

This study analyzed data from the first Brazilian National Dietary Survey (BNDS) [*Inquérito Nacional de Alimentação (INA)*], a dietary intake assessment study at individual level conducted as part of the Brazilian Household Budget Survey (HBS) [*Pesquisa de Orçamentos Familiares (POF)*], a cross-sectional population-based study conducted from March 2008 to March 2009. The BNDS collected dietary data from a representative sample of 34,003 Brazilian individuals aged ≥10 years randomly selected from about 25% of the 55,970 households evaluated in HBS. More details about the HBS sampling procedure can be found elsewhere.[17]

For the present study, adolescents aged 10–19 years, with complete data (dietary, socioeconomic, anthropometric, and demographic data), not pregnant or lactating were considered eligible ($n = 7276$).

This study was approved by the Ethics Committee of the School of Public Health, University of São Paulo (Protocol No. 2258/2011), and conducted in accordance with the Federal Law number 5534 which ensures the confidentiality of the information gathered by all Brazilian census and surveys.

Socioeconomic, demographic, and anthropometric data

Individuals' information on age, gender, geographic region (North, Northeast, Southeast, South, Midwest), household area (urban/rural), and income was collected by a structured questionnaire administered by trained interviewers in the households.

Body weight and height were measured in triplicate using digital scales and portable wall-mounted stadiometers following standardized procedures and their means were recorded. Body mass index (BMI) was calculated dividing weight by height squared (kg/m^2).

Body weight status was defined according to the BMI-for-age classification curves for children and adolescents proposed by the WHO (2007) and applied by Brazilian Ministry of Health.[18] The BMI cut-offs used for adolescents were <3rd percentile (underweight), ≥3rd and <85th percentile (normal weight), ≥85th and ≤97th percentile (overweight), and >97th percentile (obese).

Dietary data collection

Dietary data were collected by two non-consecutive 24-h food records completed by each individual in the household, in which 85% were completed on weekdays and 15% on weekends. Respondents were instructed to register all consumed foods and beverages in household measures and to report the time and place of eating occasions and cooking methods. Manuals with instructions and photos of household measures were provided to individuals to facilitate the estimation of portions. After completion of the food records, interviewers returned to the households for quality control. Dietary data were entered into software developed by Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística [IBGE]). A food composition database was developed based on compiled dietary data mainly from the Brazilian Food Composition Tables (Tabela Brasileira de Composição de Alimentos [TACO], version 2.2) and the database from Nutrition Data System for Research (NDS-R, version 8.0, MN, USA) to determine the nutritional value of each food and beverage recorded.

Breakfast definition

Since individuals did not register meal names in BNDS, the definition of breakfast was based on the typical period of time of the first daily eating occasion for the majority of Brazilians. Participants reported the time of their eating occasion rounded to the previous hour. So, if an individual ate at 8:34 a.m. they recorded this eating occasion as occurring at 8:00 a.m. Therefore, eating occasions were grouped into 1-h blocks. An eating occasion was defined as an episode of food and/or beverage consumption that occurred during a 1-h time period. In BNDS, the first eating occasion reported by the majority of individuals (96%) occurred between 6:00 and 9:59 a.m. Therefore, it was considered the breakfast meal.

Adolescents who had the first eating occasion between 6:00 and 9:59 a.m. on both dietary assessment days were considered breakfast consumers, while those who had breakfast in only one day were considered occasional consumers. Adolescents who did not report any food or beverage (excluding water) on both days between 6:00 and 9:59 a.m. were considered breakfast skippers.

Statistical analyses

Descriptive analysis of mean, percentage and 95% confidence intervals (95% CI) were performed using Stata® software (StataCorp., 2011, *Stata Statistical Software*: version 12, College Station, TX, USA) considering the complex sampling design. The differences of means of dietary intakes according to breakfast consumption status were tested through *F*-tests of regression analysis. Differences of socioeconomic, demographic, and anthropometric variables were evaluated through Pearson's chi-squared test with the Rao and Scott second-order correction. All statistical tests considered the significance level of 5% and accounted for the sampling design.

The percentage of consumption and daily mean intake of food groups were estimated for breakfast consumers, occa-

Table 1 Characteristics and daily energy and nutrient intakes of Brazilian adolescents according to categories of breakfast consumption, Household Brazilian Budgets, 2008–2009.

Characteristics	Breakfast consumers ($n = 5902$)		Occasional breakfast consumers ($n = 882$)		Breakfast skippers ($n = 492$)		p[b]
	%	(95% CI)	%	(95% CI)	%	(95% CI)	
Sex							
Men	78.5	(75.9–81)	13.3	(11.4–15.4)	8.2	(6.7–10)	0.147
Women	75.2	(72.4–77.8)	14.7	(12.9–16.8)	10.1	(8.2–12.4)	
Age group							
10–14 years	79.0	(76.4–81.3)	12.2	(10.6–14.1)	8.8	(7.1–10.9)	0.044
15–19 years	74.9	(71.9–77.6)	15.7	(13.7–18)	9.4	(7.7–11.4)	
Body weight status[a]							
Underweight	84.8	(75.2–91.2)	13.1	(7.1–23)	2.1	(0.8–5.1)	0.115
Normal weight	76.8	(74.3–79.1)	13.6	(12.1–15.3)	9.6	(8.1–11.4)	
Overweight	78.0	(73.8–81.7)	14.3	(11.3–18)	7.7	(5.5–10.5)	
Obese	70.4	(61.2–78.3)	18.8	(12.1–28)	10.8	(6.8–6.8)	
Per capita family income							
≤1 PCMW	82.4	(80.1–84.4)	11.3	(9.8–12.9)	6.4	(5–8)	<0.001
>1 to 2 PCMW	73.6	(69.1–77.6)	16.1	(13.2–19.7)	10.3	(7.8–13.3)	
>2 PCMW	62.1	(56.5–67.3)	20.6	(16.5–25.4)	17.4	(13.2–22.4)	
Geographic region							
North	86.2	(83–89)	9.8	(7.6–12.5)	4.0	(2.7–5.7)	<0.001
Northeast	87.1	(84.9–89)	8.3	(7–9.8)	4.6	(3.5–6.1)	
Southeast	69.3	(65–73.3)	17.9	(15.1–21.1)	12.8	(10.1–16.1)	
South	68.1	(62.6–73.2)	18.8	(15–23.3)	13.1	(10.3–16.6)	
Midwest	77.7	(72.3–82.3)	14.1	(10.4–18.9)	8.2	(5.3–12.3)	
Household area							
Rural	88.8	(86.2–90.9)	8.0	(6.3–10.1)	3.2	(2.1–4.8)	<0.001
Urban	74.0	(71.6–76.3)	15.4	(15.4–17.3)	10.6	(9–12.3)	

Daily energy[c] and nutrients[d]	Mean	(95% CI)	Mean	(95% CI)	Mean	(95% CI)	p[e]
Energy (kcal/day)	1877	(1867–1886)	1919	(1897–1941)	1927	(1901–1954)	<0.001
Total carbohydrates (g/day)	254.8	(249.9–259.6)	253.1	(243.1–263.1)	257.5	(238.8–276.2)	0.908
Total protein (g/day)	79.7	(78.2–81.2)	77.4	(74.4–80.4)	77.6	(72–83.2)	0.344
Total fat (g/day)	60.9	(59.5–62.3)	62.3	(59.5–65.1)	64.3	(59.1–69.5)	0.362
Saturated fatty acids (g/day)	21.4	(20.9–22)	22.3	(21.2–23.3)	23.3	(21.3–25.3)	0.112
Trans fatty acids (g/day)	3.5	(3.4–3.6)	3.6	(3.4–3.8)	3.7	(3.4–4)	0.262
Total sugar (g/day)	75.7	(73.5–77.8)	82.7	(78.7–86.6)	88.5	(81.5–95.5)	<0.001
Added sugar (g/day)	47.1	(45.5–48.7)	52.8	(49.8–55.8)	57.4	(52.1–62.6)	<0.001
Cholesterol (mg/day)	255.9	(251.3–260.6)	247.8	(238.2–257.3)	249.3	(231.2–267.4)	0.283
Total fiber (g/day)	20.2	(19.8–20.5)	19.4	(18.7–20.2)	19.3	(17.9–20.7)	0.114
Calcium (mg/day)	523.7	(512.4–535)	554.6	(534.1–575.2)	579.6	(540.5–618.8)	0.002
Phosphorus (mg/day)	983.1	(964.4–1001.7)	976.5	(939.2–1013.8)	992.1	(921.8–1062.4)	0.913
Iron (mg/day)	11.7	(11.5–12)	11.9	(11.5–12.3)	12.1	(11.3–12.9)	0.647
Zinc (mg/day)	11	(10.8–11.2)	11	(10.5–11.4)	11.1	(10.3–11.8)	0.960
Sodium (mg/day)	1607.5	(1574.9–1640)	1628.5	(1563.3–1693.7)	1681.3	(1562.4–1800.2)	0.467
Potassium (mg/day)	2319.4	(2280.5–2358.3)	2298.6	(2218.3–2378.8)	2315.1	(2165.6–2464.6)	0.898
Vitamin A (RAE) (mcg)	495.4	(486.6–504.2)	482.7	(462.7–502.7)	494.1	(458.1–530.2)	0.517
Thiamin (mg/day)	1.3	(1.2–1.3)	1.3	(1.2–1.3)	1.3	(1.2–1.4)	0.777
Riboflavin (mg/day)	1.7	(1.6–1.7)	1.7	(1.6–1.7)	1.7	(1.6–1.8)	0.552
Niacin (mg/day)	14.6	(14.3–14.9)	14.6	(14–15.2)	15	(13.9–16)	0.804
Vitamin B6 (mg/day)	1.5	(1.4–1.5)	1.5	(1.4–1.5)	1.5	(1.4–1.6)	0.773
Vitamin B12 (mcg/day)	5.2	(5.1–5.3)	4.9	(4.7–5.1)	4.8	(4.5–5.2)	0.007
Dietary folate equivalents (mcg)	274.7	(269.8–279.6)	282.1	(272.4–291.8)	288.7	(270.8–306.5)	0.177
Vitamin D (mcg/day)	3.5	(3.4–3.6)	3.2	(3–3.3)	3.1	(2.8–3.3)	<0.001
Vitamin C (mg/day)	154.1	(149.7–158.6)	136.6	(128.5–144.8)	136.2	(126.2–146.3)	<0.001

PCMW, *per capita* minimum wage; RAE, Retinol activity equivalents; BMI, Body mass index; CI, confidence interval.

[a] Body weight status was classified according to BMI-for-age classification curves for children and adolescents proposed by the World Health Organization (2007).

[b] p-values of Pearson's chi-squared test with the Rao and Scott second-order correction adjusted for the complex sampling design.

[c] Mean was adjusted for sex, age group, body weight status, *per capita* family income, geographic region, and household area.

[d] Means were adjusted for total energy intake, sex, age group, body weight status, *per capita* family income, geographic region, and household area.

[e] p-values are the *Prob* > *F* of the linear regression analysis adjusted for the complex sampling design.

Table 2 Percentage of consumers (%) and adjusted mean daily food group intakes[a] (g/day) by breakfast consumers, occasional consumers and skippers aged 10–19 years based on the mean of two-day food records, Brazilian Household Budget Survey, 2008–2009.

Food groups	Breakfast consumers ($n = 5902$)		Occasional breakfast consumers ($n = 882$)		Breakfast skippers ($n = 492$)		p[b] (prev.)	p[c] (means)
	Prevalence of consumption (%) (95% CI)	Mean (g/day) (95% CI)	Prevalence of consumption (%) (95% CI)	Mean (g/day) (95% CI)	Prevalence of consumption (%) (95% CI)	Mean (g/day) (95% CI)		
Beverages								
Juices (fruit and vegetable)	56.3 (53.9–58.7)	205.8 (202.2–209.5)	58.3 (52.7–63.8)	215.3 (208.4–222.1)	53.3 (45.7–60.8)	221.7 (210.1–233.3)	0.562	0.005
Soda pop	34.6 (34.2–39.1)	167.9 (161.8–173.9)	50.5 (45–55.9)	204.7 (193.6–215.8)	61.5 (54–68.6)	223.2 (206–240.4)	<0.001	<0.001
Coffee without milk	50.2 (47.5–52.9)	108.8 (106–111.6)	35.5 (30.5–40.9)	90.1 (85.6–94.5)	23.6 (18.1–30.2)	81.1 (74.7–87.6)	<0.001	<0.001
Coffee with milk	40.5 (38–43)	96.6 (95.4–97.8)	32.6 (27.7–38)	95.1 (92–98.2)	21.7 (15.7–29.3)	92.8 (88.5–97)	<0.001	0.184
Fruit smoothie (milk mixed with one or more fruits)	6.2 (5.2–7.4)	20.1 (19.4–20.8)	6.1 (3.7–10.2)	19 (17.7–20.3)	5.2 (2.5–10.5)	19.7 (17.9–21.5)	0.871	0.317
Tea	5.2 (3.9–6.8)	14.6 (13.8–15.3)	5 (3.2–7.7)	17.7 (16.2–19.3)	4.2 (2.2–7.8)	17.6 (15.9–19.4)	0.815	<0.001
Dairy and alternatives								
Milk, whole	34.0 (31.6–36.5)	94.2 (91.3–97.1)	38.9 (33.5–44.7)	111.5 (107.1–115.9)	38.1 (30.2–46.7)	121 (113.9–128.1)	0.235	<0.001
Yogurt	8.9 (7.6–10.4)	20.6 (19.9–21.2)	7.3 (5.4–9.9)	22 (20.6–23.4)	7.5 (5–11.3)	24.2 (22.4–26)	0.433	0.001
Cheese	14.1 (12.6–15.9)	6 (5.8–6.2)	15.1 (11.7–19.2)	6.9 (6.4–7.3)	16.3 (12.1–21.7)	7.7 (6.9–8.4)	0.614	<0.001
Low-fat and skimmed milk	1.8 (1.3–2.5)	3.6 (3.5–3.8)	0.9 (0.4–2.1)	4.5 (4.2–4.8)	0.9 (0.4–2.5)	4.8 (4.4–5.2)	0.176	<0.001
Milk drinks	1.6 (0.9–2.8)	3.8 (3.6–4.1)	3.5 (1.8–6.5)	4.9 (4.4–5.3)	1.7 (0.5–5.4)	5.7 (4.9–6.4)	0.161	<0.001
Soy milk	0.4 (0.1–1.4)	1.1 (1–1.2)	0.5 (0.2–1.5)	1.7 (1.5–1.9)	1.6 (0.5–5)	2 (1.7–2.3)	0.150	<0.001
Refined cereals								
White bread	77.6 (75.4–79.5)	68.5 (67.3–69.7)	77.1 (71.8–81.6)	68.3 (65.8–70.8)	65.4 (57.2–72.7)	68.9 (64.5–73.4)	0.002	0.962
Refined grain cookies and crackers	50.6 (48.3–52.9)	38.9 (37.6–40.1)	49.6 (44.2–55)	38.4 (35.7–41.1)	38.6 (31.7–46)	40.4 (35.6–45.1)	0.006	0.777
Typical Brazilian cereal dishes (pamonha, couscous dishes, curau)	22.9 (21–24.9)	35.8 (33.8–37.7)	17 (13.4–21.3)	22.4 (19.8–24.9)	14.6 (10.3–20.3)	19.6 (16.1–23.1)	0.002	<0.001
Cakes and sweet pies	23.8 (21.8–25.8)	27.2 (26.4–28)	25.9 (20.9–31.6)	29.5 (27.9–31)	30.3 (22.8–39)	30.9 (28.3–33.6)	0.189	0.003
Cereals and grain products (including flours, corn, tapioca)	22.2 (20.1–24.4)	20.9 (19.8–22)	14.2 (11.4–17.7)	13.4 (11.7–15.2)	11 (7.8–15.3)	10.8 (8.4–13.2)	<0.001	<0.001
Refined grains products and breakfast cereals (corn flakes, cereal flakes,''farinha láctea'', ''Mucilon'', wheat germ, wheat flour, hominy)	1.9 (1.3–2.6)	0.9 (0.8–0.9)	3.6 (0.3–1.5)	1.1 (1–1.2)	1.8 (0.9–3.9)	1.2 (1.1–1.4)	0.212	<0.001

Table 2 (*Continued*)

Food groups	Breakfast consumers ($n = 5902$)		Occasional breakfast consumers ($n = 882$)		Breakfast skippers ($n = 492$)		p^b (prev.)	p^c (means)
	Prevalence of consumption (%) (95% CI)	Mean (g/day) (95% CI)	Prevalence of consumption (%) (95% CI)	Mean (g/day) (95% CI)	Prevalence of consumption (%) (95% CI)	Mean (g/day) (95% CI)		
Whole grain cereals								
Porridge with milk (corn, oats, rice)	3.8 (3–4.9)	8.8 (8.5–9.1)	0.7 (0.2–2.2)	6.7 (6.1–7.3)	3.2 (0.8–11.6)	6.1 (5.5–6.7)	0.128	<0.001
Other whole grain products and ingredients (oatmeal, oat flour, oats, granola, popcorn, quinoa, ''Neston'')	6.2 (5.3–7.2)	1.6 (1.6–1.7)	6.5 (4.8–8.9)	1.5 (1.3–1.6)	6 (3.8–9.3)	1.5 (1.3–1.7)	0.935	0.121
Whole grain bread	1.2 (0.8–1.7)	0.5 (0.4–0.7)	0.7 (0.3–1.5)	0.6 (0.5–0.7)	1.3 (0.4–4.3)	0.6 (0.5–0.8)	0.561	0.072
Whole grain cookies and crackers	0.02 (0.01–0.2)	0.04 (0.01–0.06)	– –	– –	– –	– –	–	–
Butter and margarine	47.7 (45.2–50.2)	8.4 (8.2–8.6)	44.1 (38.3–50)	8.4 (8–8.8)	33.8 (27.2–41.2)	8.5 (7.7–9.2)	0.002	0.957
Mayonnaise, ketchup and mustard	2.1 (1.5–3)	0.4 (0.4–0.4)	3.2 (1.7–5.9)	0.6 (0.5–0.6)	4.9 (2–11.7)	0.6 (0.6–0.7)	0.128	<0.001
Eggs	30.5 (28.4–32.7)	20.2 (19.9–20.5)	24.1 (19.7–29.1)	18.4 (17.9–19)	25.3 (18.4–33.7)	17.9 (17.1–18.7)	0.071	<0.001
Fruit, vegetables, and nuts								
Fresh fruit	42.6 (40.3–45)	98.1 (95.9–100.3)	39 (33.9–44.4)	89.4 (85.4–93.5)	32.9 (26.2–40.4)	89 (82.5–95.5)	0.025	0.001
Roots and tubers	22.8 (20.7–25.1)	34.3 (33.6–35.1)	22.3 (18.1–27)	36.6 (35.2–38)	25.9 (19.7–33.1)	37 (34.8–39.1)	0.592	0.002
Vegetables (excluding roots and tubers)	38.9 (36.4–41.4)	29 (28.2–29.8)	38.2 (32.7–44)	34.2 (33–35.4)	38.4 (31.5–45.9)	36 (34.3–37.6)	0.972	<0.001
Nuts and seeds	1.7 (1.2–2.5)	0.6 (0.5–0.6)	1.5 (0.8–2.8)	0.6 (0.5–0.8)	1.9 (0.9–4.2)	0.6 (0.5–0.7)	0.868	0.050
Meat and meat products								
Meats (beef, chicken, turkey, fish)	89.2 (87.6–90.7)	150.0 (146.8–153.2)	87.8 (84.1–90.7)	135.5 (129.6–141.4)	82.86 (75.9–88.1)	131.3 (121.4–141.2)	0.032	<0.001
Processed meats (sausage, frankfurters, bacon, hamburger, nuggets, jerky beef)	20.9 (18.9–23.2)	20.0 (19.4–20.7)	28.8 (23.7–23.7)	18.7 (17.4–20)	29.2 (22.5–37)	18.6 (16.1–21)	0.002	0.110
Cold cuts (pork ham, mortadella, turkey ham)	14.2 (12.6–15.9)	5 (4.9–5.1)	17 (13.5–21.2)	5.3 (5.1–5.5)	19.7 (14.3–26.5)	5.5 (5.1–5.8)	0.074	0.007
Savoury snacks and dishes								
Pizza and salty goods (*e.g.*, esfiha, cheese bread)	23.3 (21.3–25.3)	22.2 (21.2–23.3)	28.7 (23.5–34.5)	29.5 (27.4–31.6)	33 (25.5–41.5)	33.1 (30–36.1)	0.011	<0.001

Table 2 (*Continued*)

Food groups	Breakfast consumers ($n = 5902$)		Occasional breakfast consumers ($n = 882$)		Breakfast skippers ($n = 492$)		p^b (prev.)	p^c (means)
	Prevalence of consumption (%) (95% CI)	Mean (g/day) (95% CI)	Prevalence of consumption (%) (95% CI)	Mean (g/day) (95% CI)	Prevalence of consumption (%) (95% CI)	Mean (g/day) (95% CI)		
Hot dogs and sandwiches (hamburgers, cold cuts, and/or egg sandwiches)	14.2 (12.5–16.2)	21.7 (20.8–22.7)	21.2 (16.6–26.6)	28.5 (26.8–30.3)	26.4 (18.9–35.5)	32.0 (29.5–34.6)	0.001	<0.001
Salty snacks	9.9 (8.4–11.6)	8.7 (8.4–9)	9.9 (7.3–13.3)	9.6 (9–10.2)	11.4 (6.8–18.5)	10.7 (9.7–11.6)	0.794	0.001
Sweet								
Sweets and candies	31.3 (29.2–33.6)	29.2 (28.1–30.3)	36.5 (31.4–42)	33.0 (30.7–35.3)	37.8 (30.6–45.7)	36.9 (33–40.8)	0.061	<0.001
Chocolate powder	7.3 (6.1–8.5)	2.4 (2.3–2.5)	7.8 (5.5–11.1)	3.0 (2.9–3.2)	7.4 (3.9–13.6)	3.4 (3.1–3.7)	0.922	<0.001
Jams	3.2 (2.6–4)	2.2 (2.1–2.3)	2.0 (1.2–3.3)	2.3 (2.1–2.5)	2.8 (1.5–5.4)	2.4 (2–2.7)	0.259	0.677
Sugar and honey	2.3 (1.8–2.9)	1.1 (1–1.1)	3.1 (1.7–5.5)	0.9 (0.8–1)	0.8 (0.3–2.2)	0.8 (0.7–1)	0.110	0.001
Beans and bean-based dishes	86.6 (85–88.1)	214.3 (210.3–218.2)	87.4 (84.3–90)	211.9 (203.1–220.6)	83.3 (76.9–88.2)	208.2 (194.5–221.8)	0.294	0.654
Rice and rice-based dishes	94.9 (93.5–96)	178.3 (176–180.7)	95.6 (93.4–97)	175.8 (170.6–181)	95.4 (88.2–98.3)	173.9 (165.8–182.1)	0.858	0.467
Noodles and pasta	36.6 (34.4–39)	80.7 (78.5–82.8)	36.0 (31–41.4)	91.1 (87.1–95.1)	37.9 (30.9–45.5)	98.1 (91.5–104.7)	0.907	<0.001
Soup	16.0 (14.2–18.1)	68.0 (67.1–68.9)	10.6 (8–13.8)	64.1 (62.1–66.2)	8.2 (5.5–12.1)	64.0 (61.2–66.7)	0.001	0.001
Mixed dishes (cereals with meats and/or beans)	7.2 (6.2–8.3)	14.6 (13.9–15.3)	8.3 (5.4–12.6)	9.8 (8.9–10.7)	3.7 (2.4–5.8)	8.7 (7.6–9.9)	0.084	<0.001
Alcoholic beverages (beer, wine, destilated beverages)	1.0 (0.7–1.4)	12.5 (11.5–13.4)	2.8 (1.6–4.8)	13.8 (11.8–15.7)	1.0 (0.5–2.1)	13.3 (10.6–16)	0.050	0.421

CI, confidence interval.

[a] Means were adjusted for total energy intake, sex, age group, body weight status, *per capita* family income, geographic region and household area.

[b] *p*-values of Pearson's Chi-square test with the Rao and Scott second-order correction adjusted for the complex sampling design.

[c] *p*-values are the *Prob > F* of the linear regression analysis adjusted for the complex sampling design.

sional consumers, and skippers, besides daily energy and nutrients intakes. The daily amounts of food, energy and nutrients intake were adjusted by sex, age, income, body weight status, geographic region, and household area.

The mean intake of the 15 most frequently consumed food groups and the absolute amounts of energy and nutrients provided by breakfast were estimated with adjustments for the same variables aforementioned. Furthermore, the relative contribution of breakfast to total daily consumption of energy and nutrients was calculated.

Results

Among Brazilian adolescents, 5902 (81%) were breakfast consumers, 882 were occasional consumers (12%), and 492 (7%) were breakfast skippers. About 66% of breakfast consumers and occasional consumers had the meal between 7 a.m. and 8 a.m. No differences were observed between breakfast consumers, occasional consumers, and skippers regarding sex and body weight status (Table 1). Breakfast consumption was significantly associated with age, income, geographic region, and household area ($p < 0.05$). The percentage of adolescents who consumed breakfast on both dietary assessment days was larger among younger adolescent (10–14 years), those who belonged to lower income families (≤1 *per capita* minimum wage/month), and in rural dwellers and adolescents from North and Northeast regions (Table 1).

Table 1 shows the mean daily energy and nutrients intake by breakfast consumption status. Mean intakes of total energy, total and added sugar, and calcium were higher among occasional consumers and skippers; in turn, for vitamins B12, C and D, the means were higher in breakfast consumers.

Table 2 shows the percentage of consumers and daily mean intake of food groups according to breakfast consumption status. The percentage of consumers and daily intakes of coffee without milk, typical Brazilian cereals dishes, cereals and grain products, fruits, meats, and soups were higher among breakfast consumers ($p < 0.05$). However, the percentage of consumers and daily intakes of hot dogs and sandwiches, pizza, salty goods, and soda pops were higher among breakfast skippers ($p < 0.05$). The percentage of consumers of coffee with milk, white bread, refined grain cookies and crackers, and butter/margarine was higher among breakfast consumers, while the percentage of consumers of processed meats was higher among breakfast skippers. Breakfast consumers had higher mean daily intakes of porridge with milk, eggs, sugar and honey, and mixed dishes, while occasional breakfast consumers and skippers had lower mean daily intakes of juices, tea, milk, yogurt, cheese, milk drinks, soy milk, cake and sweet pies, refined grain products, mayonnaise/ketchup/mustard, roots and tubers, vegetables, cold cuts, salty snacks, chocolate powder, and noodles/pasta.

The 15 most frequently consumed food groups at breakfast are shown in Table 3. White bread, coffee without milk, butter/margarine, coffee with milk, and whole milk were the most commonly consumed food groups at breakfast. The percentage of consumers and mean intakes at breakfast of coffee without milk, refined grain cookies and crackers, typical Brazilian cereal dishes, and eggs were higher among breakfast consumers. Higher mean intakes at breakfast of whole milk, cheese, cold cuts, chocolate powder, and pizza and salty goods were observed among occasional consumers. Considering cereals, fruit/vegetables, and dairy products as core food groups for breakfast, the consumption of all three food groups was observed in only 5% of breakfast consumers and occasional consumers. About 51% of adolescents reported consuming both cereals and dairy products at breakfast, and 32% reported the consumption of foods from the cereals group only (data not shown).

The mean nutritional content of breakfast and the relative contribution of this meal to total daily intakes are described in Table 4. On average, adolescents consumed about 310 kcal at breakfast, which contributed to 16% of the total energy intake. The contribution of breakfast to mean daily intakes of public health sensitive nutrients ranged from about 12% for total protein, 20% for total fat, 20–27% for total added sugar, 36–39% for trans fatty acids, and 29% for sodium intakes for breakfast consumers and occasional consumers, respectively. Consumption of fiber at breakfast was 12% of the total daily fiber intake for both breakfast consumers and occasional consumers. Among the micronutrients consumed at breakfast, riboflavin made the highest contribution to total daily intake (32%), followed by vitamin D (about 30%), and sodium (about 29%). Breakfast contributed less than 10% of the daily intake of folate, vitamin C, and iron.

Discussion

This study revealed that the majority of Brazilian adolescents consumed breakfast, especially those aged 10–14 years, rural dwellers, residents in North and Northeast regions, and those who belonged to low-income families.

Breakfast contributed more to total intake of some micronutrients considered of public health concern in Brazil,[19] such as calcium, phosphorus, thiamin, riboflavin, and vitamins A, B6, and D, than to total daily energy intake. However, breakfast contributed less to total daily intakes of fiber and other micronutrients such as iron, zinc, potassium, niacin, folate, and vitamins B12 and C, and about 30% of public health sensitive nutrients such as trans fat and sodium. These results could be partly explained by the fact that the most frequently consumed foods in this meal were mainly from the cereals or dairy products food groups, such as white bread, milk, butter/margarine, and refined cookies and crackers, which were in accordance with the typical Brazilian breakfast described in previous researches.[16,20]

It is noteworthy that the most frequently consumed foods by Brazilian adolescents at breakfast are not completely in agreement with the examples of recommended breakfast meals outlined in the Guidelines.[11] Notably, fresh fruits were consumed at breakfast by 5% of adolescents, and the consumption of cereals, dairy products, and fruits/vegetables at the this meal was observed in only 5% of adolescents evaluated. Another nutrient-dense food group, which was not featured in this meal, was whole grain cereals and dishes, with 3% of adolescents reporting consumption. Considered together, the poor food choices at breakfast are likely contributing to the suboptimal nutrient intakes at this meal

Table 3 Percentage of consumers (%) and adjusted mean intake of the most frequently consumed food groups at breakfast among adolescents aged 10 to 19 years ($n = 6784$), Brazilian Household Budget Survey 2008–2009.

Ranking according to the frequency of consumption at breakfast	Food groups	Breakfast consumers ($n = 5902$)		Occasional breakfast consumers ($n = 882$)		p[c] (percentage)	p[d] (means)
		Percentage of consumers (%) (95% CI)	Mean[a] (g/day) (95% CI)	Percentage of consumers (%) (95% CI)	Mean[b] (g/day) (95% CI)		
1	White bread	65.0 (62.6–67.3)	42.3 (41.5–43.1)	46.8 (41.5–52.1)	40.6 (38.7–42.4)	<0.001	0.092
2	Coffee without milk	43.1 (40.5–45.7)	69.1 (67.2–71)	21.8 (18–26.3)	57.0 (53.8–60.1)	<0.001	<0.001
3	Butter and mMargarine	41.1 (38.6–43.6)	5.9 (5.7–6)	25.8 (20.9–31.4)	5.9 (5.6–6.2)	<0.001	0.999
4	Coffee with milk	36.3 (33.8–38.8)	69.9 (68.9–70.9)	23.1 (18.7–28.2)	69.9 (67.4–72.4)	<0.001	0.980
5	Milk, whole	22.9 (20.8–25.2)	49.6 (47.7–51.5)	21.2 (16.5–26.7)	61.6 (57.7–65.4)	0.541	<0.001
6	Refined grain cookies and crackers	22.8 (20.8–25)	9.2 (9–9.3)	12.2 (9.4–15.6)	8.5 (8.1–8.8)	<0.001	0.001
7	Cakes and sweet pies	9.9 (8.6–11.3)	8.3 (8–8.6)	4.9 (3–7.9)	8.2 (7.7–8.8)	0.005	0.814
8	Typical Brazilian cereal dishes (pamonha, couscous dishes, curau)	9.5 (8.3–10.9)	15.5 (14.3–16.7)	2.8 (1.9–4.1)	7.5 (6–9)	<0.001	<0.001
9	Cheese	7.7 (6.6–8.9)	2.6 (2.5–2.7)	6.2 (4.1–9.2)	2.9 (2.7–3.2)	0.296	0.022
10	Juices (fruit and vegetable)	7.0 (6–8.3)	16.5 (16.1–16.9)	6.7 (4.4–10.1)	17.2 (16.2–18.3)	0.806	0.172
11	Cold cuts (pork ham, mortadella, turkey ham, processed meats)	6.0 (5–7.2)	1.6 (1.5–1.6)	4.3 (2.6–7)	1.8 (1.7–1.9)	0.192	<0.001
12	Eggs	6.3 (5.4–7.3)	3.7 (3.5–3.9)	2.0 (1–4)	2.5 (2.2–2.8)	0.001	<0.001
13	Chocolate powder	5.0 (4–6.1)	1.3 (1.2–1.3)	5.1 (3.2–8.1)	1.6 (1.5–1.7)	0.898	<0.001
14	Pizza and salty goods (*e.g.*, esfiha, cheese bread)	4.7 (3.9–5.7)	2.2 (2.1–2.3)	5.9 (3.6–9.6)	2.6 (2.4–2.9)	0.371	0.002
15	Fresh fruits	5.1 (4.3–5.9)	6.9 (6.7–7)	4.0 (2.6–5.9)	6.6 (6.1–7)	0.269	0.165

CI, confidence interval.

[a] Means were adjusted for energy intake at breakfast, sex, age group, body weight status, *per capita family* income, geographic region, and household area. The adjusted means were based on two-day mean intake of food groups at breakfast.

[b] Means were adjusted for energy intake at breakfast, sex, age group, body weight status, *per capita* family income, geographic region, and household area. The adjusted means were based on one-day mean intake of food groups at breakfast.

[c] *p*-values of Pearson's chi-squared test with the Rao and Scott second-order correction adjusted for the complex sampling design.

[d] *p*-values are the *Prob* > *F* of the linear regression analysis adjusted for the complex sampling design.

Table 4 Adjusted means of energy and nutrient intakes at breakfast and relative contribution (%) of this meal to total daily intake among adolescents aged 10 to 19 years ($n = 6784$), Brazilian Household Budget Survey 2008–2009.

Energy[a] and nutrients[b]	Breakfast consumers ($n = 5902$)		Occasional breakfast consumers ($n = 882$)	
	Mean[c] (95% CI)	Contribution to total daily intake (%) (95% CI)	Mean[d] (95% CI)	Contribution total daily intake (%) (95% CI)
Energy (kcal/day)	311 (309–312)	16.6 (16.5–16.7)	313 (308–317)	16.3 (16.2–16.5)
Total carbohydrates (g/day)	43.8 (42.7–45)	18 (17.6–18.5)	42.6 (39.7–45.6)	17.8 (16.6–19)
Total protein (g/day)	8.9 (8.7–9.2)	11.7 (11.4–12)	8.9 (8.3–9.5)	12.1 (11.2–12.9)
Total fat (g/day)	11.4 (11–11.7)	20 (19.2–20.8)	11.6 (10.7–12.6)	20.4 (18.5–22.3)
Saturated fatty acids (g/day)	4.7 (4.5–4.9)	21.1 (16.7–25.6)	4.9 (4.5–5.3)	24.3 (22.3–26.3)
Trans fatty acids (g/day)	1.3 (1.2–1.3)	39.3 (37.3–41.4)	1.3 (1.2–1.4)	36.7 (32.1–41.2)
Total sugar (g/day)	13.6 (13.1–14)	21.1 (17.4–24.8)	15.2 (14.1–16.2)	20.7 (18.6–22.9)
Added sugar (g/day)	7.6 (7.2–7.9)	26.9 (17.2–36.6)	8.5 (7.8–9.2)	20.1 (10.5–29.7)
Cholesterol (mg/day)	35.9 (34.8–37)	14.4 (14–14.8)	33.8 (31–36.6)	14 (12.9–15.1)
Total fiber (g/day)	2.3 (2.2–2.3)	11.9 (11.6–12.1)	2.2 (2.1–2.3)	12 (11.2–12.7)
Calcium (mg/day)	135.5 (131.7–139.3)	26.7 (26.1–27.3)	151.2 (142.4–160)	28.9 (27.2–30.5)
Phosphorus (mg/day)	165.3 (161.1–169.5)	17.6 (17.6–18)	173.2 (162.4–183.9)	18.8 (17.6–19.9)
Iron (mg/day)	1 (1–1.1)	9.1 (8.8–9.3)	1 (1–1.1)	9.1 (8.4–9.7)
Zinc (mg/day)	1.1 (1.1–1.1)	10.5 (10.3–10.8)	1.2 (1.1–1.2)	11 (10.3–11.8)
Sodium (mg/day)	436.3 (424.9–447.8)	29 (28.2–29.8)	428.6 (398.3–458.8)	28.6 (26.3–31)
Potassium (mg/day)	308 (301.6–314.4)	13.9 (13.6–14.1)	318.1 (301.4–334.7)	14.6 (13.8–15.4)
Vitamin A (RAE) (mcg)	84.3 (81.7–86.8)	17.7 (17.1–18.2)	86.7 (80.1–93.3)	19.6 (17.8–21.5)
Thiamin (mg/day)	0.3 (0.3–0.3)	23.7 (23.1–24.2)	0.3 (0.3–0.3)	23.7 (22.2–25.2)
Riboflavin (mg/day)	0.5 (0.5–0.5)	32.2 (31.6–32.8)	0.5 (0.5–0.5)	32.7 (31–34.4)
Niacin (mg/day)	1.9 (1.9–2)	14.1 (13.8–14.5)	1.9 (1.8–2)	13.6 (12.8–14.5)
Vitamin B6 (mg/day)	0.3 (0.3–0.3)	20.2 (19.7–20.6)	0.3 (0.3–0.3)	20.3 (19.1–21.6)
Vitamin B12 (mcg/day)	0.5 (0.5–0.5)	10 (9.7–10.4)	0.5 (0.5–0.5)	11.7 (10.8–12.5)
Dietary folate equivalents (mcg/day)	22.7 (22.1–23.3)	8.4 (8.2–8.6)	24.2 (22.6–25.8)	8.9 (8.3–9.4)
Vitamin D (mcg/day)	0.9 (0.8–0.9)	29.7 (28.6–30.8)	1 (0.9–1)	31 (28.2–33.8)
Vitamin C (mg/day)	12.3 (11.8–12.8)	8.7 (7.6–11.5)	11.1 (10–12.2)	8 (7.2–10.9)

RAE, Retinol activity equivalents; CI, confidence interval.

[a] Mean was adjusted for sex, age group, body weight status, *per capita* family income, geographic region, and household area.

[b] Means were adjusted for energy intake at breakfast, sex, age group, body weight status, *per capita* family income, geographic region, and household area.

[c] The adjusted means were based on two-day mean intake of food groups at breakfast.

[d] The adjusted means were based on one-day mean intake of food groups at breakfast.

(especially iron, zinc, potassium, niacin, folate, and vitamins B12 and C), and may have a negative impact on total daily nutrient intake.[4,19]

In this study, 7% of adolescents were considered breakfast skippers, and this was associated with sociodemographic and economic characteristics. The prevalence of skipping breakfast was higher among older adolescents, those who belonged to higher income families, urban dwellers, and residents of the South, Southeast, and Midwest regions.

Data from previous studies with Brazilian adolescents indicate different rates of breakfast skipping. For example, 38.1% of adolescents (11–14 years) evaluated in the PeNSE survey reported skipping breakfast three or more days per week.[16] Similarly, the prevalence of breakfast skipping among adolescents aged 12–19 years in the city of São Paulo was 38%.[20] In other studies, the prevalence ranged between 16% and 48%.[21,22] This wide variation in the prevalence of breakfast skipping across studies may be due to the methodological differences, such as the dietary assessment tool, the number of days evaluated, and the definition of breakfast skipping.[1] Furthermore, cultural and socio-economic factors may contribute to genuine differences in breakfast skipping, *e.g.*, habits, food choice and availability, and social or familial environment.[1]

Previous studies have also identified a direct association of skipping breakfast with older age in youth[5,13] and with urban environments.[23,24] However, some studies found that adolescents of higher socioeconomic status were less likely to skip breakfast,[23] which was not confirmed by the present study, considering that the prevalence of skipping breakfast was lower among low-income Brazilian adolescents. Besides the differences across the methodology of the studies, it is possible that the school setting has contributed to the higher prevalence of breakfast consumption among low-income adolescents, since they are more likely to study in public schools that participate in the PNAE.[12]

Although some findings indicate that girls tend to skip breakfast more often than boys,[1,13,25] and obese adolescents skip breakfast more frequently than their normal-weight peers,[1,3,13,25] these patterns were not observed in the present study. The current evidence linking breakfast consumption and reduced risk of excess adiposity in youth remains inconclusive, and reinforces the need of additional research about this topic.[3]

There were notable differences in food intakes when comparing breakfast consumers and skippers. Breakfast consumers had higher daily intake and/or frequency of consumption of foods that could be typically eaten at breakfast (coffee, typical Brazilian cereals dishes, cereals and grain products, fruits, meats, white bread, refined grain cookies and crackers, butter/margarine, porridge with milk, eggs, and sugar and honey) while breakfast skippers consumed more fast foods, such as hot dogs, sandwiches, and pizza and salty goods, as well as more soda pop and processed meats, which have been associated with poor health outcomes.[26] This finding suggests that those who skip breakfast may have a lower overall intake of foods recommended in the Dietary Guidelines than breakfast consumers, which is in accordance with previous research conducted in other countries that observed more nutritious daily food choices among those who eat breakfast.[1]

Regarding total daily nutrient intakes, few differences were observed between breakfast consumers and skippers, and these are likely explained by differences in daily food group intakes. Breakfast consumers had higher daily intake of vitamin B12 (which could be related to higher intakes of meats and eggs), vitamin C (present in fruits), and vitamin D (present in eggs and butter/margarine), but lower daily intake of calcium (present in dairy products). Moreover, breakfast consumers had lower total daily energy and sugar intakes, probably because the daily mean intake of energy and sugar dense foods was lower in comparison to occasional consumers and breakfast skippers. The higher daily calcium intake among occasional breakfast consumers and skippers, however, was an unexpected finding, and may be due to the larger portion sizes of dairy products (especially whole milk) in intermediate meals, such as snacks.

Despite the strengths of the present study, including the use of a large nationally representative survey, some limitations should be acknowledged. Breakfast definition excluded adolescents who ate at nontraditional breakfast times, and did not account for differences in a weekend day from a weekday. However, they represent a small portion of total population, since 0.5% of adolescents evaluated had their first eating occasion before 6 a.m. and 6% after 10 a.m.

Although having illustrative examples of good quality breakfast, the Brazilian Dietary Guidelines do not have structured definitions for nutrients and amounts of foods to be consumed at this meal, which precludes a quantitative analysis of breakfast.[11] To overcome this limitation, the present study described and compared the consumed food groups, core food groups (cereals, fruit/vegetables, and dairy products), and nutrient intake in the population.

The relative contribution of the breakfast to total nutrient intakes should be interpreted with caution. If the daily intake is low, the contribution of breakfast could be considered high (in percentage of daily intake). This may have occurred for vitamin D, since breakfast contributed to about 30% of the total daily intake, whose mean was only 3.5 mcg/day. The daily intake of this vitamin must be inadequate for a large part of the adolescents, considering that it was quite similar to the mean intake of vitamin D (3.51 mcg/day) of a representative sample of adolescents from São Paulo, Brazil, in whom the prevalence of inadequacy was 99%.[27]

The present findings indicate that although the prevalence of breakfast consumption among Brazilian adolescents was relatively high, the overall nutritional quality of this meal is suboptimal, reinforcing that adolescents and their families should be encouraged to make more nutrient-dense food choices. Improving breakfast quality provides an opportunity to narrow gaps between daily intakes and recommendations for key nutrients of concern in Brazil.

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Conflicts of interest

S. Hopkins is employed by Cereal Partners Worldwide (CPW) SA, Switzerland. C. Gugger was employed by General Mills Bell Institute of Health and Nutrition at the time of the study. M. Fisberg is a speaker in events for Abbott, Abitrigo, and Abimassa; Danone Research, EMS and Nestle; Member of the Board of Danone Institute International. Project grants from CPW, Coca-Cola and Danone Research. J.L. Pereira and M.A. Castro are researchers from Food Consumption Research Group from the School of Public Health of the University of São Paulo and performed consultancy for the manuscript development. R.M. Fisberg declares no conflicts of interest.

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