



# Eating contexts and their associations with socio-demographic factors in Brazilian adolescents (EVA-JF Study)

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## Abstract

**Objective:** To describe the eating contexts and estimate their associations with socio-demographic factors in a sample of Brazilian adolescents.

**Design:** Cross-sectional study. We used an exploratory questionnaire about eating contexts (encompassing regularity of meals, places where they occur and if they take place with attention and in company), which was submitted to cluster analysis. Subsequently, three clusters were identified: cluster 1, 'appropriate eating contexts at breakfast, lunch and dinner'; cluster 2, 'inappropriate eating context at breakfast' and cluster 3, 'inappropriate eating context at dinner'. Multinomial logistic regression models were performed, without and with adjustments, using cluster 1 as reference.

**Setting:** Twenty-nine public schools of Juiz de Fora, MG, Southeast Brazil.

**Participants:** Adolescents, 14–19-year-olds ( $n$  835).

**Results:** We observed relevant prevalence of adolescents omitting breakfast (52.9%) and dinner (39.3%), and who had the habit of eating sitting/lying on the couch/bed or standing/walking, and in front of screens. Breakfast usually occurred unaccompanied (70.8%); around half (47.5%) and little over a third (36.1%) of the sample also would usually have lunch and dinner unaccompanied, respectively. Furthermore, through multivariate analysis, we found associations of eating contexts clusters with female sex (more likely in clusters 2 and 3), age range 14–15-year-olds (less likely in cluster 2) and higher mother's schooling (more likely in cluster 3).

**Conclusions:** We verified an alarming prevalence of adolescents with eating contexts unaligned with healthy eating recommendations. Additionally, inappropriate eating contexts at breakfast and/or at dinner were associated with socio-demographic factors (sex, age range and mother's schooling).

**Keywords**  
Adolescent  
Eating contexts  
Feeding behaviour  
Food consumption  
Socio-economic factors

The second edition of the Brazilian Dietary Guidelines<sup>(1–3)</sup>, published in 2014, gained international recognition due to approaching a broadened paradigm of healthy eating, taking into consideration not only biological aspects, but also social, cultural and environmental ones, which are associated to different eating patterns. Its recommendations are of a qualitative and multidimensional nature: they do not talk of

nutrients, calories or weight loss, but of foods, meals and eating contexts.

Eating contexts encompass the regularity of the meals, places where they occur, and if they take place with a certain level of attention and in company<sup>(1–3)</sup>. Under this perspective, the key orientations of the Brazilian Dietary Guidelines consist of<sup>(1)</sup>: (i) 'eating regularly and

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carefully'; (ii) 'eating in appropriate environments'; and (iii) 'eating in company'. That is, in general, they involve circumstances which potentially influence eating choices, ingested amounts, biological exploitation (digestion and absorption), family/social life and pleasure to eat<sup>(2)</sup>.

In adolescents, it has been shown that certain eating contexts (e.g. omitting breakfast; eating out; having meals in front of screens (TV, videogames or smartphone/tablet/computer) or while studying; and having meals without company) were associated with a lower diet quality<sup>(4–10)</sup> and a greater BMI<sup>(5,9,11–13)</sup>. However, there is still a lack of studies in this field, especially regarding young individuals, a very critical gap, considering that adolescence is a phase of learning and biopsychosocial (physical, psychological and social) change<sup>(14–16)</sup>. While not children anymore, but not yet adults, adolescents begin to make conscient choices for their future and develop ideas about their role in society; therefore, they constitute a propitious age range with which to encourage good health choices and pro-social behaviours<sup>(14)</sup>.

Thus far, there are no studies which have produced detailed epidemiologic diagnoses about eating contexts of adolescents according to the recommendations of the Brazilian Dietary Guidelines. A deeper understanding of the eating habits of these young people may subsidise the development of more effective public policies and programmatic actions in the field of food and nutrition, also reflecting on long-term consequences for the entire population<sup>(14–16)</sup>. The aim of this exploratory study was to describe the eating contexts and estimate their associations with socio-demographic factors in a sample of Brazilian adolescents.

## Methods

### Study design

The analysed data comes from a school-based cross-sectional health survey called Study of the Lifestyle in Adolescence – Juiz de Fora (EVA-JF Study, Portuguese acronym)<sup>(17)</sup>. This research, more comprehensive, was developed to draw an outlook of the associations between obesity and socio-demographic, behavioural, clinic and biochemical factors in a sample of Brazilian adolescents 14–19-year-olds, who attended public schools located within the urban area of the municipality of Juiz de Fora, MG, Southeast Brazil. Additional details regarding the methodological aspects of the EVA-JF Study can be found in other publications<sup>(17–19)</sup>.

Juiz de Fora has an area of 1435·749 km<sup>2</sup> (urban perimeter of 317 740 km<sup>2</sup>) and an estimated population, in 2019, of 573 285 inhabitants. The Human Development Index, in 2010 (last available data), was 0·778, and Gross Domestic Product per capita, in 2019, was R\$32 864·04 (in Reals, Brazilian currency), equivalent to US\$8154·85 (in US Dollars). The municipality was divided into seven

administrative regions (Centre, East, Northeast, North, West, Southeast and South) e 81 urban regions<sup>(20)</sup>.

### Sample and recruitment

The sample calculation ( $n$  790) was carried out considering the following specifications<sup>(17–19)</sup>: (i) as study population, a total of 9502 actively enrolled students in 2018–2019, in the morning shifts of the last year of elementary school (9th grade) or the 3 years of high school (1st, 2nd and 3rd years) in public schools in Juiz de Fora, MG; (ii) as outcome, 8 % prevalence of obesity in Brazilian adolescents<sup>(21)</sup>; (iii) 2 % accuracy with a SE of 1 %; (iv) 95 % CI and (v) prediction of 20 % loss.

The sample was stratified by administrative regions, schools, school years, classes and sexes, with proportional allocation, that is, the sample sizes of the strata corresponded proportionally to the population. Then, in the selection phase, the adolescents from each school were chosen via a simple random draw<sup>(17–19)</sup>.

The inclusion criteria consisted of 14–19-year-olds adolescents enrolled in the morning shifts of the last year of elementary school or one of the 3 years of high school in public schools located within the urban area of Juiz de Fora, MG; without chronic or prolonged use of corticosteroids, anticonvulsants and anti-inflammatory drugs; without pacemakers and orthopaedic prosthesis and without any temporary or permanent disability. Girls who reported pregnancy or lactation were not included<sup>(17)</sup>.

Data collection occurred within school grounds (twenty-nine schools in total), privately, in the morning, from May 2018 to May 2019, with a final sample of 835 participants. All assessments were conducted by a team composed of experienced health professionals and trained research assistants. The questions in the interview were answered exclusively by the adolescents; the questionnaires were filled in and entered by the interviewers in electronic form using tablets<sup>(17,19)</sup>.

### Study variables

#### Socio-demographic factors

This section of the interview encompassed the following variables: (i) sex ('female' or 'male'); (ii) age range ('14–15-year-olds', '16–17-year-olds' or '18–19-year-olds'); (iii) school year ('9th grade of elementary school', '1st year of high school', '2nd year of high school' or '3rd year of high school'); (iv) self-reported race and ethnicity ('white', 'brown', 'black', 'indigenous' or 'yellow'; these options were then dichotomised into 'white' or 'nonwhite')<sup>(21,22)</sup>; (v) housing situation ('guests', 'renter' or 'owner'; these options were dichotomised into 'guest or renter' or 'owner'); (vi) mother's schooling ('illiterate or incomplete elementary school', 'complete elementary school or incomplete high school', 'complete high school' or 'complete higher education'); (vii) mother's occupational status

(‘unemployed’, ‘housewife’, ‘retired/pensioner’, ‘formal employment’ or ‘informal employment’; these options were dichotomised into ‘not working’ (‘unemployed’, ‘housewife’ or ‘retired/pensioner’) and ‘working’ (‘formal employment’ or ‘informal employment’)) and (viii) socio-economic status, according to the Brazilian Economic Classification Criteria 2018 by the Brazilian Association of Research Companies – ABEP (Portuguese acronym)<sup>(23)</sup>, which encompasses household characteristics and services, possession of comfort items and schooling of the head of the family (‘A’, ‘B1’, ‘B2’, ‘C1’, ‘C2’ or ‘D-E’); these options were redistributed into the socio-economic status ‘high’ (class ‘A’ or ‘B1’), ‘middle’ (class ‘B2’ or ‘C1’) and ‘low’ (class ‘C2’ or ‘D-E’’).

### *Eating contexts*

The assessment of eating contexts involved an exploratory questionnaire of twenty-three questions, administered through interview, the content of which was systematically extracted from the recommendations about modes of eating presented in the fourth chapter of the Brazilian Dietary Guidelines<sup>(1–3)</sup>. The questionnaire listed four blocks regarding eating contexts: the first three were about the main meals (breakfast, lunch and dinner), whereas the last one was about snacks. In summary, the questions referred to the regularity of meals; to the habit of having them at home or out; in quiet or noisy places; while sitting at the table, sitting/lying on the couch/bed or standing/walking; in front of screens or not and with or without company<sup>(19)</sup>.

Two pre-tests were carried out, involving a random sample of adolescents with similar profiles to the target population, but not participating in the EVA-JF Study: twenty-six students 14–19-year-olds enrolled in a public school in the municipality<sup>(19)</sup>. It is noteworthy that the second pre-test, comparing the same group of students, took place 1 month after the first. The internal consistency of the questions was analysed using Cronbach’s  $\alpha$  coefficient; its result ( $\alpha = 0.856$ ) indicated high reliability.

Greater details regarding the development of this exploratory questionnaire can be found in Neves *et al.*<sup>(19)</sup>. Figure 1 shows the twenty-three questions and their answer options (original and recategorised).

### **Statistical analyses**

#### *Descriptions of socio-demographic factors and eating contexts*

The socio-demographic factors and eating contexts were expressed through absolute (*n*) and relative (%) frequencies, with 95% CI. These analyses were carried out in the IBM SPSS software (20.0 version, © IBM Corp.), with a significance level established at 5%.

#### *Eating contexts clusters*

To explore the associations between the twenty-three questions about eating contexts and classify participants

according to patterns, we performed the cluster analysis via agglomerative hierarchical method<sup>(19)</sup>. At the end of this stage, we obtained three clusters, which cumulative variance was 51.7%: cluster 1 (*n* 595), as it reflected a more balanced set of healthy contexts for the three main meals, was entitled ‘appropriate eating contexts at breakfast, lunch and dinner’; whereas clusters 2 (*n* 144) and 3 (*n* 96), due to reflecting inadequacies at breakfast and dinner, were respectively entitled ‘inappropriate eating context at breakfast’ and ‘inappropriate eating context at dinner’<sup>(19)</sup>. Greater details regarding this analytical procedure and the interpretation of the eating contexts clusters can be found in Neves *et al.*<sup>(19)</sup>. This analysis was carried out in the R software (3.6.3 version, © The R Foundation), using the *Clustrd* and *NbClust* packages.

#### *Associations between socio-demographic factors and eating contexts clusters*

To compare the socio-demographic factors with eating contexts clusters, we used Pearson’s chi-square test with Bonferroni’s *post hoc*.

To estimate the probabilities of association between the socio-demographic factors (independent variables) and eating contexts clusters (dependent variable categories), we used multinomial logistic regression models, without and with adjustments, using cluster 1 (‘appropriate eating contexts at breakfast, lunch and dinner’) as reference: first, in the raw models, all variables that presented a  $P < 0.20$  in the third analytical step were separately assessed (sex, age range, race and ethnicity and mother’s schooling); then, in the adjusted models, they were put together, as they maintained a  $P < 0.05$ . The statistical significances were obtained via Wald’s test for heterogeneity.

These analyses were carried out in the IBM SPSS software (20.0 version, © IBM Corp.), with a significance level established at 5%.

### **Results**

#### **Description of socio-demographic factors**

The adolescents were on average 16.1 years old (SD = 1.2); 57.5% were female, 35.2% were attending the first year of high school, 64.5% were self-reported non-white, 75% resided in owned homes and 58.5% belonged to the middle socio-economic status. Most of their mothers had a schooling level of completed high school (52.4%) and formal employment (58.4%) (Table 1).

#### **Description of eating contexts**

##### *Breakfast*

We observed that 52.9% of the participants did not regularly have breakfast (19.8%, none; 33.1%, 1–4 d/week) (Table 2). Additionally, we found relevant prevalence of adolescents with the habit of having this meal on the



Questions	Answer options	
	Original	Recategorized
<b>Breakfast</b>		
"How many days per week do you usually have breakfast?"	"None", "1-2 days/week", "3-4 days/week", "5-6 days/week", or "every day".	"None", "1-4 days/week", or "5-7 days/week".
"Where do you usually have breakfast?" †	"At home", "in places like restaurants with regular breakfast food, "in cafeterias or fast food places", "at school", or "on the street, in the car or on public transportation".	"At home" or "eatout".
"Do you consider the place where you usually have breakfast quiet or noisy?" †	"Quiet" or "noisy".	---
"How do you usually have breakfast?" †	"Sitting at the table", "sitting/lying on the couch/bed", or "standing/walking".	"Sitting at the table" or "sitting/lying on the couch/bed or standing/walking".
"How frequently do you usually have breakfast while watching TV, playing video games, or using a smartphone/tablet/computer?" †	"Never", "rarely", "sometimes", "often", or "always".	"Never", "rarely or sometimes", or "often or always".
"How many days per week do you usually have breakfast with someone else?" †	"None", "1-2 days/week", "3-4 days/week", "5-6 days/week", or "every day".	"None", "1-4 days/week", or "5-7 days/week".
<b>Lunch</b>		
"How many days per week do you usually have lunch?"	"None", "1-2 days/week", "3-4 days/week", "5-6 days/week", or "every day".	"None", "1-4 days/week", or "5-7 days/week".
"How many days per week do you usually switch regular lunch food for fast food or snacks? [note: chips, pizza, hamburgers, hot-dogs, cookies, cake, sweets (e.g.: ice cream, chocolate, chewing gum, candies or lollipops), softdrinks and other sugary drinks, etc.]"		
"Where do you usually have lunch?" ‡	"At home", "in places like restaurants with regular breakfast food, "in cafeterias or fast food places", "at school", or "on the street, in the car or on public transportation".	"At home" or "eat out".
"Do you consider the location where you usually have lunch quiet or noisy?" ‡	"Quiet" or "noisy".	---
"How do you usually have lunch?" ‡	"Sitting at the table", "sitting/lying on the couch/bed", or "standing/walking".	"Sitting at the table" or "sitting/lying on the couch/bed or standing/walking".
"How frequently do you usually have lunch while watching TV, playing video games, or using a smartphone/tablet/computer?" ‡	"Never", "rarely", "sometimes", "often", or "always".	"Never", "rarely or sometimes", or "often or always".
"How many days per week do you usually have lunch with someone else?" ‡	"None", "1-2 days/week", "3-4 days/week", "5-6 days/week", or "every day".	"None", "1-4 days/week", or "5-7 days/week".
<b>Dinner</b>		
"How many days per week do you usually have dinner?"	"None", "1-2 days/week", "3-4 days/week", "5-6 days/week", or "every day".	"None", "1-4 days/week", or "5-7 days/week".
"How many days per week do you usually switch regular dinner food for fast food or snacks? [note: chips, pizza, hamburgers, hot-dogs, cookies, cake, sweets (e.g.: ice cream, chocolate, chewing gum, candies or lollipops), soft drinks and other sugary drinks, etc.]"		
"Where do you usually have dinner?" §	"At home", "in places like restaurants with regular breakfast food, "in cafeterias or fast food places", "at school", or "on the street, in the car or on public transportation".	"At home" or "eat out".
"Do you consider the location where you usually have dinner quiet or noisy?" §	"Quiet" or "noisy".	---
"How do you usually have dinner?" §	"Sitting at the table", "sitting/lying on the couch/bed", or "standing/walking".	"Sitting at the table" or "sitting/lying on the couch/bed or standing/walking".
"How frequently do you usually have dinner while watching TV, playing video games, or using a smartphone/tablet/computer?" §	"Never", "rarely", "sometimes", "often", or "always".	"Never", "rarely or sometimes", or "often or always".
"How many days of the week do you usually have dinner with someone else?" §	"None", "1-2 days/week", "3-4 days/week", "5-6 days/week", or "every day".	"None", "1-4 days/week", or "5-7 days/week".
<b>Snacks</b>		
"How often do you usually snack at times close to main meals? [note: main meals are breakfast, lunch, and dinner]"	"Never", "rarely", "sometimes", "often", or "always".	"Never", "rarely or sometimes", or "often or always".
"How often do you usually have snacks while watching TV, playing video games, or using a smartphone/tablet/computer?"		
"How often do you usually snack while studying or doing homework?"		

† Question applied to participants who have breakfast at least "1-2 days/week".

‡ Question applied to participants who have lunch at least "1-2 days/week".

§ Question applied to participants who have dinner at least "1-2 days/week".

**Fig. 1** Questions and answer options (original and recategorised) for the assessment of the adolescents' eating contexts. EVA-JF Study, Brazil, 2018–2019

**Table 1** Adolescents' socio-demographic factors. EVA-JF Study, Brazil, 2018–2019 (*n* 835)

Variables	<i>n</i>	%	95% CI*
<b>Sex</b>			
Female	480	57.5	54.1, 60.8
Male	355	42.5	39.2, 45.9
<b>Age range†</b>			
14–15-year-olds	252	30.2	27.1, 33.4
16–17-year-olds	475	56.9	53.5, 60.2
18–19-year-olds	108	12.9	10.8, 15.3
<b>School year</b>			
Ninth grade of elementary school	115	13.8	11.5, 16.2
First year of high school	294	35.2	32.0, 38.5
Second year of high school	234	28.0	25.0, 31.1
Third year of high school	192	23.0	20.2, 25.9
<b>Race and ethnicity‡</b>			
White	294	35.5	32.3, 38.8
Brown	286	34.5	31.4, 37.8
Black	227	27.4	24.4, 30.5
Indigenous	3	0.4	0.1, 0.9
Yellow	18	2.2	1.3, 3.3
<b>Housing situation</b>			
Guests	22	2.6	1.7, 3.9
Renter	187	22.4	19.7, 25.3
Owner	626	75.0	72.0, 77.8
<b>Mother's schooling</b>			
Illiterate or incomplete elementary school	34	4.5	3.2, 6.2
Complete elementary school or incomplete high school	322	43.0	39.5, 46.6
Complete high school	282	37.7	34.3, 41.2
Complete higher education	110	14.7	12.3, 17.4
<b>Mother's occupational status</b>			
Unemployed	81	10.0	8.0, 12.2
Housewife	106	13.1	10.9, 15.5
Retired/pensioner	48	5.9	4.4, 7.7
Formal employment	474	58.4	55.0, 61.7
Informal employment	103	12.7	10.5, 15.1
<b>Socio-economic status§</b>			
A	55	6.6	5.0, 8.4
B1	124	14.9	12.5, 17.4
B2	265	31.7	28.6, 34.9
C1	224	26.8	23.9, 29.9
C2	140	16.8	14.3, 19.4
D-E	27	3.2	2.2, 4.6

\*Valid percentages due to possible data losses.

†Mean age of 16.1 years (SD = 1.2).

‡Nonwhite: 'brown', 'black', 'indigenous' or 'yellow'.

§Brazilian Economic Classification Criteria 2018 by the Brazilian Association of Research Companies – ABEP (Portuguese acronym) (high: class 'A' or 'B1'; middle: class 'B2' or 'C1'; low: class 'C2' or 'D-E').

couch/bed or standing/walking (46.6%) and in front of screens (watching TV, playing videogames or using a smartphone/tablet/computer) (36.3%, often or always). More than two-thirds of the sample (70.8%) would usually have breakfast unaccompanied (23.6%, none; 47.2%, 1–4 d/week).

### Lunch

We observed that 88.9% of the participants had lunch regularly ('5–7 d/week') (Table 2). However, we have found a relevant prevalence of adolescents with the habit of having this meal on the couch/bed or standing/walking (49.7%), and in front of screens (60.6%, 'often or always'). Around half of the sample (47.5%) would usually have lunch unaccompanied (12.6%, none; 34.9%, 1–4 d/week).

### Dinner

We observed that 39.3% of the participants did not have dinner regularly (11.5%, none; 27.8%, 1–4 d/week); 18.4% would usually switch regular dinner food for a snack or fast food ('5–7 d/week') (Table 2). Furthermore, we have found a relevant prevalence of adolescents with the habit of having this meal on the couch/bed or standing/walking (58.5%), and in front of screens (63.7%, 'often or always'). A little over a third of the sample (36.1%) would usually dine unaccompanied (8.8%, none; 27.3%, 1–4 d/week).

### Snacks

We have observed an important prevalence of adolescents with the habit of snacking ('often or always') at times close to main meals (57.1%), in front of screens (45.9%), and while studying or doing homework (18.7%) (Table 2).

### Associations between socio-demographic factors and eating contexts clusters

Table 3 shows the socio-demographic factors according to eating contexts clusters. We found associations with sex, race and ethnicity and mother's schooling: cluster 3 had a greater prevalence of adolescents who were female (14.0%, female; 8.2%, male;  $P = 0.002$ ), of white race and ethnicity (15.6%, white; 9.0%, non-white;  $P = 0.011$ ), and with more schooled mothers (24.5%, complete higher education; 11.7%, complete high school; 8.4%, complete elementary school or incomplete high school; 5.9%, illiterate or incomplete elementary school;  $P < 0.001$ ).

Table 4 contains the multinomial logistic regression models for the associations between socio-demographic factors (independent variables) and eating contexts clusters (dependent variable categories), having cluster 1 as reference. In adjusted models, we found that female sex was more likely to belong to cluster 2 (OR = 1.60 (95% CI 1.06, 2.40)) and to cluster 3 (OR = 2.15 (95% CI 1.31, 3.54)). The youngest adolescents, in the 14–15-year-olds range, were less likely to belong to cluster 2 (OR = 0.46 (95% CI 0.25, 0.86)). Additionally, those with more schooled mothers were more likely to belong to cluster 3 (OR = 0.43 (95% CI 0.24, 0.79)), complete high school; OR = 0.29 (95% CI 0.15, 0.54), complete elementary school or incomplete high school; and OR = 0.20 (95% CI 0.04, 0.95), illiterate or incomplete elementary school).

### Discussion

In our exploratory study, pioneer in Brazil, carried out with a probabilistic sample of Brazilian adolescents 14–19-year-olds, students from public schools, we observed relevant prevalence of adolescents omitting breakfast and dinner, and who had the habit of eating sitting/lying on the couch/bed or standing/walking, and in front of screens. Breakfast usually occurred unaccompanied; around half

**Table 2** Adolescents' eating contexts. EVA-JF Study, Brazil, 2018–2019 (*n* 835)

Variables	<i>n</i>	%	95 % CI
<b>Breakfast</b>			
Number of d/week adolescents usually have breakfast			
None	165	19.8	17.2, 22.6
1–4 d/week	276	33.1	29.9, 36.3
5–7 d/week	394	47.2	43.8, 50.6
Place where adolescents usually have breakfast*			
At home	635	94.8	92.9, 96.3
Eat out†	35	5.2	3.7, 7.1
Perception of the place where adolescents usually have breakfast*			
Quiet	611	91.2	88.9, 93.2
Noisy	59	8.8	6.8, 11.1
The way adolescents usually have breakfast*			
Sitting at the table	358	53.4	49.6, 57.2
Sitting/lying on the couch/bed or standing/walking	312	46.6	42.8, 50.4
Frequency with which adolescents usually have breakfast while in front of screens*,‡			
Never	255	38.1	34.4, 41.8
Rarely or sometimes	172	25.7	22.5, 29.1
Often or always	243	36.3	32.7, 40.0
Number of d/week adolescents usually have breakfast with someone else*			
None	158	23.6	20.5, 26.9
1–4 d/week	316	47.2	43.4, 50.9
5–7 d/week	196	29.3	25.9, 32.8
<b>Lunch</b>			
Number of d/week adolescents usually have lunch			
None	0	0	0.0, 0.0
1–4 d/week	93	11.1	9.1, 13.4
5–7 d/week	742	88.9	86.6, 90.9
Number of d/week adolescents usually switch regular lunch food for fast food or snacks§			
None	332	39.8	36.5, 43.1
1–4 d/week	465	55.7	52.3, 59.0
5–7 d/week	38	4.6	3.3, 6.1
Place where adolescents usually have lunch			
At home	770	92.2	90.3, 93.9
Eat out†	65	7.8	6.1, 9.7
Perception of the place where adolescents usually have lunch			
Quiet	707	84.7	82.1, 87.0
Noisy	128	15.3	13.0, 17.9
The way adolescents usually have lunch			
Sitting at the table	420	50.3	46.9, 53.7
Sitting/lying on the couch/bed, standing/walking	415	49.7	46.3, 53.1
Frequency with which adolescents usually have lunch while in front of screens‡,			
Never	114	13.7	11.4, 16.1
Rarely or sometimes	215	25.7	22.9, 28.8
Often or always	506	60.6	57.3, 63.9
Number of d/week adolescents usually have lunch with someone else			
None	105	12.6	10.4, 14.9
1–4 d/week	291	34.9	31.7, 38.1
5–7 d/week	439	52.6	49.2, 55.9
<b>Dinner</b>			
Number of d/week adolescents usually have dinner			
None	96	11.5	9.5, 13.8
1–4 d/week	232	27.8	24.8, 30.9
5–7 d/week	507	60.7	57.4, 64.0
Number of d/week adolescents usually switch regular dinner food for fast food or snacks§			
None	155	18.6	16.0, 21.3
1–4 d/week	526	63.0	59.7, 66.2
5–7 d/week	154	18.4	15.9, 21.2
Place where adolescents usually have dinner¶			
At home	735	99.5	98.7, 99.8
Eat out†	4	0.5	0.2, 1.3
Perception of the place where adolescents usually have dinner¶			
Quiet	671	90.8	88.6, 92.7
Noisy	68	9.2	7.3, 11.4
The way adolescents usually have dinner¶			
Sitting at the table	307	41.5	38.0, 45.1
Sitting/lying on the couch/bed, standing/walking	432	58.5	54.9, 62.0

**Table 2** *Continued*

Variables	<i>n</i>	%	95 % CI
Frequency with which adolescents usually have dinner while in front of screens‡,¶			
Never	105	14.2	11.8, 16.8
Rarely or sometimes	163	22.1	19.2, 25.1
Often or always	471	63.7	60.2, 67.1
Number of d/week adolescents usually have dinner with someone else¶			
None	65	8.8	6.9, 11.0
1–4 d/week	202	27.3	24.2, 30.6
5–7 d/week	472	63.9	60.4, 67.3
Snacks			
Frequency with which adolescents usually snack at times close to main meals (breakfast, lunch and dinner)§			
Never	125	15.0	12.7, 17.5
Rarely or sometimes	233	27.9	24.9, 31.0
Often or always	477	57.1	53.8, 60.5
Frequency with which adolescents usually have snacks while in front of screens‡,§			
Never	110	13.2	11.0, 15.6
Rarely or sometimes	342	41.0	37.7, 44.3
Often or always	383	45.9	42.5, 49.3
Frequency with which adolescents usually snack while studying or doing homework§			
Never	397	47.5	44.2, 50.9
Rarely or sometimes	282	33.8	30.6, 37.0
Often or always	156	18.7	16.1, 21.4

\*Considering the participants who have breakfast at least '1–2 d/week' (*n* 670).

†Eat out: in places like restaurants with regular lunch food, cafeterias or fast food places, at school, on the street, in the car or on public transportation, etc.

‡In front of screens: watching TV, playing video games or using a smartphone/tablet/computer.

§Snacks: chips, pizza, hamburgers, hot dogs, cookies, cake, sweets (e.g. ice cream, chocolate, chewing gum, candies or lollipops), soft drinks and other sugary drinks, etc.

¶Considering the participants who have lunch at least '1–2 d/week' (*n* 835).

¶Considering the participants who have dinner at least '1–2 d/week' (*n* 739).

and little over a third of the sample also would usually have lunch and dinner unaccompanied, respectively. Furthermore, through multivariate analysis, we found associations of the inappropriate eating contexts at breakfast and/or at dinner with sex, age range and mother's schooling.

We would like to point out that discussing our findings bearing in mind other observations already registered in literature is a challenge, as there are many methodological differences involved in assessing eating contexts<sup>(19)</sup>. Thus far, we are not aware of studies with a similar approach to ours, which have detailed the regularity of the main meals simultaneously and in which contexts they are usually consumed, according to the recommendations of the Brazilian Dietary Guidelines<sup>(1–3,19)</sup>. Next, although not directly comparable, we have gathered pieces of evidence to support the present discussion.

In general, our findings were more worrisome than other prevalence detected by Brazilian health surveys, such as the Study of Cardiovascular Risk in Adolescents (ERICA, Portuguese acronym) (12–17-year-olds) and the Brazilian National Survey of School Health (PeNSE, Portuguese acronym) (13–17-year-olds): (i) Barufaldi *et al.*<sup>(24)</sup>, when analysing data from ERICA (*n* 74 589), found that 21.9% of the adolescents omitted breakfast and around 32% did not have the habit of having meals in the company of parents/guardians; (ii) Oliveira *et al.*<sup>(25)</sup>, when analysing the data from ERICA (*n* 74 589), found that 56.6% of adolescents had the habit of having meals while watching TV, and 39.6% would usually snack in front of screens;

(iii) Silva *et al.*<sup>(13)</sup>, when analysing the data from ERICA (*n* 71 740), found that 44.4% and 34.7% of boys, and 52.4% and 39.9% of girls, respectively, did not have lunch or dinner in the company of their parents/guardians; and (iv) Maia *et al.*<sup>(4)</sup>, when analysing the data from PeNSE (*n* 10 926), found that 31.5% of the adolescents did not have the habit of having meals in the company of their parents/guardians, and 48.8% would generally eat in front of screens or while studying. We hypothesised that our findings were more alarming than other representative national studies because we included only students enrolled in public schools, besides the differences in the instrument used to evaluate eating contexts. Barufaldi *et al.*<sup>(24)</sup>, aforementioned, have also demonstrated that the frequency of meals accompanied by the parents/guardians was different between geographic regions of Brazil and the types of school, being higher in students from the South Region and private schools; this probably explains distinctions in the characteristics of the family environment and the meals.

On the international scene, there have also been descriptions of undesirable eating contexts, some of them being supposedly less pronounced than ours (we reiterate that comparisons must be interpreted with caution, due to the methodological differences): (i) Hallström *et al.*<sup>(26)</sup>, when analysing data from the Healthy Lifestyle in Europe by Nutrition in Adolescence (HELENA) study with adolescents from nine European countries (Austria, Belgium, France, Germany, Greece, Hungary, Italy, Spain and Sweden; 12–17-year-olds; *n* 2672), found that 7%

**Table 3** Adolescents' socio-demographic factors according to eating contexts clusters. EVA-JF Study, Brazil, 2018–2019 (*n* 835)

Variables	Eating contexts clusters†						<i>P</i> *
	Cluster 1 ( <i>n</i> 595)		Cluster 2 ( <i>n</i> 144)		Cluster 3 ( <i>n</i> 96)		
	<i>n</i>	%‡	<i>n</i>	%‡	<i>n</i>	%‡	
Sex							
Female	320	66.7 <sup>a</sup>	93 <sup>a,b</sup>	19 <sup>a,b</sup>	67	14.0 <sup>b</sup>	0.002
Male	275	77.5 <sup>a</sup>	51	14.4 <sup>a,b</sup>	29	8.2 <sup>b</sup>	
Age range§							
14–15-year-olds	190	75.4	37	14.7	25	9.9	0.125
16–17-year-olds	337	70.9	80	16.8	58	12.2	
18–19-year-olds	68	63.0	27	25.0	13	12.0	
School year							
Ninth grade of elementary school	90	78.3	16	13.9	9	7.8	0.238
First year of high school	215	73.1	51	17.3	28	9.5	
Second year of high school	160	68.4	39	16.7	35	15.0	
Third year of high school	130	67.7	38	19.8	24	12.5	
Race and ethnicity							
White	204	69.4 <sup>a</sup>	44	15.0 <sup>a</sup>	46	15.6 <sup>b</sup>	0.011
Nonwhitel	387	72.5 <sup>a</sup>	99	18.5 <sup>a</sup>	48	9.0 <sup>b</sup>	
Housing situation							
Guest or renter	152	72.7	36	17.2	21	10.0	0.743
Owner	443	70.8	108	17.3	75	12.0	
Mother's schooling							
Illiterate or incomplete elementary school	23	67.6 <sup>a</sup>	9	26.5 <sup>a</sup>	2	5.9 <sup>a</sup>	0.001
Complete elementary school or incomplete high school	236	73.3 <sup>a</sup>	59	18.3 <sup>a,b</sup>	27	8.4 <sup>b</sup>	
Complete high school	203	72.0 <sup>a</sup>	46	16.3 <sup>a</sup>	33	11.7 <sup>a</sup>	
Complete higher education	68	61.8 <sup>a</sup>	15	13.6 <sup>a</sup>	27	24.5 <sup>b</sup>	
Mother's occupational status							
Not working	172	73.2	42	17.9	21	8.9	0.460
Working	407	70.5	101	17.5	69	12.0	
Socio-economic status¶							
High	125	69.8	29	16.2	25	14.0	0.238
Middle	350	71.6	80	16.4	59	12.1	
Low	120	71.9	35	21.0	12	7.2	

\*Pearson's chi-square test or Fisher's exact test, with Bonferroni's *post hoc* (different superscript letters ('a' and 'b') indicate that the proportions differed significantly).

†Cluster 1: 'appropriate eating contexts at breakfast, lunch, and dinner'; cluster 2: 'inappropriate eating context at breakfast'; cluster 3: 'inappropriate eating context at dinner'.

‡Valid percentages, per line, due to possible data losses.

§Mean age of 16.1 years (SD = 1.2).

||Nonwhite: 'brown', 'black', 'indigenous', or 'yellow'.

¶Brazilian Economic Classification Criteria 2018 by the Brazilian Association of Research Companies – ABEP (Portuguese acronym) (high: class 'A' or 'B1'; middle: class 'B2' or 'C1'; low: class 'C2' or 'D-E').

had skipped breakfast on two non-consecutive days; (ii) Smith *et al.*<sup>(27)</sup>, when analysing data from the Australian National Nutrition and Physical Activity Survey (NNPAS) with children and adolescents (2–17-year-olds; *n* 1592), found that 11.8% of boys and 14.8% of girls had skipped breakfast on 1 d, whereas 1.4% of boys and 3.8% of girls, on 2 d; (iii) Kann *et al.*<sup>(28)</sup>, when analysing the data from the Youth Risk Behavior Surveillance System (YRBSS) with North-American adolescents and adults (10–24-year-olds; *n* 14 765), found that 14.1% had not had breakfast on the 7 d prior to the study; (iv) Tambalis *et al.*<sup>(29)</sup>, when analysing data from the National Action for Children's Health program with Greek children and adolescents (8–17-year-olds; *n* 177 091), found that 22.4% of the boys and 23.1% of the girls had skipped breakfast on most days of a regular week; (v) Viljakainen *et al.*<sup>(30)</sup>, when analysing data from the Finnish Health in Teens (Fin-HIT) study with Finnish

children and adolescents (9–14-year-olds; *n* 10 569), found that 19%, 12.4% and 16.4% of the participants, respectively, had not had breakfast, lunch and dinner with regularity (on all school days of a regular week); and (vi) Larson *et al.*<sup>(31)</sup>, when analysing the data from the Eating and Activity in Teens (EAT 2010) study with North-American adolescents (average age of 14.4 years old; *n* 2793), found that breakfast and dinner had been had in family, respectively, 1.5 and 4.1 times in the week prior to the study. We speculate that our findings were apparently more alarming due to cultural issues, as lunch is the main meal of the day in Brazil, with less variation in consumption habits<sup>(32)</sup>; indeed, the regularity of skipping breakfast in other countries was similar to the one of skipping lunch in our study.

Through systematic reviews, it was shown that the omission of breakfast was associated with worse diet quality<sup>(5)</sup>, lower micronutrient ingestion (thiamine, riboflavin,



**Table 4** Multinomial logistic regression models for the associations between adolescents' socio-demographic factors (independent variables) and eating contexts clusters (dependent variable categories). EVA-JF Study, Brazil, 2018–2019 (n 835)

Variables	Eating contexts clusters†							
	Cluster 2‡ (n 144)				Cluster 3‡ (n 96)			
	Unadjusted model		Adjusted model		Unadjusted model		Adjusted model	
	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI
Sex								
Female	1.57	1.07, 2.30*	1.60	1.06, 2.40*	1.98	1.25, 3.16*	2.15	1.31, 3.54*
Male	Reference		Reference		Reference		Reference	
Age range§								
14–15-year-olds	0.49	0.28, 0.87*	0.46	0.25, 0.86*	0.69	0.33, 1.42	0.50	0.23, 1.11
16–17-year-olds	0.60	0.36, 0.99*	0.65	0.38, 1.12	0.90	0.47, 1.73	0.89	0.44, 1.80
18–19-year-olds	Reference		Reference		Reference		Reference	
Race and ethnicity								
White	0.84	0.57, 1.25	0.93	0.61, 1.42	1.82	1.17, 2.82*	1.58	0.98, 2.56
Nonwhite	Reference		Reference		Reference		Reference	
Mother's schooling								
Illiterate or incomplete elementary school	1.77	0.68, 4.60	1.40	0.52, 3.71	0.22	0.05, 0.99*	0.20	0.04, 0.95*
Complete elementary school or incomplete high school	1.13	0.61, 2.12	0.98	0.51, 1.87	0.29	0.16, 0.52**	0.29	0.15, 0.54**
Complete high school	1.03	0.54, 1.96	0.98	0.51, 1.88	0.41	0.23, 0.73*	0.43	0.24, 0.79*
Complete higher education	Reference		Reference		Reference		Reference	

\* $P < 0.05$  (Wald's test for heterogeneity).

†Cluster 1: 'appropriate eating contexts at breakfast, lunch, and dinner'; cluster 2: 'inappropriate eating context at breakfast'; cluster 3: 'inappropriate eating context at dinner'.

‡Using cluster 1 as reference (n 595).

§Mean age of 16.1 years (SD = 1.2).

||Nonwhite: 'brown', 'black', 'indigenous' or 'yellow'.

\*\* $P < 0.001$  (Wald's test for heterogeneity).



vitamins A and C, Ca, Fe, Mg and potassium)<sup>(5,6)</sup>, overweight<sup>(5,11)</sup>, higher blood pressure levels, lipid risk profile (lower HDL-c levels and higher triglyceride, total cholesterol and LDL-c levels), resistance to insulin and metabolic syndrome<sup>(5)</sup>; having meals while watching TV was associated to a lower diet quality (increased consumption of fatty foods and sugary drinks)<sup>(8)</sup> and the habit of not having meals in family was also associated to a poorer diet quality (increased consumption of fast food, salty and sweet snacks and sugary drinks, and reduced consumption of fruits and vegetables) and to a greater BMI<sup>(9)</sup>.

Authors also assume that the habit of having meals while using screens entails an 'unconscious feeding' (in which one chews less and eats more) and increases risk of exposure to the persuasive marketing of ultra-processed foods (pre-made or ready for consumption, characteristically fatty and salty or sweet, and low in dietary fibre, protein, micro-nutrients and other bioactive compounds<sup>(1-3,19,33)</sup>), which must be seen as a factual issue of public health, due to the impact of publicity on dietary choices<sup>(4,19,34-37)</sup>. Furthermore, there has been an increasing understanding that other contextual variables (e.g. eating out, in noisy places, sitting/lying on the couch/bed or standing/walking and playing videogames) also prejudice diet quality, nutritional state and family/social life<sup>(1-3,7,12,15,16,19,35)</sup>.

Regarding the comparisons between sexes, we observed that boys had breakfast, lunch and dinner more d/week, usually in a place perceived by them as quiet and sitting at the table; girls would more frequently switch regular dinner food for a snack or fast food and snacked more frequently while studying or doing homework. Previous national and international studies corroborate our findings: in boys, a higher frequency of breakfast consumption<sup>(24,27-29)</sup>, of healthy eating pattern markers (beans, fruits and vegetables)<sup>(4,38)</sup> and of meals in the company of family<sup>(13,24,31)</sup> were seen; and in girls, higher frequencies of unhealthy food consumption (fried snacks, hamburgers, hot dogs and other processed meats, sweets, chocolate and soda)<sup>(4,38,39)</sup>, of eating fast food<sup>(5)</sup> and eating while watching TV or studying<sup>(25,39)</sup> were seen. Authors suggest that such differences may be connected to the fact that girls present greater dissatisfaction with body image, which, in turn, results in disordinate, restrictive and worse quality feeding behaviours<sup>(13,15,24,27,29,40)</sup>. In regard to the comparisons between socio-economic status, we observed that the high and middle strata had lunch more days/week; the middle stratum snacked more frequently at times close to main meals and the low stratum, despite having dinner on more days, had a higher prevalence of having meals on the couch/bed or standing/walking, and in front of screens.

The socio-economic position (SEP) (estimated with proxy variables (race and ethnicity, schooling, employment situation, income and/or purchasing power)) constitutes one of the main health<sup>(41,42)</sup> and feeding<sup>(43)</sup> determiners. Studies with paediatric populations have shown that SEP was positively or inversely associated with

healthy eating patterns, depending on the economic status of their country of residence<sup>(44,45)</sup>: in developed countries, high SEP groups were more likely to eat healthy foods, whereas the low SEP ones were more likely to eat unhealthy foods; however, in developing countries the results were inconsistent.

Mayén *et al.*<sup>(46)</sup>, in a systematic review, concluded that, in low-income countries, a high SEP was associated to healthy eating patterns and, paradoxically, with a higher energy, cholesterol and saturated fats consumption. Recently, Hinnig *et al.*<sup>(45)</sup>, in another systematic review, concluded that, in countries with a high Human Development Index, children and adolescents to more schooled parents/guardians had higher quality eating patterns; but, in countries with low or medium Human Development Index, the associations were inconsistent, although some studies have evidenced lower quality eating patterns in high SEP groups.

In developing countries, the nutritional transition happens in a non-linear manner: first, it manifests in high SEP; then, as the national economy evolves and income increases, ultra-processed foods tend to undergo successive reductions in price and, consequently, low SEP groups begin to consume them more regularly, replacing traditional culinary preparations<sup>(45-47)</sup>. In that regard, Maia *et al.*<sup>(47)</sup>, when analysing the temporal variation in food prices in Brazil (1994-2030) through fractional polynomial models, predicted that, from 2026, healthy diets (based on unprocessed or minimally processed foods, and on culinary ingredients) will become more expensive than unhealthy diets (based on ultra-processed foods). Thus, it is possible to infer that sub-populations from low or medium-income countries, such as is the case of our study, may present a greater risk of obesity and its cardiometabolic consequences, due to going through urbanisation and nutritional transition processes (with growing access to screens, motorised transports, mechanised or technologically oriented labour activities and ultra-processed foods) amidst a complex scene, marked by social, economic and environmental inequity (inter and intraregional, state and municipal)<sup>(43,45,46,48-50)</sup>.

Regarding the relationship between the socio-demographic factors and the eating contexts clusters, we observed that 'inappropriate eating context at breakfast' and 'inappropriate eating context at dinner' were associated with female sex; the youngest (14-15-year-olds) were less likely to belong to the 'inappropriate eating context at breakfast' cluster and the 'inappropriate eating context at dinner' cluster was also associated to higher mother's schooling. Our findings were consistent with the aforementioned literature, in which it was proved that the female sex<sup>(4,13,24,25,27-29,31,38,39)</sup> and the highest SEP (white race and ethnicity, more schooled mothers and/or higher income)<sup>(4,31,39,45)</sup> were connected to inappropriate eating contexts and a lower diet quality, despite there being divergent evidence (medium or low SEP associated with inappropriate eating contexts (habit of skipping breakfast and of having meals in front of screens)<sup>(25,27)</sup> and

unhealthy dietary patterns<sup>(39)</sup>; and high SEP associated with appropriate eating contexts (habit of having meals in the company of family)<sup>(24)</sup> and healthy dietary patterns<sup>(44,46)</sup>. Regarding age ranges, what we found was also supposedly aligned with the literature: among the youngest, there was a higher frequency of meals in the company of family<sup>(24,31)</sup>; and among the oldest, higher omission frequency<sup>(27,29)</sup> and lower nutritional quality<sup>(26)</sup> at breakfast. In children and adolescents, meal frequency, especially at breakfast, and diet quality seem to decline with age, due to the emancipatory process and peer influence: as they age, these individuals seek social validation, spend more time away from home, and have greater autonomy to control what they eat<sup>(15)</sup>.

### **Strengths and limitations**

The main strengths of our study consist of: (i) we have been the only ones so far to approach in detail the topic of eating contexts in Brazilian adolescents (encompassing regularity of the three main meals (breakfast, lunch and dinner), the places where they occur, and if they happen with certain levels of attention and in company)<sup>(19)</sup>; and (ii) to classify the participants regarding patterns of eating contexts, we employed a quite robust statistical technique (cluster analysis)<sup>(19)</sup>. However, there are some limitations: (i) although our sample was representative, it constituted only adolescents 14–19-year-olds in public schools in Juiz de Fora, MG, which requires caution when extrapolating the results for adolescents 10–13-year-olds, from private schools and other Brazilian municipalities; and (ii) the assessment of eating contexts involved a non-validated instrument; however, our study was an exploratory one and, additionally to having theoretical scientific support<sup>(1–3)</sup>, that questionnaire was rigorously thought-through, undergoing the critical review of a committee of specialists in Nutritional Epidemiology and pre-tests<sup>(19)</sup>.

### **Conclusion**

In conclusion, we have demonstrated an alarming prevalence of adolescents who did not present eating contexts aligned with healthy eating recommendations. Furthermore, the clusters 'inappropriate eating context at breakfast' and 'inappropriate eating context at dinner' were associated with female sex; the youngest, in the 14–15-year-olds range, were less likely to belong to the 'inappropriate eating context at breakfast' cluster; and the 'inappropriate eating context at dinner' cluster was also associated with higher mother's schooling. The findings of this exploratory study, a pioneer in Brazil, provided notable contributions to the literature. It is essential to expand the approach of eating contexts on the agenda of public health and nutrition policies, with active collaboration from an assortment of actors (throughout the food system) and with more incisive actions, directed

specifically to the school setting, which is seen as a social space for education and protection.

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design, project administration (management and coordination responsibility for the research activity planning and execution) and specifically critical review of the manuscript for important intellectual content. All authors approved the final manuscript as submitted and agreed to be accountable for all aspects of the work. *Ethics of human subject participation*: This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the Research Ethics Committee of the Federal University of Juiz de Fora – UFJF (CAEE: 68601617.1.0000.5147). Written informed consent was obtained from all participants and their legal guardians.

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