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Dietary Patterns in Pregnant Adolescents

By Maria Lucia Oliveira Rossés, Amanda Vilaverde Perez,
Rafaela da Silveira Corrêa, Cecilia Alfama, Marianna Sperb,
Aline Vilaverde Perez, Edimárlei Gonsales Valério,
Vera Lúcia Bosa & Janete Vettorazzi

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Dietary Patterns in Pregnant Adolescents

Maria Lucia Oliveira Rossés [α], Amanda Vilaverde Perez [σ], Rafaela da Silveira Corrêa [ρ], Cecilia Alfama [Ѡ], Marianna Sperb [¥], Aline Vilaverde Perez [§], Edimárlei Gonsales Valério [χ], Vera Lúcia Bosa [ν] & Janete Vettorazzi [Ɵ]

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Conclusion: The study confirmed that pregnant teenagers tend to adopt the food pattern Junk Food, regardless of sociodemographic aspects.

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Author α Ѡ § χ Ɵ: Postgraduate Program in Health Sciences: Gynecology and Obstetrics, Universidade Federal do Rio Grande do Sul (UFRGS). Rua Ramiro Barcelos, 2400, Santa Cecilia, 90035-002, Porto Alegre, RS, Brazil. e-mails: cee.alfama@gmail.com, mariannasperb@yahoo.com.br, mariarosses@gmail.com

Author σ ρ § Ɵ : Faculty of Medicine (FAMED), Universidade Federal do Rio Grande do Sul. (UFRGS). Rua Ramiro Barcelos, 2400, Santa Cecilia, 90035-002, Porto Alegre, RS, Brazil.
e-mails: marisbaraini@gmail.com, amandavperez@gmail.com

Author ¥: Department of Nutrition, Faculty of Health Sciences, Centro Universitário Ritter dos Reis - UniRitter. Rua Orfanotrófio, 555, Santa Tereza, 90840-440, Porto Alegre, RS, Brazil.
e-mail: rafaeladscorrea@gmail.com

Author § Ɵ : Department of Gynecology and Obstetrics, Faculty of Medicine (FAMED), UFRGS. Rua Ramiro Barcelos, 2400, Santa Cecilia, 90035-002, Porto Alegre, RS, Brazil. e-mails: evalerio@hcpa.edu.br, jvettorazzi@hcpa.edu.br

Author § Ɵ: Service of Gynecology and Obstetrics.Hospital de Clínicas de Porto Alegre (HCPA). Rua Ramiro Barcelos, 2350/1125, Santa Cecília, 90035-003, Porto Alegre, RS, Brazil.

Author ν: Department of Nutrition, Faculty of Medicine (FAMED) and Postgraduate Program in Food, Nutrition and Health, Universidade Federal do Rio Grande do Sul (UFRGS). Rua Ramiro Barcelos, 2400, Santa Cecilia, 90035-002, Porto Alegre, RS, Brazil.
e-mail: vbosa@hcpa.edu.br

I. Introduction

In Brazil, about 17.5% of births are from adolescent mothers. (1, 2, 3) Several transformations take place in adolescence, a time when external factors may have a greater influence on food behavior. Besides familial eating habits, friends' habits, and sociocultural values and rules, the media and trends surrounding teenagers are also factors that affect food choices (4). Compared to other life stages, adolescents have energy needs, macro and micronutrients increased, including calcium, iron, and zinc (5). Therefore, adolescent pregnant women have higher nutritional requirements to maintain maternal health and ensure adequate fetal growth and development (6).

Nutrition has a strong influence on maternal and fetal health during pregnancy, but we did not find studies that specifically address dietary patterns in pregnant adolescents. Adolescent nutritional habits become a center of concern when malnourished teens become pregnant. Thus, the analysis of dietary patterns can be useful for the measurement of individual nutrients in studies. Nutritional condition is one of the most important and modifiable factors affecting the health of the pregnant adolescent and the fetus. We aimed to identify the dietary patterns among pregnant adolescents in southern Brazil.

II. Methods

Between July 2014 and July 2016, we conducted a cross-sectional study among postpartum adolescents (≥ 10 years and ≤ 20 years) in a university hospital in southern Brazil. We excluded those with a gestational age <20 weeks or who were unable to answer the questionnaires. After analysis of food intake, women who consumedless than 600 kcal/day or more than 6000 kcal/day were also excluded, as per the research by Leal and Santos (7, 8). The final sample consisted of 294 subjects.

We collected data at the obstetric hospital unit after informed consent. We applied a questionnaire on sociodemographic and nutritional variables and reviewed their obstetrical data. Ethics and Research Committee of Hospital de Clínicas de Porto Alegre approved the project (number 140491; protocol no. at PlataformaBrasil35265514.3.0000.5327).

The analysis included: household income (defined as the number of minimum wages earned by a family); marital status; self-declared race; educational attainment; self-declared pre-gestational weight; measured height and pre-gestational BMI; weight gain during pregnancy (calculated by the difference between the last measured weight and the declared weight at the beginning of pregnancy); and gestational age at delivery, according to the method employed by Capurro (9). The pre-gestational nutritional status was established by calculating the Body Mass Index for Age (BMI/A) and analyzing the Z-score. Subjects were classified as low weight ($Z < -2$ SD), eutrophic (-2 SD $\leq Z \leq +1$ SD), overweight ($+1$ SD $< Z \leq +2$ SD), or obese ($Z > +2$ SD) (10). We determined the weight adequacy ranges for full-term pregnant women ≱ 37 weeks), which were equivalent to 12.5 to 18 kg for women with low pre-gestational weight; 11.5 to 16 kg for eutrophic women; 7 to 11.5 kg for overweight women; and 5 to 9.1 kg for obese women (11).

We assessed the usual intake patterns throughout the whole pregnancy period. Asemiquantitative food frequency questionnaire (FFQ) developed and validated for use with pregnant women (12)and adapted to the studied population was used for analyzes food intake. The intake frequency options were converted into daily intake values: "more than three times/day" = 3; "two to three times/day" = 2; "once a day" = 1; "five to six times/week" = 0.79; "two to four times/week" = 0.43; "once a week" = 0.14; "one to three times/month" = 0.07; "never or almost never" = 0. We extracted nutritional information on the composition of foods from the National Nutrient Database (13) and searched in the Brazilian Table of Food Composition (14) data for items that were not present in the National Nutrient Database. The 88 FFQ items were pooled into 29 groups according to similarities in nutritional content or botanical composition, as described in Table 1(15). Food items mentioned by more than 80% of the sample and not previously included in the list were also added to the analysis, totaling 91 items. We converted the intake of each group into a percentage of the daily caloric intake (16).

We exclude seven foods/groups (whole grains, cassava flour, whole wheat bread, butter, fresh fish, canned fish, and alcoholic beverages) due to being consumed by less than 20% of the study population, which resulted in a final total of 22 groups. The exclusion prevented the formation of groups of "nonconsumers" that could mischaracterize the identified food patterns (17). We calculated median and interquartile ranges for each of the food groups that remained in the study (18) and compared then using the Mann-Whitney U test for independent samples.

We used cluster analysis based on the food groups to identify dietary patterns and then derived two non-overlapping groups (food standards) using the κ-means method. We used pattern names similar or equal to the ones found in studies carried out with the same methodology (19, 20, 21, 22).

As described in the literature, a minimum of five subjects is required for each food or food group to constitute a food pattern (22), with ten or more being ideal. In this study, there were 13.4 subjects per group.

We used SPSS software version 18.0 for performed statistical analysis. For expressed categorical variables we used absolute (n) and relative (%) frequencies. Continuous variables were expressed as mean and standard deviations (±SD) in normal distributions or as median and interquartile ranges (P25 - P75) in asymmetrical distributions. The level of significance was 5% ($p \leq 0.05$; 95% confidence interval (CI). Shapiro-Wilk test was used for test normality in all analyzed variables. We used the chi-squared test with adjusted residual analysis, Student's t-test, and the Mann-Whitney U test for independent samples to analyze the associations between dietary patterns according to the type and distribution of variables and number of categories (23).

III. Results

The sample consisted of 294 postpartum adolescents. They were grouped into two clusters, referred to as "Traditional Diet" and "Junk Food." The mean age was 17.83 ± 1.29 years, with no difference between clusters: 17.83 ± 1.20 years for the Traditional Diet and 17.77 ± 1.35 years for Junk Food (p = 0.759).Of the total subjects, 65% were self-declared Caucasians. In the Traditional Diet group, 63.1% of subjects were self-declared Caucasians, compared to 66% in Junk Food (p = 0.624). The mean number of years of study was 9.04 ± 2.17 for the whole sample, 9.11 ± 2.14 years for the Traditional Diet group, and 9.33 ± 2, 00 years for the Junk Food group (p = 0.303). Most of the sample consisted of single unmarried subjects (83.6%), with a similar percentage for both groups (Traditional Diet: 82.5%; Junk Food: 84.1%). Household income was between 1.5 and 3 minimum wages for 62% of the total sample, with similar values for both groups (Traditional Diet: 61%; Junk Food: 62.6%) (p = 0.800).

Primiparous adolescents comprised 83.3% of the total sample. The mean pre-gestational BMI was 23.71 ± 5.04 kg / m2. 67% of subjects in the Traditional Diet cluster and 62.3% in Junk Food were eutrophic (p = 0.687). Excessive weight gain during pregnancy occurred in 42.9% of pregnant women, totaling 37.5% in the Traditional Diet pattern and 45.8% in Junk Food (p = 0.068). Table 2 shows the sociodemographic and anthropometric details of the sample.

We used cluster analysis to identify the patterns and quality of the food consumed. The first cluster referred to as "Traditional Diet" food standard (n = 103), presented a higher intake of traditional Brazilian food

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items, i.e., rice and beans (p <0.001). The second cluster, referred as "Junk Food" food standard (n = 191), was characterized by a higher intake of meat (p = 0.006), snacks (p = 0.019), chips (p= 0.035), candies, and soft drinks (p<0.001). Figure 1 shows the food groups most consumed in each group.

Traditional	Junk food
Refined cereals white rice and pasta, cooked cornmeal Legumes beans, lentils, peas, chickpeas	Meats beef, pork, organ meat, chicken Snacks pizza, snacks such as kibbeh, pastries Chips chips, french fries Candies ice cream, sugar, candy, chocolate powder, chocolate bars/bonbons, pudding, dulce de leche, sweetened condensed milk Soft drink light or regular soft drink, artificial powdered juice

Figure 1: Food groups most consumed according to dietary patterns.

In the Traditional Diet pattern, legumes accounted for 20.85% of the total energy intake, while refined cereals accounted for 11.4%. In Junk Food, chips (2.57%), sweets (9.59%), and soft drinks (10.37%), when combined with snack consumption (1.69%), accounted for 24.22% of the total energy value (TEV) consumed. White bread intake was also higher in Junk Food (12.62%) than in the Traditional Diet (9.77%), but with a marginal statistical difference (p = 0.059) between groups.

Intake of foods classified as vegetables (leafy vegetables and other vegetables), dairy products (milk, yogurt, and cheese), and fruit did not differ significantly between groups. For leafy vegetables p = 0.238, for other vegetables p = 0.895; for milk p = 0.796, for yogurt p = 0.277, for fruit p = 0.986 and p = 0.372 for cheese. Vegetables, including leafy vegetables and other types, accounted for less than 1% of the TEV consumed for both groups (Traditional Diet: 0.65%; Junk Food: 0.61%). These findings are in Table 3.

We found no significant associations between eating patterns and pre-gestational BMI/socio-demographic variables, were identify (Pearson's x^2 test): age(p = 0.759), educational attainment (p = 0.303). With Mann-Whitney U test: color (p = 0.624), marital status (p = 0.923), household income (p = 0.800), and pre-gestational BMI (p = 0.687). There was a marginally-significant association between adequacy of gestational weight gain and the Traditional Diet pattern (p = 0.068).

Adolescents in the Traditional Diet cluster had a significantly higher intake of protein (in grams, p = 0.03; in %TEV, p <0.001), magnesium, folate, iron ($p \leq$ 0.0001), and potassium (p = 0.005). Meanwhile, adolescents in the Junk Food cluster consumed greater total fat in grams and %TEV (p<0.001) and a higher amount of saturated fat and cholesterol in grams (p<0.001), with a marginal significance for higher caloric intake (p = 0.066). Carbohydrate intake in grams and %TEV did not differ between clusters (p = 0.170 and p = 0.399).

The mean value of sodium consumption was 4551.42mg for the Traditional Diet and 4294.64mg for Junk Food, with no significant difference between groups (p = 0.087). Calcium intake was 1235.23mg for the Traditional Diet cluster and 1297.03mg for Junk Food (p = 0.407). Table 4 described each group distribution of macro- and micronutrient consumption.

IV. Discussion

Adolescence is a transitional period and subject to external influences, which modifies eating habits. We

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identified two dietary patterns: Traditional Diet and Junk Food. The Junk Food pattern was characterized by a higher intake of easily-accessible, ready-made food items widely advertised in the media: snacks, chips, sweets, and soft drinks. Previous studies with non-pregnant adolescents (22, 23, 24, 25) also had seen these data, which suggests that this age group tends to increased consumption of foods considered unhealthy. In the present study, where the Junk Food cluster grouped 65% of the sample, the intake pattern was the same as the one adopted by non-pregnant adolescents. This suggests that junk food group tends to keep the same dietary pattern during pregnancy, a fact that may be related to the characteristics of adolescence. Conversely, a study carried out among adult pregnant women found a change in intake patterns, with a reduction in the intake of ultra-processed foods and a slight increase in the consumption of *in nature*/minimally-processed foods (26).

In our study, only 35% of subjects adhere to the Traditional Diet pattern, characterized by higher consumption of the standard Brazilian foods, i.e., rice or pasta and beans for the main meals (lunch and dinner). Weight gain during pregnancy was more healthy for pregnant women who followed this pattern. Previous findings showed that eutrophic adolescents followed a diet based on the traditional Brazilian standard (20, 27, 28), and a study carried out by Sichieri (20) revealed that adherence to this standard in adults was a protective factor against overweight. Encouraging the intake of foods belonging to the Brazilian dietary pattern would be an great measure to prevent obesity and excess weight gain among pregnant Brazilian adolescents.

We identified a higher caloric intake in the group Junk Food, which is consistent with other studies among non-pregnant adolescents (29, 30, 31). The "soft drinks" and "candies" food groups contributed the most to caloric intake in this dietary pattern. According to a systematic review carried out by Trumbo in the United States, sweetened drinks, one of the major contributors to the high caloric intake of the American population(32), are associated with lower consumption of water, milk, fruits, and vegetables and higher consumption of ultra-processed foods. These eating habits are related to an increased risk of adverse health consequences, such as micronutrient deficits, weight gain, diabetes, and hypertension (33). The pregnant adolescents in this study who consumed more sugars from candies and sweetened drinks showed bigger weight gain during pregnancy, with 19.96% of their caloric intake coming from these food groups.

Meat consumption was higher in the Junk Food pattern, a factor that may have contributed to the higher intake of fats and cholesterol observed in this cluster. However, traditional diet group had higher protein intake. In a Portuguese cohort (34) study with 7591 adults, unhealthy eating patterns characterized by a lower intake of vegetables, fresh fruit, fish, dairy products, and water associated with high meat consumption. Gregório *et al*. found an independent association between younger individuals and higher meat consumption. This is consistent with our results, which showed a repetition of this dietary pattern among young individuals, regardless of gestation status.

The intake of magnesium, potassium, and folate was higher in the Traditional Diet pattern, but the levels were within the recommended amounts for the entire sample. Iron intake was also higher in the Traditional Diet pattern, but iron levels were lower than the recommended in both clusters. Previous studies on inadequate iron intake in adolescence, particularly in females (8, 35) and in adult pregnant women (36), have pointed to the adverse effects caused by iron deficiency in both adolescence and pregnancy. The findings reinforce the need to encouraging this population to seek adequate iron intake through food sources and supplements, especially during pregnancy.

In our study, calcium intake was closer to the recommended amounts for adolescent pregnant women, with lower average consumption in the Junk Food standard (95% adequacy). Previous studies have also identified a deficit in calcium intake, mainly in adolescents (8, 35). Inadequate calcium intake might put this population at risk for calcium deficiency as adolescence is the period of peak bone mass acquisition. Additionally, deficient calcium intake may affect fetal bone formation.

We also identified an excess sodium intake, which figured at almost twice the maximum recommended amounts according to Veiga et al. (35). This finding points to the need to increase awareness in the adolescent population, especially in pregnant teenagers, about the risks and adverse health effects of excessive sodium intake, both during pregnancy and in the long term.

Excessive weight gain during pregnancy occurred in 42.9% of our sample. According to Kac et al. (37), delivering the first child before the age of 23 and having a gestational weight gain over 12 kg are predictors associated with maintenance of weight gain. Additionally, excess weight gain during pregnancy may lead to the retention of postpartum weight (38). Gigante *et al*. (39) showed that adolescents who had been pregnant at least once had a higher BMI compared to nulliparous adolescents. These factors may contribute to the high rate of obesity found in young Brazilian women. Other studies are needed to verify the association between excess weight gain during pregnancy in adolescence and obesity in adulthood within this specific group.

According to Brazilian population data, overweight in adolescent girls increased significantly from 2008 (23.4%) to 2015 (31.1%) (IBGE 2008-09; IBGE 2015). The study by Fonseca et al. (40), which assessed 712 pregnant women, found that 34.7% of them were overweight at the beginning of gestation and 36.9% had excessive gestational weight gain. Similarly, we classified 34.6% of adolescents in our study as pre-gestational overweight, and 42.9% showed excess weight gain during pregnancy. In addition to being a public health problem, obesity and overweight in adolescence are risk factors for cardiovascular diseases and diabetes (41).

This study has a few limitations. The sample collected, due to comprising a very restricted population, was not enough to demonstrate significant differences associated with socio-demographic aspects between groups. Besides, feeding studies that use food surveys are susceptible to bias, as they rely on the respondents' memory, understanding of the tools, and the skill of the interviewers. The FFQ used was validated for pregnant women; however, our sample was composed just of pregnant adolescents, and we did not find references to this population in the validated FFQ literature. Further studies with similar sample characteristics are needed to compare the dietary profiles of different groups of pregnant women.

We conclude that adolescent pregnant women have, for the most part, an unhealthy diet pattern. These findings may serve as an incentive to improve eating patterns in this population, as the current one is associated with obesity and other chronic non-communicable diseases in the long term.

Table 1: Classification of food groups consumed by pregnant adolescents based on nutritional content and botanical composition.

	Food or food groups	Group composition
1.	Refined cereals	White rice and pasta, cooked cornmeal
2.	Whole cereals#	Brown rice and whole pasta
3.	Legumes	Beans, lentils, peas, chickpeas
4.	Cassava flour#	Cassava flour
5.	White bread	French bread and sliced bread, homemade bread
6.	Whole bread#	Whole weat and rye bread
7.	Cookies	Cookies, crackers, cake
8.	Potato/cassava	Cooked potato, cassava
9.	Popcorn	Popcorn
10.	Leafy vegetables	Leafy vegetables (lettuce, chicory, collard greens, and cabbage)
11.	Fruit	Fruit and natural juice
12.	Onion/garlic	Onion/garlic
13.	Other vegetables	Non-leafy vegetables (including corn in the corb, excluding garlic and onion)
14.	Eggs	Eggs
15.	Milk	Whole, semi-skimmed and skimmed milk
16.	Yogurt	Plain and light yogurt
17.	Cheese	Cheese
18.	Creamy cheese/margarine/mayonnaise	Creamy cheese/margarine/mayonnaise (ultraprocessed, similar form of consumption)
19.	Butter	Butter
20.	Meat	Meat (beef, pork, organ meat, chicken)
21.	Sausages	Sausages and processed meats (ham*/mortadella*, sausages, hamburguers, bacon/lard)
22.	Fresh fish#	Fresh fish, shrimp
23.	Canned fish#	Canned tuna and sardines
24.	Snacks	Pizza, snacks such as kibbeh, pastries
25.	Chips	Chips, french fries
26.	Candies	Ice cream, sugar, candy, chocolate powder, chocolate bars/bonbons, pudding, dulce de leche, sweetened condensed milk*)
27.	Soft drink	Light or regular soft drink, artificial powdered juice
28.	Coffee#	Coffee
29.	Alcoholic beverages#	Alcoholic beverages (wine, beer and other acoholic beverages)

Table 2: Sociodemographic and anthropometric characteristics of the pregnant adolescents.

Characteristics	Total sample	Dietary pattern: Traditional (n=103)	Dietary pattern: Snacks and candies (n=191)	*p* value *
Age (n=294)	17.83 ± 1.29	17.83 ± 1.20	17.77 ± 1.35	0.759[a]
Race (n=294)				
White	191 (65.0)	65 (63.1)	126 (66.0)	0.624[b]
Nonwhite	103 (35.0)	38 (36.9)	65 (34.0)	
Year of study (n=294)	9.04 ± 2.17	9.11 ± 2.14	9.33 ± 2.00	0.303[a]
Marital status (n=292)				
Single without partner	244 (83.6)	85 (82.5)	159 (84.1)	
Single with partner	38 (13.0)	14 (13.6)	24 (12.7)	0.923[b]
Married	10 (3.4)	4 (3.9)	6 (3.2)	
Family income (minimumwage) (n=245)				
< 1,5	63 (25.7)	23 (28)	40 (24.5)	
1,5 a 3	152 (62.0)	50 (61)	102 (62.6)	0.800[b]
> 3	30 (12.2)	9 (11)	21 (12.9)	
Pre-gestational BMI (n=280)	23.71 ± 5.04			
Underweight	4 (1.4)	2 (2.1)	2 (1.1)	
Eutrophy	179 (63.9)	65 (67)	114 (62.3)	0.687[b]
Overweight	58 (20.7)	19 (19.6)	39 (21.3)	
Obesity	39 (13.9)	11 (11.3)	28 (15.3)	
Adequacyof gestational weight gain (n=275)				
Insufficient	75 (27.3)	23 (24)	52 (29.1)	
Adequate	82 (29.8)	37 (38.5)	45 (25.1)	0.068[b]
Excessive	118 (42.9)	36 (37.5)	82 (45.8)	

BMI: body mass index

** Significance: $p \leq 0.05$*

[a] *Mann Whitney U test.*
[b] *Pearson's chi squared test*

Table 3: Description of dietary patterns in pregnant adolescents according to the %VET of each food/food group.

Foods/groups	Traditional (n=103)	Snacks and candies (n=191)	*p*-value *
Refined cereals	11.4 [7.75 – 14.72][1]	8.6 [9.1 – 10.7]	≤0.0001
Legumes	20.85 [17.73 – 25.96][1]	5.46 [2.76 – 9.69]	≤0.0001
White bread	9.77 [5.14 – 17.21]	12.62 [5.61 – 20.23]	0.059
Cookies	3.15 [0.95 – 6.58]	4.66 [1.98 – 8.23]	0.051
Potato/cassava	0.51 [0.00 – 1.22]	0.52 [0.00 – 1.43]	0.895
Popcorn	0.00 [0.00 – 0.21]	0.00 [0.00 – 0.19]	0.924
Leafy vegetables	0.07 [0.02 – 0.18]	0.06 [0.16 – 0.14]	0.238
Fruit	3.92 [2.30 – 8.23]	4.37 [2.00 – 8.82]	0.986
Onion/garlic	0.31 [0.18 – 0.44]	0.29 [0.17 – 0.38]	0.183
Other vegetables	0.58 [0.26 – 0.48]	0.55 [0.24 – 1.38]	0.895
Eggs	0.29 [0.00 – 0.74]	0.35 [0.10 – 1.00]	0.286
Milk	4.71 [1.43 – 9.78]	4.96 [1.72 – 8.93]	0.796
Yogurt	0.64 [0.00 – 2.39]	0.43 [0.00 – 2.25]	0.277
Cheese	0.25 [0.00 – 1.25]	0.46 [0.00 – 1.59]	0.372
Creamy cheese/margarine/mayonnaise	0.78 [0.33 – 1.34]	0.87 [0.43 – 1.61]	0.227
Meat	7.81 [4.38 – 10.41]	8.51 [6.01 – 13.65][1]	0.006
Sausages	1.15 [0.59 – 1.96]	1.33 [0.61 – 2.25]	0.359
Snacks	1.37 [0.28 – 2.70]	1.69 [0.61 – 3.77][1]	0.019
Chips	1.79 [0.78 – 4.03]	2.57 [0.90 – 6.39][1]	0.035
Candies	5.87 [3.62 – 9.23]	9.59 [5.97 – 14.96][1]	≤0.0001
Soft drink	6.29 [3.23 – 9.77]	10.37 [5.34 – 17.09][1]	≤0.0001

%TEV: percentage of total energy value.
** Mann-Whitney U test for p. Significance: ≤ 0.05.*
[1] Food / food groups with a higher consumption.
Not presented: food / food groups that were consumed by less than 20% of the sample.

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Conflict of interest: The authors have no conflicts of interest to declare.

Contributor statement

JV, EGV, RCS, and VLB conceived/designed the study and worked on data collection. CA and MV worked on data collection. MLOR, JV, VLB, and RCS carried out the initial analyses, drafted the initial manuscript, and critically reviewed and revised the manuscript. Amanda VP write and correct the article. Aline VP translate for English. All authors read and approved the final manuscript as submitted.

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