Breakfast patterns and weight status among adolescents – a study on the Brazilian National Dietary Survey 2008-2009

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Abstract

Examine the composition of breakfast concerning weight status is essential for evaluating adolescent health and understanding this gap. This study aimed to identify breakfast patterns and investigate the relationship with weight status among Brazilian adolescents. We used a subsample of 7,425 adolescents aged 10-19 years from the 2008-2009 Brazilian Household Budget Survey. Breakfast eaters were those with intake of at least 50 kcal (209.2kJ) between 5 and 10 a.m. Breakfast dietary patterns were derived by principal component factor analysis with varimax rotation. We performed logistic regression analyses between breakfast patterns and weight status, considering the complexity of the survey sample design. Three breakfast patterns were identified explaining 44.8% of data variability: (1) the Cereal, protein, fruit beverages and Northern/Northeastern pattern, characterized by high consumption of cookies, meats, dairy products, preparations with corn, eggs, fruit juices/fruit drinks/soy-based drinks, tubers/roots/potatoes, and cereals, and negative adherence to cold cut meat and savory snacks/crackers; (2) the Protein-based pattern, characterized by positive loadings for cold cut meat, milk and cheese, and negative for cookies, fruit juices/fruit drinks/soy-based drinks, tubers/roots/potatoes, and cereals; and (3) the Mixed pattern, with positive loadings for cakes, coffee/tea, bread, fruit juices/fruit drinks/soy-based drinks, chocolate/desserts, and savory snacks/crackers. No association was found between skipping and weight status. Overweight adolescents had lower adherence to the Cereal, protein, fruit beverages and Northern/Northeastern pattern pattern (OR=0.67; 95% CI 0.47; 0.96). This is the first study to address dietary patterns at the meal level with adolescent population-based data, which requires further investigation.

Keywords: adolescent, body mass index, breakfast, dietary pattern, population-based.
Introduction

Childhood obesity is a global challenge due to its increasing global prevalence that will overwhelm health systems and economies in Brazil and other countries\(^{(1,2)}\). Without an effective public policy to manage the problem, Brazil is expected to become the fifth country in the number of obese aged 5-19 years old, representing 7.7 million children\(^{(3)}\). Only behind Mexico, Brazil assumes the second position of the highest Gross Domestic Product (GDP) loss due to obesity among Organization for Economic Cooperation and Development (OECD) countries\(^{(4)}\). With a higher risk to persist to adulthood\(^{(5,6)}\), obesity negatively affects school development. It is related to weight-related stigma, which can impair the quality of life\(^{(7,8)}\). Childhood obesity has also been associated with higher blood pressure, lower levels of HDL cholesterol\(^{(9)}\) and higher fasting glucose\(^{(10)}\).

Identifying dietary patterns is relevant due to its higher capacity to predict overall disease risk than assessment based on individual food or nutrient intake\(^{(11,12)}\). People consume meals that consist of synergic and complex combinations of several foods and nutrients\(^{(12)}\). The Brazilian Population Dietary Guidelines state that diet should consider meals and eating patterns more than nutrients and foods and provide guidance on food combinations for breakfast and other main meals (lunch and dinner)\(^{(13)}\). The Brazilian Dietary Guide is an international reference due to its scope and accessibility in the approach of healthy eating and sustainability, besides the clear recommendations of the Brazilian diet to be plant-based and based on fresh and processed foods, thus avoiding the ultraprocessed products\(^{(14,15)}\).

Research on the role of breakfast skipping and breakfast composition on obesity remain inconclusive\(^{(16)}\) despite the importance of breakfast’s composition for healthy eating\(^{(17-19)}\). This is partially due to unstandardized methodological breakfast definitions between studies and variations considering the local context\(^{(20,21)}\). A posteriori identification of breakfast patterns according to the correlations between food items could contribute to understand dietary patterns at the meal level further. Despite most commonly consumed food groups by Brazilian adolescents at breakfast are coffee and tea, breads, butter/margarine,milk, cakes and cookies, packaged snacks, corn-based dishes, cheese, processed meats, and fruit juice, with saturated fatty acids, sodium and free sugar exceeding the recommended maximum limits of daily energy intake,\(^{(22)}\) understanding how the composition of the breakfast relates to obesity is a further gap to be evaluated.
Few studies have focused on dietary patterns at the meal level\(^{(23,24)}\). In Brazil, while one in every four adolescents is overweight\(^{(25)}\), the relationship between dietary breakfast patterns and weight status in adolescents is a gap that must be evaluated. Thus, this study aims to address breakfast patterns and investigate the relationship with weight status among Brazilian adolescents by using population-based data.

**Methods**

Study population and variables’ measurement

Brazilian representative study data on the cross-sectional *National Dietary Survey* (NDS) with a 25% representative subsample (n=34,003 individuals) of 10-year-old or above household members from the Brazilian Household Budget Survey (HBS) 2008-2009 (n=55,970), coordinated by the Brazilian Institute of Geography and Statistics (IBGE) with a representative sample of Brazilian households\(^{(26)}\). A two-stage cluster sampling was conducted for the HBS. Primary sampling units were census tracts from 550 sampling strata. This stage considered geographical and socioeconomic homogeneity. Private permanent households composed the secondary sampling units. Adults and elderly, pregnant women, and breastfeeding mothers were excluded from the NDS study, resulting in a subsample of 7,425 adolescents aged 10-19 years.

Data on two non-consecutive days’ food records were collected from NDS participants. Participants were asked to record all foods and beverages consumed each day (food items, amount consumed, time, and place). Usual energy intake for each food was obtained from NDS food composition and food portion tables\(^{(27,28)}\). More information on training and validation of the food records can be found elsewhere\(^{(26)}\).

Despite giving useful information on dietary intake, food records capture short term intake and, as consequence, fail to estimate day-to-day variation. To overcome this limitation, we obtained usual food, daily and breakfast energy intakes with the National Cancer Institute method (NCI), that consider within person variability, zero intakes, and inclusion of covariates to improve intake prediction (age, sex and country region).

First, food records were analyzed to evaluate which food item was consumed in each hour of the day. As definition of eating occasion was not available in the food records every hour with any food consumption was defined as an eating occasion. We then calculated the energy intake for each eating occasion. Second, each food record between 5:00 a.m. and 10:00 a.m. was examined. Third, we classified as breakfast eaters were those
who consumed at least 50 calories (209.2 kilojoules) in the breakfast usual energy intake between 5 a.m. and 10 a.m. When more than one eating occasion occurred in the delimited interval the most caloric meal was chosen as breakfast. Breakfast-skippers were the adolescents with usual energy intake below 50 calories and zero energy consumption in both food records in the delimited period. The criteria to define the breakfast by time clock and energy intake was based on the previous literature and other studies applied the same breakfast frequency criteria\(^{23,29}\).

Body Mass Index (BMI) \([\text{weight}/(\text{height})^2]\) was calculated on measured weight [with a portable electronic scale with 150 kilograms (kg) capacity and graduations of 100 grams (g)] and height [with a portable stadiometer with a retractable treadmill measuring up to 200 centimeters (cm) and 0.1 cm precision]. Imputation procedures were applied for erroneous or missing responses at the critical review stage. Detailed information is available and published elsewhere\(^{30}\).

Weight status was evaluated by using BMI-for-age z-score cutoff points based on the reference population aged 5-19 years, proposed by World Health Organization (WHO)\(^{31}\). BMI-for-age z-scores were estimated with WHO-Anthro Plus, version 3.2.2\(^{32}\). WHO classifies (1) thinness when BMI-for-age < -2 z-scores; (2) adequate BMI-for-age > -2 and <+1 z-scores; (3) overweight when BMI-for-age >+1 and <+2 z-scores; and (4) obesity when BMI-for-age > +2 z-scores.

Anthro-Plus WHO child’s age limits the BMI-for-age analysis to 228 completed months. Since there were 570 (7.68\%) non-classified data for participants older than 228 months, their weight status was based on adult BMI classification. Criteria for 19-year-old individuals used in this study were consistent with the definitions set forth by the WHO where: BMI < 18.5 kg/m\(^2\) is classified as underweight; BMI 18.5-24.9 kg/m\(^2\) as normal weight; BMI 25-30 kg/m\(^2\) as overweight, (which is equivalent to BMI-for-age >+1 and <+2 z-scores) and BMI ≥ 30 kg/m\(^2\) as obese (which is equivalent to BMI-for-age >+2 z-scores)\(^{31}\). Weight status was classified as a binary variable for the final models of this study. As underweight/thinness (n=297; 3.6\%) and obesity (n=346; 5.3\%) frequencies were low in this study, those classified as thinness/underweight were added to adequate BMI-for-age/normal weight, and obese adolescents were incorporated into overweight classification.

To estimate equivalent per capita monthly income the total income for the household (self-reported) was equivalized according to the Organization for Economic
Cooperation and Development (OECD) modified equivalence scale, which assigns weights according to the number and age of household members\(^{(34-36)}\). We used relative poverty to describe the study sample. Relative poverty considers individuals’ position concerning the overall living standards and lifestyles of their society\(^{(37)}\). A household income 60% below the mean or median is considered as relative poverty\(^{(38)}\). We defined relative poverty as the adolescents with equalized income below 60% of the Brazilian median\(^{(34-36)}\).

Statistical analyses

We conducted an exploratory factor analysis with principal components estimation and Varimax rotation to derive dietary breakfast patterns. We initially identified 18 food groups of usual intakes. We considered eigenvalues over 1.5 and adequate communalities equal to or above 0.10 to select the number of factors to be retained. After identifying the number of factors (breakfast patterns), the Varimax rotation was performed to maximized higher and minimized lower factor loadings, which simplifies interpretation. The cutoff point over 0.25 (in the module) for the factor loadings after rotation was established for each food group to compose the breakfast patterns. Then, factor scores were estimated by regression analyses\(^{(39)}\). For this study, food items were grouped considering their nutritional value, the Brazilian population’s intake, and scientific literature on food grouping to estimate dietary patterns\(^{(23,40,41)}\). The food items that were mentioned by less than 2.5% of the study sample were excluded from the analyses.

The National Cancer Institute method was applied to estimate usual food and breakfast energy intakes to consider between and within person variability among food records, episodically consumed foods, and asymmetric amount distribution\(^{(42)}\).

The associations between breakfast skipping and breakfast patterns factor scores with weight status were estimated by logistic regression modeling, crude, and adjusted for potential confounders (sex, age, equivalent monthly per capita income, the region of the country, and daily energy intake). Weight status was applied as a binary variable for these analyses. Regression analyses considered the survey sample design’s complexity using SAS OnDemand for Academics® (SAS Institute Inc., Cary, USA). This study was conducted according to the Declaration of Helsinki and all procedures involving human subjects were approved by the local ethics committee.
Results

On average, adolescents were 14.5 years old, 35.3% were breakfast-skippers, 21.4% were overweight and 17.1% were living in relative poverty. The highest proportion was from the Southeast area (39.4%). About 16.1% of adolescents in this study were overweight, and 5.3% were obese. More girls than boys were thin. Adolescents who were younger, relatively poor, and from the Southeast were more likely to be overweight or obese. Adolescents from the Northeast were less likely to be overweight or obese, and those from the North were less likely to be obese only (Table 1).

We identified three breakfast patterns of Brazilian adolescents, which explained 44.8% of data variability. We named the patterns following the food groups with higher factor loadings. The Cereal, protein, fruit beverages and Northern/Northeastern pattern pattern had positive loadings for cookies, meats, dairy products, preparations with corn, eggs, fruit juices, fruit drinks or soy-based drinks, tubers, roots or potatoes, cereals, and negative loadings cold cut meat, and savory snacks or crackers. The Protein-based diet pattern had positive loadings for cold cut meat, milk, cheese, and negative for cookies, fruit juices, fruit drinks or soy-based drinks, tubers, roots or potatoes, and cereals. The Mixed pattern was characterized by the intake of cakes, coffee or tea, bread, fruit juices, fruit drinks or soy-based drinks, chocolate or desserts, savory snacks, or crackers (Table 2).

Table 3 shows the logistic regression analyses for breakfast frequency, breakfast patterns, and binary weight status, the response variable. There was no significant association between skipping breakfast, Protein-based or Mixed breakfast patterns with binary weight status. The Cereal, protein, fruit beverages and Northern/Northeastern pattern was inversely associated with weight status (OR=0.67, p-value=0.028).
Discussion

Brazilian adolescents who usually have breakfast encompass the three main breakfast dietary patterns: the Cereal, protein, fruit beverages and Northern/Northeastern pattern, named as such due to higher adherence to cookies, meats and dairy, accompanied by beverages, but also to food groups that represent usual breakfast from North and Northeast Brazilian regions, such as tubers, roots and potatoes, preparations with corn and eggs, as observed in previous research using the same data of the present study\(^{(22)}\); the Protein-based pattern, characterized as such by the inclusion of milk, cheese and processed meats; and a third breakfast pattern named Mixed, because bread and coffee, fruit juices and cakes were the main breakfast consumed food items among Brazilian adolescents\(^{(22)}\). We also found that adolescents with overweight or obesity had lower adherence to the Cereal, protein, fruit beverages and Northern/Northeastern pattern. Nevertheless, our study showed no relationship between skipping breakfast and weight status.

In common, the three patterns of the study were composed of food items that represent both a healthy and an unhealthy diet. On the one hand, the Cereal, protein, fruit beverages and Northern/Northeastern pattern was characterized by a healthier diet due to the higher adherence to traditional Brazilian food groups mostly consumed at breakfast among adolescents from Northern (roots and tubers) and Northeastern regions (corn-based dishes and eggs)\(^{(22)}\). On the other hand, this pattern presented higher adherence to cookies, and fruit and soy-based drinks. In common, both food groups are composed of homemade and processed cookies and beverages as well as ultra-processed unhealthy cookies and sugar-sweetened beverages. The named Mixed pattern includes healthy food items usually consumed by the Brazilian adolescents\(^{(43)}\), such as coffee and bread, and also unhealthier ones, as some sugar-sweetened beverages, chocolate, desserts, savory snacks, and crackers. In the same sense, the protein-based includes both cold cut ultra-processed food items and in natura or processed foods, such as cheese and milk.

Comparing our findings to overall dietary patterns for Brazilian adolescents, the Study of Cardiovascular Risk in Adolescents (ERICA), a nationwide school-based survey with adolescents aged 12 to 17 years, the authors also found three overall dietary patterns for most Brazilian geographic regions. The labeled Mixed pattern was partially characterized by most eaten food items usually consumed in Brazilian lunch and dinner, which are rice, meat, and beans\(^{(43)}\). Despite ERICA dietary patterns being evaluated on the overall daily basis the authors labeled a Bread-and-coffee pattern which had similarities to
the Mixed breakfast pattern from our study. Their Unhealthy pattern also has similarities with some foods of our Mixed pattern which includes cakes and cookies, sugar-sweetened beverages, and sweets/desserts. In the North region, the authors observed a fourth overall dietary pattern characterized by typical regional foods, consisting of tubers, fruits, and vegetables, which resembles the present study's Cereal, protein, fruit beverages and Northern/Northeastern pattern\(^{(44)}\). Other studies have shown that North and Northeast Brazilian consume traditional local foods like fish with flours and starches, cassava, and corn-based preparations, such as tapioca and corn couscous\(^{(45-47)}\).

Another study with Brazilian adolescents that gathered data from the National School-Based Health Survey (PeNSE)\(^{(48)}\) with ninth-graders from private and public schools identified three overall dietary patterns by cluster analysis. They labeled a Healthy pattern characterized by a higher intake of cooked vegetables, fruits, milk, raw vegetables, and beans and a lower intake of cookies, crackers, candy, soda, fried snacks, cold cuts, and French fries.\(^{(48)}\) Showing opposed frequencies, the authors found an overall dietary pattern named Unhealthy, and a named Mixed pattern due to lower level of discrepancy between consumption of the target foods. Through factor analysis of at-home and away-from-home overall dietary patterns of adolescents aged 10-19 years from the NDS 2008-2009, Cunha et al.\(^{(49)}\) observed three overall dietary patterns for both places chosen for food consumption: (1) Traditional, due to higher adherence to meat, rice and beans; (2) Bread-and-Butter, similar to our Mixed breakfast pattern and; (3) the Western pattern, unhealthier, with some food items commonly observed within our Protein-Based pattern. Despite differences among studies, partially explained by different methods applied to analyze food patterns and diverse study population, what the studies showed in common is that Brazilian adolescents share both healthy and unhealthy dietary patterns, in particular, at breakfast, which is of concern due to increasing consumption of ultra-processed products and a reduction of traditional food items at this stage of life\(^{(44,50,51)}\).

Our findings of overweight adolescents related with lower adherence to the Cereal, protein, fruit beverages and Northern/Northeastern pattern may reflect the role of a higher dietary fiber intake on excess body weight, as shown in two systematic reviews\(^{(52,53)}\). In the present study, the higher-fiber intake can be due to the consumption of cereals, tubers and roots. Moreover, the lower glycemic index (GI) of the meat, dairy products and eggs as sources of protein from this pattern could be associated to low daily energy intake and, thus, a lower chance of being overweight\(^{(54,55)}\). Examining 1,102 individuals aged 20 years and
above from São Paulo, Brazil, a cross-sectional population-based survey revealed associations between dietary patterns and metabolic cardiovascular disease risk factors (56). A pattern with high positive loadings on rice and beans and low-to-moderate loadings on red meats, eggs, whole milk, butter/margarine, and sugar was related to lower body weight and waist circumference, and was mediated by serum leptin. These findings suggest a potential protective role of dietary patterns based on higher dietary fiber intake and lower GI against weight gain.

We did not identify another study in Brazil assessing the relationship between breakfast patterns and overweight among adolescents, which make comparisons more difficult. However, results in the same direction for Brazilian adults using NDS data were found by Baltar et al. (23). The authors revealed a positive association between BMI and the Northern Brazilian pattern, characterized by high consumption of meats, preparations with corn, eggs, tubers/roots/potatoes, dairy products, savory snacks/crackers, fruit juices/fruit drinks/soy-based drinks. The Southeastern Brazilian pattern was inversely associated with BMI, characterized by cold cut meat, milk, cheese, coffee/tea, and bread (23) which resembles a combination of the Mixed and Protein-based patterns of our study. Healthier, the Traditional Lebanese pattern (positive loadings for vegetables, legumes, bread, rice, fruits, fish, and vegetable oils) was negatively associated with overweight (57). Longitudinal studies are needed to further understand the role of breakfast composition on weight gain.

The cross-sectional survey in a nationally representative sample of 2,019 Swiss adults derived dietary patterns using principal component analysis based on the intake of 22 breakfast-specific food groups (58). Of the three breakfast patterns, the Prudent breakfast, characterized by fruit, unprocessed and unsweetened cereal flakes, nuts/seeds, yogurt, was negatively associated with abdominal obesity, and the authors explained that the association was partly due to a healthier diet in the rest of the day (58). No association was observed between Traditional – white bread, butter, sweet spread – or Western breakfasts – processed breakfast cereals and milk – and adiposity outcomes (58).

At the meal level, a study on 933 participants from the Health Survey of São Paulo, Brazil, found greater adherence only to the Traditional lunch pattern associated with lower BMI in insufficiently active individuals (24). This pattern was characterized of higher contributions for rice, beans, cassava, flour, milk and sugar. Besides the Traditional pattern, four other lunch patterns were derived from 22 food groups by factor analysis (Western, Sweetened juice, Salad, and Meats) but none of them were significantly
associated to the outcome\textsuperscript{24}. Other studies showed an inverse association between the Traditional pattern (both overall and at the meal level) and weight outcomes such as waist circumference and BMI \textsuperscript{41,59,60}. It is important to emphasize that the comparison between studies is hampered by diverse findings and lack of studies at the meal level.

This study observed no association between skipping breakfast and weight status. The scientific literature on the subject has mixed findings\textsuperscript{61-68}. While cross-sectional studies consistently showed skipping breakfast related to overweight and obesity, contrary to our findings, cohort and intervention studies have mixed observations\textsuperscript{61-65}. Thus, systematic reviews and metanalyses recommend further investigation of the role of breakfast frequency on body weight and adiposity outcomes\textsuperscript{66-68}.

One issue that deserves attention is the inconsistent definitions of breakfast and breakfast-skipping\textsuperscript{23,24,29,69}. Prevalence levels vary greatly considering mixed definitions of breakfast and skipping combined with different populations\textsuperscript{23,24,29,69}. While the prevalence of skipping breakfast was 35.3\% in our study, higher and lower values can be found for Brazilian adolescents\textsuperscript{23,24,29,69}. Another study using the same data found 6.9\% of adolescents as skippers, but they only considered breakfast as the first meal of the day eaten between 4 a.m. and 11 a.m.\textsuperscript{22}. In this study, breakfast definition considered the time (5 to 10 a.m.) plus a minimum of 50 kcal of usual energy intake. A study evaluating high school students from technical schools of São Paulo, Brazil, found a high breakfast-skipping prevalence (51\%)\textsuperscript{70}. The question "with whom the participants had breakfast" implies the need for companionship at the meal and could explain skippers’ high frequency. Baltar et al.\textsuperscript{23} found similar skipping breakfast prevalence (33.1\%) for Brazilian adults. The authors applied the same breakfast definition as our study. Hassan et al.\textsuperscript{21} observed only 9.6\% breakfast-skippers among sixth-graders from a study sample of students from private and public schools of the metropolitan region of Rio de Janeiro, Brazil. The authors observed that the prevalence increased to 26.1\% when they changed the definition to categorize irregular breakfast. The participants were asked how often they had breakfast; those who responded less than five times a week were classified as having irregular breakfast, and those who responded “never or almost never” were classified as skippers. Consequently, comparisons between findings are hindered, and a consistent method to evaluate breakfast is required.

Our study’s first limitation is the cross-sectional design that prevents causal inference of the associations and, thus, our findings must be confirmed in prospective studies. Second, residual confounding might have biased the associations between
breakfast patterns and weight status despite the adjustment for potential confounders. Third, the three identified breakfast patterns explained 44.8% of the total variance, which explains most variance but is imperfect and reveals the complexity of breakfast patterns among Brazilian adolescents. Other studies, however, showed some values around our estimated variance. Baltar et al. (23) found that the three Brazilian adult’s breakfast patterns explained 47.7% of the total variance. A Swiss study on adults found the three main identified dietary patterns, which explained only 26% of the total variance (53). Fourth, breakfast was not described by the study participants, and some may have had breakfast in a broader period than the settled by the researchers and might be labeled as skippers. Fifth, as we observed only one meal, we cannot affirm whether the associations were related to breakfast eating alone or in combination with other eating occasions along the day; however, the analysis was adjusted by daily energy intake. Sixth, because we used secondary data there was no information on physical activity. Since weight gain depends on the balance between the energy expenditure and dietary intake (71), adjustment for physical activity should be taken into account in further studies.

The strengths of this study recall on data from a large, representative sample of the Brazilian adolescent population. Furthermore, we derived a breakfast composition pattern based on the usual food intake applying the NCI method. Adolescents’ daily food items consumed may not be well represented because of data collection of only two non-consecutive days food records. However, the NCI method’s application enables regular food consumption. Despite secondary data, our analyses were adjusted for most recognized confounders. Finally, this is the first study examining adolescents’ breakfast patterns and their association with weight status in Brazilian nationally-representative data.

Breakfast contribution to almost 1/5 (17.7%) of Brazilian adolescent’s daily energy intake (22) and our study's national representativeness point out the need for health and food policies to improve and value the breakfast eating at the age group. Dietary breakfast patterns are still a blind spot despite studies focusing on the role of breakfast on several health outcomes. Our study mainly adds to previous research given dietary patterns’ approach capacity to examine breakfast composition.
Acknowledgments

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Conflict of Interest

None.

Author contributions

B.K.H. and contributed to data analysis and manuscript writing. D.B.C. and R.O.S. contributed to data analysis and manuscript revision.

V.T.B. contributed to study design and supervising, data analysis, manuscript conception and final revision.
Accepted manuscript

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<td>31.83</td>
<td>25.22*</td>
<td>20.53*</td>
</tr>
<tr>
<td></td>
<td>(10,175,204)</td>
<td>(448,063)</td>
<td>(8,005,348)</td>
<td>(1,356,035)</td>
<td>(365,758)</td>
</tr>
<tr>
<td>Midwest</td>
<td>7.33</td>
<td>8.38</td>
<td>7.52</td>
<td>6.93</td>
<td>5.10</td>
</tr>
<tr>
<td></td>
<td>(2,455,540)</td>
<td>(99,977)</td>
<td>(1,891,736)</td>
<td>(372,905)</td>
<td>(90,922)</td>
</tr>
<tr>
<td>Southeast</td>
<td>39.36</td>
<td>36.57</td>
<td>37.49</td>
<td>45.73*</td>
<td>48.40*</td>
</tr>
<tr>
<td></td>
<td>(13,187,961)</td>
<td>(436,277)</td>
<td>(9,430,424)</td>
<td>(2,459,095)</td>
<td>(8,621,660)</td>
</tr>
<tr>
<td>South</td>
<td>13.43</td>
<td>8.50</td>
<td>13.00</td>
<td>13.95</td>
<td>21.28</td>
</tr>
</tbody>
</table>

SD – standard deviation, P-values of Multinomial regression models: *p-value<0.05; †p-value<0.01; ‡p-value<0.001

<table>
<thead>
<tr>
<th>Food Groups</th>
<th>Factor 1 CPFBN†</th>
<th>Factor 2 Protein</th>
<th>Factor 3 Mixed</th>
<th>Communality estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meats</td>
<td>0.86*</td>
<td>0.10</td>
<td>0.03</td>
<td>0.75</td>
</tr>
<tr>
<td>Eggs</td>
<td>0.82*</td>
<td>0.07</td>
<td>0.01</td>
<td>0.68</td>
</tr>
<tr>
<td>Preparations with corn</td>
<td>0.81*</td>
<td>0.04</td>
<td>-0.17</td>
<td>0.69</td>
</tr>
<tr>
<td>Tuber, roots, or potatoes</td>
<td>0.75*</td>
<td>-0.44</td>
<td>0.05</td>
<td>0.76</td>
</tr>
<tr>
<td>Dairy products‡</td>
<td>0.70*</td>
<td>-0.02</td>
<td>0.04</td>
<td>0.49</td>
</tr>
<tr>
<td>Cereals</td>
<td>0.67*</td>
<td>-0.61*</td>
<td>0.00</td>
<td>0.82</td>
</tr>
<tr>
<td>Cookies</td>
<td>0.52*</td>
<td>-0.33*</td>
<td>-0.12</td>
<td>0.40</td>
</tr>
<tr>
<td>Fruit juices, fruit drinks, or soy-based drinks</td>
<td>0.43*</td>
<td>-0.33*</td>
<td>0.43*</td>
<td>0.48</td>
</tr>
<tr>
<td>Cold cut meats</td>
<td>-0.31*</td>
<td>0.74*</td>
<td>0.06</td>
<td>0.65</td>
</tr>
<tr>
<td>Cheese</td>
<td>0.13</td>
<td>0.73*</td>
<td>-0.14</td>
<td>0.57</td>
</tr>
<tr>
<td>Milk</td>
<td>-0.19</td>
<td>0.53*</td>
<td>0.11</td>
<td>0.33</td>
</tr>
<tr>
<td>Coffee or tea</td>
<td>0.13</td>
<td>0.10</td>
<td>0.64*</td>
<td>0.44</td>
</tr>
<tr>
<td>Savory snacks or crackers</td>
<td>-0.40*</td>
<td>0.11</td>
<td>0.47*</td>
<td>0.39</td>
</tr>
<tr>
<td>Cakes</td>
<td>-0.01</td>
<td>-0.09</td>
<td>0.45*</td>
<td>0.21</td>
</tr>
<tr>
<td>Chocolate or desserts¥</td>
<td>-0.09</td>
<td>0.07</td>
<td>0.44*</td>
<td>0.21</td>
</tr>
<tr>
<td>Bread</td>
<td>0.06</td>
<td>0.15</td>
<td>0.38*</td>
<td>0.17</td>
</tr>
<tr>
<td>Oil or butter</td>
<td>0.03</td>
<td>0.15</td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>Fruits</td>
<td>0.03</td>
<td>0.06</td>
<td>-0.09</td>
<td>0.01</td>
</tr>
<tr>
<td>Eigenvalues</td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td><strong>4.89</strong></td>
<td><strong>1.74</strong></td>
<td><strong>1.44</strong></td>
<td></td>
</tr>
<tr>
<td>% of accumulated explained variance</td>
<td><strong>27.16</strong></td>
<td><strong>36.80</strong></td>
<td><strong>44.82</strong></td>
<td></td>
</tr>
</tbody>
</table>

* Pointed out as loads > |0.25|; ¥ Including chocolate drinks and candies; † Excluding milk-based desserts and cheese; † CPFBN: Cereal, protein, fruit beverages and Northern/Northeastern pattern

<table>
<thead>
<tr>
<th></th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1 – Breakfast frequency*</td>
<td>1.10</td>
<td>0.89, 1.36</td>
</tr>
<tr>
<td>Model 2 – Breakfast dietary patterns*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPFBN†</td>
<td>0.67</td>
<td>0.47, 0.96</td>
</tr>
<tr>
<td>Protein-based</td>
<td>1.02</td>
<td>0.90, 1.17</td>
</tr>
<tr>
<td>Mixed</td>
<td>1.01</td>
<td>0.82, 1.25</td>
</tr>
</tbody>
</table>

OR – Odds Ratio; 95% CI – confidence intervals; *Logistic regression analysis was adjusted for gender, age, equivalent monthly per capita income, region of the country and daily energy intake; † CPFBN: Cereal, protein, fruit beverages and Northern/Northeastern pattern