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# Main Food Sources of Energy, Nutrients and Dietary Fiber, According to the Purpose and Degree of Processing, for Beneficiary Adolescents of the '*Bolsa Família*' Program in Brazil

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**Abstract** The consumption of processed foods has risen since the 1970s in developing countries such as Brazil, mainly among children and adolescents. The aim of this study was to describe the contribution of foods, classified by purpose and degree of processing and inclusion of food additives, to energy, macronutrients, dietary fiber, vitamins, and minerals intake for individuals between 10 and 18 years-old beneficiaries of the '*Bolsa Família*' Program (BFP) in Brazil. The data is from the personal food consumption module of the National Household Budget Survey (cross-sectional study), conducted by the Brazilian Institute of Geography and Statistics (IBGE), in 2008-2009. Food products were classified into three distinct categories: 1) fresh and minimally processed foods; 2) processed foods (containing food additives, except flavoring and coloring agents); and 3) highly processed foods (containing flavoring and coloring agents).Adolescents from the sample were grouped in two groups: BFP beneficiaries or non-beneficiaries. Average values and standard deviations of energy, dietary fiber, and nutrients ingested during one day were calculated. Beneficiaries of the BFP, in relation to the others, obtain more energy content from fresh and minimally processed foods. However, the sum of energy from processed and highly processed products provided most of the energy. Highly processed foods were highlighted as sources of trans fatty acids, but also contain considerable amounts of calcium and vitamin $B_1$. Fresh and minimally processed foods were the main sources of dietary fiber, minerals (except for manganese), folate, vitamin A (only for boys) and vitamin E. Processed foods were major sources of vitamins of B complex, C, A (only for girls), and D vitamins. Thus, analysis about the purpose and degree of processing that food undergone may help public policy makers to design effective initiatives at improving nutrition status of population.

**Keywords** Adolescents, Food processing, Energy intake, Nutrients, ´*Bolsa Família*' Program

## 1. Introduction

Poverty can be defined as the lack of permanent supply of basic needs such as food, health, clothing, housing, education and transportation to the population. Poverty is the main cause of food insecurity, which is the deprivation of regular and permanent access to sufficient amount of quality food [15] [34].

In Brazil, the '*Bolsa Família*' Program (BFP), was created in 2003. Studies have shown that this benefit has been used mainly for food purchase [27] [14] [31]. The BFP provides support to low-income families, who hold a salary up to US$ 60.00 *per capita* [7]. The amount of the benefit granted by the government varies according to the household income, number of children and adolescents, pregnant women and/or breast feeding mothers [9]. In March 2013, the average value of the benefit was US$ 64.54 per month per family and the total number of families benefited from the program amounted to 13,872,243, totaling 49,637,552 people [11].

These families are frequently more exposed to deficiency diseases (caused by insufficient intake of micronutrients), obesity and associated comorbidities, due to excessive energy intake [10]. The easy access and, consequently, increased consumption of industrialized and highly processed foods have been observed in samples of this group, especially among the youngsters [27] [31] [45] [1] [44].

In 2005, Hawkes [21] stated an issue that was happening mainly from 1980's on. The author warned that the reduction of diversity of plant and animal species in foods by

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transnational food companies would bring effects, which would compromise the diet balance and health condition of the population. The possible role of 'high value foods', or highly processed food, that are manufactured in different countries in a standardized process was also highlighted. These products have undergone extensive processing, distinguishing them from products known as primarily processed, such as vegetable oils and sugar.

In 2009, Monteiro [37] underlined that processing methods are applied to most foods consumed in developed and developing countries. In addition, a system co-written by the Monteiro [38] classified foods into three groups: 1) fresh and minimally processed; 2) foods and cooking ingredients; and 3) ultra-processed foods. The food from group 2 refers to "primarily processed" and food from group 3 have similar concept of highly processed foods described by Hawkes [21].

However, considering the technological point of view, the adopted categorization includes in the same group (Group 3 or highly processed), foods subjected to distinct processing levels, such as fresh foods preserved in salt, sugar or oil, and foods consisting of little or no fresh ingredient.

Studies on epidemiology show correlations between diets consisting primarily of highly processed foods and weight gain and increased risk of cardiovascular diseases and diabetes during lifetime. On the other hand, dietary patterns composed primarily of fresh or minimally processed foods seem to have a protective effect against these disorders [24] [25] [20] [2] [32] [22] [41] [47].

Food processing and preparation can cause enzyme inactivation, eliminate or inactivate toxic substances of natural occurrence, eliminate pathogenic or spoilage microorganisms (especially mesophilics), increase not only shelf life but also the acceptance of consumers by changing sensory aspects, such as color, flavor and aroma [46]. The techniques applied in food manufacture and food storage, as well as food transport can result in significant nutrient loss in foods [39] [33] [53] [46] [19]. Nevertheless, the industry can replace these substances by adding natural or synthetic vitamins, minerals and amino acids. Another feature applied by the industry is food supplementation by adding nutrients, not necessarily found originally in the food, especially in formulations and children-targeted products [46]. Based on current legislations, Brazil has also adopted supplementation in cases of insufficient intake of certain essential nutrients, as it is observed in other countries. Fortified corn and wheat flour (except for the whole wheat flour because of its manufacturing process) with iron and folate, salt with iodine, and margarine with vitamin A are good examples of enriched foods [4].

The aim of this study is to describe the contribution of foods, classified according to the purpose and degree of processing, in the energy, nutrients and dietary fiber intake for beneficiary adolescents of the BFP in Brazil.

# 2. Methods

### 2.1. Database

The data used refer to individual dietary intake obtained from the food consumption module of the Household Budget Survey (HBS) from 2008-2009, conducted by the Brazilian Institute of Geography and Statistics (IBGE). The sampling technique used a two- stratified conglomerate (geographical and socioeconomic) of the census sectors from the Demographic Census of 2000. It was selected by probability proportional to the number of households in the sector from each stratum. The households were defined randomly without replacement in each sector. In order to capture seasonal variations of food consumption, the strata were distributed along the 52 weeks of the year [28]. The data were collected in 13,569 households of all Brazilian states and the number of subjects at age 10-18 years was 6,938 [28].

Trained interviewers from IBGE applied a questionnaire with 1,500 foods and beverages, 106 measurement units and 15 preparation modes (raw, grilled/broiled/barbecued, fried, braised, in white or red sauce, with butter/oil, stewed, in soup, baked, roasted, breaded/fried, with garlic and oil, vinaigrette and curd) [28].

The individuals completed two non-consecutive food diaries on pre-determined days spanning one week, which considered food and beverage ingested inside or outside home. However, only data from the first day, which tend to be more reliable, was analysed [28].

The information provided was confirmed in the following situations: a) no registration of consumption in periods greater than three hours; b) whenever fewer than five items were recorded in one day; c) data on food consumption often not included in food consumption surveys, such as candies, snacks and soft drinks; d) diet food or light; e) added sugar [48] [28].

The questionnaire and the method for its application were tested previously, and the food diary model used was validated for the energy expenditure estimation by applying the double-labeled water technique. Both stages involved distinct samples that were not part of the sampling used in the survey [28]. The detailed description of the HBS method can be consulted with details in other publications [48] [28].

### 2.2. Food Classification

A food classification system was elaborated to evaluate food contribution in energy, nutrients, and dietary fiber intake, according to the purpose and processing degree. The system is similar to the one suggested by Monteiro et al. [38], but it uses the presence of food additives as an additional criterion. These substances may be considered indicators of the technologies used in the food manufacturing process.

- Category 1: fresh foods or subjected to minimal processing, in order to ease the conservation and consumption or prevent food borne diseases. Food additives are unusual in these foods. The category comprises fruits, vegetables, cereals, rice, vegetables, bulbs, roots, rhizomes, tubers, stalks, beans, other legumes,

mushrooms, nuts, herbs, honey, meat, fish, eggs, herbal teas, infusions, coffee, and milk.

- Category 2: processed foods derived from food raw material and/or fresh food, obtained by technological processes, which may contain the majority of food additives, except coloring and flavoring agents. The category consists of pasta, flour, cereal, vegetable oils, canned and processed foods of plant origin, fats of animal origin (butter, milk cream and cream), sweets, sugars and sweeteners, processed meats (e.g., *blanquet* turkey breast), baked products, juices and vitamins, dairy products, meals, and processed fish.

- Category 3: highly processed foods obtained by extensive processes that, in general, mischaracterize the properties of their ingredients. Despite having coloring and flavoring agents in their formulation, these foods also may even contain other food additives. These functional classes – colors and flavors – act exclusively on the sensory characteristics [17] and may emphasize flavors, odors and aromas naturally found or confer new ones, which may have not be related to the chemical composition or ingredients list. Due to these characteristics, the presence of flavoring and coloring agents in the formulation, these foods were characterized as highly processed. This category includes "fantasy or artificial foods", that is, foods processed to imitate natural foods, although they predominantly contain substances not found in the food they imitate [3]. The category comprises cookies, crackers, carbonated beverages, processed meats (for example: burgers and nuggets), sweets, chocolates, candies, chewing gum, industrialized non-carbonated beverages or powder beverages, instant noodles with sauce, dehydrated soups, dairy products, sandwiches, pizzas, and plant-origin products containing coloring and/or flavoring agents.

The identification of the occurrence and the functional classes of food additives found in food products was possible by consulting packaging label information written by manufacturers or enterprises that trend these food products. This step was conducted between December 7, 2012 and February 25, 2013 in two stores from two supermarket chains in Piracicaba and São Paulo cities, both in São Paulo State, Brazil.

Additional criteria were established to the classification system:

- Food items from Category 1 that were grilled, served with vinaigrette and grilled or broiled were kept in this category. This criterion was based on the amount of soybean oil (Category 2 ingredient) added in these foods (less than 1% of the product final composition, required for consumption), which was considered low;

- Food items from Category 1that were prepared with amounts of soybean oil, butter and flour greater than 1% in the product final composition were transferred to Category 2. It consists of fresh and minimally processed foods served sautéed, stew, fried, in red or white sauce, with garlic and oil, with butter, oil, breaded or battered;

- Processed foods, whose composition of coloring and flavoring agents varies according to the manufacturer, were included in Category 3 when at least the product of one manufacturer contained these additives in the ingredient list;

- Food items with generic descriptions were classified according to similar foods or products. For example, "crackers" and other generic descriptions for cookies and crackers were included in Category 3;

- Descriptions that included the brand of the manufacturers, whose labels were not possible to be analyzed, were classified according to similar products;

- Polished white rice, widely distributed and marketed in all Brazilian geographic regions [49], with 69.2% of domestic production coming from the State of Rio Grande do Sul [30], was included in Category 1. This classification was chosen due to the polishing, which is a relevant processing step, helps the shelf life extension, and consequently the access to the population to this cereal [46];

- Food items classified in the group of "pasta" integrated Category 2 (despite the presence of coloring agents in products of some manufacturers), because the degree of processing of these food items was not considered high and no other additives were identified among the ingredients that compose these products;

- Preparations were classified according to their ingredients. For that purpose, we consulted information on the ingredient list in the table of food composition table from IBGE [29]. In the absence of this type of information, specific publication research was consulted [18].

### 2.3. Nutrients and Dietary Fiber Intake

The nutrient and dietary fiber contents in the foods consumed by the Brazilian population sample were obtained from the Nutritional Composition List of Foods Consumed in Brazil established by IBGE through HBS of 2008-2009 [29]. In the absence of national data, food compositions adopted are, mostly, from United States [29]. The sodium content corresponded to the sum of sodium contents in foods and added sodium, which was estimated based on data of the NDSR program [51] and considered for vegetables, leafy vegetables, legumes, roots, cereals, rhizomes, tubers, bulbs, pastas, meats, eggs, derivatives of these foods and preparations [29]. The methodology employed by the IBGE in its entirety was recorded in specific publication [29].

The total content (average values) of nutrients was described and compared, primarily, with the Estimated Average Requirements (EAR) and, in the absence of these values, with Adequate intakes (AI) and accepted Upper Levels (UL) intake from the National Academy of Sciences (NAS).

Regarding the macronutrients and dietary fiber, acceptable ranges for energy participation and maximum contents recommended by WHO and FAO [52] for daily consumption were adopted: 55-75% for carbohydrates, 15-30% for lipids, and 10-15% for proteins, at least 25g of dietary fiber, less

than 10% saturated fatty acids, less than 1% of trans fatty acids between 6-10% of polyunsaturated fatty acids and less than 300 mg of cholesterol. In the case of recommendations expressed in the Total Energy Content (TEC), a calculation was done, in which, grams were converted using the results for the total energy consumed and the application of the values of Atwater conversion (4 kcal per gram of carbohydrates and protein and 7 kcal per gram of lipids).

The nutrients obtained with supplements and medicines, as well as the mineral water content were not included in this study.

### 2.4. Statistical Analysis

Weighted averages and standard deviations were calculated for the group of beneficiaries (22.4% of observations) and the groups of non-beneficiaries of the 'Bolsa Família' Program (BFP).

For statistical analyzes, it was used the Statistical Analysis System-SAS®, version 9.3.

## 3. Results and Discussion

### 3.1. Energy Intake

The energy intake by beneficiary adolescents of the BFP was lower than the observed for non-beneficiaries in almost all geographic regions/groups of states, except for girls from the Southern and Center-Western regions (Table 1). However, typically, and regardless of participating in social programs, low-income families have less access to food and, consequently, lower energy intake.

**Table 1.** Intake of energy by adolescents, regarding domicile, sex and participation in the Brazilian '*Bolsa Família*' Program (BFP). 2008-2009

| Domicile and sex | Participation in BFP | Participation in TEC | | | | | | TEC in kcal |
|---|---|---|---|---|---|---|---|---|
| | | Category 1 | | Category 2 | | Category 3 | | |
| | | Average (dp) | % | Average (dp) | % | Average (dp) | % | |
| Brazil | | | | | | | | |
| Boys | Yes | 874.0 (29.9) | 43.6 | 814.9 (27.2) | 40.6 | 315.4 (21.6) | 15.7 | 2006.0 (46.7) |
| | No | 756.3 (16.9) | 33.9 | 948.6 (24.9) | 42.6 | 518.8 (20.7) | 23.3 | 2227.9 (37.5) |
| Girls | Yes | 713.8 (18.8) | 38.7 | 782.3 (22.8) | 42.4 | 347.5 (20.0) | 18.8 | 1846.0 (34.6) |
| | No | 620.9 (14.2) | 32 | 813.1 (16.9) | 42 | 502.1 (21.1) | 25.9 | 1937.7 (27.4) |
| Northern Region | | | | | | | | |
| Boys | Yes | 954.0 (55.1) | 41.2 | 1088.7 (104.7) | 47 | 272.9 (41.1) | 11.8 | 2317.9 (148.4) |
| | No | 818.7 (44.9) | 34.4 | 1103.1 (45.6) | 46.3 | 459.6 (60.9) | 19.3 | 2382.3 (96.0) |
| Girls | Yes | 786.9 (56.8) | 40.8 | 869.3 (51.9) | 45.1 | 268.2 (33.9) | 13.9 | 1927.4 (94.4) |
| | No | 764.4 (35.9) | 35.9 | 991.7 (48.4) | 46.6 | 366.7 (30.3) | 17.2 | 2127.7 (58.4) |
| Northeastern Region | | | | | | | | |
| Boys | Yes | 820.9 (27.2) | 43.8 | 787.1 (33.6) | 42 | 263.3 (18.3) | 14.1 | 1873.5 (43.5) |
| | No | 710.1 (28.4) | 32.9 | 1002.4 (39.3) | 46.4 | 437.7 (33.0) | 20.3 | 2158.6 (64.0) |
| Girls | Yes | 691.3 (22.2) | 37.9 | 778.6 (29.3) | 42.6 | 353.2 (27.5) | 19.3 | 1825.6 (43.7) |
| | No | 618.0 (24.8) | 33.1 | 858.3 (33.8) | 46 | 390.2 (24.0) | 20.9 | 1867.5 (44.2) |
| Minas Gerais, Espírito Santo, and Rio de Janeiro States | | | | | | | | |
| Boys | Yes | 933.4 (57.1) | 43.2 | 775.1 (61.4) | 35.9 | 451.2 (87.0) | 20.9 | 2161.6 (129.6) |
| | No | 821.8 (35.8) | 35.6 | 930.5 (57.8) | 40.3 | 555.7 (40.3) | 24.1 | 2310.3 (72.1) |
| Girls | Yes | 763.3 (61.4) | 42.7 | 759.0 (65.8) | 42.5 | 263.8 (38.7) | 14.8 | 1786.1 (83.1) |
| | No | 709.4 (37.6) | 35.8 | 742.2 (37.8) | 37.5 | 529.5 (47.8) | 26.7 | 1981.3 (56.1) |
| São Paulo State | | | | | | | | |
| Boys | Yes | 1075.1 (200.6) | 48.4 | 686.7 (83.5) | 30.9 | 460.0 (119.4) | 20.7 | 2221.8 (250.9) |
| | No | 751.2 (39.4) | 33,5 | 893.4 (70.0) | 39.9 | 594.6 (60.7) | 26.5 | 2239.6 (108.1) |
| Girls | Yes | 698.9 (85.7) | 39 | 636.5 (97.3) | 35.5 | 447.4 (103.9) | 25 | 1792.7 (202.1) |
| | No | 545.0 (30.7) | 28.5 | 810.4 (43.1) | 42.4 | 554.6 (54.4) | 29 | 1910.5 (71.7) |
| Southern Region | | | | | | | | |
| Boys | Yes | 684.3 (67.6) | 36.7 | 807.5 (104.0) | 43.4 | 370.4 (57.7) | 19.9 | 1862.2 (142.2) |
| | No | 686.3 (49.5) | 31.7 | 917.2 (37.6) | 42.3 | 552.9 (40.9) | 25.5 | 2166.7 (65.8) |
| Girls | Yes | 597.6 (53.8) | 30.2 | 807.8 (96.8) | 40.8 | 576.4 (99.9) | 29.1 | 1981.8 (149.4) |
| | No | 550.2 (29.8) | 28.3 | 788.8 (37.4) | 40.6 | 603.1 (51.7) | 31 | 1945.0 (71.0) |
| Central-Western Region | | | | | | | | |
| Boys | Yes | 959.8 (68.6) | 48 | 797.8 (75.8) | 39.9 | 240.2 (41.6) | 12 | 1997.7 (98.5) |
| | No | 781.9 (35.3) | 37 | 956.2 (54.9) | 45.3 | 370.5 (26.7) | 17.6 | 2110.6 (79.8) |
| Girls | Yes | 785.8 (49.5) | 39.4 | 873.8 (108.8) | 43.8 | 333.5 (54.8) | 16.7 | 1993.1 (115.3) |
| | No | 619.0 (27.2) | 33.1 | 766.4 (30.8) | 40.9 | 483.5 (87.9) | 25.8 | 1872.1 (78.6) |

Note: values in kilocalories; BFP = '*Bolsa Família*' Program; TEC = Total Energy Content; SD = Standard Deviation

Beneficiary adolescents obtained most energy from minimally processed or fresh foods. The contribution of these foods in the TEC ranged from 36.7% (Southern region) to 48.4% (São Paulo State) for boys and between 30.2% (Southern region) and 42.7% (Minas Gerais, Espírito Santo, and Rio de Janeiro States) for girls. However, foods from Category 2 were the main source of energy in the diet of beneficiary adolescents in the Northern and Southern regions and for girls in the Northeastern and Midwestern regions. Additionally, highly processed foods (Category 3) showed significant participation in the TEC of beneficiaries, although smaller in relation to non-beneficiaries, ranging between 11.8% (boys from the Northern region) and 29.1% (girls from São Paulo State).

The energy proportion of minimally processed and fresh foods did not surpass the total share of foods from Categories 2 and 3 in the TEC in any region or group of states.

These results are consistent with other studies involving smaller number of BFP beneficiaries. Research conducted on households with national representativeness disclosed by IBASE in 2008 found a preference for consumption of processed foods, especially with high energy density. This preference comes mainly from individuals with a monthly income per capita higher than US$ 30.17 [27] [31]. A study performed with preschoolers ($n$ = 189) from poor areas in a city of the Northeastern region, observed that only 58% of the subjects used to have beans as part of the daily meal. However, the frequency of consumption of highly processed foods, such as soda, cookies, candies, chocolates and snacks in package was high [45].

Childhood and adolescence are characterized by the period in human growth when intense physical transformations occur, involving special nutritional needs. During this period, individuals also show accelerated emotional, cognitive and social development. Thus, the choice for foods depends on an intricate series of social, economic, ideological, political, geographical, and cultural factors [23], which should be considered by public programs and policies in food and nutrition. In this scenario, a possible explanation for a high consumption of highly processed foods among the low-income families, mainly adolescents, is a result of marketing strategies, which are implemented by enterprises that encourage the purchase of industrialized foods. Studies conducted in the cities of Florianópolis, Santa Catarina State [44], and Guariba, São Paulo State [1], both in Brazil; indicate that the access to these foods is eased for students with low socioeconomic status enrolled in public schools.

The impact of TV commercials on feeding preferences and purchase choices for highly processed foods by low-income adolescents are reported in studies conducted in municipalities in the Southern, Southeastern and Northeastern regions in Brazil [36] [13] [40]. On the other hand, parents and caregivers beneficiaries of the BFP tendto please their children purchasing these types of foods [27].

### 3.2. Macronutrients and Dietary Fiber Intake

Table 2 shows that the carbohydrate and lipid contents (average values) in foods agreed with the acceptable ranges and were slightly higher, in the case of proteins. No group showed the recommended amounts of dietary fiber or polyunsaturated fatty acids. However, there was an excessive intake of trans fatty acids was.

In this research, highly processed foods had high contents of trans fatty acids (between 63.6% for beneficiary boys and 64.9% for non-beneficiary girls). Also, it was found significant contents of saturated fatty acids (from 23.7% for beneficiary boys to 36% for non-beneficiary girls), lipids (between 24.2% for beneficiary boys and 34.4% for non-beneficiary girls).

Category 3 foods also provided significant contents of polyunsaturated fatty acids, ranging from 20% for beneficiary boys and 30% for non-beneficiary girls of BFP. The results are possibly explained by the presence of vegetable oils in the formulation of these food products.

Category 2 supplied significant amounts of cholesterol, with more than 60% of the total in the diet (from 64.5% for beneficiary girls to 68.2% for non-beneficiary boys). Foods and preparations from this category were also the main sources of saturated fatty acids (between 43% and 46.9% for non-beneficiary girls and boys, respectively) and lipids (between 42.9% for beneficiaries and 43.5% and 45.8% for non-beneficiaries women and men, respectively).

The dietary fiber was obtained mainly by the intake of minimally processed and fresh food, which accounted for 60.1% (non-beneficiary girls) and 69.6% (beneficiary men) of the total consumed.

High-fat and low-fiber diets for children and adolescents are associated with metabolic syndrome, according to epidemiological studies [50] [47].

In this scenario, an important opportunity is the public incentive for the industry to reformulate its products. In Brazil, two official reports published by National Health Surveillance Agency (ANVISA) define the amounts of macronutrients in food formulations that can be reviewed and contribute to intake reduction. RDC No. 360, December 23, 2003 [6] requires food manufacturers to disclose the contents of total, saturated and trans fats on the package label of products, whose formulations contain higher contents. RDC No. 24, June 15, 2010 [8] requires the use of warning messages in advertisements for beverages with low nutritional value (e.g., soda) and foods containing high contents of sugar, sodium, saturated and trans fats. Although these legislations may help consumers to choose foods with less energy, fat, sodium and/or sugar (since provided public supervision is effective), there are needed additional actions to stimulate the consumption of a healthy diet with food sources of micronutrients and phytochemicals.

Another potential resource is the additional taxation for unhealthy products. This strategy has been adopted in countries such as Denmark, Hungary, the United Kingdom, Northern Ireland and France [42].

**Table 2.** Intake of macronutrients and dietary fiber by adolescents, according to sex and the participation in the Brazilian '*Bolsa Família*' Program. 2008-2009

| Domicile and sex | Participation in BFP | Participation in TEC | | | | | | TEC in kcal | Reference values |
|---|---|---|---|---|---|---|---|---|---|
| | | Category 1 | | Category 2 | | Category 3 | | | |
| | | Average (dp) | % | Average (dp) | % | Average (dp) | % | | |
| Boys | | | | | | | | | |
| Proteins (g) | Yes | 42.3 (2.2) | 50.8 | 34.8 (1.7) | 41.8 | 6.1 (0.4) | 7.4 | 83.2 (2.4) | 50-75 |
| | No | 34.8 (1.0) | 39.9 | 41.0 (1.6) | 46.9 | 11.5 (0.5) | 13.2 | 87.3 (1.8) | 56-84 |
| Carbohydrates (g) | Yes | 134.8 (3.9) | 46.4 | 112.4 (4.0) | 38.7 | 43.0 (3.2) | 14.8 | 290.5 (6.5) | 276-376 |
| | No | 118.9 (2.9) | 38.2 | 122.5 (3.1) | 39.3 | 70.1 (2.9) | 22.5 | 311.7 (5.0) | 306-418 |
| Lipids (g) | Yes | 18.64 (1.1) | 32.8 | 24.4 (1.1) | 42.9 | 13.7 (0.9) | 24.2 | 56.8 (1.9) | 33-67 |
| | No | 15.9 (0.4) | 22.6 | 32.2 (1.4) | 45.8 | 22.2 (1.0) | 31.6 | 70.4 (1.8) | 37-74 |
| Dietary Fiber | Yes | 16.1 (0.6) | 69.6 | 5.4 (0.2) | 23.3 | 1.7 (0.1) | 7.1 | 23.2 (0.6) | Higher than 25 |
| (g) | No | 13.7 (0.4) | 63 | 5.5 (0.2) | 25.4 | 2.5 (0.1) | 11.6 | 21.7 (0.4) | Higher than 25 |
| Saturated fatty acids | Yes | 5.8 (0.3) | 30.5 | 8.7 (0.5) | 45.7 | 4.5 (0.3) | 23.7 | 19.1 (0.7) | Up to 22 |
| (g) | No | 5.3 (0.1) | 20.8 | 11.9 (0.7) | 46.9 | 8.1 (0.4) | 32.2 | 25.3 (0.8) | Up to 25 |
| Trans fatty acids | Yes | 0.4 (0.0) | 13 | 0.8 (0.0) | 23.5 | 2.1 (0.2) | 63.6 | 3.3 (0.2) | Up to 2 |
| (g) | No | 0.4 (0.0) | 9.1 | 1.1 (0.1) | 27.2 | 2.6 (0.2) | 63.7 | 4.2 (0.2) | Up to 2 |
| Polyunsaturated fatty acids | Yes | 5.1 (0.2) | 41 | 4.8 (0.2) | 38.9 | 2.5 (0.2) | 20 | 12.3 (0.3) | 13-22 |
| (g) | No | 4.18 (0.1) | 30.4 | 5.9 (0.2) | 43.1 | 3.6 (0.2) | 26.5 | 13.7 (0.3) | 15-25 |
| Cholesterol (mg) | Yes | 77.6 (7.3) | 29.7 | 170.8 (10.5) | 65.2 | 13.4 (1.5) | 5.1 | 261.8 (11.2) | Up to 300 |
| | No | 56.7 (3.0) | 20.6 | 188.1 (9.8) | 68.2 | 30.8 (1.7) | 11.2 | 275.6 (10.6) | Up to 300 |
| Girls | | | | | | | | | |
| Proteins (g) | Yes | 33.7 (1.4) | 45.8 | 33.3 (1.4) | 45.3 | 6.5 (0.4) | 8.8 | 73.6 (1.8) | 46-69 |
| | No | 29.0 (1.0) | 39.6 | 33.6 (1.0) | 45.8 | 10.6 (0.4) | 14.5 | 73.2 (1.2) | 48-73 |
| Carbohydrates (g) | Yes | 110.1 (2.8) | 41.5 | 108.2 (3.4) | 40.8 | 46.9 (2.7) | 17.7 | 265.4 (4.9) | 254-346 |
| | No | 96.9 (2.2) | 35 | 110.0 (2.6) | 39.7 | 70.0 (3.1) | 25.3 | 277.0 (4.2) | 266-363 |
| Lipids (g) | Yes | 15.6 (0.7) | 28.7 | 23.4 (1.1) | 42.9 | 15.5 (1.0) | 28.4 | 54.5 (1.5) | 31-62 |
| | No | 13.4 (0.4) | 22.2 | 26.2 (0.8) | 43.5 | 20.7 (1.1) | 34.4 | 60.3 (1.2) | 32-65 |
| Dietary Fiber | Yes | 12.5 (0.4) | 63.9 | 5.2 (0.2) | 26.4 | 1.9 (0.1) | 9.8 | 19.6 (0.4) | Higher than 25 |
| (g) | No | 11.0 (0.3) | 60.1 | 4.6 (0.1) | 25.4 | 2.7 (0.1) | 14.6 | 18.3 (0.3) | Higher than 25 |
| Saturated fatty acids | Yes | 5.1 (0.2) | 27.3 | 8.2 (0.4) | 43.8 | 5.4 (0.5) | 28.9 | 18.6 (0.6) | Up to 21 |
| (g) | No | 4.5 (0.1) | 20.9 | 9.3 (0.3) | 43 | 7.8 (0.5) | 36 | 21.7 (0.5) | Up to 22 |
| Trans fatty acids | Yes | 0.3 (0.0) | 11.7 | 0.7 (0.0) | 24.3 | 2.0 (0.1) | 64.1 | 3.1 (0.2) | Up to 2 |
| (g) | No | 0.3 (0.0) | 9.2 | 0.9 (0.0) | 25.9 | 2.3 (0.2) | 64.9 | 3.6 (0.2) | Up to 2 |
| Polyunsaturated fatty acids | Yes | 3.9 (0.1) | 33.7 | 4.8 (0.2) | 40.7 | 3.0 (0.2) | 25.6 | 11.7 (0.4) | 12-21 |
| (g) | No | 3.3 (0.1) | 27.4 | 5.1 (0.2) | 42.7 | 3.6 (0.2) | 30 | 11.9 (0.3) | 13-22 |
| Cholesterol (mg) | Yes | 66.3 (4.5) | 28.9 | 148.0 (6.7) | 64.5 | 15.3 (1.3) | 6.7 | 229.6 (7.0) | Up to 300 |
| | No | 56.8 (3.6) | 23.6 | 156.1 (6.2) | 65 | 27.4 (1.5) | 11.4 | 240.2 (6.9) | Up to 300 |

Notes: BFP= '*Bolsa Família*' Program; Reference values = acceptable ranges published by WHO and FAO [51]; rounded figures; 0.00 = zero numeric data resulting from rounding numerical data originally positive

### 3.3. Vitamins and Minerals Intake

Tables 3 and 4 show that the average amounts of vitamins A, E, D and folate ingested (average values) by adolescents in the BFP did not comply with daily recommendations for this age group. On the other hand, non-beneficiaries showed similar needs, exceptgirls, forvitamin A intake.

Folate is responsible for DNA synthesis, repair, and methylation. Insufficient intake of folate can result in mental impairment in children and megaloblastic anemia [16].

Vitamin A deficiency is probably the main cause of blindness in children in developing countries. Contents of vitamin A found in the diet, however, may probably be underestimated, since the contribution of pro-vitamin A carotenoids was not considered.

Foods classified in Category 1 were the main folate suppliers (61.7% and 52.4% for boys and girls, respectively), despite the prescription in RDC No. 344, December 13, 2002 [5], requiring the fortification of corn and wheat flour (classified in Category 2) with folic acid, since June 2004.

**Table 3.** Vitamin intake for boys, according to their participation in the Brazilian '*Bolsa Família*' Program. 2008-2009

| Vitamins | Participation in BFP | Participation in TEC | | | | | | Total | EAR |
|---|---|---|---|---|---|---|---|---|---|
| | | Category1 | | Category 2 | | Category 3 | | | |
| | | Average (dp) | % | Average (dp) | % | Average (dp) | % | | |
| Vitamin A | Yes | 203.9 (73.0) | 48.6 | 159.4 (16.2) | 38.0 | 56.2 (5.9) | 13.4 | 419.5 (74.8) | 630 |
| (µg) | No | 122.1 (16.0) | 25.0 | 278.6 (54.4) | 56.9 | 88.7 (6.5) | 18.1 | 489.4 (57.1) | 630 |
| Vitamin E | Yes | 2.6 (0.1) | 60.5 | 1.4 (0.1) | 32.3 | 0.3 (0.0) | 7.2 | 4.3 (0.1) | 12 |
| (mg) | No | 2.1 (0.0) | 48.4 | 1.8 (0.1) | 40.0 | 0.5 (0.0) | 11.6 | 4.4 (0.1) | 12 |
| Vitamin $B_1$ | Yes | 0.4 (0.0) | 31.7 | 0.6 (0.0) | 47.5 | 0.3 (0.0) | 20.8 | 1.2 (0.0) | 1 |
| (mg) | No | 0.3 (0.0) | 22.5 | 0.7 (0.0) | 50.0 | 0.4 (0.0) | 27.5 | 1.4 (0.0) | 1 |
| Vitamin $B_2$ | Yes | 0.6 (0.0) | 36.1 | 0.8 (0.0) | 51.3 | 0.2 (0.0) | 12.7 | 1.6 (0.0) | 1.1 |
| (mg) | No | 0.5 (0.0) | 26.1 | 1.0 (0.0) | 53.8 | 0.4 (0.0) | 19.6 | 1.8 (0.0) | 1.1 |
| Vitamin $B_3$ | Yes | 18.0 (0.8) | 46.4 | 17.2 (0.5) | 44.5 | 3.5 (0.1) | 9.1 | 38.7 (0.8) | 12 |
| (mg) | No | 14.0 (0.4) | 32.2 | 22.6 (0.6) | 52.1 | 6.7 (0.2) | 15.5 | 43.4 (0.7) | 12 |
| Vitamin $B_{12}$ | Yes | 2.3 (0.5) | 48.2 | 2.2 (0.2) | 45.8 | 0.3 (0.0) | 5.8 | 4.8 (0.6) | 2 |
| (µg) | No | 1.5 (0.1) | 29.0 | 3.2 (0.4) | 59.7 | 0.6 (0.0) | 11.4 | 5.3 (0.4) | 2 |
| Folate | Yes | 168.1 (8.1) | 61.7 | 91.2 (4.5) | 33.5 | 13.2 (1.8) | 4.8 | 272.6 (8.9) | 330 |
| (µg) | No | 133.4 (3.8) | 44.0 | 137.7 (6.3) | 45.4 | 31.9 (2.4) | 10.5 | 303.3 (7.3) | 330 |
| Vitamin $B_6$ | Yes | 0.6 (0.0) | 39.3 | 0.8 (0.0) | 51.7 | 0.1 (0.0) | 9.0 | 1.5 (0.0) | 1.1 |
| (mg) | No | 0.5 (0.0) | 28.8 | 0.9 (0.0) | 57.7 | 0.2 (0.0) | 12.9 | 1.6 (0.0) | 1.1 |
| Vitamin C | Yes | 41.7 (9.7) | 20.8 | 157.0 (33.8) | 78.4 | 1.5 (0.2) | 0.7 | 200.2 (34.8) | 63 |
| (mg) | No | 24.9 (3.3) | 15.3 | 135.5 (15.2) | 83.2 | 2.5 (0.2) | 1.6 | 163.0 (15.5) | 63 |
| Vitamin D | Yes | 1.6 (0.1) | 40.7 | 1.9 (0.2) | 49.9 | 0.4 (0.1) | 9.7 | 3.8 (0.3) | 10 |
| (µg) | No | 1.3 (0.1) | 36.6 | 1.5 (0.1) | 41.0 | 0.8 (0.0) | 22.4 | 3.7 (0.1) | 10 |

Notes: BFP = '*Bolsa Família*' Program; EAR = estimated average intake for 14-18 year--old boys (NAS, 2011); rounded figures; 0.00 = zero numeric data resulting from rounding numerical data originally positive

**Table 4.** Vitamin intake for girls, according to their participation in the Brazilian '*Bolsa Família*' Program. 2008-2009

| Vitamins | Participation inBFP | Participation in TEC | | | | | | Total | EAR |
|---|---|---|---|---|---|---|---|---|---|
| | | Category1 | | Category2 | | Category3 | | | |
| | | Average (dp) | % | Average (dp) | % | Average (dp) | % | | |
| Vitamin A | Yes | 128.9 (23.5) | 36.3 | 167.1 (21.4) | 47 | 59.3 (5.4) | 16.7 | 355.3 (32.8) | 485 |
| (µg) | No | 163.8 (31.9) | 31.4 | 267.3 (51.9) | 51.3 | 90.3 (8.2) | 17.3 | 521.3 (64.3) | 485 |
| Vitamin E | Yes | 1.9 (0.1) | 52.3 | 1.3 (0.0) | 36.0 | 0.4 (0.0) | 11.7 | 3.7 (0.1) | 12 |
| (mg) | No | 1.7 (0.0) | 45.5 | 1.5 (0.0) | 39.7 | 0.6 (0.0) | 14.7 | 3.8 (0.1) | 12 |
| Vitamin $B_1$ | Yes | 0.3 (0.0) | 28.9 | 0.6 (0.0) | 49.1 | 0.2 (0.0) | 21.1 | 1.1 (0.0) | 0.9 |
| (mg) | No | 0.3 (0.0) | 22.0 | 0.6 (0.0) | 48.8 | 0.4 (0.0) | 28.5 | 1.2 (0.0) | 0.9 |
| Vitamin $B_2$ | Yes | 0.5 (0.0) | 33.8 | 0.8 (0.0) | 52.0 | 0.2 (0.0) | 14.2 | 1.5 (0.0) | 0.9 |
| (mg) | No | 0.5 (0.0) | 26.9 | 0.9 (0.0) | 50.9 | 0.4 (0.0) | 21.6 | 1.7 (0.0) | 0.9 |
| Vitamin $B_3$ | Yes | 14.3 (0.5) | 39.9 | 17.7 (0.5) | 49.2 | 3.8 (0.2) | 10.7 | 35.9 (0.6) | 11 |
| (mg) | No | 12.6 (0.4) | 32.7 | 19.8 (0.5) | 51.3 | 6.2 (0.2) | 15.9 | 38.6 (0.5) | 11 |
| Vitamin $B_{12}$ | Yes | 1.6 (0.2) | 38.6 | 2.2 (0.2) | 53.6 | 0.3 (0.0) | 7.5 | 4.1 (0.2) | 2 |
| (µg) | No | 1.7 (0.2) | 33.7 | 2.7 (0.4) | 54.4 | 0.6 (0.0) | 11.9 | 5.0 (0.5) | 2 |
| Folate | Yes | 128.7 (6.0) | 52.4 | 98.0 (5.1) | 39.9 | 18.6 (2.3) | 7.6 | 245.6 (8.9) | 330 |
| (µg) | No | 108.8 (3.8) | 41.1 | 121.7 (4.3) | 46.0 | 34.2 (2.4) | 12.9 | 264.8 (5.5) | 330 |
| Vitamin $B_6$ | Yes | 0.5 (0.0) | 35.1 | 0.7 (0.0) | 55.0 | 0.1 (0.0) | 9.9 | 1.3 (0.0) | 1 |
| (mg) | No | 0.4 (0.0) | 29.5 | 0.8 (0.0) | 54.8 | 0.2 (0.0) | 15.1 | 1.5 (0.0) | 1 |
| Vitamin C | Yes | 27.4 (3.3) | 14.6 | 158.1 (24.4) | 84.6 | 1.4 (0.2) | 0.7 | 186.8 (24.5) | 56 |
| (mg) | No | 24.1 (1.9) | 16.2 | 121.9 (11.7) | 81.9 | 2.8 (0.2) | 1.9 | 148.7 (11.9) | 56 |
| Vitamin D | Yes | 1.3 (0.1) | 38.6 | 1.7 (0.2) | 51.5 | 0.3 (0.0) | 9.9 | 3.3 (0.2) | 10 |
| (µg) | No | 1.3 (0.1) | 41.3 | 1.1 (0.1) | 35.8 | 0.7 (0.0) | 22.6 | 3.1 (0.1) | 10 |

Notes: BFP = '*Bolsa Família*' Program: EAR = estimated average intake for 14-18 year-old girls(NAS, 2011); rounded figures; 0.00 = zero numeric data resulting from rounding numerical data originally positive

Fresh and minimally processed foods were also the main sources of vitamin E (60.5% and 52.3% respectively for boys and girls), as well as of vitamin A for beneficiary boys of the BFP (48.6%).

Foods and preparations of Category 2 were the main sources of several vitamins, such as C (78.4% and 84.6% for boys and girls, respectively), A (47% for girls), D (49.9% for boys and 51.5% for girls), $B_2$ (51.3% for boys and 52% for girls), $B_6$ (51.7% for boys and 55% for girls), $B_{12}$ (53.6% for girls), $B_3$ (49.2% for girls) and $B_1$ (47.5% for boys and 49.1% for girls).

Highly processed foods provided, in general, low vitamin contents, especially for beneficiary adolescents of the BFP. However, these foods had a significant vitamin $B_1$intakein both groups (between 20.8% for beneficiary boys and 28.5% for non-beneficiary girls).

In regard of minerals intake, Tables 5 and 6 show that the diet for adolescents provided excessive sodium content as well as insufficient calcium, magnesium, phosphorus and potassium content. The deficiency observed for non-beneficiaries were similar, except for phosphorus, as it was observed in boys.

Phosphorous and magnesium are essential for energy metabolism. Concerns related to the high sodium intake for adolescents are relevant. Therefore, initiatives to reduce the contents of this mineral in processed foods have been observed in specific legislation, as well as in agreements between the Brazilian public sectors and industry [43]. Sodium and potassium play important roles in maintaining osmotic pressure and water balance. Excess of sodium intake and potassium deficiency can cause high blood pressure and increase the risk of death from cardiovascular disease during lifetime [12].

An adequate calcium intake by adolescents is essential, because the skeleton formation (bone mineral content expansion) reaches its peak, on average, between 12.5 years -old for girls and 14.2 for boys [26].

The iron content in diets (average values) is adequate; however, its bioavailability may be affected by low vitamin A intake, as it was observed. The correlation between serum levels of these micronutrients was observed in cross-sectional studies involving preschoolers, as well as pregnant women and breastfeeding mothers [35].

Fresh and minimally processed foods were the main sources of most minerals in the diet of beneficiaries of the BFP. The intake of foods from Category 2was the main manganese source and, along with foods from Category 1, provided 85.9% of phosphorous (43% each).

Beneficiary girls showed slightly higher average amounts of sodium intake from foods from Category 1 (45.9%), compared to foods from Category 2 (40.2%). The boys in this group, on the other hand, obtained 50.8% of sodium from fresh and minimally processed foods and 38.3% from processed foods and preparations (without highly processed foods in the recipe). However, making a comparison between energy and sodium intake, it was noticed that only foods from Category 1 supplied less amount of energy (43,6% for boys and 38,7% for girls) than sodium (50,8% for boys and 45,9% for girls).

**Table 5.** Minerals intake for boys, according to their participation in the Brazilian '*Bolsa Família*' Program. 2008-2009

| Minerals | Participation in BFP | Participation in TEC | | | | | | Total | DRI |
|---|---|---|---|---|---|---|---|---|---|
| | | Category 1 | | Category 2 | | Category 3 | | | |
| | | Average (dp) | % | Average (dp) | % | Average (dp) | % | | |
| Calcium | Yes | 274.1 (11.9) | 58.3 | 119.0 (8.6) | 25.3 | 77.3 (8.7) | 16.4 | 470.4 (16.6) | 1,100 |
| (mg)* | No | 258.5 (6.8) | 43.3 | 178.9 (9.3) | 30.0 | 159.1 (7.7) | 26.7 | 596.7 (12.5) | 1,100 |
| Phosphorous | Yes | 468.8 (21.6) | 47.9 | 394.5 (19.5) | 40.3 | 115.6 (9.8) | 11.8 | 979.2 (28.4) | 1,055 |
| (mg)* | No | 399.7 (10.7) | 36.9 | 466.9 (16.7) | 43.1 | 215.0 (9.1) | 19.9 | 1,082.4 (21.3) | 1,055 |
| Magnesium | Yes | 155.9 (6.6) | 58.9 | 85.6 (3.9) | 32.3 | 23.3 (1.9) | 8.8 | 264.9 (7.1) | 340 |
| (mg)* | No | 129.2 (4.1) | 49.3 | 94.1 (3.0) | 35.9 | 38.6 (1.8) | 14.7 | 262.2 (5.3) | 340 |
| Manganese | Yes | 2.8 (0.4) | 77.8 | 0.7 (0.0) | 19.5 | 0.1 (0.0) | 2.5 | 3.7 (0.4) | 2.2 |
| (mg)** | No | 3.3 (0.7) | 77.0 | 0.8 (0.0) | 18.8 | 0.2 (0.0) | 4.2 | 4.3 (0.7) | 2.2 |
| Iron | Yes | 7.1 (0.4) | 58.2 | 4.0 (0.1) | 32.4 | 1.2 (0.1) | 9.4 | 12.3 (0.4) | 7.7 |
| (mg)* | No | 6.1 (0.2) | 45.6 | 5.2 (0.2) | 39.3 | 2.0 (0.1) | 15.0 | 13.3 (0.2) | 7.7 |
| Zinc | Yes | 6.0 (0.3) | 53.4 | 4.3 (0.2) | 38.4 | 0.9 (0.1) | 8.2 | 11.2 (0.4) | 8.5 |
| (mg)* | No | 5.2 (0.1) | 41.4 | 5.6 (0.2) | 44.7 | 1.7 (0.1) | 13.9 | 12.5 (0.3) | 8.5 |
| Copper | Yes | 0.755 (0.1) | 60.4 | 0.372 (0.0) | 29.8 | 0.123 (0.0) | 9.8 | 1,250 (0.1) | 0.685 |
| (mg)* | No | 0.570 (0.0) | 41.3 | 0.592 (0.1) | 42.9 | 0.218 (0.0) | 15.8 | 1,380 (0.1) | 0.685 |
| Selenium | Yes | 33.9 (2.6) | 37.9 | 50.7 (3.4) | 56.8 | 4.8 (0.5) | 5.3 | 89.4 (3.8) | 45 |
| (μg)* | No | 24.2 (1.2) | 26.9 | 55.3 (2.3) | 61.6 | 10.3 (0.6) | 11.5 | 89.8 (2.7) | 45 |
| Potash | Yes | 1,514.8 (60.7) | 61.4 | 778.5 (30.6) | 31.6 | 173.0 (15.4) | 7.0 | 2,467.4 (65.8) | 4,700 |
| (mg)** | No | 1,284.1 (31.0) | 50.3 | 945.6 (30.0) | 37.1 | 320.4 (13.7) | 12.6 | 2,551.8 (44.2) | 4,700 |
| Sodium | Yes | 1,703.0 (65.0) | 50.8 | 1,285.0 (61.8) | 38.3 | 363.2 (24.5) | 10.8 | 3,351.2 (82.7) | 2,300 |
| (mg)*** | No | 1,484.2 (37.4) | 41.6 | 1,443.9 (45.8) | 40.5 | 635.2 (33.8) | 17.8 | 3,563.6 (66.5) | 2,300 |

Notes: BFP = '*Bolsa Família*' Program; DRI = dietary reference intake values for 14-18 year-old boys; * = estimated average requirement; ** = adequate intake; *** = tolerable maximum intake levels; rounded figures; 0.00 = zero numeric data resulting from rounding numerical data originally positive.

**Table 6.** Minerals intake for girls, according to their participation in the Brazilian '*Bolsa Família*' Program. 2008-2009

| Minerals | Participation in BFP | Participation in TEC | | | | | | Total | DRI |
|---|---|---|---|---|---|---|---|---|---|
| | | Category1 | | Category 2 | | Category 3 | | | |
| | | Average (dp) | % | Average (dp) | % | Average (dp) | % | | |
| Calcium | Yes | 232.7 (9.4) | 53.0 | 119.1 (6.2) | 27.2 | 86.7 (8.1) | 19.8 | 438.8 (13.6) | 1,100 |
| (mg)* | No | 222.5 (6.9) | 40.2 | 169.6 (8.4) | 30.7 | 161.0 (8.3) | 29.1 | 553.3 (12.5) | 1,100 |
| Phosphorous | Yes | 383.0 (14.9) | 43.2 | 378.5 (14.7) | 42.7 | 123.6 (8.7) | 14.0 | 885.9 (21.0) | 1,055 |
| (mg)* | No | 344.2 (10.2) | 36.3 | 397.6 (11.3) | 41.9 | 206.8 (9.0) | 21.8 | 949.0 (15.3) | 1,055 |
| Magnesium | Yes | 123.6 (4.6) | 53.4 | 81.6 (2.8) | 35.3 | 25.8 (1.8) | 11.2 | 231.3 (5.5) | 300 |
| (mg)* | No | 105.0 (3.0) | 46.6 | 81.1 (2.0) | 36.0 | 39.3 (1.9) | 17.4 | 225.6 (3.7) | 300 |
| Manganese | Yes | 2.0 (0.2) | 71.0 | 0.7 (0.0) | 24.4 | 0.1 (0.0) | 4.3 | 2.8 (0.2) | 1.6 |
| (mg)** | No | 3.7 (0.8) | 79.7 | 0.7 (0.0) | 15.7 | 0.2 (0.0) | 4.6 | 4.6 (0.8) | 1.6 |
| Iron | Yes | 5.4 (0.2) | 51.8 | 3.8 (0.1) | 36.4 | 1.2 (0.1) | 11.7 | 10.4 (0.2) | 7.9 |
| (mg)* | No | 4.8 (0.2) | 42.4 | 4.5 (0.1) | 40.0 | 2.0 (0.1) | 17.5 | 11.3 (0.2) | 7.9 |
| Zinc | Yes | 4.8 (0.2) | 48.9 | 4.0 (0.2) | 40.7 | 1.0 (0.1) | 10.3 | 9.8 (0.2) | 7.3 |
| (mg)* | No | 4.3 (0.2) | 40.7 | 4.5 (0.2) | 42.9 | 1.7 (0.1) | 16.4 | 10.5 (0.2) | 7.3 |
| Copper | Yes | 0.514 (0.0) | 49.3 | 0.394 (0.0) | 37.8 | 0.133 (0.0) | 12.8 | 1,042 (0.0) | 0.685 |
| (mg)* | No | 0.514 (0.0) | 40.2 | 0.547 (0.1) | 42.7 | 0.221 (0.0) | 17.3 | 1,280 (0.1) | 0.685 |
| Selenium | Yes | 28.2 (2.3) | 33.5 | 49.4 (2.8) | 58.8 | 6.4 (0.7) | 7.6 | 84.0 (3.5) | 45 |
| (μg)* | No | 22.2 (1.4) | 28.4 | 45.4 (1.5) | 58.2 | 10.5 (0.6) | 13.4 | 78.1 (2.0) | 45 |
| Potash | Yes | 1,217.1 (40.5) | 56.6 | 744.1 (27.6) | 34.6 | 187.7 (13.6) | 8.7 | 2,150.2 (49.0) | 4,700 |
| (mg)** | No | 1,076.0 (28.2) | 48.3 | 837.5 (23.2) | 37.6 | 312.7 (14.3) | 14.0 | 2,227.3 (34.0) | 4,700 |
| Sodium | Yes | 1,337.1 (43.7) | 45.9 | 1,170.2 (42.7) | 40.2 | 404.7 (23.6) | 13.9 | 2,912.3 (62.0) | 2,300 |
| (mg)*** | No | 1,163.9 (33.1) | 39.5 | 1,235.0 (32.8) | 41.9 | 548.4 (25.6) | 18.6 | 2,947.4 (48.3) | 2,300 |

Notes: BFP = Brazilian '*Bolsa Família*' Program; DRI = dietary reference intake for 14-18 year–old girls; * = estimated average requirement; ** = adequate intake; *** = tolerable upper intake levels; rounded figures; 0.00 = zero numeric data resulting from rounding numerical data originally positive.

The excessive sodium intake corroborates with statements found in the literature, and additional taxation in products containing sodium chloride can be an alternative for controlling it. Food and nutritional education should be reinforced in schools to reduce the amount of salt added during cooking procedures of minimally processed and fresh foods.

Highly processed foods were considered significant calcium sources, especially of adolescents non-beneficiaries of the BFP (26.7% for boys and 29.1% for girls), and contributed with 16.4% for boys and 29.1% for girls.

The results for micronutrients are average values and the reference levels adopted are recommended for people between 14-18 years-old, who require higher levels of folate, vitamin E, Mg and P compared to adolescents at 10-13 years-old.

# 4. Conclusions

The analysis of food consumption based on the purpose and degree of processing that foods undergo can assist in regulatory and educational actions for the industry and consumers regarding public health.

Beneficiary adolescents of the '*Bolsa Família*' Program, in general, obtain higher proportions of energy from fresh or minimally processed foods than non-beneficiaries. However, the main source of energy intake is the sum of processed and highly processed foods.

Minimally processed and fresh foods are the main sources of dietary fiber, folate, vitamin E, vitamin A (only for boys) and most of the minerals (except manganese). On the other hand, processed foods are the principal sources of complex B vitamins, vitamin C and D.

Highly processed foods are important sources of trans fatty acids. These products also contain considerable amounts of calcium and vitamin $B_1$.

Regarding to sodium intake, it is recommended special attention to the amount of salt added in fresh, minimally processed, and processed foods.

Micronutrient sources in diets are similar for beneficiaries of BFP and other individuals. Thus, National interventions focusing on both beneficiaries and non-beneficiaries can encourage the consumption of fruits, vegetables, leafy vegetables, cereals and legumes. Hence, they can contribute to the fight against hypovitaminosis as well as preventing chronic diseases in adolescents.

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