

The impact of the Bolsa Família Program on food consumption: a comparative study of the southeast and northeast regions of Brazil

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Abstract *The aim of this study was to evaluate the impact of the Bolsa Família Program (PBF) on food consumption in the northeast and southeast regions of Brazil. The database was obtained from the individual food consumption module of the Household Budget Survey conducted in 2008-09. Consumption was assessed through two food records. The food was categorized into four groups: fresh or minimally processed food; culinary ingredients; processed food; and ultra-processed food. To analyze the impact, the propensity score matching method was used, which compares the individual recipients and non-recipients of the PBF in relation to a group of socioeconomic characteristics. After the propensity score was calculated, the impact of the PBF was estimated through the nearest-neighbor matching algorithm. In both regions, more than 60% of the daily total calories consumed by PBF recipients came from foods that had not undergone industrial processing. The recipients of PBF had a low level of consumption of processed and ultra-processed food in both regions, and an increased level of consumption of fresh or minimally processed food in the northeast. The results indicate the importance of adopting intersectoral policies in parallel to the PBF in order to strengthen healthy eating practices.*

Key words *Food consumption, Social policy, Processed food*

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Introduction

In the last half of the twentieth century, political, social and cultural changes modified the forms of food production, supply, distribution and consumption, as well as the morbidity and mortality profile of the Brazilian population¹.

The implementation of social policies in the areas of education, health, employment and social assistance have contributed to the reduction of poverty and hunger in Brazil². On the other hand, changes in dietary habits, such as the increased consumption of processed foods and reduced consumption of foods typical of the national diet, have contributed to an increase in the prevalence of chronic non-communicable diseases³. These changes have been observed at all socioeconomic levels, including those with lower incomes^{3,4}.

The consumption of processed and ultra-processed foods among the poorest sections of the population may be related to real increases in household income levels, especially those benefiting from income transfer programs^{4,5}. Increased purchasing power may favor access to industrialized products, which are still relatively more expensive than fresh or minimally processed foods in Brazil^{4,6}.

The *Bolsa Família* Program (PBF), which is one of the largest income transfer programs in the world, was created by Provisional Measure No. 132 in October 2003; it was transformed into a Law in 2004 and regulated by Decree No. 5,209/2004. The target population is families living in poverty (with a monthly per capita income of R\$ 77.01 to R\$ 154) and extreme poverty (with a monthly per capita income less than R\$ 77)⁷.

Literature reports highlight the fact that income from the program is primarily spent by recipients on food^{6,8,9}. However, the program's effect on changes in the dietary pattern may be influenced by the dependence of families on the income derived from it and the place of residence of the recipients, i.e. families residing in regions with unfavorable socioeconomic contexts, such as the northeast, tend to buy more basic and lower cost foods, while those residing in economically more developed regions have greater access to industrialized foods and are more likely to buy them⁶.

The regional distribution of the PBF in Brazil shows that approximately 75% of recipient families live in two important macro-regions, the northeast and southeast, which comprise two-thirds of the Brazilian population and rep-

resent the extremities of uneven development in Brazil¹⁰.

The social and economic contexts in which families receiving PBF reside can produce situations of multiple vulnerabilities that are related to the feeding and nutrition of their members. This makes it important to evaluate the impact of the program on the consumption of food and/or food groups by recipients living in regions with different socioeconomic contexts, which can influence food choices and consequently the quality of food that is consumed.

Therefore, the aim of this study was to evaluate the impact of the PBF on food consumption in the northeast and southeast regions of Brazil.

Methods

Sampling and database

The database used in this study came from the Household Budget Survey (POF), which was conducted by the Brazilian Institute of Geography and Statistics (IBGE) between May 19th 2008 and May 18th 2009. The sample size of this survey was 4,696 census sectors, which corresponded to 55,970 households. This constituted a survey with a representative sample of the Brazilian population that covered urban and rural areas of all the regions and units of the Brazilian Federation¹¹. The data referring to the northeast and southeast regions were used for the present study.

The POF sampling was performed in two stages. The first stage consisted of the geographic and economic stratification of the census sectors (primary sampling units) of the IBGE's 'Master Sample of Household Surveys'. The Master Sample sectors were selected by probabilistic sampling that was proportional to the number of households in the sector¹¹.

The second stage consisted of the selection of permanent, private households, which were selected by simple random sampling without replacement within each sector. The sectors were distributed over 12 months to ensure representativeness during the four quarters of the year¹¹.

Assessment of food consumption

Due to the importance of research about food consumption at the national level, the POF evaluated individual food consumption in a module called the 'National Food Survey' (INA). This

was the first study to use a subsample (13,569 households and 34,003 residents) to analyze information regarding the individual food intake of all residents aged 10 years or over in surveyed households¹¹.

Individuals were instructed to record detailed information regarding food intake on two non-consecutive days. Information such as the quantity of food, time of consumption, type of preparation, and place of consumption (inside or outside the home) was included in the food questionnaire¹¹.

The IBGE researchers reviewed all the food records in order to identify possible errors. After this review, the food consumption information was entered into a portable computer using a specific data entry program. This program contained a database of approximately 1,500 food items that were selected from 5,686 records from the 2002-03 POF food and beverage database. In this program, 15 options were available regarding the preparation of food and 106 options regarding home-based measures. Foods that were not included in the program database were included by the researchers¹¹.

Due to the complexity of the POF, situations such as incomplete data and suspicious consumption values were observed. Thus, to control the quality of information, a data consistency check procedure (critique and imputation) was carried out, which resulted in the exclusion of 29 individuals whose records were considered to be incomplete¹¹.

The 1,120 food items – referred to by individuals in the records – were analyzed and classified according to the type of industrial processing to which they were submitted before their acquisition, preparation and consumption. The official ‘Food Guide for the Brazilian Population’ was used as a reference to perform this classification¹².

According to this guide, four food categories can be defined depending on the type of processing. The first includes fresh or minimally processed foods, which are those purchased for consumption without having undergone any alteration after leaving the natural state, or which are subject to minimum changes (cleaning, removal of inedible parts, refrigeration, etc.). Foods like fruits, vegetables, legumes, roots and tubers are some examples of this group. The second category includes products extracted from foods, or directly from nature, which are used in cooking preparations, such as oils, fats, sugar and salt¹². In the present study it was decided to denominate this group as culinary ingredients.

The third group covers products essentially manufactured with the addition of salt and/or sugar to a fresh or minimally processed food. The processing techniques include baking, drying, fermentation, packaging in cans or glass, and the use of preservation methods such as salting, brining, curing and smoking; canned vegetables, candied fruits and cheeses are some examples. The last category includes ultra-processed foods whose manufacture involves several stages and processing techniques, as well as the use of various industrial additives (soft drinks, filled cookies, fast foods and sweets in general are some examples)¹².

The quantities of food were converted to grams and kilocalories of energy (kcal) based on the ‘Food Conversion Table’ of the personal consumption block. This table was prepared by the IBGE based on data from the ‘Brazilian Food Composition Table’ and from the US ‘Department of Agriculture Table’, as well as from food labels¹¹.

Propensity Score matching and the impact of the PBF

Because the individuals in the sample were not randomly distributed in groups of recipients (intervention group) and non-recipients (control group), a technique was used for the two groups in relation to some socioeconomic characteristics. The procedure used was propensity score matching (PSM). PSM is one of the most important pairing methods used for the evaluation of public policies; it was developed to solve the problem of multidimensionality of pairing since it can be implemented from a single control variable, the propensity score¹³.

In this context, the propensity score can be defined as the probability of an individual being a beneficiary of the PBF given their socioeconomic characteristics. This makes it possible to adjust the biases between the intervention and control groups. To use this method it is necessary to guarantee two hypotheses: 1) the balance of socioeconomic characteristics (this means that sample selection requires that participation in the program is independent of the results); 2) the existence of a common support region (for each intervention group there should be a corresponding control group)¹³.

In the present study, the propensity score was estimated by using a probit regression model that determined the probability of participation of the individuals in the PBF, given their socioeco-

conomic characteristics. In this regression analysis the dependent variable was a dummy which assumed a value equal to one if they were recipients of the program and zero for non-recipients. The explanatory variables were as follows: average per capita income; number of individuals living in the household; total number of children in the family; total number of children and adolescents; total bathrooms; the existence of an electrical supply; sanitary disposal; garbage collection; type of wall coating; location of the dwelling (urban or rural); gender; skin color of individuals; and level of education of the head of household.

After the propensity score was estimated, the subgroups within the control group with probabilities similar to those of the intervention group were identified. Then, for each block of the propensity score, a test was performed to determine whether the average of each variable used in the model did not differ between recipients and non-recipients (balance of variables). After this stage, a final number of blocks were defined and the calculation of the average treatment effect on the treated (ATT) was performed by the nearest-neighbor matching algorithm, with replacement¹³. Using this method, each unit of the intervention group (beneficiary individual) was paired with a unit from the control group (non-beneficiary) with the closest value for the propensity score.

The ATT was determined to evaluate the impact of the PBF on the average total caloric consumption (expressed in kcal, per capita, per day) for each of the following food groups: fresh or minimally processed; culinary ingredients; processed; and ultra-processed.

Data analysis

All the analyses were performed using Stata software, version 12.0, considering the complex design of the sample. The Stata 'pscore.ado' application was used to calculate the propensity score and the ATT. A significance level of 5% was adopted in all the statistical tests.

To characterize the beneficiary and non-beneficiary individuals in the two macro-regions, the mean and percentage values of the demographic and socioeconomic variables were estimated. Fisher's exact test was used to compare differences in proportions, and Student's t-test was used for differences in the means.

This study forms part of a larger project entitled 'The evaluation of the effectiveness of the *Bolsa Família* Program in terms of the nutritional

status and food consumption of recipients living in the northeast and southeast of Brazil', which was approved by the Ethics Committee on Human Research of the Federal University of Viçosa.

Results

The sample for estimating the impact of the PBF on the consumption of food groups in the northeast region totaled 4,260 individuals, of which 17.30% were recipients of the program; in the southeast the sample was 1,715 individuals, of which 7.55% were recipients.

Regarding the socioeconomic disparities in both regions, it was observed that the individuals who were recipients of the program had a lower per capita monthly income, lower education, and were older than non-recipients. Furthermore, the majority were female (Table 1).

The total number of children and adolescents, who are the target of the program, was higher in recipient households in the two regions. Recipients living in the northeast had less access to basic services, such as garbage collection, sewerage and the presence of masonry walls in households, compared to non-recipients in this region (Table 1).

The average daily energy consumption of recipients in the northeast was 1,410 kcal and that of non-recipients was 1,557 kcal. Approximately 68% of the total energy intake of recipients came from fresh or minimally processed foods. The consumption of ultra-processed foods by non-recipients in this region was 1.8 times higher than the consumption of recipients (Table 2).

In relation to the southeast region, the average daily energy consumption of recipients was 1,467 kcal, and that of non-recipients was 1,636 kcal. Similarly to the northeast, more than 60% of the total energy intake consumed by recipients came from fresh or minimally processed foods. The level of consumption of ultra-processed foods was 1.3 times higher for non-recipients compared to recipients (Table 2).

The caloric intake of processed foods (11.60%) and ultra-processed foods (16.60%) in the total caloric consumption of recipients in the southeast was higher than the results observed for recipients in the northeast (10.40% for processed foods and 15% for ultra-processed foods) (Table 2).

However, these results do not fully represent the impact of the PBF. To estimate this impact, the probability of each individual being a recipient of the program was initially calculated. The

Table 1. Socioeconomic and demographic characteristics of a sample of recipients and non-recipients of the *Bolsa Família* Program in the northeast and southeast of Brazil. POF 2008-09.

Variables	Northeast			Southeast		
	Receive bolsa família	Do not receive bolsa família	p	Receive bolsa família	Do not receive bolsa família	p
Characteristics of individuals						
Per capita monthly income	117.13	125.05	< 0.01 ^a	183.60	202.35	< 0.01 ^a
Age	37.70	27.80	< 0.01 ^a	36.15	30.60	< 0.01 ^a
Education (years of schooling)	3.70	4.65	< 0.01 ^a	4.80	5.65	< 0.01 ^a
Level of education of head of household (years of schooling)	2.70	3.30	0.01 ^a	4.65	4.75	0.18 ^a
% Female	89.01%	46.96%	< 0.01 ^b	86.40%	53.30%	< 0.01 ^b
% White	23.34%	21.30%	0.22 ^b	35.15%	37.20%	0.65 ^b
% Black	9.09%	7.90%	0.27 ^b	10.95%	11.97%	0.73 ^b
% Mixed race	66.60%	70.10%	0.07 ^b	53.90%	50.40%	0.45 ^b
Characteristics of household						
Number of inhabitants	4.90	5.10	< 0.01 ^a	4.85	4.75	0.28 ^a
Total children	2.65	2.80	0.06 ^a	2.65	2.30	0.10 ^a
Total children and adolescents	2.73	2.05	< 0.01 ^a	2.75	2.30	< 0.01 ^a
Total rooms	5.20	5.65	< 0.01 ^a	5.31	5.45	0.19 ^a
Total bathrooms	0.80	0.95	< 0.01 ^a	1.01	1.05	0.09 ^a
% of homes with garbage collection	58.07%	63.0%	0.01 ^b	73.40%	80.55%	< 0.01 ^b
% of homes with electrical supply	95.50%	94.10%	0.12 ^b	99.20%	98.60%	0.54 ^b
% of homes with piped water supply	67.03%	69.10%	0.30 ^b	93.75%	95.60%	0.33 ^b
% of homes with sewage outlet	9.60%	12.65%	< 0.01 ^b	51.50%	54.00%	0.59 ^b
% of homes with masonry walls	85.80%	89.50%	0.01 ^b	97.60%	96.65%	0.55 ^b
% in rural areas	39.40%	36.30%	0.12 ^b	31.25%	27.04%	0.30 ^b

Source: prepared by the authors from POF 2008-09 microdata.

Level of significance of test = 5%; ^a Student's t-test; ^b Fisher's exact test.

results of the probit estimation models of the propensity score are summarized in Table 3.

For most of the variables, the estimated coefficient values showed the signs that were expected. In the northeast region, the variables that reduced the probability of participation in the PBF were as follows: higher per capita monthly income; level of education of the head of the household; the existence of garbage collection; and greater number of bathrooms. In contrast, a higher number of children and adolescents, and being female, increased the chances of participation in the program (Table 3).

In the southeast region, factors such as a higher per capita monthly income, level of education of the head of the household, and the presence of a garbage collection service reduced the probability of participation in the program, while, similarly to the situation in the northeast,

a higher number of children and adolescents, and being female, increased the chances of participation in the program (Table 3).

After estimating the probability of participating in the program, the individuals were paired (intervention versus control) according to this probability. This divided the variation of the propensity score into seven different strata or blocks (seven subgroups within the intervention and control groups) that presented similar score values (common support region).

Some observations from the control group were automatically excluded from the sample at the time of pairing because they presented propensity score values outside the common support region. This resulted in a final sample of 4,259 individuals (17.30% of which were program participants) in the northeast, and 1,515 individuals (8.50% program participants) in the southeast.

The impact of the PBF (ATT) on the consumption of food groups was calculated by using the nearest-neighbor pairing algorithm. In the northeast, recipients of the program had an average consumption of 125 kilocalories more per capita of fresh or minimally processed food than non-recipients. In terms of the consumption of

processed and ultra-processed foods, it was observed that recipients of the program consumed, on average, 166 and 183 kilocalories less than non-recipients for these two groups of foods, respectively (Table 4).

In the southeast, recipients of the program had a lower consumption of processed food (96

Table 2. Absolute and relative consumption of fresh or minimally processed foods, culinary ingredients, processed, and ultra-processed foods, of recipients and non-recipients of *Bolsa Família* Program in the northeast and southeast of Brazil. POF 2008-09.

Food groups	Recipients		Non-recipients		p ^a
	Kcal/day	% of total energy intake	Kcal/day	% of total energy intake	
Northeast					
Fresh or minimally processed food ^b	957.50	67.92	886.60	56.93	0.031
Culinary ingredients	95.20	6.75	104.30	6.70	0.062
Processed food	146.25	10.37	214.95	13.80	0.012
Ultra-processed food ^c	210.90	14.96	351.55	22.57	0.001
Total	1409.85		1557.40		0.001
Southeast					
Fresh or minimally processed food ^b	956.78	65.20	945.71	57.81	0.071
Culinary ingredients	97.18	6.62	105.96	6.48	0.068
Processed food	169.65	11.56	206.71	12.64	0.027
Ultra-processed food ^c	243.84	16.62	377.35	23.07	0.001
Total	1467.45		1635.73		0.031

^a T-test to compare averages. ^b Includes culinary preparations based on these foods. ^c Includes alcoholic beverages.

Table 3. Probit model of participation in the *Bolsa Família* Program in the northeast and southeast of Brazil. POF 2008-2009.

Variables	Northeast				Southeast			
	Coefficient	Standard error	p-value	CI _{95%}	Coefficient	Standard error	p-value	CI _{95%}
Average per capita income	-0.1032	0.000747	0.015	-0.111 -0.015	-0.0303	0.00968	0.002	-0.078 0.001
Existence of electrical supply	0.5081	0.182195	0.051	0.156 0.750	-0.5144	0.717143	0.743	-0.656 0.051
Existence of masonry walls	0.1173	0.104844	0.911	0.040 0.228	0.2190	0.442426	0.621	0.085 0.232
Existence of sewage outlets	0.1171	0.134186	0.383	0.033 0.140	0.0287	0.172084	0.867	-0.013 0.052
Existence of garbage collection	-0.1867	0.098088	0.047	-0.233 -0.017	-0.1911	0.174358	0.003	-0.289 -0.022
Total bathrooms	-0.1524	0.084779	0.042	-0.265 -0.014	-0.1401	0.184586	0.455	-0.215 -0.008
Total residents	-0.0666	0.029885	0.056	-0.084 -0.028	-0.0163	0.65416	0.803	-0.020 -0.011
Total children and adolescents	0.3693	0.153817	0.015	0.146 0.393	0.3646	0.268867	0.036	0.125 0.382
Total children	0.0132	0.315575	0.674	0.006 0.282	0.0598	0.05980	-0.317	-0.001 0.182
Residence in urban areas	0.0510	0.095066	0.591	0.011 0.144	-0.6792	0.170421	0.690	-0.698 0.044
Female	0.7446	0.083783	0.001	0.229 0.752	0.7647	0.152829	0.001	0.352 0.785
Mixed race	-0.1448	0.075774	0.056	-0.155 -0.011	-0.0709	0.132751	0.590	-0.095 -0.032
Level of education of head of household	-0.0247	0.012115	0.041	-0.038 0.004	-0.0702	0.017061	0.044	-0.089 0.063

Source: prepared by the authors from POF 2008-09 microdata.

Note: CI: confidence interval.

kilocalories less than non-participants) and ultra-processed food (126 kilocalories less than non-participants). Differently from what was observed in the northeast, there was no impact of the program on the consumption of fresh or minimally processed foods in this region (Table 4).

Discussion

In this study, which used data from two Brazilian regions and utilized the propensity score to form similar intervention and control groups, it was found that PBF recipients had a lower consumption of processed and ultra-processed foods in both regions, and a higher consumption of fresh or minimally processed foods in the northeast. Even taking into account the socioeconomic discrepancies that exist between these two macro-regions, more than 60% of the daily caloric intake consumed by recipients of the PBF came from foods that did not undergo industrial processing.

These results, especially those referring to recipients of the program residing in the northeast, comply with the central recommendation of the 'Food Guide for the Brazilian Population', which states: "Always choose fresh or minimally processed foods and culinary preparations instead of ultra-processed foods"¹².

Studies reported in the literature regarding the evaluation of the impact of the PBF on food consumption have traditionally analyzed isolated components, i.e., food and/or nutrients^{6,9}. How-

ever, some researchers have criticized this type of approach and suggested the analysis of the industrial processing of foods¹⁴⁻¹⁶, as recommended by the 'Food Guide for the Brazilian Population'.

The type of industrial processing may influence the forms of production, distribution and commercialization of foods, as well as the nutritional composition; however, this approach is still scarcely explored in studies that evaluate and monitor food consumption, even in studies that analyze significant increases in the consumption of processed and ultra-processed foods, and the association of this consumption with the occurrence of chronic non-communicable diseases¹⁷⁻¹⁹.

The present study is pioneering in using the proposals of the 'Food Guide for the Brazilian Population' to evaluate the impact of the PBF on food consumption, comparing two regions that stand out as being at the opposite ends of social and economic development in Brazil. Socioeconomic disparities between the northeast and southeast regions can influence the impact of the program on food consumption, and this was portrayed in the results, since recipients of the PBF in the northeast presented a higher level of consumption of fresh or minimally processed foods and a lower level of consumption of processed and ultra-processed foods compared to recipients living in the southeast.

Other research carried out regarding the Brazilian population has confirmed that the consumption of processed and ultra-processed foods is higher in more economically developed regions such as the south and southeast^{20,21}.

Table 4. Impact of the *Bolsa Família* Program on the consumption of food groups in the northeast and southeast of Brazil. POF 2008-2009.

Food groups	ATT	Standard error	t
Northeast			
Fresh or minimally processed food	125.30	85.93	3.25 ^a
Culinary ingredients	-12.45	9.35	-0.49
Processed food	-165.80	90.95	-3.98 ^a
Ultra-processed food	-182.65	100.15	-3.45 ^a
Total	-125.55	84.42	-2.40 ^b
Southeast			
Fresh or minimally processed food	15.25	8.65	1.32
Culinary ingredients	-9.85	6.65	-1.12
Processed food	-95.90	30.25	-2.43 ^b
Ultra-processed food	-125.75	82.24	-2.65 ^a
Total	-145.35	91.86	-2.32 ^b

Source: prepared by the authors from POF 2008-09 microdata.

Note: ATT = average treatment effect on the treated. Statistics t: ^a significant at 1%; ^b significant at 5%.

In relation to the population that benefits from the PBF, regional studies^{9,22} and a national study⁶ differ from the present study in that they report higher levels of consumption of processed foods by recipients of the program; however, those studies did not use pairing through the propensity score to evaluate the impact of the PBF. As previously mentioned, the use of this method to form similar intervention and control groups is recommended to assess the impact of public policies since it minimizes sample selection bias.

Although recipients of the PBF had lower levels of consumption of processed and ultra-processed foods in both regions, it is noteworthy that recipients living in the southeast had a percentage of energy intake from ultra-processed foods of approximately 17%.

In Brazil, regardless of income level, over the last three decades there has been a reduction in the consumption of basic and traditional foods, such as rice and beans, and conversely the consumption of ultra-processed foods, such as cookies and soft drinks, has increased by about 400%^{20,23}. These results demand attention because processed and ultra-processed foods have an unfavorable nutritional profile, such as higher energy density, higher content of sugar, saturated fat and trans fats, as well as containing less fiber²³. Some characteristics of these foods favor their excessive consumption, for example, the commercialization of large portions, hyper-palatability, durability, ease of transportation, as well as persuasive and large-scale marketing and publicity strategies^{24,25}.

The PBF forms part of a wider agenda of actions to provide social protection and to combat hunger in Brazil; the program is intended for families facing multiple situations of vulnerability. Despite some controversy about how families spend the money they are allocated, buying food is the main way in which the money is spent. However, food choice is a multi-determinate process that evolves social, political, economic and cultural factors²⁶. It is critical to adopt intersectoral measures that reinforce the consumption of fresh or minimally processed foods, especially in regions such as the southeast, where the results of this study showed a higher level of consumption of processed and ultra-processed foods.

It is essential to provide actions linked to the PBF that promote education regarding food and nutrition. However, it is worth noting that adopting adequate and healthy food habits is not a purely individual issue. Education regarding food and nutrition is fundamental to promote healthy eat-

ing because it comprises structural strategies that range from food production to consumption²⁷.

Adequate and healthy food is a basic human right, which is constitutionally guaranteed, so this guarantee must be a commitment on the part of the state. Consequently, it is crucial to adopt intrasectorial and intersectoral policies, in conjunction with the PBF, in order to ensure this right.

The use of propensity score matching to estimate the impact of the PBF, and the use of the new food classification system proposed by the 'Food Guide for the Brazilian Population', are highlighted as strengths of this study.

The limitations of this study include the errors inherent in the method used to evaluate individual food consumption (the food records). However, other methods of assessing food consumption are also subject to errors, and the choice of food records was mainly due to the fact that it was the method that best fitted the PBF's system of data collection (which is based on recording information in a notebook). The POF only includes those aged over 10 years old, which makes it impossible to make inferences about the food consumption of children.

In addition, the POF is a cross-sectional survey that does not allow the temporal analysis of food consumption. Starting in 2011, with the implementation of the 'Brazil without Misery Plan', important changes occurred within the scope of the PBF such as increased coverage and increases in the monetary value transferred⁷. Therefore, continuing the present study (in line with the next publication of the POF) would be interesting in order to evaluate trends in the food consumption of recipients of the PBF.

Propensity score matching is a technique that was developed to solve the problem of the sizing of pairing. Using this method makes it possible to minimize the errors associated with selection bias and, consequently, recipients and non-recipients of the PBF can be effectively compared. However, it cannot be affirmed that all the variables selected for the calculation of the scores were, in fact, the most relevant, because when choosing them the availability of variables investigated by the POF was taken into account.

Conclusions

The insufficient consumption of fresh or minimally processed foods can lead to micronutrient deficiencies, as well as increasing the risk of developing chronic diseases.

The recipients of the *Bolsa Família* Program presented lower levels of the consumption of processed and ultra-processed foods in both regions (northeast and southeast) and a higher level of consumption of fresh or minimally processed foods in the northeast. These results indicate that recipients of the program, especially those residing in the northeast, comply with the recommendations of the 'Food Guide for the Brazilian Population', which emphasizes the importance of the consumption of fresh or minimally processed food.

However, studies of the temporal analysis of food consumption in the Brazilian population have shown an increase in the consumption of ultra-processed foods, especially among the lower socioeconomic strata, which illustrates the need to monitor food consumption trends according to the degree of industrial processing of foods in relation to recipients of the *Bolsa Família* Program, so that measures can be adopted to promote adequate and healthy food.

Collaborations

N Sperandio designed the study, wrote and revised the intellectual content, and approved the final version. CT Rodrigues analyzed and interpreted the results and approved the final version. SCC Franceschini critically reviewed the content and approved the final version. SE Priore critically reviewed the content and approved the final version.

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