Access to governmental programs/benefits and food insecurity in urban and rural areas of Northeast Brazil

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Abstract *This paper analyzes food insecurity (FI) in urban and rural areas of the Northeast region of Brazil associated with certain social determinants and access to governmental benefits/programs. Data about FI from the National Household Budget Survey (2017-2018) were analyzed, including socio-economic variables and access to government benefits/programs of supplemental income (Bolsa Família, Ongoing transfer benefits, Food voucher and Food basket). Multinomial logistic regression models were performed to assess the relationship between FI and access to government programs/benefits. Half of the families in the Northeast were classified as being subject to FI, the prevalence and severity being higher in rural households. The composition of the family, with at least one retired individual, significantly reduced the probability of being FI at all levels of severity. Access to the Food basket (in cash) benefit and Bolsa Família was associated with being a factor of protection against severe FI in rural areas, while in urban areas the food voucher benefit was the main factor of protection. Income transfer programs and access to social benefits contribute to combatting FI, highlighting the importance of maintaining and scaling-up these initiatives for vulnerable populations.*

Key words *Food and nutritional security, Income transfer, Government programs*

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Introduction

Food and nutrition security (FNS) has been defined as the "realization of everyone's right to regular and ongoing access to quality food in sufficient quantities, without compromising access to other essential needs, being based on eating practices that promote health and respect cultural diversity and that are environmentally, culturally, economically and socially sustainable"[1]. In Brazil, access to adequate and healthy food is a constitutional right, and it is the duty of the state to develop intersectoral public policies to ensure the FNS of the population. Food insecurity (FI), a measure that is connected with FNS in population studies, expresses the uncertainty or lack of access to sufficient and quality food in a population. It remains one the most pressing social and public health problems to be faced in Brazil and the world[2-5].

Eradicating hunger and malnutrition in all its forms is one of the objectives outlined by the Food and Agriculture Organization of the United Nations (FAO) in the 2030 Agenda for Sustainable Development[6]. Through the application of FI perception scales in the last three reports on the state of FI in the world, the FAO has warned countries about the risk of hunger returning and it attributed the persistence of FI rates to such factors as socioeconomic conditions, economic slumps, and adverse weather events[7-9]. In absolute numbers, 2 billion people were affected by FI worldwide in 2019, 205 million of which in Latin America and the Caribbean[6]. After the outbreak of the COVID-19 pandemic, the FAO estimated an increase of between 83 and 132 million people who will experience FI as a direct result of the pandemic[10].

In Brazil, national studies documented a decade of reductions in FI levels across the country, between 2003 and 2014[11-13], but they also pointed to the risks of increasing FI in the country as a result of the dismantling of FNS and social policies, added to the political and economic crises in the last five years[14,15]. In the context of the current health crisis, data from the National Survey that evaluated the effects of the COVID-19 pandemic on FI in Brazil showed that more than 50% of Brazilians were classified at some level of FI, and 19.1 million were experiencing hunger, with the prevalence of FI being higher in the Northeast region and more severe among rural, low-income families for who the reference person is a female, black or colored, or low-schooled person[16].

This scenario marking the return of hunger and FI in Brazil raised the importance of studies on the subject focused on contributing to monitoring the levels of FI in Brazil, with emphasis on the socially vulnerable population. There is also a need for studies that explore the association between FI and access to government benefits and programs in order to contribute to the development of strategies to combat hunger and FI. Given the above, the objectives of this study were to analyze socioeconomic and demographic factors associated with FI in urban and rural areas of the Northeast region of Brazil and estimate the association of FI with access to benefits and/ or government programs in cash, based on data from the 2017-2018 Family Budget Survey of the Brazilian Institute of Geography and Statistics (POF 2017-2018, IBGE).

Method

Type of study and sampling

Data was analyzed from the POF 2017-2018, conducted by the Brazilian Institute of Geography and Statistics (IBGE) between July 2017 and July 2018. The POF 2017-2018 adopts a cluster sampling plan in two stages with geographical (Brazilian regions and urban/rural situation) and statistical stratifications (household income variable according to the 2010 demographic census) of the so-called primary sampling units corresponding to the census sectors of the 2010 Demographic Census. This sample was structured in order to enable the analysis of results by Brazilian region (North, Northeast, Midwest, Southeast, South) and by urban and rural situation. Data were collected at home by trained interviewers and there was strict data quality control[17]. More information about the sample and data collection is available on the IBGE website[18]. For this study, we used 19,150 primary sampling units located in the Northeast region of Brazil, which reach a population size of 17,848,855 households in the expanded format.

Food insecurity

The outcome of interest in this study was FI as measured by the Brazilian Food Insecurity Scale (*Escala Brasileira de Insegurança Alimentar*, EBIA). EBIA is a scale adapted from the American instrument Household Food Security Survey Module, which has been validated in population-based studies in Brazil since 2003[19]. The the-

oretical framework of this instrument considers food deprivation as a progressive phenomenon experienced at the household level, and in the most severe cases, at the individual level. EBIA evaluates access to food in dimensions that include fear of suffering from food deprivation, reduced quality and/or quantity of food accessed by the family, and hunger[20].

The POF 2017-2018[21] used the updated version of EBIA containing 14 dichotomous items (yes/no) that evaluate the deprivation of the family's nutrition in the last three months; of these, seven items are exclusive to families with at least one resident aged up to 18 years in the household. Based on the sum of affirmative answers of the EBIA, the FI classification of the families is estimated according to levels of FI severity, namely: (i) food security (FS) when the questions of the scale are answered negatively, which characterizes that there was no fear or worry among family members of suffering food deprivation in the three months preceding the survey; (ii) mild FI – concern of suffering food deprivation in the near future; (iii) moderate FI – when there is a restriction in the quality of food; and (iv) severe FI – when hunger was experienced among the adults and/or children of the household[21].

Variables related to social inequalities for FI

According to the availability of information in the microdata of the POF 2017-2018, 12 exposure variables were selected, including four government programs and/or benefits: (1) *Bolsa Família* (conditional income transfer program aimed at low income families below the poverty line)[22]; (2) *Benefício de Prestação Continuada* (BPC) (a social benefit in the amount of one minimum wage for people with disabilities who have a long-term physical, mental, intellectual or sensory impediment or for the elderly over 65 years; in both cases, the family income must be less than 1/4 of the minimum wage)[22]; (3) *Cartão Alimentação* (aid, voucher or cash benefit for food purchase, usually linked to formal work); and (4) *Cesta de Alimentos* (cash benefit). This information was taken from the individual income module of the POF 2017-2018, in the section on income transfer programs, pensions, retirements, aid and other income, and it refers to access in the last 12 months.

Co-variables related to inequalities for FI were identified to characterize the households, namely: gender, race/color and schooling level of the head of household, number of residents of the household, monthly family income *per capita*, presence of retirees in the household, the situation of the household - own home, paying rent, assigned or another situation, and daily access to water[23].

Data analysis

Descriptive analyses were carried out for the FI situation and other population exposure variables in subsamples of households located in the urban and rural areas of the Northeast region. Pearson's chi-square tests were applied to explore the association of FI and the explanatory variables of interest in the group of families living in the urban and rural areas. All variables associated with FI with a significance level up to 20% (p-value up to 0.20) were selected for the multivariate model.

The analyses considered the prevalence ratio as an estimator since the outcome under study - FI of the household – was categorized into three levels (FS [reference outcome] and four levels of FI – mild, moderate and severe FI). Regression models were performed separately for the urban and rural areas, including the selected socioeconomic and demographic variables. To verify the association of access to government benefits/programs with FI, multinomial logistic regression models were developed separately for each benefit/program, with adjustments for socioeconomic and demographic variables. The interaction between the monthly family income *per capita* and access to government benefit/program variables was also investigated. As a result, an interaction term was included in the models applied to the *Bolsa Família* and *BPC* programs. For the *Cartão Alimentação* and *Cesta de Alimentos* benefits, the adjustment was made with the inclusion of the variable income in the model, without the interaction term. All specified models were tested for collinearity.

The analyses were developed in the Stata-IC software, version 15.0[24]. In all analyses, the *survey* module was used for the expanded sample, and confidence intervals (CI) of 95%, with a significance level of 5%, were considered to check the statistical association between the variables.

According to Resolution No. 466 of December 12, 2012, of the National Research Ethics Commission (*Comissão Nacional de Ética em Pesquisa*, CONEP), studies that use publicly available secondary data that do not identify the participants of the research, which is the case of the database used in this study, do not require

approval by the local Ethics Committee of the CEP-CONEP system.

Results

Table 1 shows the prevalence of FS and FI in the Northeast region according to the urban or rural location of the household. As can be seen, half of the households in the Northeast region were classified as being in some degree of FI (49.7%), with a higher prevalence for those located in the rural area (57.9%) when compared to the urban area (47.8%). FI was also more severe in rural families, of which 16.8% and 8.9% were classified as having moderate and severe FI, respectively.

When comparing the socioeconomic and demographic characteristics of the families according to the area of residence, there was greater social vulnerability in the rural environment (Table 1). When comparing the data of households according to area of residence, most families were composed of up to four residents (urban: 71.4%; rural: 68.2%), with the head of household self-declaring the race/skin color as black or brown (urban: 73.9%; rural: 79.5%) in both the rural and urban areas. In the urban area, 52% of the heads of household are male while in the rural area this figure is 62.3%. The schooling level of the head of household also differed according to the area of residence, being significantly higher among the heads of households in the urban area of northeastern Brazil (more than four years of study: 74.6%). A higher percentage of families living in their own homes was observed in the rural area (83%) when compared to the urban area (72.6%). Regarding income, 41.6% and 20.2% of families reported an income below 1/2 minimum wage in the rural and urban areas, respectively. In most households and in both areas, the absence of a retiree in the family composition (urban: 68.4%; rural: 61.3%) and daily access to water (urban: 66.2%; rural: 58.3%) was reported.

Regarding the access to the government benefits/programs under study, 45.7% of rural families had access to *Bolsa Família*, while in the urban area this percentage was 24.2%. The proportion of families who reported receiving the *Cesta de Alimentos* (in cash), *Cartão Alimentação* and *BPC* benefits was less than 10% in both areas of residence under study.

In the urban area, all the variables under study were associated with FI in the bivariate analysis, while in the rural area, no association was observed between FI and access to water and the *BPC* benefit (table 2 and 3).

When analyzing the association of the studied variables with FI levels for households in the urban area, all variables of the head of household (gender, years of study and race/skin color), family income, daily access to water and home ownership were exposure factors associated with FI, at all levels of severity. In the rural areas, only the gender of the head of household and family income were significantly associated with FI levels. This information can be seen in Table 4.

The presence in the family of at least one retired individual was associated with FI as a protective factor; that is, it reduced the likelihood of the family being classified as having FI, at all levels of severity and for urban and rural households (Table 5). Receiving the *Cesta de Alimentos* benefit and participating in the *Bolsa Famíla* program was associated as a protective factor for severe FI in the rural area. In the urban area, receiving the *Cartão Alimentação* benefit was associated as a protective factor for FI at all levels of severity. Among urban households, the Bolsa Familia program was a protective factor for mild and moderate FI.

Discussion

The first objective of this study was to analyze the FI situation in households in the Northeast region of Brazil according to the area of residence – urban or rural. These results showed a higher proportion of FI (+10.1%) in the rural area when compared with the urban area. The percentages of moderate/severe FI in the urban (18.8%) and rural (25.7%) regions were higher than the results observed in the 2013 IBGE National Household Sample Survey, when 12.5% of urban households were found to be in moderate/severe FI against 20.1% of rural households[25].

A study conducted in Brazil between November and December 2020 pointed out that only 26.9% of the households surveyed in the Northeast were classified as FS[26]. In the same period, the 1st National Survey on FI in the COVID-19 scenario was conducted by the Brazilian Network for Research and Sovereignty and FNS (*Rede Brasileira de Pesquisa e Soberania e SAN*) with a representative sample of 2,180 households. It documented alarming rates of moderate/severe FI, affecting 34.9% and 29.3% of rural and urban households in the Northeast, respectively[16]. These results corroborate the increase in the severity of FI in Brazil that was revealed in the data of the POF 2017-2018.

Table 1. Socioeconomic, demographic and access to government benefits/programs characteristics of urban and rural households in the Northeast, Brazil, 2017-2018.

Variables	Northeast		Urban area		Rural area		p-value
	%	CI 95%	%	CI 95%	%	CI 95%	
Food insecurity							
Food security	49.2	(48.5; 50.8)	52.2	(51.0; 53.5)	42.1	(39.9; 44.8)	< 0.001
Light FI	29.8	(28.9; 30.7)	29.0	(28.0; 30.0)	32.2	(30.4; 34.1)	
Moderate FI	13.4	(12.6; 14.2)	12.2	(11.5; 13.0)	16.8	(14.8; 19.1)	
Severe FI	7.1	(6.6; 7.6)	6.6	(6.07; 7.08)	8.9	(7.6; 10.3)	
Household density							
Up to 4 residents	70.6	(69.8; 71.3)	71.4	(70.6; 72.2)	68.2	(66.3; 70.0)	< 0.001
5 or more residents	29.4	(28.6; 30.2)	28.6	(27.7; 29.4)	31.8	(30.0; 33.7)	
Gender of the head of household							
Female	45.4	(44.3; 46.5)	48.0	(47.0; 49.1)	37.7	(34.7; 40.8)	< 0.001
Male	54.6	(53.4; 55.6)	52.0	(50.9; 53.0)	62.3	(58.1; 65.3)	
Race/color of the head of household							
Black or mixed-race	74.4	(73.8; 75.0)	73.9	(72.9; 74.8)	79.5	(77.1; 81.6)	< 0.001
White/Asian	25.6	(25.0; 26.2)	26.1	(25.1; 27.1)	20.5	(18.4; 22.9)	
Schooling of the head of household							
Up to 4 years of study	32.7	(31.6; 33.6)	25.4	(24.4; 26.4)	53.9	(51.4; 56.3)	< 0.001
More than 4 years of study	67.3	(66.3; 68.3)	74.6	(73.6; 75.5)	46.1	(43.6; 48.6)	
Home status							
Own paid/paying	75.2	(74.3; 76.1)	72.6	(71.6; 73.5)	83.0	(80.9; 84.9)	< 0.001
Rented, assigned or other	24.8	(23.8; 25.6)	27.4	(26.5; 28.4)	17.0	(15.6; 19.1)	
Monthly household income per capita							
Up to 1/4 MW (up to R$ 238.5)	8.2	(7.7; 8.8)	5.7	(5.2; 6.1)	15.7	(14.1; 17.5)	< 0.001
Between 1/4 and 1/2 MW (R$ 477)	17.4	(16.7; 18.2)	14.5	(13.8; 15.2)	25.9	(24.1; 27.7)	
Above 1/2 MW	74.3	(73.4; 75.2)	79.8	(78.9; 80.7)	58.4	(56.2; 60.5)	
Retirees in the household							
Yes	33.3	(32.4; 34.3)	31.6	(30.6; 32.6)	38.7	(36.4; 41.0)	< 0.001
No	66.7	(65.6; 67.5)	68.4	(67.4; 69.4)	61.3	(59.0; 63.6)	
Access to Bolsa Família							
Yes	28.7	(28.7; 30.7)	24.2	(23.2; 25.3)	45.7	(43.4; 47.9)	< 0.001
No	70.3	(69.3; 71.3)	75.5	(75.7; 76.7)	54.3	(52.0; 56.5)	
Received Cesta de Alimentos							
Yes	0.9	(0.7; 1.1)	1.0	(0.8; 1.3)	0.7	(0.4; 1.1)	0.1205
No	99.1	(98.8; 99.2)	99.0	(98.7; 99.1)	99.3	(98.9; 99.2)	
Received Cartão Alimentação							
Yes	6.2	(5.7; 6.8)	8.1	(7.4; 8.8)	0.9	(0.5; 1.5)	< 0.001
No	93.7	(93.2; 94.2)	91.9	(91.2; 92.6)	99.1	(98.5; 99.5)	
Access to BPC							
Yes	5.4	(5.0; 5.8)	5.5	(5.0; 6.0)	5.2	(4.4; 6.0)	0.4889
No	94.6	(94.1; 94.9)	94.5	(94.0; 95.0)	94.8	(94.0; 95.6)	
Daily access to water							
Yes	65.1	(63.3; 66.8)	66.2	(64.4; 67.9)	58.3	(50.5; 65.7)	0.040
No	34.7	(33.1; 36.6)	33.8	(32.1; 35.6)	41.7	(34.3; 49.5)	

FI: food insecurity; MW: minimum wage; BPC: Benefício de Prestação Continuada (Continuing Benefit Conveyance).

Source: Authors.

The reduction of FI in Brazil between 2003 and 2014 was attributed to the development of intersectoral public policies related to FNS, and the increase in the vulnerability of the northeastern population to hunger and FI in 2018 is a potential consequence of the dismantling of these

Table 2. Distribution of the food security and insecurity situation by socioeconomic, demographic and access to government programs characteristics in households in the urban region. Northeast, Brazil, 2017-2018.

Variables	FS	FI			p-value
		Light	Moderate	Severe	
	(%, CI 95%)	(%, CI 95%)	(%, CI 95%)	(%, CI 95%)	
Household density					
Up to 4 residents	53.4 (52; 54.7)	29.9 (28.7; 31.0)	11.3 (10.6; 12.0)	5.4 (4.9; 6;0)	< **0.001**
5 or more residents	49.5 (47.5; 51.5)	26.8 (25.2; 28.4)	14.4 (12.9;16.1)	9.3 (8.3; 10.4)	
Gender of the head of household					
Female	47.8 (46.3; 49.4)	30.0 (28.7; 31.3)	14.4 (13.4; 15.5)	7.8 (7.1; 8.5)	< **0.001**
Male	56.4 (54.8; 57.9)	28.0 (26.8; 29.3)	10.2 (9.3; 11.0)	5.4 (4.8; 6.1)	
Schooling of the head of household					
Up to 4 years of study	43.3 (41.3; 45.3)	28.9 (27.2; 30.6)	16.6 (15.3; 18.0)	11.2 (10.0; 12.5)	< **0.001**
More than 4 years of study	55.3 (53.9; 56.7)	29.0 (27.9; 30.1)	10.7 (9.9; 11.5)	5.0 (4.5; 5.5)	
Race/color of the head of household					
Black or mixed-race	49.7 (48.3; 51.0)	30.0 (28.9; 31.2)	13.2 (12.3; 14.2)	7.1 (6.5; 7.8)	< **0.001**
White/Asian	59.8 (57.8; 61.7)	26.1 (24.6; 27.7)	9.2 (8.3; 10.3)	4.9 (4.1; 5.7)	
Home status					
Own	54.0 (52.6; 55.5)	28.1 (26.9; 29.2)	11.7 (10.9; 12.6)	6.2 (5.6; 6.8)	< **0.001**
Rented, assigned or other	47.5 (45.6; 49.5)	31.3 (29.7; 33.0)	13.5 (12.4; 14.8)	7.6 (6.7; 8.6)	
Family income					
Up to 1/4 MW (up to R$ 238.5)	23.6 (20.4; 27.2)	33.4 (30.1; 36.9)	24.7 (21.8; 28.0)	18.2 (15.7; 28.0)	< **0.001**
Between 1/4 and 1/2 MW (R$ 477)	30.6 (28.3; 32.9)	36.7 (34.3; 39.1)	21.4 (19.4; 23.5)	11.3 (9.8; 12.9)	
Above 1/2 MW	58.2 (56.9; 59.5)	27.2 (26.2; 28.2)	9.6 (8.9; 10.4)	4.9 (4.4; 5.4)	
Retirees in the household					
Yes	59.1 (57.4; 60.8)	25.7 (24.3; 27.2)	10.6 (9.5; 11.9)	4.5 (3.9; 5.2)	< **0.001**
No	49.1 (47.7; 50.5)	30.5 (29.3; 31.7)	13.0 (12.6; 13.8)	7.5 (6.9; 8.1)	
Access to Bolsa Família					
Yes	30.9 (28.9; 32.9)	37.2 (35.2; 39.2)	19.6 (18.0; 21.2)	12.4 (11.1; 13.8)	< **0.001**
No	59.1 (57.8; 60.3)	26.4 (25.3; 27.4)	9.9 (9.1; 10.6)	4.7 (4.2; 5.2)	
Received Cesta de Alimentos					
Yes	35.7 (26.2; 46.5)	36.2 (25.0; 49.1)	17.8 (11.9; 25.7)	10.3 (5.7; 17.9)	**0.01**
No	52.4 (51.2; 53.6)	28.9 (27.9; 29.9)	12.2 (11.4; 12.9)	6.5 (6.0; 7.0)	
Received Cartão Alimentação					
Yes	60.0 (56.5; 63.5)	27.2 (24.2; 30.4)	9.8 (7.7; 12.4)	3.0 (2.1; 4.2)	< **0.001**
No	51.6 (50.3; 52.8)	29.1 (28.1; 30.2)	12.4 (11.7; 13.2)	6.9 (6.3; 7.4)	
Access to BPC					
Yes	43.3 (39.3; 47.4)	31.9 (28.2; 35.9)	15.1 (12.3; 18.6)	9.6 (7.4; 12.4)	< **0.001**
No	52.8 (51.5; 54.0)	28.8 (27.8; 29.8)	12.0 (11.3; 12.8)	6.4 (5.9; 6.9)	
Daily access to water					
Yes	55.5 (53.9; 57.1)	28.2 (26.9; 29.6)	10.7 (9.8; 11.8)	5.5 (4.9; 6.1)	< **0.001**
No	48.8 (46.8; 50.7)	29.8 (28.3; 31.4)	13.7 (12.5; 15.0)	7.7 (6.9; 8.7)	

FS: food security; FI: food insecurity; MW: minimum wage; BPC: Benefício de Prestação Continuada (Continuing Benefit Conveyance).

Source: Authors.

public policies[15]. Researchers have evaluated the federal government's investment in 19 government programs related to the Sustainable Development Goals and observed an 84.6% reduction in the budget for FNS-related programs between 2014 and 2017[27]. Between 2014 and 2018, Vascon-

Table 3. Distribution of food security and insecurity by socioeconomic, demographic and access to government program characteristics in rural households. Northeast, Brazil, 2017-2018.

| Variables | FS | FI | | | p-value |
| | | Light | Moderate | Severe | |
	(%, CI 95%)	(%, CI 95%)	(%, CI 95%)	(%, CI 95%)	
Household density					
Up to 4 residents	43.1 (40.0; 46.2)	32.9 (30.8; 35.1)	16.8 (14.6; 19.2)	7.2 (5.9; 8.7)	< 0.001
5 or more residents	39.8 (36.2; 43.6)	30.7 (27.7; 33.8)	17.0 (14.4; 20.0)	12.5 (10.2; 15.2)	
Gender of the head of household					
Female	38.1 (34.4; 42.0)	34.7 (31.8; 37.6)	18.0 (15.5; 20.8)	9.2 (7.5; 11.4)	0.020
Male	44.5 (41.1; 47.9)	30.7 (28.6; 32.9)	16.1 (13.8; 18.8)	8.6 (7.2; 10.3)	
Schooling of the head of household					
Up to 4 years of study	41.7 (38.7; 44.9)	29.9 (27.6; 32.4)	18.1 (15.5; 20.8)	10.2 (8.6; 12.2)	0.003
More than 4 years of study	42.5 (39.2; 45.8)	34.,9 (32.1; 37.8)	15.4 (13.0; 18.1)	7.3 (5.8; 9.0)	
Race/color of the head of household					
Black or mixed-race	40.9 (38.1; 43.9)	31.9 (29.9; 33.9)	17.7 (15.3; 20.3)	9.5 (8.0; 11.1)	0.029
White/Asian	46.2 (41.6; 50.9)	33.7 (29.4; 38.3)	13.7 (10.7; 17.2)	6.3 (4.3; 9.3)	
Home status					
Own	43.6 (40.7; 48.5)	32.2 (30.1; 34.3)	16.3 (14.2; 18.6)	8.0 (6.8; 9.5)	<0.001
Rented, assigned or other	34.9 (30.0; 40.1)	32.4 (28.5; 36.5)	19.7 (15.6; 24.5)	13.1 (10.2; 16.6)	
Family income					
Up to 1/4 MW (up to R$ 238.5)	20.6 (16.9; 24.8)	38.1 (33.9; 42.5)	22.4 (18.5; 26.7)	18.9 (15.3; 23.3)	< 0.001
Between 1/4 and 1/2 MW (R$ 477)	31.1 (26.5; 36.1)	36.1 (32.2; 40.1)	22.7 (18.8; 27.0)	10.1 (7.6; 13.3)	
Above 1/2 MW	52.7 (49.0; 56.4)	28.9 (26.1; 31.8)	12.8 (10.6; 15.4)	5.6 (4.5; 6.7)	
Retirees in the household					
Yes	52.7 (48.8; 56.6)	27.8 (24.8; 30.9)	14.0 (11.6; 16.8)	5.5 (4.3; 7.2)	< 0.001
No	35,4 (32,2; 38,8)	34,9 (32,6; 37,3)	18,7 (16,3; 21,3)	11,0 (9,3; 12,9)	
Access to Bolsa Família					
Yes	29.5 (26.2; 33.1)	35.9 (33.0; 38.9)	23.3 (20.0; 26.8)	11.3 (9.4; 13.5)	< 0.001
No	52.7 (49.1; 56.3)	29.0 (26.4; 31.7)	11.5 (9.6; 13.7)	6.8 (5.5; 8.5)	
Received Cesta de Alimentos					
Yes	26.9 (11.8; 50.4)	42.9 (23.4; 64.9)	29.7 (14.2; 51.9)	0.4 (-; 0.3)	0.071
No	42.2 (39.5; 45.0)	32.1 (30.3; 33.9)	16.8 (14.7; 19.0)	8.9 (7.7; 10.4)	
Received Cartão Alimentação					
Yes	50.0 (24.4; 75.6)	45.5 (21.5; 71.8)	3.2 (0.8; 12.4)	1.3 (0.2; 9.3)	0.123
No	42.0 (30.4; 44.8)	32.0 (30.2; 33.9)	17.0 (14.9; 19.3)	8.9 (7.7; 10.4)	
Access to BPC					
Yes	43.1 (35.0; 51.6)	32.0 (23.9; 41.4)	17.7 (11.2; 27.0)	7.1 (4.1; 12.1)	0.898
No	42.1 (39.3; 44.9)	32.1 (30.3; 34.0)	16.8 (14.8; 10.0)	9.0 (7.7; 10.5)	
Daily access to water					
Yes	46.9 (41.4; 51.3)	32.7 (29.2; 36.4)	12.9 (9.9; 16.6)	8.1 (5.5; 11.8)	0.511
No	44.9 (37.9; 52.1)	31.2 (26.8; 35.9)	16.6 (12.3; 21.9)	7.3 (5.1; 10.4)	

FS: food security; FI: food insecurity; MW: minimum wage; BPC: Benefício de Prestação Continuada (Continuing Benefit Conveyance).

Source: Authors.

celos and Machado[28] recorded a significant reduction in the budget of federal programs (food baskets (-67%), food procurement program (-67%)). Other studies have observed that other programs, such as *Assistência Técnica e Extensão Rural* (Rural Technical Assistance and Extension, ATER; -71%) and *Água para Todos* (Water for All; -94%), are also of relevant for FNS, especially in the context of rural vulnerability in the Brazilian northeast[29,30].

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Table 4. Prevalence ratio (PR) of food insecurity by socioeconomic, demographic and access to government programs characteristics among families living in the rural and urban areas of the Northeast, Brazil, 2017-2018.

Variables	Light FI		Moderate FI		Severe FI	
	Crude PR (CI 95%)	Adjusted PR[1] (CI 95%)	Crude PR (CI 95%)	Adjusted PR[1] (CI 95%)	Crude PR (CI 95%)	Adjusted PR[1] (CI 95%)
Rural area						
5 or more residents	1.01 (0.8; 1.2)	-	1.09 (0.9; 1.3)	-	**1.89 (1.4; 2.6)**	**1.60 (1.1; 2.2)**
Female gender	**1.31 (1.1; 1.6)**	**1.44 (1.2; 1.8)**	**1.30 (1.0; 1.7)**	**1.45 (1.1; 1.9)**	1.24 (0.9; 1.7)	**1.51 (1.1; 2.1)**
Up to 4 years of study	0.87 (0.7; 1.0)	-	1.19 (0.9; 1.5)	**1.59 (1.2; 2.0)**	**1.44 (1.1; 1.9)**	**2.04 (1.5; 2.8)**
Race/color black/mixed-race	1.07 (0.8; 1.3)	-	**1.46 (1.1; 2.0)**	**1.42 (1.0; 1.9)**	**1.69 (1.1; 2.7)**	**1.64 (1.0; 2.6)**
Rented/assigned home	**1.25 (0.9; 1.6)**	-	**1.51 (1.1; 2.1)**	-	1.03 (1.4; 2.9)	**1.65 (1.2; 2.3)**
Income up to 1/4 MW	**3.38 (25; 4.2)**	**2.80 (2.1; 3.7)**	**4.48 (3.1; 6.4)**	**3.85 (2.6; 5.7)**	**8.64 (5.9; 12.7)**	**6.03 (4.0; 9.1)**
Income between 1/4 and 1/2 MW	**2.11 (1.5; 2.8)**	**1.87 (1.3; 2.6)**	**3.00 (2.1; 4.3)**	**2.67 (1.8; 4.0)**	**3.05 (2.0; 4.6)**	**2.30 (1.5; 3.5)**
Retirees in the household	**0.53 (0.4; 0.7)**	**0.69 (0.5; 0.9)**	**0.50 (0.4; 0.6)**	**0.69 (0.5; 0.9)**	**0.34 (0.2; 0.5)**	**0.50 (0.3; 0.7)**
Urban area						
5 or more residents	0.97 (0.9; 1.1)	-	**1.37 (1.2; 1.6)**	**1.19 (1.0; 1.4)**	**1.84 (1.6; 2.2)**	**1.51 (1.2; 1.8)**
Female gender	**1.26 (1.1; 1.4)**	**1.28 (1.1; 1.4)**	**1.67 (1.5; 1.9)**	**1.68 (1.5; 1.9)**	**1.68 (1.4; 2.0)**	**1.74 (1.5; 2.1)**
Up to 4 years of study	**1.27 (1.1; 1.4)**	**1.37 (1.2; 1.5)**	**1.98 (1.7; 2.3)**	**1.97 (1.7; 2.3)**	**2.87 (2.4; 4.4)**	**3.08 (2.5; 3.8)**
Race/color black/mixed-race	**1.38 (1.2; 1.5)**	**1.27 (1.1; 1.4)**	**1.72 (1.5; 1.9)**	**1.48 (1.3; 1.7)**	**1.76 (1.4; 2.1)**	**1.46 (1.2; 1.8)**
Rented/assigned home	**1.27 (1.1; 1.4)**	**1.19 (1.1; 1.3)**	**1.31 (1.1; 1.5)**	**1.20 (1.0; 1.4)**	**1.40 (1.2; 1.7)**	**1.28 (1.0; 1.6)**
Income up to 1/4 MW	**3.02 (2.4; 3.7)**	**2.36 (1.9; 3.0)**	**6.32 (5.0; 8.0)**	**4.62 (3.5; 6.0)**	**9.2 (7.0; 12.1)**	**5.0 (3.6; 6.8)**
Income between 1/4 and 1/2 MW	**2.56 (2.2; 2.9)**	**2.22 (1.9; 2.5)**	**4.22 (3.6; 4.9)**	**3.46 (2.9; 4.1)**	**4.4 (3.6; 5.3)**	**3.09 (2.5; 3.9)**
Retirees in the household	**0.70 (0.6; 0.8)**	**0.74 (0.7; 0.8)**	**0.68 (0.6; 0.8)**	**0.71 (0.6; 0.8)**	**0.49 (0.4; 0.6)**	**0.44 (0.3; 0.6)**
Non daily access to water	**1.20 (1.1; 1.3)**	**1.16 (1.0; 1.3)**	**1.45 (1.2; 1.7)**	**1.34 (1.1; 1.5)**	**1.60 (1.2; 1.7)**	**1.45 (1.2; 1.7)**

MW: minimum wage. [1] Multinomial logistic regression with the inclusion of all variables cited in the table for rural and urban areas. PRs with p-value < 0.05 are presented.

Source: Authors.

This reduction in the budget reflects the progressive loss of priority of Human Right to Adequate Food and FNS[31] in the government's agenda. Another emblematic example was the extinction of the National Council for Food and Nutrition Security (*Conselho Nacional de Segurança Alimentar e Nutricional*) on president Jair Bolsonaro's first day in office in 2019[32], as it is also a result of the implementation of fiscal austerity measures that have reduced federal investments in health, education and social protection policies[27,28,33-35].

In line with this scenario of eroding social and universal public policies in Brazil, the actions of the Brazilian government when faced with the COVID-19 pandemic to mitigate the economic and social effects of the health crisis were established late and constituted essentially emergency actions of access to income and food[36]; that is, they were limited in the face of the repercussions of the pandemic for FNS in Brazil[37].

In addition to the increasing number of families in FI, this study also highlights that the disparities between regions were maintained, since the percentages of moderate/severe FI in the rural region were higher than in the urban region in the surveys previously conducted by the IBGE[25]. In a systematic review that examined eleven studies on the diagnosis of FI in rural areas in Brazil (2008-2017), the authors pointed to FI and severe FI prevalence rates ranging from 32.2% to 88.8% and 3% to 39.5%, respectively[38]. The authors also highlighted that a significant majority of the studies observed FI results that were higher than those of the 2013 PNAD, and that these results can be attributed to difficulties in the implementation of public policies in rural areas.

The greatest exposure to FI among rural families is a historical portrait of social and geographical inequality, which manifests in Brazil through differences in economic, social and human development between urban and rural territories. In the Northeast, the vulnerability of the region is concentrated in the semiarid region, a territory that corresponds to 20% of Brazilian lands and is located in the interior of the country. Formed mostly by small municipalities, the

Table 5. Prevalence ratio (PR)1 for food insecurity and its severities and the access to government programs among families residing in the rural and urban areas of the Northeast, Brazil, 2017-2018.

	Light FI		Moderate FI		Severe FI	
	Crude PR	**Adjusted PR**	**Crude PR**	**Adjusted PR**	**Crude PR**	**Adjusted PR**
	(CI 95%)	**(CI 95%)**	**(CI 95%)**	**(CI 95%)**	**(CI 95%)**	**(CI 95%)**
Rural area						
Access to BF[2]	**2.21**	**1.60**	**3.62**	**2.54**	**2.94**	**1.47**
	(1.7; 2.8)	**(1.3; 2.0)**	**(2.7; 4.8)**	**(1.9; 3.4)**	**(2.1; 4.1)**	**(1.0; 2.1)**
Access to BF X income[3]	-	**0.99**	-	**0.99**	-	**0.99**
		(0.9; 1.0)		**(0.9; 0.9)**		**(0.9; 0.9)**
Received Cesta de Alimentos[2]	2.10	2.06	2.78	3.03	**0.07**	**0.07**
	(0.7; 6.5)	(0.7; 5.9)	(0.9; 9.0)	(0.9; 9.6)	**(0.0; 0.6)**	**(0.0; 0.6)**
Received Cartão alimentação[2]	1.19	1.71	**0.16**	0.29	0.12	0.28
	(0.4; 3.8)	(0.5; 3.8)	**(0.3; 0.8)**	(0.0; 1.6)	(0.1; 1.1)	(0.0; 2.6)
Urban area						
Access to BF[2]	**2.69**	**2.06**	**3.80**	**2.13**	**5.06**	**2.79**
	(2.4; 3.0)	**(1.8; 2.3)**	**(3.3; 4.4)**	**(1.8; 2.5)**	**(4.2; 6.0)**	**(2.2; 3.5)**
Access to BF X income[3]	-	**0.99**	-	**0.99**	-	0.99
		(0.9; 0.9)		**(0.9; 0.9)**		(0.9; 1.0)
Received Cesta de Alimentos[2]	**1.84**	**2.02**	**2.15**	**2.51**	**2.31**	**2.44**
	(1.0; 3.3)	**(1.1; 3.7)**	**(1.3; 3.5)**	**(1.5; 4.3)**	**(1.2; 4.6)**	**(1.2; 4.9)**
Received Cartão alimentação[2]	**0.80**	0.96	**0.68**	1.03	**0.37**	**0.53**
	(0.7; 0.9)	(0.8; 1.1)	**(0.5; 0.9)**	(0.7; 1.4)	**(0.2; 0.5)**	**(0.3; 0.8)**
Access to BPC	**1.35**	1.18	**1.53**	1.41	**1.84**	1.38
	(1.1; 1.6)	(0.7; 2.1)	**(1.2; 2.0)**	(0.6; 3.2)	**(1.2; 2.0)**	(0.7; 2.8)
Access to BPC X income[3]	-	0.99	-	0.99	-	0.99
		(0.9; 1.0)		(0.9; 1.0)		(0.9; 1.0)

BF: Bolsa Família; FI: food insecurity; BPC: Benefício da Prestação Continuada (Continuing Benefit Conveyance).
[1] Multinomial logistic regression, the PR with p-value < 0.05 are shown in bold. [2] Adjustment variables: number of residents in the household, gender, years of education and race/color of the head of household, home status, monthly family income per capita, presence of retiree in the household, and daily access to water (only for the urban area model). [3] Adjustment variables and interaction term between monthly family income per capita and access to the Bolsa Familia program.

Source: Authors.

semi-arid region is characterized by climatic conditions with persistent droughts, poverty and poor infrastructure, which increase the challenges to overcome FI[39].

All socioeconomic and demographic factors studied were associated with mild, moderate or severe FI. In both regions, low family income stood out as an important factor of exposure to FI. The risk of being in severe FI was 6 and 5 times higher for families with an income *per capita* of less than 1/4 of the minimum wage when compared to families with an income greater than 1/2 of the minimum wage, in the rural and urban regions, respectively.

This association between family income and FI has already been widely explored in the scientific literature[13,23]. In addition to the family in-

come debate, the results also pointed to the presence of retirees at home as a protective factor for FI at all levels of severity, in both regions. Some studies point to the vulnerability to FI among elderly people living alone or with families who depend economically on the retirement to meet the needs of the households[40], but other studies corroborate this study and highlight that the presence of retirees in the family can represent access to a stable income and economic security[41,42].

In this sense, FI is not only related to the size of the household's income, but also to its stability[43,44]. In other words, it is possible that families are deprived of access to food as a result of job instability and the informality of work, and a retiree in the family context is a safe source of income and a protective factor against FI. Focusing

especially on the rural context, Lopes, Medeiros[45] studied the importance of rural social security payments among women from a *Quilombola* community in the state of Pará. They found that retirement is operationalized as a vehicle that supplies more than basic needs and provides investment in agricultural production and increases the women's autonomy of choice, including regarding food.

The analyses of this study also pointed out that all socioeconomic and demographic factors studied were associated as a risk factor for FI, at some level of severity, for households in the urban region of the northeast of the country; a fact that was not observed in the rural area of the region. In this sense, it should be noted that the absence of an association between access to water and FI levels can be explained by the high water scarcity faced in the region.

Another objective of this study was to estimate the association of FI with access to cash benefits and/or government programs. One result that stands out is the low percentage of Brazilian households that accessed the programs/benefits under study: *Bolsa Família* (28,7%), *Cesta de Alimentos* (0,9%), *Cartão Alimentação* (6,2%), and *BPC* (5,4%), which is in alignment with the debate regarding the dismantling of public FNS and social protection policies in Brazil. Studies have described a state with few proposals regarding the implementation of government FNS initiatives and the stagnation and reduction of the allocation of federal resources in social and food programs, before[27, 28, 46] and during the COVID-19 pandemic[47-49].

Our findings also reinforce the relevance of government income programs to improve access to food, given the inverse association between FI and access to the *Bolsa Família, Cesta de Alimentos* and *Cartão Alimentação* programs. Differences were observed between families living in urban and rural regions. In the urban region, the *Carta Alimentação* program had a protective effect for all levels of FI severity while *Bolsa Família* had it for mild and moderate FI. In the rural region, on the other hand, *Bolsa Família* was a protective factor for mild, moderate and severe FI and the *Cartão Alimentação* program for severe FI.

On the one hand, these results express the urgent need for the implementation and strengthening of income transfer programs in the urban and rural context; and on the other hand, they further highlight the socio-economic disparities between the regions. That is, in the social and cost-of-living context of the urban region, the

benefits from programs like *Bolsa Família* and *Cesta de Alimentos* are possibly insufficient to be configured as a protective factor against severe FI, while in the rural region, in a context of greater vulnerability and instability regarding access to income, the *Bolsa Família* constituted a protective factor against FI. The *Cartão Alimentos* program, a cash benefit for the purchase of food, usually linked to formal work, was associated as a protective factor against FI only in the urban region. In this sense, it is believed that this result was observed in this study due to the greater access to formal work in the urban area when compared with the rural region.

There are few studies evaluating the association between FI and access to government programs. To our knowledge, there are no studies on FI and the *BPC, Cartão Alimentação* and *Cesta de Alimentos* programs. Regarding *Bolsa Família*, other researchers have already reported the association between the program and FI, revealing both the program's focus on vulnerable families[30,50] and its protective effect against FI[13]. The results of this study pointed out that about 70% of families entitled to the *Bolsa Família* program in urban and rural regions are facing FI, pointing out that the program reaches the most vulnerable families and that higher income transfer values should possibly be adopted for a more efficient response to overcome FI.

Limitations

This study has limitations that need to be discussed. This study did not consider the eligibility criteria of the programs/benefits studied in the population. Some of the families that did not access the studied programs could not meet the eligibility criteria, which could have attributed to a selection bias. However, as positive points one could state that the analysis was adjusted for other social and economic factors and included an interaction factor with income in order to reduce biases.

Another limitation refers to the POF data collection instrument itself. The *Cartão Alimentação* and *Cesta de Alimentos* benefits are included in the module referring to other family income; that is, they are another source of monetary resources available to the family, in addition to income from work. In this section, a set of variables is contemplated that refers to government benefits, including the *Cartão Alimentação* and *Cesta de Alimentos* variables. However, there is no specification regarding the sector or level of govern-

ment that offers the benefit. As such, we cannot affirm that the *Cartão Alimentação* program is the initiative of the National Worker's Food Program (*Programa Nacional de Alimentação do Trabalhador*) or a labor benefit of the private sector, nor that the *Cesta de Alimentos* program is in fact a governmental or non-governmental initiative. Despite this, we can state based on the results that the receipt of additional resources in the family, which are suggested to be used for food purchases, is an initiative that contributes to improve access to food.

In conclusion, this study corroborates the high permanence of FI in the population of the Northeast region of Brazil, as well as the greater vulnerability to hunger in the rural region. Programs related to income transfers and access to stable income through retirement contributed to coping with FI in Brazil, especially in vulnerable regions. These results once again highlight the need for income transfer initiatives as a strategy to combat FI, and reinforce the urgency of maintaining and expanding food access and income transfer programs as a strategy to reduce FI.

Collaborations

PA Palmeira analyzed the data and wrote the article. J Bem-Lignani and R Salles-Costa guided and reviewed the data analysis and the manuscript. All authors read and approved the final version of the manuscript.

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References

1. Brasil. Lei nº 11.346, de 15 de novembro de 2006. Cria o Sistema Nacional de Segurança Alimentar e Nutricional – SISAN com vistas em assegurar o direito humano à alimentação adequada e dá outras providências. *Diário Oficial* 2006; 15 nov.

2. Food and Agriculture Organization of the United Nations (FAO). Global strategic framework for food security and nutrition 2017 [Internet]. [acessado 2022 May 19]. Available from: https://www.csm4c-fs.org/wp-content/uploads/2016/02/CFS_OEWG_GSF_2017_05_10_01_Updated_GSF_EN.pdf

3. Trudell JP, Burnet ML, Ziegler BR, Luginaah I. The impact of food insecurity on mental health in Africa: a systematic review. *Social Science & Medicine* 2021; 278:113953.

4. Oliveira KHD, Almeida GM, Gubert MB, Moura AS, Spaniol AM, Hernandez DC, Pérez-Escamilla R, Buccini G. Household food insecurity and early childhood development: systematic review and meta-analysis. *Matern Child Nutr* 2020; 16(3):e12967.

5. Roncarolo F, Potvin L. Food insecurity as a symptom of a social disease: Analyzing a social problem from a medical perspective. *Can Fam Physician* 2016; 62(4):291-292.

6. Food and Agriculture Organization of the United Nations (FAO), International Fund for Agricultural Development (IFAD), United Nations International Children's Emergency Fund (UNICEF), World Food Program (WFP), World Health Organization (WHO). *The state of food security and nutrition in the world 2020. Transforming food systems for affordable healthy diets*. Rome: FAO; 2020.

7. Food and Agriculture Organization of the United Nations (FAO), International Fund for Agricultural Development (IFAD), United Nations International Children's Emergency Fund (UNICEF), World Food Program (WFP), World Health Organization (WHO). *The state of food security and nutrition in the world. Safeguarding against economic slowdowns and downturns*. Rome: FAO; 2019.

8. Food and Agriculture Organization of the United Nations (FAO), International Fund for Agricultural Development (IFAD), United Nations International Children's Emergency Fund (UNICEF), World Food Program (WFP), World Health Organization (WHO). *the state of food security and nutrition in the world: bulding climate resilience for food security and nutrition*. Rome: FAO; 2018.

9. Food and Agriculture Organization of the United Nations (FAO), International Fund for Agricultural Development (IFAD), United Nations International Children's Emergency Fund (UNICEF), World Food Program (WFP), World Health Organization (WHO). *the state of food security and nutrition in the world 2017. Building resilience for peace and food security*. Roma: FAO; 2017.

10. High Level Panel of Expertes (HLPE). Impacts of COVID-19 on food security and nutrition: developing effective policy responses to address the hunger and malnutrition pandemic. *HLPE issues paper* 2020. [cited 2022 may 19]. Available from: https://www.fao.org/3/cb1000en/cb1000en.pdf

11. Cabral CS, Lopes AG, Lopes JM, Vianna RP. Food security, income, and the Bolsa Familia program: a cohort study of municipalities in Paraiba State, Brazil, 2005-2011. *Cad Saude Publica* 2014; 30(2):393-402.

12. Gubert MB, Santos SMC, Santos LMP, Pérez-Escamilla R. A Municipal-level analysis of secular trends in severe food insecurity in Brazil between 2004 and 2013. *Global Food Security* 2017; 14:61-67.

13. Palmeira PA, Salles-Costa R, Pérez-Escamilla R. Effects of family income and conditional cash transfers on household food insecurity: evidence from a longitudinal study in Northeast Brazil. *Public Health Nutr* 2020; 23(4):756-767.

14. Costa NS, Santos MO, Carvalho CPO, Assunção ML, Ferreira HS. Prevalence and factors associated with food insecurity in the context of the economic crisis in Brazil. *Current Developments in Nutrition* 2017; 1(10): e000869.

15. Sousa LRM, Segall-Correa AM, Ville AS, Melgar-Quinonez H. Food security status in times of financial and political crisis in Brazil. *Cad Saude Publica* 2019; 35(7):e00084118.

16. Rede Brasileira de Pesquisa em Soberania e Segurança Alimentar (PENSSAN). *VIGISAN – Inquérito Nacional sobre Insegurança Alimentar no Contexto da Pandemia da Covid-19 no Brasil*. Rio de Janeiro: Rede PENSSAN; 2021.

17. Instituto Brasileiro de Geografia e Estatística (IBGE). *Pesquisa de orçamentos familiares 2017-2018 – primeiros resultados*. Rio de Janeiro: IBGE; 2019.

18. Instituto Brasileiro de Geografia e Estatística (IBGE). Site do Instituto Brasileiro de Geografia e Estatística. 2021. [acessado 2021 jun 3]. Available from: https://www.ibge.gov.br

19. Perez-Escamilla R, Segall-Correa AM, Kurdian Maranha L, Sampaio MMF, Marin-Leon L, Panigassi G. An adapted version of the U.S. Department of Agriculture Food Insecurity module is a valid tool for assessing household food insecurity in Campinas, Brazil. *J Nutr* 2004; 134(8):1923-1928.

20. Kepple AW, Segall-Corrêa AM. Conceptualizing and measuring food and nutrition security. *Cien Saude Colet* 2011; 16(1):187-199.

21. Instituto Brasileiro de Geografia e Estatística (IBGE). *Pesquisa de orçamentos familiares: 2017-2018 – análise da segurança alimentar no Brasil*. Rio de Janeiro: IBGE; 2020.

22. Brasil. Ministério da Cidadania. Site do Ministério da Cidadania. [acessado 2021 jun 3]. Disponível em: https://www.gov.br/cidadania/pt-br

23. Lignani JB, Palmeira P, Antunes MML, Salles-Costa R. Relationship between social indicators and food insecurity: a systematic review. *Rev Bras Epidemiol* 2020; 23:E200068.

24. Stata-IC. Stata. 15.0 ed. College Station, TX: Stata Corporation; 2021.

25. Instituto Brasileiro de Geografia e Estatística (IBGE). *Pesquisa Nacional por Amostra de Domicílios: Segurança Alimentar 2013*. Rio de Janeiro: IBGE; 2014.

26. Galindo E, Teixeira MA, Araújo M, Motta R, Pessoa M, Mendes L, Rennó L. Efeitos da pandemia na alimentação e na situação da segurança alimentar no Brasil. *Working Paper Series Food for Justice* 2021; Working Paper 4.

27. Souza LEPF, Barros RD, Barreto ML, Katikireddi SV, Hone TV, Sousa RP, Leyland A, Rasella D, Millett CJ, Pescarini J. The potential impact of austerity on attainment of the Sustainable Development Goals in Brazil. *BMJ Global Health* 2019; 4(5):e001661.

28. Vasconcelos F, Machado M, Madeiros M, Neves J, Recine E, Pasquim E. Public policies of food and nutrition in Brazil: from Lula to Temer. *Rev Nutr* 2019; 32:e180161.

29. Palmeira P, Araújo Mattos R, Pérez-Escamilla R, Salles-Costa R. Multisectoral government programs and household food insecurity: evidence from a longitudinal study in the semiarid area of northeast, Brazil. *Food Security* 2020; 13:525-538.

30. Cherol CCS, Ferreira AA, Salles-Costa R. Governmental programmes associated with food insecurity among communities of descendants of enslaved blacks in Brazil. *Public Health Nutr* 2020: 24(10):3136-3146.

31. Santarelli M, David G, Burity V, Rocha N. *Informe Dhana 2019: autoritarismo, negação de direitos e fome*. Brasília: FIAN Brasil; 2019.

32. Ribeiro CIR. A extinção do Conselho Nacional de Segurança Alimentar e Nutricional e a agenda de alimentação e nutrição. *Cad Saude Publica* 2019; 35(2): e00009919.

33. Malta M. Human rights and political crisis in Brazil: public health impacts and challenges. *Glob Public Health* 2018; 13(11):1577-1584.

34. Paes-Sousa R, Schramm JMA, Mendes LVPM. Fiscal austerity and the health sector: the cost of adjustments. *Cien Saude Colet* 2019; 24(12):4375-4384.

35. Silva WP, Barbosa EP. Austeridade e neoliberalismo no Brasil pós-golpe. *Sítio Novo* 2020; 4(3):336-347.

36. Alpino TM, Santos CRB, Barros DC, Freitas C. COVID-19 e (in)segurança alimentar e nutricional: ações do Governo Federal brasileiro na pandemia frente aos desmontes orçamentários e institucionais. *Cad Saude Publica* 2020; 36(8):e00161320.

37. Ribeiro-Silva R, Pereira M, Campello T, Aragão E, Guimarães JM, Ferreira AJF, Barreto ML, Santos SMC. Implicações da pandemia COVID-19 para a segurança alimentar e nutricional no Brasil. *Cien Saude Colet* 2020; 25(9):3421-3430.

38. Trivellato PT, Morais DC, Lopes SO, Miguel ES, Franceschini SCC, Priore SE. Insegurança alimentar e nutricional em famílias do meio rural brasileiro: revisão sistemática. *Cienc Saude Colet* 2019; 24(3):865-874.

39. Pérez-Marin AM, Rogé P, Altieri MA, Forero LFU, Silveira L, Oliveira VM, Domingues-Leiva BE. Agroecological and Social Transformations for Coexistence with Semi-Aridity in Brazil. *Sustainability* 2017; 9:990.

40. Tognon FAB, Follador FAC, Mello GR, Almeida LEFD, Vieira AP, Frigo EP. Segurança alimentar: um estudo com idosos. *Revista Espacios* 2017; 38(19):25.

41. Rosa TE, Mondini L, Gubert MB, Sato GS, Benício MHA. Segurança alimentar em domicílios chefiados por idosos, Brasil. *Rev Bras Geriatr Gerontol* 2012; 15(1):69-77.

42. Men F, Tarasuk V. Severe food insecurity associated with mortality among lower-income Canadian adults approaching eligibility for public pensions: a population cohort study. *BMC Public Health* 2020; 20:1484.

43. Tarasuk V. *Implications of a basic income guarantee for household food insecurity*. Thunder Bay: Northern Policy Institute; 2017.

44. Li N, Dachner N, Tarasuk V. The impact of changes in social policies on household food insecurity in British Columbia, 2005-2012. *Prev Med* 2016; 93:151-158.

45. Lopes MR, Medeiros M, Tecchio A. A aposentadoria rural e a construção da autonomia feminina no território Quilombola de Porto Alegre, Pará. *Raízes* 2020; 40(2):347-365.

46. Salvador ES. O desmonte do financiamento da seguridade social em contexto de ajuste fiscal. *Serv Soc Soc* 2017; 130:426-446.

47. Nalesso A, Rizzotti M, Mustafa S. Desmonte da Proteção Social: uma análise da implementação do auxílio emergencial. *Temporalis* 2021; 19(37):219-236.

48. Carvalho CA, Viola PCAF, Sperandio N. How is Brazil facing the crisis of food and nutrition security during the COVID-19 pandemic? *Public Health Nutr* 2021; 24(3):561-564.

49. Neves JA, Machado ML, Oliveira LDA, Moreno YMF, Medeiros MAT, Vasconcelos FAG. Unemployment, poverty, and hunger in Brazil in Covid-19 pandemic times. *Rev Nutr* 2021; 34:e200170.

50. Palmeira PA, Bem-Lignani J, Maresi VA, Mattos RA, Interlenghi GS, Salles-Costa R. Temporal changes in the association between food insecurity and socioeconomic status in two population-based surveys in Rio de Janeiro, Brazil. *Social Indicators Research* 2019; 144(13):1349-1365.