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Factors associated with food security in households in the urban area of the state of Tocantins, Northern Brazil

Fatores associados à insegurança alimentar em domicílios da área urbana do estado do Tocantins, Região Norte do Brasil

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ABSTRACT: *Objective:* To evaluate the factors associated with food insecurity in families living in the urban area of Tocantins/Brazil. *Methods:* This is a population-based cross-sectional study conducted in the urban area of 22 municipalities in the 8 microregions of the state. A semi-structured questionnaire was applied to the head of household to obtain socioeconomic and demographic data, and the Brazilian Food Insecurity Scale (EBIA) was used to assess food insecurity at home. The anthropometric assessment of the residents was made by measuring weight, height/length and waist circumference. Multinomial logistic regression was performed to assess the association of food insecurity with individual/household variables, and Pearson's chi-square test was used to compare whether there was a difference in the prevalence of food insecurity between microregions and between families with and without individuals under 18 years. *Results:* A total of 596 households were evaluated, of which 63.4% were in a food insecurity situation. The final model of the multivariate analysis showed that low head-of-household schooling, low *per capita* income, receiving social assistance benefits and lack of clean drinking water in the household were associated with food insecurity (p < 0.05). *Conclusions:* The findings of this study reveal the high prevalence of food insecurity in the families studied and their associated factors, showing the need for local actions and public policies to improve health conditions, education and income of the population, and consequently, improve the scenario of food and nutritional insecurity in the state.

Keywords: Food and nutritional security. Social conditions. Cross-sectional studies. Public policy.

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RESUMO: *Objetivo:* Avaliar os fatores associados à insegurança alimentar de famílias residentes na zona urbana do Estado do Tocantins, Brasil. *Métodos:* Trata-se de um estudo transversal, de base populacional, realizado na área urbana de 22 municípios das oito microrregiões do Estado. Foram aplicados um questionário semiestruturado ao chefe de família, para obtenção dos dados socioeconômicos e demográficos, e a Escala Brasileira de Insegurança Alimentar (EBIA), para avaliação da insegurança alimentar no domicílio. A avaliação antropométrica dos moradores foi feita a partir da aferição de peso, estatura / comprimento e perímetro da cintura. Realizou-se regressão logística multinomial, para avaliar a associação da insegurança alimentar com as variáveis individuais / domiciliares, e o teste do χ² de Pearson foi empregado para comparar se houve diferença da prevalência de insegurança alimentar entre as microrregiões e entre famílias com e sem indivíduos menores de 18 anos. *Resultados:* No total, foram avaliados 596 domicílios, dos quais 63,4% se encontravam em insegurança alimentar. O modelo final da análise multivariada mostrou que baixa escolaridade do chefe de família, baixa renda *per capita*, recebimento de benefício de programa socioassistencial e falta de água potável no domicílio foram associados à insegurança alimentar (p < 0,05). *Conclusões:* Os achados deste estudo revelam a elevada prevalência de insegurança alimentar nas famílias estudadas e seus fatores associados, mostrando a necessidade de ações e políticas públicas locais para melhoria das condições de saúde, de educação, de renda da população e, consequentemente, do cenário da insegurança alimentar e nutricional no Estado.

Palavras-chave: Segurança alimentar e nutricional. Condições sociais. Estudos transversais. Políticas públicas.

INTRODUCTION

Food insecurity is a complex and multidimensional phenomenon, with a heterogeneous distribution between regions, states and cities in Brazil[1]. The different prevalence values show inequalities, which also occurs between municipalities in the same region, with the North and Northeast regions presenting the most worrying situations[2]. Food insecurity is associated not only with low availability of food, but also with social vulnerability[3]. It is related to the structure of society, the labor market[4] and characteristics such as age, educational level of the head of the family, economic situation, unemployment, race / color and number of residents in the households[5,6].

To measure the food insecurity condition of families, since 2004, several studies have used the Brazilian Food Insecurity Scale (EBIA)[4,7-11], an instrument validated for the Brazilian population based on the adaptation of the North American Food Insecurity Scale[12] and which assesses the perception of individuals in relation to access to food in the household[13]. The application of EBIA allows the assessment of trends and impacts of food insecurity, in addition to identifying the vulnerability of the population's food access condition. Also, its articulation with other indicators allows to adequately delineate the food insecurity status[5].

Despite the reduction in severe food insecurity in Brazil, the highest prevalence is still concentrated in municipalities in the North region, more specifically in the urban area[14], and in the Northeast region, presenting a heterogeneous distribution in the intra-regional context[15]. Therefore, knowing the prevalence and factors associated with food insecurity

in different regions is key for planning targeted public actions and policies that meet local needs, seeking to improve the population's health conditions[2,16]. Thus, this study aimed to assess the prevalence and factors associated with food insecurity in families living in the urban area of the state of Tocantins.

METHODS

This is a cross-sectional, population-based study, part of the "Project to Strengthen the Food and Nutrition Security System in the States of Amapá, Pará and Tocantins", proposed by the Ministry of Social Development (MDS), conducted from September 2016 to July 2017 in the urban area of 22 municipalities in Tocantins, the youngest state in the federation, located in the Northern region of the country. According to the last demographic census, the state has a population of 1,383,445 inhabitants, distributed in 139 municipalities and eight microregions, of which 78.8% live in the urban area[17]. In order to obtain the representative sample size of the population, a probabilistic sample by conglomerates was used, in three stages: first, 22 municipalities were randomly drawn, contemplating the eight microregions proportionately and making up 15% of the total of municipalities in the State. Subsequently, urban census tracts were classified and drawn in each municipality, then a block was drawn and a corner on this block was the starting point for the households assessed. The researchers made as many visits as necessary until the number of households established in the sample calculation was reached. The sample was calculated in the OpenEpi® program using the following formula in Equation 1:

$$n = [EDFF*Np(1-p)]/ [(d2/Z21\text{-}\alpha/2*(N\text{-}1)+p*(1\text{-}p)] \qquad (1)$$

For the size of the population (N), the following were considered: total households in the urban area of the state of Tocantins according to the last Census[17] (N = 317,376), prevalence (p) of food insecurity in the state[14] (p=37.6%), tolerable error (d) of 5%, confidence level of 95%, standard score of normal distribution (Z) of 1.96 and effect of the study design (EDFF) of 1.5. At the end, 10% were added to control confounding factors, finding a representative value for the total number of households in the urban area of Tocantins of n = 595. The number of households was divided based on a systematic draw proportional to the size of each municipality.

A pilot study was carried out in a non-randomized municipality, with the objective of testing the data collection equipment, instruments and logistics. Data collection was conducted from home visits, in which an assessment was carried out of food and nutritional security and its determinants at the individual/household level, with the application of a semi-structured questionnaire to the head of household, that is, the reference person responsible for the household or so considered by its residents[14], to obtain socioeconomic and demographic data. The variables analyzed were: sex, self-declared race/color, age, total

years of schooling and paid activity of the interviewee, in addition to the number of residents in the household, *per capita* income, receiving or not receiving social assistance benefits (Bolsa Família Program), household condition (owned, rented, lent/loaned), presence or absence of teenagers and children under 18 in the household, basic sanitation (sewage, garbage collection and drinking water situation in the household) presence of food production for self-consumption.

The EBIA, composed of 14 questions, was used to assess food insecurity. Based on the head of the family's perception of the access to food in the household in the past three months, EBIA generates a classification divided into four levels of food insecurity: food security, mild food insecurity, moderate food insecurity and severe food insecurity. For households with individuals under 18 years of age, food security (0 points), mild food insecurity (1 to 5 points), moderate food insecurity (6 to 10 points) and severe food insecurity (11 to 14 points) scenarios were considered. Households with only adults and/or elderly were classified as having food security (0 points), mild food insecurity (1 to 3 points), moderate food insecurity (4 to 6 points) and severe food insecurity (7 to 8 points)[14].

Data entry was performed in duplicate in Microsoft Excel® 2010. The consistency check and statistical analysis of the data were performed using the Stata software, version 14.0. The internal consistency of the EBIA responses was assessed using Cronbach's alpha coefficient, with values greater than 0.7 being considered satisfactory.

The levels of food insecurity found from the EBIA results were considered as a dependent variable, using food security as a reference and grouping the categories of moderate and severe food insecurity to increase the accuracy of the analyzes. Since the dependent variable was composed of three categories (food security, mild food insecurity and moderate/severe food insecurity), the multinomial logistic regression model was used to assess its association with individual/household variables.

Pearson's χ^2 test was used to compare the prevalence of food insecurity in families with and without individuals under 18 years of age. Multinomial bivariate analysis was performed, in which the explanatory variables that were associated with the outcome with $p < 0.20$ were inserted through the backward strategy in the multivariate logistic model, and those with less significance (higher p value) were removed from the model one by one. Significant variables ($p < 0.05$) remained in the final model, with their estimates expressed as odds ratios and 95% confidence intervals (95%CI).

This study was approved by the Research Ethics Committee at Universidade Federal de Viçosa for research with human beings, and all participants signed an informed consent prior to the interview.

RESULTS

A total of 596 households were assessed. According to Table 1, there was a predominance of female heads of family (77.2%), brown in color (56.5%), aged between 18 and

Table 1. Characterization of the studied families, according to socioeconomic and demographic data. Tocantins, Brazil, 2016–2017 (n = 596).

Variables	n (%)
Head of household	
Sex	
Male	136 (22.8)
Female	460 (77.2)
Race/color	
White/yellow	137 (23.0)
Black	107 (18.0)
Brown	337 (56.5)
Indigenous	15 (2.5)
Age group (years)	
18 to 49	326 (54.7)
50 to 64	146 (24.5)
65 or older	124 (20.8)
Years of schooling	
< 4 years	138 (23.1)
4 to 8 years	156 (26.2)
> 8 years	302 (50.7)
Paid activity	
Yes	289 (48.5)
No	307 (51.5)
Households	
Number of residents	
Up to 4	465 (78.0)
5 to 6	107 (18.0)
≥ 7	24 (4.0)
Resident under 18 years old	
Yes	318 (53,4)
No	278 (46,6)

Table 1. Continuation.

Variables	n (%)
Social assistance benefit	
Yes	115 (19.3)
No	481 (80.7)
Per capita* income	
Up to ¼	48 (8.9)
¼ to ½	160 (29.8)
> ½ to 1	195 (36.4)
> 1 to 2	93 (17.4)
> 2	40 (7.5)
Household condition	
Owned	427 (71.6)
Rented	119 (20.0)
Lent/loaned	50 (8.4)
Garbage collection	
Collected by public service	545 (91.4)
Buried and/or burned	51 (8.6)
Sewage	
Public network	102 (17.1)
Open pit/ditch	19 (3.2)
Septic tank	475 (79.7)
Drinking water	
Yes	352 (59.1)
No	244 (40.9)
Food production for self-consumption	
Yes	507 (85.1)
No	89 (14.9)
General food insecurity situation	
Food security	218 (36.6)
Mild food insecurity	244 (40.9)
Moderate/severe food insecurity	134 (22.5)

*n = 536.

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49 years (54.7%), without a paid activity (51.5%) and with less than 8 years of schooling (49.3%). As for the characteristics of the households, it was observed that 78.0% had up to 4 residents and 53.4% had residents under 18 years old. *Per capita* income was less than or equal to half a minimum wage for 38.7% of families, with 19.3% of them benefiting from a social assistance program. A total of 28.4% of households were rented or lent/loaned. Most of them (82.9%) had no sewage system and 40.9% did not have access to drinking water. However, in 91.4%, there was garbage collection by the public service. Most families (85.1%) produced food at home for self-consumption.

Regarding the food insecurity situation in the households evaluated, 40.9% (n = 244) were in mild food insecurity, and 22.5% (n = 134), in moderate/severe food insecurity, making a total of 63.4 % of households in some food insecurity condition (Table 1). The internal consistency analysis of the EBIA was considered satisfactory, since it showed a Cronbach's alpha value equal to 0.89. The overall prevalence of food insecurity was higher (67.6%) in families that had individuals under 18 years of age, but the moderate/severe food insecurity degree affected mostly households that did not have residents under 18 (24.1%) (data not shown in table). There were statistically significant differences in the prevalence of food insecurity between these families (p = 0.011).

From the bivariate analysis, an association was observed between food insecurity and characteristics of the heads of household and of the households studied (p < 0.20) (data not shown in table). It was found that mild food insecurity was positively associated with households that had female heads (p = 0.021) and with families that had individuals under 18 (p = 0.004), and negatively associated with families that did not produce food for self-consumption (p = 0.039). The chance of moderate/severe food insecurity increased in households with heads of family aged between 50 and 64 years (p = 0.044), with the fact that the head of the household does not have a paid activity (p = 0.001), with households without garbage collection (p = 0.011) and without access to drinking water (p < 0.001) and with heads of family with less than 8 years of schooling (< 0.001). Higher number of residents in the household, presence of adolescents in the household, receiving benefits from a social assistance program and lower *per capita* income were positively associated with both mild and moderate/severe food insecurity (p < 0.05).

The final model of the multivariate analysis presented in Table 2 shows the variables that remained associated with food insecurity (p <0.05). Low schooling of the head of household, lower *per capita* income, receiving benefits from a social assistance program and absence of drinking water at home remained positively associated with food insecurity, while families with children under 18 were inversely associated with this condition.

It was observed that the years of schooling of the head of the family were associated with the families' moderate/severe food insecurity situation, and that the *per capita* family income was associated with both mild and moderate/severe food insecurity, that is, worse schooling and income conditions increase the chance of the household being in a situation of food insecurity. Households with individuals under 18 years of age were less likely to be

Table 2. Final model of the multivariate analysis of the association between food insecurity and the characteristics of the head of household and households in the urban area. Tocantins, Brazil, 2016–2017 (n = 536).

Variables	MFI		p value	MoFI/SFI		p-value
	OR	95%CI		OR	95%CI	
Head of household						
Years of schooling						
> 8	1.0			1.0		
4 to 8	0.71	0.42 – 1.17	0.180	2.31	1.24 – 4.30	0.008
> 4	1.44	0.81 – 2.55	0.210	4.56	2.31 – 9.03	< 0.001
Households						
Per capita income						
> 2	1.0			1.0		
> 1 to 2	1.17	0.51 – 2.67	0.703	1.83	0.36 – 9.29	0.465
> ½ to 1	2.13	0.98 – 4.64	0.055	4.06	0.88 – 18.76	0.073
From ¼ to ½	4.66	1.98 – 10.96	< 0.001	12.44	2.55 – 60.64	0.002
Up to ¼	3.12	0.97 – 10.09	0.057	25.0	4.32 – 144.4	< 0.001
Resident under 18 years old						
No	1.0			1.0		
Yes	1.05	0.66 – 1.65	0.850	0.52	0.28 – 0.95	0.034
Social assistance benefit						
No	1.0			1.0		
Yes	2.13	1.07 – 4.24	0.031	2.42	1.10 – 5.33	0.028
Drinking water						
Yes	1.0			1.0		
No	1.07	0.70 – 1.63	0.757	1.74	1.04 – 2.93	0.036

OR: odds ratio; 95%CI: 95% confidence interval; p value: significance level (p < 0.05); MFI: mild food insecurity; MoFI/SFI: moderate/severe food insecurity.

in moderate/severe food insecurity situation and families receiving social assistance benefits, in this case the Bolsa Família Program, had a greater chance of being in a food insecurity situation at all levels when compared to those who did not receive the benefit. Not having access to drinking water in the household increased the chances of moderate/severe food insecurity by 1.74.

DISCUSSION

According to the data collected in this research, the municipalities evaluated showed a high percentage of food insecurity (63.4%), from its mild form, when there is concern about ensuring regular and permanent access to food, to moderate and severe levels, characterized by restricted access to food or even hunger[18]. These results are higher than the prevalences described in the National Household Sample Survey (PNAD) of 2013, in which 22.6% of Brazilian households, 36.1% of those in the North Region and 37.6% in the state of Tocantins, were in a situation of food insecurity, highlighting the prevalence of the State above the national average and the North Region average[14].

High prevalences of food insecurity were also found in surveys carried out in municipalities in the north of Alagoas, where 63.7% of the households studied were at some level of food insecurity[19;] in households located in the urban area of Brazil's Legal Amazon[10] and in the Northeast Region[20], which presented 51.8 and 54.2% of families, respectively, in a condition of food insecurity. In addition, in these studies, some factors associated with food insecurity corroborate the findings of this investigation, such as: years of schooling of the head of household[19], low *per capita* income[10,20], individuals benefiting from social assistance program[19,20] and absence of access to drinking water in the household[10,19].

Previous studies have also shown a positive relationship between food insecurity and the low level of schooling of the head of the household[3,11,19,21,22] and the low per capita *family income*[3,4,11,21,23], as was also found in this study. It can be said that food insecurity is closely related to income, since its limitations commonly result in restricted access and availability of food. Similarly, the level of schooling is also closely related to this situation, as it is considered a proxy for income[24].

A noteworthy result in this study is the inverse association between moderate/severe food insecurity and the presence of individuals under 18 years of age, since other studies have reported a higher prevalence of food insecurity in households with individuals under 18 years of age[14,19,25,26]. It is worth remembering that, in general, the highest percentage of food insecurity in this study was found in households with residents under 18 years old. Possibly, this inverse relationship with food insecurity is due to the fact that moderate and severe food insecurity prevailed among households without children and adolescents in six of the eight microregions studied.

In the sample surveyed, 33.9% of households had elderly residents; in addition, most of these households were in a situation of food insecurity and had only residents over 18 years of age (data not described in table). The aspects described above justify the greater chance of severe food insecurity in households only with individuals over 18 years of age found in this research, as the elderly tend to have lower levels of income and schooling when they belong to families in a food insecurity situation. In addition, when the elderly person has greater disability, an adult individual often stops working to dedicate themselves to their care, and start relying only on the elderly person's retirement[27]. In addition, food insecurity

in households with elderly persons, even if they are not low-income, can also be associated with higher expenses with medicine and health services[28].

The fact that families receiving social assistance benefits from the Bolsa Família Program have a greater chance of food insecurity corroborates the results of other studies[4,19,20,23], demonstrating that households with beneficiaries are in a situation of greater socioeconomic vulnerability[23].

A systematic review of the literature that assessed food insecurity in different regions of Brazil also pointed out that studies with beneficiary populations of the Bolsa Família Program found a greater chance of moderate food insecurity when compared to population bases[29].

It is noteworthy that, in this sample, most of the families that received social assistance benefits (82.5%) had a *per capita* income of up to ½ minimum wage (data not shown in table), a factor related to food insecurity in the households surveyed.

The high prevalence of food insecurity among beneficiaries of social programs compared to non-beneficiaries at the same socioeconomic level points to the need for a greater understanding of other characteristics of this population. Due to how difficult it is for a family to get out of extreme poverty without State subsidy, the Federal Government invests in social assistance programs in order to fight hunger and poverty[26]. Therefore, the relevance of the social protection that these benefits provide for the beneficiary families must be considered[30].

Households without access to drinking water were more likely to experience moderate/severe food insecurity, which corroborates studies conducted in Rio de Janeiro and Paraíba[21,31]. Higher prevalence of food insecurity also occurred in households with an absence of treated water evaluated in the municipalities of Picos, Piauí, and Viçosa, Minas Gerais[11,32].

It should be noted that access to quality water is also considered a basic human right and must be guaranteed for the entire population[33]. Also, according to the World Health Organization (WHO), the lack or precariousness of water supply constitutes a public health risk, as it causes infectious and parasitic diseases that affect the nutritional status of individuals and, consequently, contribute to food insecurity among families[10].

Among the main findings of this study, it was observed that the variables *per capita* income, years of schooling of the head of the household, receiving benefits from a social assistance program and absence of drinking water in the household were associated only with moderate/severe food insecurity. Although only *per capita* income was also positively associated with mild food insecurity, it is known that, in general, food insecurity, at all levels, is directly associated with the population's socioeconomic and demographic characteristics.

Factors generally related to poverty and difficulty in access to public policies, such as basic sanitation, quality water, health and education, determine the conditions of food and nutritional insecurity of a population, thus showing the scope and complexity of this phenomenon[34]. This socioeconomic connotation of food insecurity in Brazil was also evident in the 31 studies analyzed by Bezerra et al.[29], which considered the frequencies and factors associated with food insecurity in different sociodemographic scenarios.

Discrepancies in access to safe and healthy food are consequences of inequity in socially produced food security and negatively impact the quality of life of families[35]. Therefore, based

on the identification of families that are vulnerable to these situations, it is possible to define priorities and local actions to guarantee food and nutritional security and the human right to adequate food.

One limitation to be considered is in relation to the EBIA's hypersensitivity and the need for the interviewee's understanding, memory and perception when answering it, which may underestimate or overestimate the true situation of the family regarding food insecurity. However, it should be noted that EBIA has been widely used in Brazil, being considered a highly valid and relevant instrument for assessing and monitoring food insecurity[36].

The main findings of this study reveal, therefore, the high prevalence of food insecurity in the families studied, with the low level of schooling of the head of the household, the lower per capita income, the receipt of benefits from social assistance programs and the lack of drinking water in the household being factors associated with food insecurity. These conditions, added to others that contribute to the situation of food insecurity, make these families more vulnerable, showing the need and the importance of local public actions and policies, both to improve health and education conditions and to generate jobs and income for the population, resulting in an improvement in the scenario of food and nutritional insecurity in the State. Finally, due to the scarcity of research on food and nutritional security in the Northern Region and Tocantins, and because it is a representative sample of the population, the data presented here must be considered, as new research is key to facing the problems related to food and nutritional insecurity in municipalities and the state.

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