

Factors associated with food insecurity risk and nutrition in rural settlements of families

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Abstract *Food insecurity occurs when the right to food in adequate quality and quantity on a regular basis is disrespected. This study aimed to identify food and nutrition insecurity (FNI) and its possible association with socioeconomic and dietary variables in rural settlements of Sergipe. We verified food insecurity through the Brazilian of Food Insecurity Scale and associations via odds ratio multivariate regression analysis. We evaluated 179 families from four rural settlements in the state of Sergipe. An FNI prevalence of 88.8% was identified (48.6% light insecurity, 25.1% moderate and 15.1% severe). An adjusted statistical association was found between FNI and variables family income per capita ($OR_a = 3.11$, $p = 0.008$) and food variety ($OR_a = 2.73$, $p = 0.004$). Families showed high prevalence of food and nutritional insecurity, determined by low income and low variety of food in this population. It is essential to implement more effective and comprehensive public policies that actually ensure food security, also aiming at nutrition education and greater food production opportunities.*

Key words *Rural settlements, Food security, Socioeconomic factors*

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Introduction

According to Law 11.346/2006, Food and Nutrition Security (FNS) includes the realization of the universal right to regular and permanent access to quality food in sufficient quantity, without compromising access to other essential needs, based on health-promoting food practices that respect cultural diversity and are environmentally, culturally, economically and socially sustainable¹.

Food insecurity measured according to the Brazilian Food Security Scale (EBIA) ranges from the lightest level, where there is concern about the uncertainty of access to food, to the most serious level, characterized by hunger. The UN estimated that, in 2013, 867 million people worldwide were chronically undernourished and 70% of people living in Food and Nutrition Insecurity (FNI) were from rural areas².

In Brazil, despite the reduction when compared to 2004, 22.6% of households are in some level of food insecurity, which represents 52 million people. The rural area shows prevalence of food insecurity higher than the urban area, and the Northeast has the highest percentages of food insecurity in Brazil, as well as the highest percentage of families in moderate or severe food insecurity in the Brazilian rural area³.

An important part of the rural population is in the settlements, since it represents almost 1 million of Brazilian families. In addition, it promotes an increased food supply and a decreased rural exodus. The Northeast accounts for about 30% of these families, but with only 11.2% of the hectares allocated to settlements in Brazil⁴.

In Sergipe, most of the settlements are located in low-fertility soils, dry climate and low infrastructure and are far from economically active areas⁵. Although agrarian reform is a project of national relevance with a high-level commitment in its implementation, land appropriation is no guarantee of food security⁶⁻⁸.

Studies have shown the relationship of FNI with lower family income, low schooling, greater number of household residents, inadequate basic sanitation, lack of employment relationship and higher prevalence among rural families⁹. As for food intake, besides the quantitative restriction identified by the Brazilian Food Insecurity Scale (EBIA), FNI has also been associated with a lower dietary quality, with lower consumption of protein-rich foods (belonging to the group of legumes, milk and derivatives, meat and eggs) and regulators (fruits and vegetables), as well as greater lack of meals and glycidic uptake⁹.

The importance of a healthy and adequate diet for the promotion of health and the prevention of diseases by both nutrients' deficit and excess is known¹⁰.

Considering the eradication of hunger as a goal of the millennium², the vulnerability of rural settlements and the importance of the topic for the formulation of more effective public policies, this study aimed to evaluate the association between food insecurity and dietary and socioeconomic variables of families in rural settlements in Sergipe.

Methodology

This cross-sectional analytical study was part of the research project "Participatory Experimentation and Agroecology in Rural Settlements of Sergipe" under the coordination of EMBRAPA Coastal Tablelands in partnership with the Federal University of Sergipe. Socioeconomic, anthropometric, dietary and food insecurity data were collected between May 2011 and 2013.

The study population consisted of 179 families, out of 184 families, belonging to four settlements located in Sergipe regions, such as the São Sebastião (ARSS, Pirambu, Eastern Sergipe), the José Gomes da Silva (ARJGS, Lagarto, Central-South Sergipe), the Novo Marimbondo (ARNM, Tobias Barreto, Central-South Sergipe) and the José Felix de Sá (ARJFS, Aquidabã, Mid-hinterland of Sergipe). According to the National Institute for Colonization and Agrarian Reform (INCRA), 170 families benefited from agrarian plots in these four settlements, however, during collection, we noted that some children of the beneficiaries formed families and built residences within the parents' plot, which justifies a larger number of participants in the survey¹¹.

Properly trained personnel carried out data collection, thus, it was necessary for researchers to remain in the settlements for a few weeks due to the difficult access and distance of locations.

Families were visited in their homes and, after signing the Informed Consent Form, the head of the family, he/she who contributed with the highest income, answered a previously structured socioeconomic questionnaire and the 24-hour reminder. In addition, a method adapted and validated for the Brazilian urban and rural population used by the Brazilian Institute of Geography and Statistics (IBGE) for National Household Sample Survey (PNAD) was also applied.

This method consists of 15 questions with a yes/no answer on food restriction due to eco-

conomic constraints in the last three months. The following cutoff points according to affirmative answers were considered for families with members under 18 years of age: 1-5 light insecurity (LI), 6-10 moderate insecurity (MI) and 10-15 severe insecurity (SI). For families without children under 18 years of age, affirmative answers cutoff points were: 1-3 LI, 4-5 MI, 6-8 SI, and no affirmative response was considered as food security for both cases¹². Food security or insecurity situation was adopted as a dependent variable. Anthropometric measurements were also performed on all family members, totaling 706 people.

The socioeconomic variables investigated refer to schooling, profession, age, gender and monthly income of residents of each household, as well as participation in some type of Government Cash Transfer Program (CTP). The criterion adopted in this paper for the definition of poverty and extreme poverty lines uses cut-off points designated by the World Bank, where US\$ 1.00 per day per person is the extreme poverty line and US\$ 2.00 per day per person is the poverty line¹³, calculated from the total family income, including CTP amounts.

For greater reliability, the 24-hour reminder was applied with the help of a photo album with portions of various foods of varying size made from several other albums¹⁴⁻¹⁷.

Nutrient intake and food groups were estimated using the Nutrition Data System for Research software (NDSR, Version 2011, Minneapolis, University of Minnesota), a computerized diets analysis program. The nutrient content data of the software were compared to the Food Composition Table (TACO), and when less than 80% or in excess of 120% were corrected according to the value found in the reference table¹⁸. The evaluation was based on the Dietary Reference Intake¹⁹ and according to the Brazilian Food Guide¹⁰.

A varied diet is one consisting of at least five food groups, excluding oils and fats and sweets and sugars groups.

As for anthropometric measures, BMI was calculated for adults and elderly and BMI/age for children and adolescents, identifying the nutritional status. Diagnosis was based on WHO recommendations²⁰.

Tools used were Lider electronic scale, P-150M model, with capacity of 150 kg, with 100g scale; Altuxeta portable stent with bilateral scale of 35 to 213 cm and 0.1cm resolution; Sanny Medical measuring tape in flat steel with

0.5cm width and 0.1cm precision and; Lange® adipometer developed by Cambridge Scientific Industries, USA.

Statistical analysis was performed with IBM SPSS Statistics 16.0 software. Descriptive analyzes were performed to characterize population, Pearson's chi-square test and gross and odds ratio-adjusted prevalence ratios, which were applied to investigate the association between independent (socioeconomic, dietary and anthropometric) variables with prevalence of food insecurity. Associations with $p < 0.20$ were selected for the adjusted multivariate regression model, with a statistical significance of $p < 0.05$ and CI of 95%.

For better statistical adjustment, dependent variables were classified into two groups: 1) Food and Nutrition Security and Light Food Insecurity (FNS – LFI) and 2) Moderate and Severe Food Insecurity (MSFI). Research was approved by the Ethics Committee for Research with human beings, Federal University of Sergipe.

Results

In these settlements, lands are mainly geared to agriculture, while only a small part is destined to cattle raising. Its main common crops are maize, beans and manioc. These foods are generally used for subsistence, but are also marketed at street markets when they exceed production. Regarding cultivation, vegetable gardens are set in some houses, aiming the local commerce. The use of agrochemicals is common practice, and these are bought by the farmers themselves in agricultural houses, not always with the correct technical recommendation.

They have incomplete infrastructure, with electric power, but not all have piped water, solid waste disposal and sewage treatment. Settlements lack operational schools or health centers, therefore, it is necessary to move to neighboring communities. Settlements leisure activities are mainly to go to bars, football games, local festivities and religious mass.

Sociodemographic characterization of the four settlements in Sergipe (Tables 1 and 2) analyzed from 179 families showed that, of the heads of households, 73.2% were male, 40.2% were overweight, 71.5% were farmers and 67.4% had four or fewer people residing in the household. It is important to highlight that two heads of families were not submitted to anthropometry evaluation due to their absence in the settlements on collection days. Thus, the nutritional status

sample was reduced to 177 individuals. The most common family composition was a couple with children (62.6%). It is important to note that no head of household had access to higher education and 78.2% had incomplete elementary education. In addition, 19% of households were classified below the poverty line (extreme poverty).

While none of the settlements studied have schools, when compared to schooling between heads and children of the family, children have higher schooling, with 1.9% of illiteracy, 11% of incomplete secondary education and 0.6 % attending higher education, corroborating results from other studies²¹.

The prevalence of food insecure families was 88.8%, of which 48.6% with LFI, that is, with uncertainty regarding access to food in the future, 25.1% with MFI, indicating a qualitative and quantitative food restriction for adults, and 15.1% with SFI, meaning a quantitative restriction even for children, with possible hunger episodes²². Cronbach's alpha reached 0.91, which is excellent, showing that questions were answered

Table 1. Characterization of food, sociodemographic and socioeconomic insecurity of settled families. Sergipe, 2014.

Characterization	N	Frequency (%)
Food (in)security		
Food Security	20	11
Light Insecurity	87	49
Moderate Insecurity	45	25
Severe Insecurity	27	15
People in the household		
≤ 4	121	68
5 – 6	35	19
≥ 7	23	13
Cash Transfer Beneficiaries		
Yes	149	83
No	30	17
Family Composition		
Couple without children	27	15
Couple with children	112	63
Single mother with children	13	7
Other relatives	27	15
Income per capita		
Extreme poverty	34	19
Poverty	47	26
Above poverty line	98	55

according to the theoretical expectation of the very scale, in increasing order of seriousness of food insecurity.

Table 2. Sociodemographic and nutritional characterization of heads of settled families. Sergipe, 2014.

Characterization	N	Frequency (%)
Age group		
Elderly	39	22
Adults	136	76
Adolescents	4	2
Gender		
Male	131	73
Female	48	27
Schooling		
Illiterate	28	16
Elementary school – Incomplete	140	78
Elementary school – Complete	4	2
Secondary school – Incomplete	4	2
Secondary school – Complete	3	2
Occupation		
Unemployed	3	2
Self-employed	128	71
Retired	34	19
Housewife	7	4
Other (Formal Contract)	7	4
Nutritional State (BMI)*		
Low weight	19	11
Eutrophy	86	48
Overweight	72	40
Low Intake of Food Groups		
Cereals, breads, tubers and roots.	119	66
Fruits	160	89
Vegetables	162	90
Meat	19	11
Milk and dairy products	168	94
Legumes and oilseeds	33	18
Oil and fat	67	37
Sugar and candies	79	44
Varied diet		
Yes	113	63
No	66	37
Sufficient diet		
Yes	20	11
No	159	89

* Considering a sample size of 177 heads of household.

Associations between variables are described in Table 3. A statistical association was found between Food and Nutrition Insecurity (FNI) and variables per capita family income, meat and eggs group intake, interval between meals and varied diet.

There were no associations with significant differences between food insecurity and energy intake, schooling, protein intake (g/kg) and with regard to the number of household residents. There were also no associations between being a beneficiary or not of a Cash Transfer Program (CTP) and gender of the head of the family and FNI.

In Table 4, we can observe the odds ratio and the 95% confidence interval of FNI determinants

in the final model of the adjusted regression. Variables that remained related to food insecurity were unvaried diet and per capita income “extreme poverty” that were, respectively, 2.7 and 3.11 times more likely to be in MSFI. Categories interval between meals and protein intake remained in the model for better adjustment of variables.

Discussion

The main findings of this study include the identification of high FNI rates (88.8%) in rural settlements in Sergipe and the relationship of this situation associated with low income and low

Table 3. Gross Odds Ratio (OR) and Confidence Interval (CI) for food (in) security according to variables related to family and data of the head of the household in rural settlements. Sergipe, 2014.

Variable	FNS - LFI		MSFI		P-value*	OR	CI 95%	
	N	%	N	%			Low	High
Schooling					0.117	1.903	0.845	4.287
Illiterate	13	46.4	15	53.6				
Literate	94	62.3	57	37.7				
Income <i>per capita</i>					0.001	3.483	1.593	7.616
Extreme poverty	12	35.3	22	64.7				
No extreme poverty	95	65.5	50	34.5				
Underage with Low Weight					0.102	2.773	0.781	9.846
Yes	4	36.4	7	63.6				
No	103	61.3	65	38.7				
Overweight					0.199	1.492	0.810	2.749
Yes	39	54.2	33	45.8				
No	67	63.8	38	36.2				
Meat and Eggs Group					0.008	3.709	1.338	10.278
Below	6	31.6	13	68.4				
Adequate and Above	101	63.1	59	36.9				
Protein Intake (g/kg)					0.056	2.914	0.934	9.089
Below EAR	5	35.7	9	64.3				
Adequate and Above	102	61.8	63	38.2				
Interval Between Meals					0.007	2.441	1.267	4.701
≥ 4 hours	59	52.2	54	47.8				
< 4 hours	48	72.7	18	27.3				
Varied Diet					0.000	3.502	1.853	6.618
No	27	40.9	39	59.1				
Yes	80	70.8	33	29.2				

* Pearson's Chi-square test. FNS - Food and Nutrition Security. LFI - Light Food Insecurity. MSFI - Moderate and Severe Food Insecurity.

food variety. When compared to data published by PNAD (2014), the prevalence of FNI found in this study was more than triple the average found in Brazil (22.6%) and considerably higher than the prevalence found in the Northeast (38.1%). The moderate and severe food insecurity in this study is 40.2%, much higher than the rural areas of the Northeast (20.1%) and Brazil (7.8%)³. With regard to other settlements in different regions of the country, whose percentage of MSFI ranges from 0 to 22%, we note that the prevalence presented in this study is a matter of much greater concern^{6,7,8,21,23}. The low food production during the collection period may have probably exacerbated these percentages, especially due to water scarcity caused by frequent droughts in the studied region, considering that, in 2013, the worst drought in the last 30 years left 1,228 municipalities in the northeast region in a state of emergency²⁴.

The FAO Statistical Yearbook (2013) reported that, between 2010 and 2012, 19.1% of the world's population suffered from deprived access to food, with a higher percentage in low-income countries and a higher concentration in Africa (28.9%) than in developing countries (22.5%). When viewed in more detail, it is possible to identify that North Africa has a much lower percentage (5.8%) than sub-Saharan Africa (33.3%). Countries with the worst rates are Burundi (81.4%), Cameroon (77.8%), Eritrea (75.4%), Somalia (74.3%), which are close to the percentage found in this study, and Zambia (56.3%), all of these Africans, in addition to Haiti (53.2%), located in Central America².

The lack of association between FNI, energy intake and body composition variables may reflect the nutritional transition, demonstrating

that FNI is not necessarily characterized by malnutrition anymore. Some studies have already identified a relation between food insecurity and overweight, since it has increased in the economically disadvantaged classes, probably due to the acquisition of foods with low nutritional value and high caloric density at lower prices^{9,25,26}.

In contrast to other studies^{9,27-30}, schooling showed no association with FNI, probably because this population is very homogeneous regarding low schooling, a result also found in other settled populations^{7,21,31}. Low schooling contributes to people generally not getting well paid work opportunities outside the settlements, not promoting increased income and decreased food insecurity. At the same time, there is hope for improvement, since an increasing number of children and adolescents are achieving higher levels of schooling, which may reflect improvements in relation to the current situation.

The lack of association between FNI and gender of the head of the family goes against other studies that found the greatest vulnerability to FNI when family head was female^{27,30}. In this study, the prevalence of the same profession (farmers) with similar conditions to produce food and the low prevalence of female heads of household with child and without spouse influenced this result. However, it should be noted that, in general, when women are recognized as the receiving beneficiaries of funds from cash transfer programs, families are strengthened, as there is an acknowledgment that funds will be obtained for their benefit. In addition, they prioritize the diet of children and when food is insufficient, as in the case of this study, there is a need to support women even more so that they can feed themselves and ensure family sustenance. However, it

Table 4. Gross odds ratio adjusted by multivariate logistic regression for moderate and severe food insecurity in rural settlement families. Sergipe, 2014.

Variables	MSFI		CI 95%		P-Value	OR _a	CI 95%	
	N	%	Low	High			Low	High
Extreme Poverty	22	64.7	1.338	10.278	0.008	3.111	1.351	7.164
Unvaried diet	39	59.1	1.853	6.618	0.004	2.737	1.370	5.469
Interval between meals	54	47.8	1.267	4.701	0.129	1.748	0.850	3.595
Protein Intake (g/kg)	9	64.3	0.934	9.089	0.17	2.405	0.687	8.420

OR_b = Gross Odds Ratio OR_a = Adjusted Odds Ratio. CI = Confidence Interval.

MSFI = Moderate and Severe Food Insecurity.

is perceived that, even with several public policies stimulating women empowerment, this is still far from the truth in many rural areas.

It is known that low family income is one of the main determinants of FNI.^{9,27-30,32,33} In this population, the average monthly income was R\$ 651.00 (US\$192,69), a figure slightly lower than the minimum wage in force in 2013, which was R\$ 678.00 (US\$ 200,59). Some 83.2% of the families received some type of government CTP. Of these, 73.7% received the *Bolsa Família* (Family Grant) Program (PBF). It is important to highlight the role of this program toward improving family income and its effectiveness in reducing FNI³⁴. Possibly, without the presence of CTPs, the situation of food insecurity would have been even worse, since some families declared that this was the only source of fixed income.

Nevertheless, while increased income decreases the possibilities of FNI due to increased purchasing power and that most of the income has been shown to be geared to the purchase of food³⁵, several studies indicate that improved income does not necessarily imply better diet quality^{26,35-38} and nutritional status³⁹. A study by the Brazilian Institute of Social and Economic Analyses (IBASE) which identified the repercussions of the PBF on the food security of beneficiary families found an increased purchase of sugars, cookies and other industrialized products, as well as a preference for food purchases that children enjoy most³⁵. Another study carried out with the PBF beneficiary population in the city of Curitiba found a monotonous diet and low consumption of fruits, vegetables and dairy products, a result similar to this study³⁶.

In this study, it was observed that, among the food groups with intake below the recommended minimum, fruits (89.4%), vegetables (90.5%) and milk and derivatives (93.9%) stand out. These data reflect a high percentage of inadequacy for several nutrients such as fiber (90%), vitamin A (77.1%), C (73.7%) and E (96%), as well as minerals such as calcium (86%), magnesium (90%) and potassium (91.6%) (data not shown). It is important to note that adequate intake of these nutrients can reduce the risk of cardiovascular disease, improve plasma cholesterol levels and increase the efficiency of the immune system¹⁶.

The most consumed food groups were meat, legumes, oils and fats (considered by the high frequency of foods prepared by frying and consumption of margarine cited by 29.05% of the population), as well as the group of sweets (rep-

resented mainly by white sugar, 91.6%, frequently used in the preparation of coffee) and the group of cereals, pasta, roots and tubers, where the most cited foods were couscous (67.03%), manioc flour (59.7%), white rice (79.3%) and white bread (56.98%).

It is important to mention that the food produced in the agrarian lots was basically corn, beans and manioc, in addition to a small production of vegetables and fruits. However, preference is given to trade in free markets. Associating these factors, we can understand the low intake of fruits, vegetables and milk and dairy products in this population. Possibly, the inadequate consumption of nutrients by the head of the family is due to the unavailability of all the food groups at home, suggesting that a similar consumption by other members of the family.

These results are similar to those of the Family Budget Survey (POF) in the years 2002-03 and 2008-09, which identified a declining consumption of fruits and vegetables, becoming insufficient, and excess calories from sugar and saturated fat in the diet of Brazilians, as well as a greater consumption of rice, beans, legumes, roots and tubers in rural areas and manioc flour in the Northeast. The consumption of milk, fruits, vegetables and meats has been shown to increase with income, unlike beans, tubers and roots^{40,41}. A high inadequacy for vitamins A, C, E, calcium and magnesium was also identified for age group from 19 to 59 years, regardless of the household being urban or rural⁴².

In this study, we understand that having a varied diet implies the ingestion of five food groups of the six main ones (fruits, vegetables, legumes, cereals, meats and milk and derivatives). This invariably requires not only a satisfactory family income of individuals, but also the existence of good eating habits, valuing food diversity, issues that are not always directly correlated.

The study has an important limitation regarding the period of data collection in view of the drought that occurred in the region. Such situation may have contributed to the diet and planting of the families and, consequently, to the perception of food insecurity. Another possible limitation was the use of EBIA, a psychometric scale that verifies the perception of food insecurity and possibly its food safety classification does not contemplate the definition of FNS of Law 11.366/2006. However, this is a method adapted to the Brazilian urban and rural population, with simple application and analysis, characterizing families at different levels of FNI. In addi-

tion to the easy understanding by the respondent and low cost, it is more frequently used in studies, including in national surveys, which allows greater reliability in the comparison of results. It should be noted, however, that this study reports a household survey conducted in four agrarian reform settlements located in three different regions of the state. It is possible that data shown represent the reality of other settlements in the region. In addition, it is unheard of to identify low dietary variety as a risk factor for food insecurity in rural settlement populations.

This result raises the importance of strengthening cash transfer public policies, such as the PBF, and that encourage the small farmer from more vulnerable families, such as the food purchase program (PAA). In addition, it is essential that they be associated with health education in the countryside, greater promotion of agroecological production, valuing of regional foods and their local marketing. It is believed that, given the results found, these could be key strategies to improve the food insecurity landscape of this population. Further studies with this population are also proposed to designate other possible food insecurity determinants and thus provide a better formulation of public policies.

Final considerations

The families studied showed high prevalence of food and nutritional insecurity, determined by low family income and low food variety. The population of this study evidenced great social vulnerability, even with a large portion receiving government cash transfers, predominantly the *Bolsa Família* Program. We also observed a monotonous diet based on rice, manioc flour, couscous, white bread, beans, meats and coffee. Consequently, also insufficient food, since much of the population cannot achieve even the minimum recommendation for important food groups such as milk and dairy products, fruits and vegetables. Although land tenure dignifies a previously forgotten population, these people still experience hardships in terms of access to education, basic sanitation, health and technical assistance services. In addition, food habits of this population may favor the prevalence and/or occurrence of NCDs, especially those related to food. Therefore, more effective comprehensive public policies that actually ensure food security are also required, aiming at food education and more possibilities to produce food. Thus, in the future, one can avoid the emergence of diseases and important psychological traumas arising from food insecurity.

Collaborations

JA Almeida participated in the data collection, analysis and discussion of results and was in charge of writing. Student co-advisor AS Santos coordinated data collection and discussion of results. MAO Nascimento participated in the data collection, analysis and discussion of results. JVC Oliveira participated in the data collection, analysis and discussion of results. DG Silva participated in the statistical Review and discussion of results. Student advisor RS Mendes-Netto participated in the whole process, from project design to data collection, analysis and discussion of results and the writing process.

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