Food insecurity in families with children under five years of age on the Brazil-Peru Amazon border

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Abstract:

Food and nutrition security is the regular and permanent access to quality food in sufficient quantity. The aim of this study was to estimate the prevalence and factors associated with food insecurity in households with children under five in the Amazon frontier Brazil - Peru. The study was conducted in 352 households in Assis Brasil (Brazil) and 89 households Iñapari (Peru), finding a prevalence of food insecurity of 40.6 % and 38.2 % , respectively (p = 0.856) . In Assis Brasil, having domicile with wood floors or land increased by 2.47 times the odds of food insecurity compared to cement floors, ceramic or quarry tiles . Belonging to the poorest tertile increased the chance of food insecurity in 6.04 times (p < 0.001), and the increment of each new resident increased by 37 % the chance of food insecurity in the household . In Iñapari, only living in house made of wood or with a wood floor was associated with food insecurity, showing that income is still the main factor associated with food insecurity in the Amazonian borders.

Keywords: food security, border health, hunger.

INTRODUCTION

Food and nutritional security consists in ensuring the right for all to regular and permanent access to quality food in sufficient amounts without compromising access to other essential needs, based on dietary practices that can promote health and respect cultural diversity and that are environmentally, culturally, economically and socially sustainable[1].

The major international measure to achieve food security is based on the first of the Millennium Development Goals (Eradicate extreme poverty and hunger)[2], concomitantly with the human right to a proper diet. It is estimated that 1 billion people worldwide do not have access to sufficient food in order to meet basic nutritional requirements or live in a condition of continual hunger, which indicates moderate and severe food insecurity[3].

The National Survey by Household Sampling (*Pesquisa Nacional por Amostragem de Domicílios - PNAD*), conducted in 2009, estimated that the prevalence of food insecurity in urban areas in Brazil was 30.9% and that severe food insecurity was 5.0%. The largest preva-lence rates were found in the Northeastern (46.1%) and Northern (40.3%) Regions. In Acre, 47.5% of the families residing in urban areas lived in food insecurity, and 10.4% were found to be in a severe condition[4].

Food insecurity is mainly determined by poverty and social inequality[5]. Studies that analyze factors associated with food insecurity are decisive for designing programs and public policies of preventive character and for health promotion[6].

The outcomes of food insecurity can be observed mainly in the most vulnerable groups. Child mortality, impaired physical and mental development, low weight at birth, maternal mortality, increased school dropout and poorer school performance are events related to the lack of a healthy quality diet as a consequence of precarious access to income and to goods and services[7]. For instance, low birth at weight is still a common feature in Acre[8], while low weight for height in school children is not frequent[9]. This could be a consequence of maternal exposition to food insecurity during pregnancy, which is modified later by food received at school. Various international studies have reported a direct relationship

of food insecurity with an impaired nutritional status in children[10-13], and nutritional deficits are still a common feature in Brazilian children less than five years old[14], suggesting a high prevalence of food insecurity in some areas of the country.

Although some studies have been performed on food insecurity in the general population in the Amazon[15,16], there are no specific publications addressing the situation of children in that region. The Amazon has a large diversity of fish and fruit, which should represent an abundant supply of energy, protein, vitamins and minerals, thus providing excellent health, nutrition and life-quality standards to its different population groups[17]. However, the social and economic reality added to the precarious health and nutritional conditions reported in that region strongly contrast with its richness of biological resources.[17] This study aimed at estimating the prevalence of and the factors associated with food insecurity in families with children under five years of age on the Brazil-Peru Amazon border.

■ METHODS

The study was conducted in the cities of Assis Brasil (Brazil) and Iñapari (Peru), located on the triple border formed by Brazil, Bolivia and Peru. Assis Brasil is located on the Acre River Valley (*Vale do Rio Acre*), 344 miles to the Southwest of Rio Branco, the capital city of Acre state. It covers an area of 4,974 km^2, and it is bordered by the city of Brasiléia, to the East, and by the cities of Bolpebra (Bolivia) and Iñapari (Peru), to the South. In 2010, Assis Brasil had a total population of (urban and rural areas) of 6,017 inhabitants (3,057 men and 2,960 women) of whom 12.76% were 0 to 4 years old[18].

The city of Iñapari, with 21,126 km^2, is located in the department of Madre de Dios, in the Amazon province of Tahuamanu. It is limited by the Acre River, on the border with Brazil, and the Yaverija River, on the border with Bolivia, thus being 241 km away from Puerto Maldonado. In 2007, its population comprised 996 individuals[19], and the population forecast for 2010 was of 1,434 people[20].

The population studied was selected from the census of households showing at least one child under 5 years of age, residing in the urban areas in the cities of Assis Brasil and Iñapari. Such households were found by using the Health Care Units of both cities.

Data were collected from January to February 2011 by means of interviews using questionnaires in order to investigate the children's socioeconomic, environmental and parental characteristics as well as their nutritional status.

Data concerning the family and family head's income were collected. However, that information was inadequate for analysis due to various reasons (inconsistent income due to temporary jobs, refusal to inform about income or lack of knowledge about the income of all family members or about income in the form of goods instead of money). Therefore, the researchers opted for designing a wealth index for the families, as those vali-

dated by Filmer and Pritchett for urban areas[21], which was described in detail in a previous study[22].

Digital pediatric scales (Soehnle®) with 10-g precision and 16-kg maximum capacity were used to measure the body weight of children under 2 years of age. A portable digital scale (Plenna®) with 100-g precision and 150-kg maximum capacity was used for children over two years of age. The children's length was obtained by using a portable infantometer with 1-cm precision placed on a flat surface. The height of children over 2 years of age was measured by a wooden stadiometer with 0.1-cm precision mounted on a wall without baseboards at a 90° degree angle in relation to the floor. All the anthropometric measurements were taken in duplicates. Whenever the two measurements differed, a third one was taken, and the two closest measurements were selected.

The Brazilian Food Insecurity Scale (*Escala Brasileira de Insegurança Alimentar - EBIA*) was adopted to measure the magnitude of family food insecurity. It was obtained by means of a structured questionnaire whose questions followed an increasing order of severity, beginning with those related to the concern about the possibility of lack of food, addressing the reduction in food quality and quantity in the family and finalizing with specific questions about the lack of food for one or more days[23]. Studies in Peru usually use the Latin American and Caribbean Food Security Scale (ELCSA). ELCSA was based on EBIA, and they are both very similar[24]. Since the objective was to compare both cities EBIA was used in both countries.

Statistical analysis

The socioeconomic index was obtained by Principal Component Analysis (PCA), using software XL-STAT, version 7.5.2 (Addinsoft, New York, NY, covariance parameters (n -1) and correlation biplot / coefficient = n, as described by Filmer and Pritchett[21]. Such index was created based on the presence of twenty-one consumer goods and house appliances (television, music system, DVD player, gas stove, refrigerator, washing machine, telephone, bicycle, blender, electric iron, car, sofa, satellite dish, cellular telephone, motorcycle, computer, boat, motor boat, water well, power generator and microwave oven), as described in a previous publication[22].

Height deficit was identified by the index height for age by adopting the cutoff point for height deficit for age ≤ -2 scores Z[25].

In order to analyze the food insecurity questionnaire, each affirmative answer represented 1 point, and the sum of such affirmative answers was the scale score, which ranged in the amplitude of 0 to 15 points. The families obtaining 0 points were considered to be in food security; slight insecurity from 1 to 5 points; moderate insecurity from 6 to 10 points and severe insecurity from 11 to 15 points.

A database was created in software SPSS 13.0 (SPSS Inc., Chicago, IL). The distribution of independent variables was identified by using the Kolmogorov-Smirnov test. Software R 2.14.0 was used for simple logistic regression analysis by analyzing the associated

factors and potential confusion factors, including categorical and continuous variables.

Initially, the independent variables showing associations with food insecurity with a *p* value < 0.20 (chi-square test for heterogeneity and of linear tendency) were selected to enter the final multiple model. In a second phase, multiple logistic regression was performed according to the stepwise forward method, and all the variables showing a *p* value < 0.05 were retained in the final model. The quality of fitting of the model was evaluated by the variance value, AIC (Akaike's Information Criterion) values.

The study was approved by the Ethics Committee for Human Research of Acre Federal University (Brazil) and of *Instituto Nacional de Salud* (Lima, Peru), processes 23107.008153/2010-92 UFAC and 2010-CI-59 – INS). Informed consent was obtained from the participants in the study or from the parents or legal guardians of the minors prior to the interview.

■ RESULT

Of the 441 households with children under 5 years of age identified, 352 (79.82%) were located in Assis Brasil, and the others in Iñapari.

Table 1 shows the comparison of the socioeconomic and demographic characteristics between the families in Assis Brasil (AB) and Iñapari (IN). In both cities, the houses are predominantly made of wood or similar materials, with wooden or earthen floors. The majority of streets are unpaved; however, in Iñapari, there are more sidewalks (47.2%) than in Assis Brasil (24.4%, p < 0.001).

Table 1: Socioeconomic, demographic and nutritional characteristics. Assis Brasil; Iñapari, 2011

Variables	Assis Brasil (n = 352)		Iñapari (n = 89)		p-value
	N	%	N	%	
Predominant material in the house					0,282
Wood or similar materials	301	85,5%	72	80,9%	
Cement or brick	51	14,5%	17	19,1%	
Household floor material					0,484
Wood or earth	243	69,0%	58	65,2%	
Cement, brick, ceramic tile	109	31,0%	31	34,8%	
Street Material					0,704
Unpaved or earth	258	73,3%	67	75,3%	
Brick or asphalt	94	26,7%	22	24,7%	
Sidewalk					< 0,001
No	266	75,6%	47	52,8%	
Yes	86	24,4%	42	47,2%	
Electricity in the household					0,625
No	12	3,4%	4	4,5%	
Yes*	340	96,6%	85	95,5%	
Garbage collected by public service					0,512
No	28	8,0%	9	10,1%	
Yes	324	92,0%	80	89,9%	
Open sewage					0,005
No	213	60,5%	68	76,4%	
Yes	139	39,5%	21	23,6%	
Lavatory					< 0,001
Sanitary with running water	214	60,8%	33	37,1%	
Common grave or missing	138	39,2%	56	62,9%	
Don't have running water systems	111	31,5%	29	32,6%	0,849
Don't live in their own home	107	30,4%	45	50,6%	< 0,001
Number of persons per household					0,277
≤ 4	187	53,1%	53	59,6%	
> 4	165	46,9%	36	40,4%	
Family income ≤ 1 Salary in last 30 days	132	40,5%	13	15,1	< 0,001
Head of the family had not paid work in the last 90 days	50	16,8%	6	6,7%	0,03
Receive a grant-aid*	99	28,1%	50	56,2%	< 0,001
Education of the main caregiver					< 0,001
< 8 years	182	51,7%	26	29,5%	
≥ 8 years	170	48,3%	62	70,5%	
Transportation					< 0,001
Walk or bike	252	71,6%	45	50,6%	
Motorcycle	54	15,3%	36	40,4%	
Car	46	13,1%	8	9,0%	
Children with low height for age in the household	52	15,5%	8	9,1%	0,124

* In Iñapari, electrical power is supplied from the 06h 00h In Assis Brasil, through the "bolsa família" program (average of 70 reais per person).
** In Iñapari, distribution of milk through the "glass of milk".

Sanitary conditions are more favorable in Assis Brasil, where there is a predominance of garbage collection by public and sanitary services. The households have running water systems. Nevertheless, open sewers are more frequently found in that city (39.5%) than in Iñapari (23.6%, *p* = 0.005).

As regards economic characteristics, they seem to be more favorable Iñapari, where there is a predominance of family incomes that are higher than minimum wages and where heads of families more often have remunerated jobs. However, the number of families on social welfare and who do not own their own homes is also larger. The education of younger-than-five-year-old children's main care providers was better in Iñapari, as 70.5% of such carers reported to have attended school for 8 years or longer (AB: 48.3%, p < 0.001). The mean prevalence of height deficit for age in children was 12.3%, and there were no significant statistical differences between the two cities (AB: 15.5%; IN: 9.1%, *p* = 0.124).

The prevalence of food insecurity in the cities was similar (Table 2). Assis Brasil showed 40.6% and Iñapari 38.2% (*p* = 0.856). When it was stratified by type, Assis Brasil sho wed 24.1% of slight food insecurity and 16.5% of moderate and severe food insecurity.

Table 2: Brazilian Scale of Food insecurity and prevalence of food insecurity. Assis Brasil; Iñapari, 2011

Variables	Assis Brasil (n= 352)		Iñapari (n= 89)		p-value
	N	%	N	%	
Issues of the Brazilian Scale of Food Insecurity					
1. Concern that the food was over	92	26,1%	26	29,2%	0,558
2. The food is over	62	17,6%	19	21,3%	0,416
3. Ran out of money for a healthy and varied diet	128	36,4%	22	24,7%	0,038
4. Had to make do with only a few foods to feed a resident <20 years	88	25,0%	15	16,9%	0,105
5. Can not offer any resident <20 years a healthy and varied diet	102	29,0%	20	22,5%	0,222
6. A resident <20 years did not eat enough food	39	11,1%	10	11,2%	0,967
7. Some adult decreases the amount of food or did not do meals	53	15,1%	17	19,1%	0,351
8. Head of the family ate less because they had no money	58	16,5%	18	20,2%	0,627
9. Family head was hungry but did not eat because he had no money	25	7,1%	9	10,1%	0,564
10. Head of the family lost weight by not having money to buy food	23	6,5%	4	4,5%	0,552
11. An adult was a whole day without eating	18	5,1%	6	6,7%	0,736
12. Decreased the amount of food a resident < 20 years	39	11,1%	12	13,5%	0,769
13. Head of the family failed to offer a meal to any resident < 20 years	24	6,8%	7	7,9%	0,832
14. A resident < 20 years was hungry but head of the family could not afford food	23	6,5%	6	6,7%	0,879
15. A resident < 20 years was a whole day without eating	4	1,1%	3	3,4%	0,284
Food Insecurity Level					0,949
Food Safety	209	59,4%	55	61,8%	
'Mild' Insecurity	85	24,1%	19	21,3%	
'Moderate' Insecurity	37	10,5%	10	11,2%	
'Severe' Insecurity	21	6,0%	5	5,6%	

In Assis Brasil, socioeconomic and demographic characteristics varied according to the level of food security (Table 3). In the households showing severe and moderate food insecurity, unfavorable housing, sanitation and income conditions predominated, such as: wooden or earthen floors, unpaved streets without sidewalks, family income equal to or lower than minimum wages, among others. On the other hand, slightly more favorable conditions predominated in the households showing food security, such as brick houses with running waters systems and income equal to or higher than minimum wages. The households classified as being in mild insecurity showed similar physical housing conditions to those in moderate and severe insecurity, while sanitation conditions and income indicators showed to be intermediate between the households with food security and insecurity (Table 3).

In Iñapari, the households showed different physical characteristics according to the food security situation. Wooden houses with earthen floors were more frequent for households classified as being in food insecurity (Table 4).

The factors associated with food insecurity in the city of Assis Brasil, as obtained by multiple logistic regression, were wooden or earthen house floors, belonging to the poorest tercile and the number of household members (Table 5). Having a house with wooden or earthen floors increased the chances of being in food insecurity by 2.47-fold as compared to having a house with cement, brick, ceramics or tile floors. Belonging to the poorest tercile increased the chance of food insecurity by 6.04 - fold (*p* < 0.001), and the addition of each new dweller increased the chance of food insecurity in the household by 37%.

■ DISCUSSION

The Brazil-Peru-Bolivia border region is formed by different nationalities, ethnicities and cultures that participate in the intense movements of people circulation in the region. The physical location poses similar challenges to both cities (Assis Brasil and Iñapari), while the cultural habits and economy of each country may be modifying factors of life conditions.

Socioeconomic and sanitation conditions in Assis Brasil and Iñapari show similarities and differences. The physical characteristics of the households are similar, con-

Table 3: Socioeconomic characteristics, demographic and stunting according to (in) security food level. Assis Brasil, 2011

Variables	Total (n = 352) N	%	Security Food (n = 209) N	%	Mild Insecurity (n = 85) N	%	Moderate and Severe (n = 58) N	%	p-value
Predominant material in the house									**0,001**
Wood or similar materials	301	85,5%	167	79,9%	81	95,3%	53	91,4%	
Cement or brick	51	14,5%	42	20,1%	4	4,7%	5	8,6%	
Household floor material									**< 0,001**
Wood or earth	109	69,0%	123	58,9%	68	80,0%	52	89,7%	
Cement, brick, ceramic tile	243	31,0%	86	41,1%	17	20,0%	6	10,3%	
Street Material									**< 0,001**
Unpaved or earth	258	73,3%	138	66,0%	68	80,0%	52	89,7%	
Brick or asphalt	94	26,7%	71	34,0%	17	20,0%	6	10,3%	
Sidewalk	86	24,4%	67	32,1%	13	15,3%	6	10,3%	**< 0,001**
Lavatory									**< 0,001**
Sanitary with running water	214	60,8%	152	72,7%	43	50,6%	19	32,8%	
Common grave or missing	138	39,2%	57	27,3%	42	49,4%	39	67,2%	
Don't have running water systems	111	31,5%	41	19,6%	36	42,4%	34	58,6%	**< 0,001**
Don't live in their own home	107	30,4%	54	25,8%	25	29,4%	28	48,3%	**0,004**
> 4 residents per household	165	46,9%	82	39,2%	46	54,1%	37	63,8%	**0,002**
Family income ≤ 1 Salary in last 30 days	132	40,5%	52	26,9%	45	55,6%	35	67,3%	**< 0,001**
Head of the family had not paid work in the last 90 days			29	15,3%	8	12,3%	13	29,5%	**0,042**
Receive a grant-aid*	99	28,1%	32	15,3%	34	40,0%	33	56,9%	**< 0,001**
Socioeconomic index									**< 0,001**
Tertile richest	128	-	101	48,8%	21	24,7%	6	10,3%	
2nd tertile	131	-	77	37,2%	32	37,6%	22	37,9%	
Tertile poorest	91	-	29	14,0%	32	37,6%	30	51,7%	
Education of the main caregiver									**< 0,001**
< 8 years	182	51,7%	81	38,8%	55	64,7%	46	79,3%	
≥ 8 years	170	48,3%	128	61,2%	30	35,3%	12	20,7%	
Car or bike for transportation	252	71,5%	79	37,8%	18	21,2%	3	5,2%	**< 0,001**
Children with low height for age in the household	52	15,50%	22	10,9%	18	22,5%	12	22,2%	**0,018**

* Grant-aid through the "bolsa família" program (average of 70 reais per person).

Table 4: Socioeconomic characteristics, demographic and stunting according to (in) security food level. Iñapari, 2011

Variables	Total (n = 89) N	%	Security Food (n = 55) N	%	Insecurity Food (n = 85) N	%	p-value
Predominant material in the house							0,013
Wood or similar materials	72	80,9%	40	72,7%	32	94,1%	
Cement or brick	51	14,5%	42	20,1%	4	4,7%	
Household floor material							< 0,001
Wood or earth	31	65,2%	26	47,3%	32	94,1%	
Cement, brick, ceramic tile	58	34,8%	29	52,7%	2	5,9%	
Street Material							0,838
Unpaved or earth	67	75,3%	41	74,5%	26	76,5%	
Brick or asphalt	22	24,7%	14	25,5%	8	23,5%	
Sidewalk	42	47,2%	26	47,3%	16	47,1%	
Lavatory							0,468
Sanitary with running water	33	37,1%	22	40,0%	11	32,4%	
Common grave or missing	56	62,9%	33	60,0%	23	67,6%	
Don't have running water systems	29	32,6%	14	25,5%	15	44,1%	0,068
Don't live in their own home	45	50,6%	27	49,1%	18	52,9%	
> 4 residents per household	36	40,4%	24	43,6%	12	35,3%	0,436
Family income ≤ 1 Salary in last 30 days	13	15,1%	7	13,2%	6	18,2%	0,55
Head of the family had not paid work in the last 90 days	6	6,7%	2	3,9%	4	12,5%	0,199
*Receive a grant-aid**	50	56,2%	27	49,1%	23	67,6%	0,086
Socioeconomic index							0,188
	29	-	20	36,4%	9	26,5%	
Tertile richest	29	-	20	36,4%	9	26,5%	
2nd tertile	31	-	21	38,2%	10	29,4%	
Tertile poorest	29	-	14	25,5%	15	44,1%	
Education of the main caregiver							0,983
< 8 years	26	29,5%	16	29,6%	10	29,4%	
≥ 8 years	62	70,5%	38	70,4%	24	70,6%	
Car or bike for transportation	44	49,4%	28	50,9%	16	47,1%	0,724
Children with low height for age in the household	8	9,1%	6	10,9%	2	6,1%	0,705*

* In Iñapari, distribution of milk through the "glass of milk".

Table 5: Factors associated with food insecurity obtained by multiple logistic regression. Assis Brazil

Variables	OR crude	(CI 95%)	OR adjust	(CI 95%)	p-value
Household floor material					
Cement, brick, ceramic tile	1	1	1	1	
Wood or earth	3,64	(2,15 - 6,15)	2,47	(1,38 - 4,41)	0,002
Socioeconomic index					
Tertile richest	1	1	1	1	
2nd tertile	2,32	(1,36 - 3,99)	1,73	(0,96 - 3,11)	0,07
Tertile poorest	7,45	(4,12 - 13,46)	6,04	(3,2 - 11,41)	< 0,001
Number of household members (continuous var.)	1,34	(1,17 - 1,52)	1,37	(1,18 - 1,59)	< 0,001

sidering that they are located in the Amazon region, and the availability and cost of construction materials are similar. The number of households with electric power supply and public garbage collection is also similar, thus showing that the Amazon region has already managed to create the necessary conditions for public services and electric power distribution in its realms, although, in Iñapari electric power is supplied only during part of the day; income and sanitation conditions, one the other hand, are very different in the two cities. Family income, employment rates, maternal education and sanitation conditions provided by public authorities (more sidewalks and fewer open sewers) are better in Iñapari, but individual sanitation conditions are improved in Assis Brasil (more houses with toilets with running water). On the other hand, the number of households with running water inside is similar. Considering these results, we can state that some socio-environmental characteristics are due to the geographic location (a remote region of the Amazon), while others probably result from the very cultural conditions of each country (for instance, a larger number of cesspools in the city where family income is higher).

Studies on other border areas with these characteristics, such as the Argentina-Brazil-Paraguay Triple Frontier, have pointed out various social and health problems that are common to the three border countries, such as the binomial malnutrition/overweight, child sexual exploitation, drug trafficking and respiratory diseases[26,27]. Food security is related to the estimation of food availability, in terms of quantity and quality. The Amazon region has peculiarities as regards the supply of food and its variability. Beef and lamb production entails deforestation; game meat, although abundant, cannot be consumed. The Amazon soil and climate are improper for various cultures, which causes the demand for foodstuffs importation to be large. On the other hand the logistics for nonperishable food distribution is complex and results in high cost to consumers while perishable food is difficult to distribute before it becomes improper for consumption. Even the supply of regional edible fruit is heterogeneous within the Amazon, and such difficulties can equally affect both cities due to their geographic location. However, food from the Andes, such as grapes, plums and tuna as well as tubers and grains can reach Iñapari, but, although it would favor a larger variability of foodstuffs, the same does not happen in Assis Brasil due to international restrictions. Despite this fact, the prevalence of food insecurity found in this study be-

tween Assis Brasil and Iñapari was similar, thus showing that both border cities are susceptible to the same determinant factors for food insecurity. Therefore, it is a problem that is common to the two countries.

The prevalence of food insecurity found by our study in Assis Brasil is lower than the average in Acre state (47.5%); however, it must be taken into account that PNAD joins results from urban and rural areas, in addition to gathering data from the capital with data from isolated cities from inner Acre state, the access to which is only by inland waterways or air. In these remote areas of the state are cities with the highest prevalence of malnutrition in Brazil[28], which is probably the reason why the mean prevalence of food insecurity in Acre is larger than that in the Northern Region as well as than the national average. Additionally, our study involves only families that have children under 5 years of age while PNAD samples all households.

There are few data available concerning estimates of food insecurity in the Amazon region. A study on 194 families from the urban area of Manaus estimated that the prevalence of food insecurity affected 89.1% of families[15]. In the Legal Amazon in Mato Grosso state - Brazil, a study on households with adolescents in the urban area estimated the prevalence of moderate and severe food insecurity as 23,1%[16].

The estimates by PNAD for the Northern and Northeaster Regions were 3.1 and 3.5-fold higher than that for the Southern Region[29]. In agreement with that report, a recent study conducted in Pelotas (RS) estimated the prevalence of food insecurity as 11%[30].

In Peru, there is only one published study on food security to this date. Vargas and Penny[31] estimated the prevalence of food insecurity in three regions in Peru (the seacoast, Andes and Amazon regions) in 2002. The San Martin Region (Peruvian Amazon) showed the highest prevalence (56%), and the Andes Region showed the lowest prevalence of food insecurity (51%). Although the collection instrument was different from that used in our study, the prevalence of food insecurity in Iñapari was lower than that found by Vargas and Penny[31]. A real decrease in food insecurity may have occurred in the Peruvian Amazon between 2002 and 2011, considering that the same occurred in the Brazilian Amazon (58.9% of food insecurity in Acre by the 2004 PNAD to 47.5% by the 2009 PNAD)[4]. Another explanation for the difference found is due to the fact that our study included only families from the urban area that had children under 5 years of age.

The main causes for food insecurity in Iñapari and Assis Brasil refer to unfavorable socioeconomic conditions (low income, large number of dwellers and households that are not made of bricks). These data are confirmed by other studies[30,32,33] that also identified an association of a large number of dwellers in the household(32), houses made of wood[30] and low family income[34,35] with higher food insecurity prevalence. In addition to these variables, deficient basic sanitation[33,36] and the poor education of the reference person in the family[32,36] were also more frequent in families living in food insecurity.

In this investigation, almost half of the families in Assis Brasil reported a monthly income that was lower than or equal to minimum wages. According to the Family Budget Survey (*Pesquisa de Orçamento Familiar - POF 2008-2009*)[37] total income is one of the main determinants in the construction of the family budget: the lowest the family's monthly income, the largest the proportion of households in a situation of moderate or severe food insecurity[4].

CONCLUSION

This study shows that, in the Amazon Region, income is still the main factor associated with food insecurity. Considering that the food available in the Amazon retail shops is more expensive than in the other regions in Brazil, it is important that studies on the edible potential of regional fruit and fish and new technologies for using them be performed in order to promote food security.

CONTRIBUTIONS

AAR, NAV, CHMLE and MdaSN conceived the study and developed the study protocol; TMP, FLCCB, HOG, BMD, AMB, ACM, JAFJ, APS, RGC, ASG, TSA, CSMO, MdaSN, AAR, NAV and CHMLE participated in the process for selecting the research instrument and the sampling strategy, in addition to performing data collection; SASM, AAR, and MdaSN analyzed and interpreted the data. AAR and MdaSN wrote the manuscript. All the other authors participated in the critical review of the manuscript and contributed to the discussion of results and to the review of the intellectual content in the research. A8l the authors read and approved the final version of the manuscript.

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Resumo:

A segurança alimentar e nutricional consiste na realização do direito de todos ao acesso regular e permanente a alimentos de qualidade, em quantidade suficiente, sem comprometer o acesso a outras necessidades essenciais, tendo como base práticas alimentares promotoras de saúde que respeitem a diversidade cultural e que sejam ambiental, cultural, econômica e socialmente sustentáveis. O objetivo deste estudo foi estimar a prevalência e os fatores associados a insegurança alimentar em famílias com crianças menores de cinco anos na fronteira amazônica Brasil – Peru. O estudo foi realizado nos municípios de Assis Brasil (Brasil) e Iñapari (Peru) localizados na tríplice fronteira formada por Brasil, Bolívia e Peru. Dos 441 domicílios com crianças menores de 5 anos identificados, 352 (79,82%) localizavam-se em Assis Brasil, e os demais em Iñapari. As prevalências de insegurança alimentar nos municípios são semelhantes. Assis Brasil apresentou 40,6% e Iñapari 38,2% (p=0,856). Em Assis Brasil, ter domicilio com piso de madeira ou terra aumentou em 2,47 vezes a chance de insegurança alimentar comparado a piso de cimento, tijolo, cerâmica ou lajota. Pertencer ao tercil mais pobre aumentou a chance da insegurança alimentar em 6,04 vezes (p < 0,001), e o incremento de cada novo morador aumentou 37% a chance de insegurança alimentar no domicílio. Este estudo mostra que na região amazônica a renda ainda é o principal fator associado a insegurança alimentar.

Palavras-chave: segurança alimentar e nutricional, saúde na fronteira, fome.