Food insecurity in rural families in the extreme south of Brazil

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Abstract *This study aimed to track the prevalence of Food Insecurity (FI) and to study associated factors in households with children, women and older adults in the rural area of the city of Rio Grande, RS. This is a cross-sectional population-based study, with systematic sampling of 80% of permanently inhabited households. A short version of the Brazilian Scale of Food Insecurity (EBIA) was employed. The associated factors included data referring to the head of the household, as well as data referring to the household. The levels of prevalence and prevalence ratios and their respective confidence intervals were calculated for food insecurity through Poisson regression with robust variance. Of the 1,627 domiciles interviewed, 26% were in an FI situation, and households that included three populations were higher. The most affected domiciles were those in which the head of the household had less than four years of schooling, with more residents, without animal husbandry, belonging to the lowest income quartile and receiving family grants ("Bolsa Família" Program). This study showed the relevance and magnitude of the FI problem in the rural region of Rio Grande since knowledge about the actual FI prevalence of this region is unknown.*

Key words *Food and nutrition security, Prevalence, Rural population, Risk factors*

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Introduction

Food and Nutrition Security is defined as the universal right to regular and permanent access to quality and sufficient food, without compromising access to other essential needs. It should be based on food practices that promote health and respect cultural diversity in an environmentally and socially sustainable way. The unavailability of food, lower purchasing power or inadequate use at the household level is the characterization of Food and Nutritional Insecurity[1,2].

It is known that Food Insecurity (FI) affected 35.3% of private rural households in 2013 in Brazil. The different prevalence levels between the regions emphasize the regional inequality, more perceived in the North (41.4%) and Northeast (50.1%) regions, where the prevalence is twice as low[3]. In Rio Grande do Sul, the National Household Sample Survey (PNAD) data for 2009 and 2013 show prevalence rates for rural regions of 14.2% and 15.3%, respectively[3]. In areas not covered by the PNAD, such as rural areas of small and medium-sized municipalities, the prevalence of FI is unknown, and in these municipalities, the concentration of poverty may be higher[4].

Besides the higher concentration of poverty, food access is difficult in these areas. One of the reasons would be the shift from farming activities to non-farming activities, due to the crisis in agriculture and mechanization of production, which transformed rural areas into areas with typically urban traits, where the population is not dependent on income from agricultural activities[5]. Another reason is rural dwellers' difficulty in transportation to access goods and services and some specific food goods due to lower income concentration[6,7].

In Brazil, in 2015, the economic crisis caused an increase of 4.1 million people living in poverty, of which 1.4 million are in extreme poverty[8]. Thus, Brazil's exit from the hunger map, observed in 2014, may be reversed due to economic aspects that affect the Food Security (FS) of the population[9]. The lack of food in sufficient quantity and quality is a significant problem for families who were already in an FI situation before 2015 and for those who later entered the situation[8]. It is also known that the most severe damage of FI occurs primarily in children, women and the elderly, which are vulnerable groups[10].

In children, this inadequate consumption of food from the qualitative and quantitative point of view and the low household income are factors related to growth and development deficit[11,12].

Besides socioeconomic disadvantage at work, food deprivation is the main reason for vulnerability in women. Women prioritize their children or husbands, and they are restricted to a level of hunger and malnutrition, thus causing FI[13,14]. In the older adults, the psychological, social, economic factors and the aging process explain this increased susceptibility to FI[15].

Thus, this study aimed to track the prevalence of FI in the rural area of a medium-sized municipality in the extreme south of Brazil, among households with children up to five years of age, women of childbearing age and older adults, and to identify risk factors to increase knowledge about FI distribution in this type of municipality and population.

Methods

The cross-sectional, population-based study was conducted in the rural area of the municipality of Rio Grande (RS), located in the extreme south of Brazil, 250 km from the border with Uruguay and about 300 km from the state capital, Porto Alegre. This study was part of a Research Consortium entitled "Health of Rio Grande's rural population", which aimed to determine the life and health conditions of children, women of childbearing age and older adults in the rural area of the municipality of Rio Grande (RS), Brazil. This municipality has an area of approximately 2,709 km², and its population was estimated at around 208,000 inhabitants in 2016, of which 4% live in the rural area, distributed in approximately 3,000 households and 24 census tracts.

The study population consisted of households with at least one of the three age groups: children up to five years of age, women of childbearing age (15 to 49 years) and older adults (over 60 years of age). If the household had at least one child older than five years, the mother was also interviewed, as responsible for the child. Only households with heads of household who were 18 years or older were included.

The sample size was calculated in the EpiInfo version 7.0 program using an estimated prevalence of Food Insecurity in this population of 35%, 95% confidence level, and error of three percentage points for more or less, and a 10% was added to this amount for possible losses and refusals, resulting in 1,067 households. A statistical power of 80% was used to calculate the risk factors, with a 95% confidence level, a Relative Risk of 1.7 was considered, as well as a 2-to-1 ratio of

non-exposed (household income > 1 minimum wage) with exposed (household income ≤ 1 minimum wage), and prevalence of FI in unexposed of 18%. This amount was grossed up by 10% to cater for losses and refusals, and 20% for confounding factor, resulting in 1,133 households.

Systematic random sampling was performed in permanently inhabited households in the rural area of Rio Grande, where four out of five households were selected to comprise 80% of each population (women aged 15-49 and older). Then, a number from one to five was drawn in each census tract, which corresponded to the skip. Regarding the sampling of children under five years of age, a census of households was conducted. Thus, the households skipped for the sampling of women between 15 and 49 years old and older adults were approached to verify whether there were residents under five years of age. In this case, the skip was annulled and the mother was interviewed through the child's and household's questionnaires.

As a data collection instrument, a short version of the Brazilian Food Insecurity Scale (EBIA) proposed by Santos[16] was used. This version contains five questions and detects FI in the household, with high sensitivity and specificity, 95.7% and 100% respectively, concerning the original scale[16]. In the affirmative answer of at least one issue of scale, the household was characterized as "Food Insecure".

Data were collected from April to October 2017 by six previously trained interviewers. Tablets were used through the RedCap® program to collect data. Data collection quality control was performed through the application of a short version of the questionnaire, in 10% of the visited domiciles. The re-interviews were conducted through telephone calls by the master's students of the consortium. The Kappa statistic for the household ranged from 0.52 to 0.94.

The independent variables used to analyze the associated factors were: head of the household (man, woman without partner, woman with partner), self-reported skin color (white, black/brown), age categorized in full years (18-29 years, 30-39 years, 40-59 years, 60 to 69 years and 70 years or more), number of residents in the household (1, 2, 3, 4, 5 or more), quartiles of household income (classified from the lower quartile mean to the highest quartile mean), schooling (< 4 years, 4-11 years, 12 or more years), receiving the Family Grant ("*Bolsa Família*") (no, yes), animal husbandry (no, yes) and food growing/cultivation (no, yes).

Data were analyzed in the Stata program, version 14.1 (Stata Corp., College Station, USA). The analysis was initially descriptive, where the percentages of the categories of each independent variable were calculated. In the case of food insecurity, the general prevalence and its 95% confidence interval (95% CI) were calculated. Subsequently, the factors associated with Food Insecurity were analyzed through Poisson regression with a robust estimation of the variance, obtaining crude and adjusted PR and their respective 95% CI. The choice of the Poisson regression for this analysis instead of the logistic regression built on the understanding that its use is more appropriate in cross-sectional studies whose prevalence of the outcome is high[17,18].

The multivariate analysis followed a three-level hierarchical analysis model[17]. The first level included the sociodemographic variables, the second contained the variables on food cultivation and animal husbandry, and the third level, household income and receipt of a family grant. Then, the variables of each level were adjusted to each other, using backward regression. Those with p < 0.20 were maintained to be adjusted with the variables of the next level to avoid positive confounding. A p-value of p < 0.05 from a two-tailed test was adopted in all statistical tests.

The research was approved by the Health Research Ethics Committee of the Federal University of Rio Grande, according to Resolution Nº 466/12, and the informed consent was obtained from all the respondents.

Results

In the household approach in the rural area of Rio Grande, RS, 1,785 households were eligible for the study, of which 1,627 had the head of the household interviewed (8.9% of losses). Of the households sampled, 35.7% had only women of childbearing age, 40.6% had only older adults, 17.6% had children under the age of 5 and women of childbearing age, 5.0% had women of childbearing age and older adults, and 1.1% had all three population groups. There were no households with only children, or with both children and older adults.

Table 1 shows the distribution of households concerning socioeconomic and demographic variables. We can observe a predominance of households with female heads of the household living with a partner (54.4%), white (88.3%), with 4-11 years of schooling (49.4%), which do

Table 1. Distribution of a sample of households by socioeconomic and demographic variables, Rio Grande, Rio Grande do Sul, Brazil, 2017. (N: 1,627).

Characteristic	N	%	FI prevalence	P
Head of household				0.0001*
Man	501	30.8	20.6	
Woman without a partner	241	14.8	20.3	
Woman with a partner	883	54.4	30.7	
Self-reported skin color				0.13
White	1,437	88.3	25.4	
Black/other	190	11.7	30.5	
Age of head of household				0.0001*
18-29	273	16.8	25.6	
30-39	319	19.6	29.6	
40-59	371	22.3	35.8	
60-69	357	21.9	22.1	
70 +	307	18.9	15.1	
Nº of residents in the household				0.0001*
1	234	14.4	16.7	
2	488	30.0	20.4	
3	460	28.3	26.9	
4	288	17.7	34.0	
5 +	157	9.6	39.7	
Schooling				0.003*
12 years and over	327	20.2	18.7	
4-11 years	800	49.4	27.4	
< 4 years	493	30.4	28.7	
Animal husbandry				0.02*
No	978	60.1	28.1	
Yes	649	39.9	22.9	
Food growing and cultivation				0.006*
No	1,135	69.8	28.0	
Yes	491	30.2	21.4	
Family grant				0.0001*
No	1,451	89.3	23.0	
Yes	174	10.7	51.1	
Income quartiles				0.0001*
Upper	367	23.8	15.0	
3	405	26.2	20.8	
2	361	23.4	30.8	
Lower	410	26.6	37.6	

not grow food and do not practice animal husbandry (69.8% and 60.1%, respectively). Also, one in ten households had residents enrolled in the *Bolsa Família* Program (10.7%).

The Food Insecurity situation was 26% (95% CI 23%-28%). The FI prevalence varied significantly (p < 0.001) per population groups existing in the households. The highest prevalence was observed in the households with the three groups (children under five, women of childbearing age and older adults), reaching 44%. In households with only women of childbearing age, FI was 32%; and in households with children and women of childbearing age, and households with

women and older adults, FI was 29%. The lowest prevalence of FI was observed in households with only older adults (18%).

Table 1 also shows the prevalence of FI according to the characteristics of the families. Except for the variable skin color of the head of the household, all other differences were significant. The highest prevalence is observed in households where women are the head of the household and live with their partner (30.7%), and are aged 40-59 years (35.8%). FI was 1.5 times more likely in households with more than five residents compared to those in which only one person lived, and increased progressively with declining income quartiles (37.6% in the poorest vs. 15% in the richest). Also, FI was also higher in households with no animal husbandry and food growing. FI was twice as large in households where the head of the household was a beneficiary of cash benefits programs (*Bolsa Família*).

Table 2 shows the crude and adjusted PR. We can observe that, after adjustment, households with heads of household aged 70 years or older (PR 0.63), with less than 4 years of schooling (PR 2.14), households with five or more residents (PR 1.73), with animal husbandry for sale or consumption (PR 0.83) and who were beneficiaries of the *Bolsa Família* program (RP 1.52) remained significantly associated with FI. There was a significant linear trend (inverse association) between FI and household income and was almost 1.5 times more likely in the lowest income quartile compared with the highest income quartile.

Discussion

In this study, FI reached more than a quarter of rural households, and we could identify households with a higher risk of this outcome, evidenced by low socioeconomic and educational levels, low participation in cash benefits programs, a higher number of residents in the household and lack of subsistence agriculture. Although the prevalence of FI observed in this study is lower than that found in other Brazilian studies, most of them were performed in the northeast region. These surveys were carried out in several municipalities in the Northeast in different years and found prevalence levels ranging from 52.1% to 88.5%[10,19-22], which may be due to socioeconomic gaps between regions.

The PNAD brings prevalence of FI to the rural regions of the country in 2009 and 2013, of 35.2% and 35.3%, respectively. When analyzed by regions, the South has lower indices than the other states, 14.2% in 2009 and 15.3% in 2013[3], and are, thus, lower than those found in this study. The difference with FI found in this study can be explained by the fact that the sample design of the PNAD does not include municipalities such as the region that is the object of this research[4,8]. Another aspect that may explain this gap in the prevalence is that this present study included households with specific groups (children up to five years of age, women of childbearing age and older adults), who may be more predisposed to FI, while the PNAD included all households, regardless of age groups.

When FI was analyzed by the presence of the population groups, the households that had children, women and older adults had an increased FI prevalence (44%). These groups are considered to be vulnerable to FI[10] since they feel the first effects of restricting food in both quality and quantity. Also, as per Hoffmann[2], the presence of children under 18 and the number of residents make these households more susceptible to FI.

Two hypotheses are brought about regarding the higher prevalence of FI in households where women live with a partner: first, only one resident or partner works, and in this case there is a lower per capita income; the second, the woman self-declares as head of the household, since the partner is possibly unemployed and the income per capita is also reduced. However, there are no elements in this research or other studies that can prove any of these possibilities.

Regarding age, FI was lower in the age group of 70 years or more, even when adjusted for other factors, something that can be explained by the receipt of pensions that complement the household income[19].

The variables that underpin the socioeconomic level (number of residents at home, household income and schooling) make up an FI severity triad and are strong risk factors[10], and all three were found in this study.

The FI increased progressively with the number of residents in the household, even with a linear trend, and was consistent with other studies conducted in rural areas[6,10,19,23-25]. This finding shows that family size is not necessarily accompanied by a higher household income. Large families have higher food and consumer goods expenditure but not all household members have an income[6].

Schooling is another FI-related socioeconomic factor[10,19,26-28]. It was significantly associated with the outcome in both crude and adjusted

Table 2. Crude and adjusted prevalence ratios (PR) for Food Insecurity by variables of the final regression model. Rio Grande do Sul, Brazil, 2017. (N: 1,627).

Characteristic	Crude Analysis		Adjusted Analysis	
	PR (95%CI)	p	PR (95%CI)	p
Head of household[1]		0.0001b*		0.20[b]
Man	1		1	
Woman without a partner	0.99 (0.73; 1.34)		0.94 (0.70; 1.26)	
Woman with a partner	1.49 (1.22; 1.82)		1.24 (0.93; 1.48)	
Self-reported skin color[1]		0.1		0.6
White	1		1	
Black/other	1.20 (0.95; 1.51)		1.07 (0.85; 1.33)	
Age of head of household[1]		0.0001b*		0.002[b*]
18-29	1		1	
30-39	1.16 (0.89; 1.50)		1.13 (0.87; 1.99)	
40-59	1.40 (1.09; 1.78)		1.28 (0.99; 1.64)	
60-69	0.86 (0.65; 1.14)		0.91 (0.65; 1.28)	
70 +	0.59 (0.42; 0.82)		0.63 (0.42; 0.95)	
Nº of residents in the household[1]		0.0001a*		0.0001[a*]
1	1		1	
2	1.22 (0.87; 1.71)		1.05 (0.74; 1.49)	
3	1.62 (1.70; 2.23)		1.24 (0.85; 1.80)	
4	2.04 (1.47; 2.84)		1.54 (1.04; 2.27)	
5 +	2.38 (1.69; 3.34)		1.73 (1.16; 2.57)	
Schooling[1]		0.005b*		0.0001[b*]
12 years and over	1		1	
4-11 years	1.47(1.14; 1.89)		1.54 (1.20; 1.99)	
< 4 years	1.53(1.17; 2.00)		2.14 (1.62; 2.82)	
Animal husbandry[2]		0.02*		0.04*
No	1		1	
Yes	0.81 (0.68; 0.97)		0.83 (0.70; 0.99)	
Food growing[2]		0.007*		0.06
No	1		1	
Yes	0.76 (0.63; 0.93)		0.82 (0.68; 1.01)	
Family grant program[3]		0.0001*		0.0001*
No	1		1	
Yes	2.22 (1.87; 2.64)		1.52 (1.24; 1.86)	
Income quartiles[3]		0.0001a*		0.0001[a*]
Upper	1		1	
3	1.38 (1.01; 1.88)		1.37 (1.00; 1.87)	
2	2.05 (1.54; 2.74)		1.78 (1.33; 2.38)	
Lower	2.50 (1.90; 3.29)		2.30 (1.72; 3.07)	

[a] Trend test. [b] Heterogeneity test. 1 1st level of the hierarchical analysis model. 2 2nd level of the hierarchical analysis model. 3 3rd level of the hierarchical analysis model.

analysis, with the risk of higher FI is found in households where the head had less than four years of schooling.

The analysis also showed the existence of a linear trend, in the association between FI and income quartiles, and the households of the lower quartile were much more likely to show FI than households of the highest quartile. These data are consistent with the literature[6,10,19-21,24]. According to Hoffman[2], household income is the variable with the highest impact when it comes to FI. In recent years, the economic crisis in Brazil has increased the number of individuals living in poverty and extreme poverty in the country,

causing more individuals to exceed the poverty line, consequently increasing the social vulnerability of households and the risk of FI[8].

Regarding food growing or cultivation and animal husbandry, only animal husbandry for sale or family consumption remained associated in the adjusted analysis. Studies show that these means of production used for household consumption, exchange between families, sharing or selling support a better diet in these households, increasing FS[6,28,29]. The lack of association between food growing and FI may be due to a limitation of the study of adequately quantifying the agricultural production goods among the households studied.

Regarding the large proportion of households with no food cultivation and animal husbandry, the rural area of Rio Grande has some aspects that do not favor the practice of these activities or other type of activity, such as, for example, fishing is predominant in the islands sectors. There is also a vast extension of sandy land, not favoring agriculture or livestock. On the other hand, sectors close to the urban area have an urban structure.

Households with *Bolsa Família* program beneficiaries were 52% more likely to be at risk of FI after adjustment. In this context, both the PNAD and the National Survey on Demography and Health of Children and Women (PNDS) show an increased prevalence of FI in these households in recent years[23,30], which is a significant concern, if indeed cash benefits programs are insufficient to change the context of households within the lower income stratum. Also, it is necessary to take into account the low coverage (only 10.7%) of the *Bolsa Família* Program in the rural region of Rio Grande.

Studies indicate that the receipt of this benefit contributes to the income supplementation of vulnerable households and facilitates access to food, especially in the promotion of FS[21,31,32]. However, another study states that the program alone is not enough to ensure an FS[29] condition, which is linked to a more complex socio-economic situation. Because this is a cross-sectional study, the prevalence of FI in these households before the implementation of the program is un-

known, and the prevalence of FI may have been higher in this case.

One of the limitations of this study is its cross-sectional design, which hinders the inference of causality about the associations, as is the case of the analysis between the receipt of *Bolsa Família* and FI, thus resulting in reverse causality. However, it is possible to establish associations and identify groups most affected by the outcome. Another limitation is the recall bias, but it has been minimized by the short time bracket of the short EBIA scale, which refers to the last 3 months, as well as the full version of EBIA.

The scale used in this study was a short version of the EBIA[16], which was proposed to reduce the study's time and cost. The short scale had not yet been used in any rural region, only in urban areas, where it detected FI and FS with high sensitivity and specificity, 95.7% and 100%, respectively[16], compared to the original scale. This short scale was employed because the study was included in a research consortium, with a pre-established limit of questions for each researcher. The main limitation of this scale is that it does not detect the levels of severity of FI (mild, moderate or severe) as the original scale does, hampering the detection of FI's most severe case, where there is a quantitative reduction of food among children, disruption of family dietary patterns or hunger[3].

It can be observed that the FI in the rural population of Rio Grande is considerable since a little more than a quarter of the household of the rural area of the municipality are in this situation. A higher prevalence was observed in the households with the three groups, reaching 44%. Among them, the most affected are the residents of households with the worst socioeconomic indices. Also, being a rural resident is associated with increased food insecurity, regardless of subsistence farming.

Support networks between communities and households and ways of sharing food, such as fairs and exchanges, can be ways to improve families' access to sufficient quantity and quality of food. Given that the rural area is a favorable environment for food production, this activity should be encouraged through public policies to encourage agricultural production.

Collaborations

NM Maas worked on the project design, project outline, research, methodology, fieldwork, data analysis and interpretation and writing of the article. RA Mendoza-Sassi worked on the design of the project, analysis and interpretation of data, critical analysis of the content and revision of the version to be published. RD Meucci worked on the project design, methodology, critical content analysis and revision of the version to be published. JA Cesar worked on the project design and critical content analysis.

References

1. Brasil. Lei nº 11.346, de 15 de setembro 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 da União* 2006; 18 set.

2. Hoffmann R. Pobreza, Insegurança Alimentar e desnutrição no Brasil. *Estud Av*. 1995; 9(24):159-172.

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

4. Instituto Brasileiro de geografia e Estatística (IBGE). 2010. *Indicadores sociais municipais: uma análise dos resultados do universo do censo demográfico 2010*. Coordenação de População e Indicadores Sociais. [acessado 2018 Fev 13]. Disponível em: https://censo2010.ibge.gov.br/noticiascenso.html?busca=1&id=3&id-noticia=2019&t=indicadores-sociais-municipais-2010-incidencia-pobreza-maior-municipios-porte-medio&view= noticia

5. Baldasi OV. Mudanças no meio rural e desafios para o desenvolvimento sustentável. São Paulo Perspec. 2001; 15 (1):155-165.

6. Silva EPK, Medeiros DS, Martins PC, Souza LA, Lima GP, Rêgo MAS, Silva, TO, Freire AS, Silva FM. Insegurança Alimentar em comunidades rurais no Nordeste brasileiro: Faz diferença ser quilombola? *Cad Saude Publica* 2017; 33(4):e00005716:1-14.

7. Barbosa ALNH, Menezes TA, Andrade BC. Demanda por produtos alimentares nas areas rurais e urbanas do Brasil. *Pesquisa e Planejamento Econômico* 2014; 44(3):507-544.

8. Instituto de pesquisa econômica aplicada (IPEA). *Boletim de políticas sociais: acompanhamento e análise.* nº 23, 2015. [acessado 2018 Fev 13]. Disponível em: http://www.ipea.gov.br/portal/index.php?option=-com_content&view=article&id=25812&Itemid=9

9. Food and Agriculture Organization of the United Nations (FAO). *Brasil em resumo.* [acessado 2018 Mar 20]. Disponível em http://www.fao.org/brasil/fao-no-brasil/brasil-em-resumo/en/

10. Aires JS, Martins MC, Joventino ES, Ximenes LB. (In) Segurança alimentar em famílias de pré escolares de uma zona rural do Ceará. *Acta Paul Enferm* 2012; 25(1):102-108.

11. Carneiro LBV. *Associação entre Insegurança Alimentar e deficiências de micronutrientes em crianças assistidas pelo SUS no município do Rio de Janeiro* [tese]. Rio de Janeiro: Escola Nacional de Saúde Pública Sergio Arouca; 2015.

12. Sperandio N, Priore SE. Prevalência de insegurança alimentar domiciliar e fatores associados em famílias com pré-escolares, beneficiários do Programa Bolsa Família em Viçosa, Minas Gerais, Brasil. *Epidemiol. Serv. Saúde* 2015; 24(4):739-748.

13. Siliprandi E. Políticas de Segurança Alimentar e Relações de Gênero. *Cadernos de Debate UNICAMP* 2004; 5(11):38-57.

14. Ivers LC, Cullen KA. Food Insecurity: special considerations for women. *Am J Clin Nutr* 2011; 94:1740-1744.

15. Lu JS, Frongillo Junior EA. Nutritional and health consequences are associated with food assistance programmes over time in the elderly. *Public Health Nutri* 2009; 12(11):2113-2119.

16. Santos LP, Lindemann IL, Motta JVS, Mintem G, Bender E, Gigante DP. Proposta de versão curta da Escala Brasileira de Insegurança Alimentar. *Rev Saude Publica* 2014; 48(5):783-789.

17. Barros AJ and HirakataVN. Alternatives for logistic regression in cross-sectional studies: an empirical comparison of models that directly estimate the prevalence ratio. *BMC Med. Res. Methodol.* 2003; 20(3):21.

18. Victora CG, Huttly SR, Fuchs SC, Olinto MTA. The role of conceptual frameworks in epidemiological analysis: a hierarchical approach. *Int J Epidemiol* 1997; 26(1):224-227.

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

20. Vianna RPDT, Segall-Corrêa AM. Insegurança alimentar das famílias residentes em municípios do interior do estado da Paraíba, Brasil. *Revista de Nutrição* 2008; 21(Supl.):111s-122s.

21. Rocha EMB, Lima RT, Almeida PC. Insegurança alimentar relacionada à área de residência em município do Semiárido brasileiro. *Cad Saúde Colet* 2014; 22(2):205-211.

22. Oliveira JS, Lira PIC, Andrade SLLS, Sales AC, Maia SR, Batista Filho M. Insegurança Alimentar e estado nutricional de crianças em São João do Tigre, no semi-árido do Nordeste. *Rev Bras Epidemiol* 2009; 12(3):413-423.

23. Instituto Brasileiro de Geografia e Estatística (IBGE). *Pesquisa Nacional por Amostra de Domicílios – PNAD 2004 – 2009. Segurança alimentar, Brasil.* Rio de Janeiro: IBGE; 2010.

24. Ihab An RA, Wan Manan WM, Wan Suriati WN, Zallilah MS, Rusli AM. Nutritional outcomes related to household food insecurity among mothers in rural. *J Health Popul Nutr* 2013; 31(4):480-489.

25. Pico Fonseca SM, Pachón H. Factores asociados con la seguridad alimentaria en un Municipio Rural del norte del Cauca, Colombia. *Arch. latinoam. Nutr* 2012; 62(3):227-233.

26. Regassa N, Stoecker BJ. Household food insecurity and hunger among households in Sidama district. *Public Health Nutr* 2012; 15(7):1276-1283.

27. Guerrero N, Walsh MC, Malecki KC, Nieto FJ. Urban-Rural and Regional variability in the Prevalence of Food Insecurity: the Survey of the Health of Wisconsin. *WMJ* 2014; 113(4):133-138.

28. Tomayko EJ, Mosso KL, Cronin KA, Carmichael K, Kim K, Parker T, Yaroch AL, Adams AK. Household food insecurity and dietary patterns in rural and urban American Indian families with Young children. *BMC Public Health* 2017; 17(1):611.

29. Instituto Brasileiro de Análises Sociais e Econômicas (Ibase). *Repercussões do Programa Bolsa Família na Segurança Alimentar e Nutricional das famílias beneficiadas.* Ibase; 2008.

30. Brasil. Ministério da Saúde (MS). Centro Brasileiro de Análise e Planejamento. *Pesquisa Nacional de Demografia e Saúde da Criança e da Mulher – PNDS 2006: dimensões do processo reprodutivo e da saúde da criança*. Brasília: MS; 2009. [Série G. Estatística e Informação em Saúde].

31. Segall-Corrêa AM, Marin-Leon L, Helito H, Pérez-Escamilla R, Santos LMP, Paes-Souza R. Transferência de renda e Segurança Alimentar no Brasil: análise dos dados nacionais. *Rev. Nutr. Campinas* 2008; 21(Supl.):39s-51s.

32. Cabral CS, Lopes AG, Lopes JM, Vianna RPT. Segurança alimentar, renda e Programa Bolsa Família: estudo de coorte em municípios do interior da Paraíba, Brasil, 2005-2011. *Cad Saude Publica* 2014; 30(2):393-402.

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