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Proposal of a short-form version of the Brazilian Food Insecurity Scale

Proposta de versão curta da Escala Brasileira de Insegurança Alimentar

ABSTRACT

OBJECTIVE: To propose a short version of the Brazilian Food Insecurity Scale.

METHODS: Two samples were used to test the results obtained in the analyses in two distinct scenarios. One of the studies was composed of 230 low income families from Pelotas, RS, Southern Brazil, and the other was composed of 15,575 women, whose data were obtained from the 2006 National Survey on Demography and Health. Two models were tested, the first containing seven questions, and the second, the five questions that were considered the most relevant ones in the concordance analysis. The models were compared to the Brazilian Food Insecurity Scale, and the sensitivity, specificity and accuracy parameters were calculated, as well as the kappa agreement test.

RESULTS: Comparing the prevalence of food insecurity between the Brazilian Food Insecurity Scale and the two models, the differences were around 2 percentage points. In the sensitivity analysis, the short version of seven questions obtained 97.8% and 99.5% in the Pelotas sample and in the National Survey on Demography and Health sample, respectively, while specificity was 100% in both studies. The five-question model showed similar results (sensitivity of 95.7% and 99.5% in the Pelotas sample and in the National Survey on Demography and Health sample, respectively). In the Pelotas sample, the kappa test of the seven-question version totaled 97.0% and that of the five-question version, 95.0%. In the National Survey on Demography and Health sample, the two models presented a 99.0% kappa.

CONCLUSIONS: We suggest that the model with five questions should be used as the short version of the Brazilian Food Insecurity Scale, as its results were similar to the original scale with a lower number of questions. This version needs to be administered to other populations in Brazil in order to allow for the adequate assessment of the validity parameters.

DESCRIPTORS: Food Security. Scales. Questionnaires, utilization. Validation Studies.

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RESUMO

OBJETIVO: Propor versão curta da Escala Brasileira de Insegurança Alimentar. Foram analisados dois estudos constituídos por amostra de 230 famílias de baixa renda, de Pelotas, RS, e de 15.575 mulheres com base nos dados da Pesquisa Nacional de Demografia e Saúde, de 2006.

MÉTODOS: Foram utilizadas duas amostras para testar os resultados obtidos nas análises em dois cenários distintos. Um dos estudos foi composto por 230 famílias de baixa renda, de Pelotas, RS, e o outro, por 15.575 mulheres, cujos dados foram obtidos na Pesquisa Nacional de Demografia e Saúde de 2006. Foram testados dois modelos, o primeiro contendo sete questões e o segundo as cinco consideradas mais relevantes na análise de concordância. Os modelos foram comparados à Escala Brasileira de Insegurança Alimentar, calculando-se os parâmetros de sensibilidade, especificidade e acurácia e o teste de concordância de kappa.

RESULTADOS: Comparando as prevalências de insegurança alimentar entre a Escala Brasileira de Insegurança Alimentar e os dois modelos, as diferenças ficaram em torno de dois pontos percentuais. Na análise de sensibilidade, a versão curta de sete questões obteve 97,8% e 99,5% na amostra de Pelotas e da PNDS, respectivamente, enquanto a especificidade foi de 100% em ambos os estudos. O modelo de cinco questões mostrou resultados semelhantes (sensibilidade de 95,7% e 99,5% na amostra de Pelotas e da PNDS, respectivamente). A versão de sete questões apresentou teste de kappa de 97,0% e a versão de cinco questões, de 95,0%, na amostra de Pelotas. Já na amostra da PNDS, os dois modelos apresentaram kappa de 99,0%.

CONCLUSÕES: Sugere-se o modelo com cinco questões para ser utilizado como versão curta da Escala Brasileira de Insegurança Alimentar, visto que apresentou resultados semelhantes à escala original com menor número de questões. É necessário que essa versão seja aplicada em outras populações do Brasil, de forma a permitir adequada avaliação dos parâmetros de validade.

DESCRITORES: Segurança Alimentar e Nutricional. Escalas. Questionários, utilização. Estudos de Validação.

INTRODUCTION

The fulfilment of the right to regular and permanent access to sufficient amounts of high-quality foods without hindering the access to other essential needs is known as food security.^a Food insecurity levels range from worry and anguish brought by the uncertainty of having food regularly to lack of food.^{a,b}

An instrument that assesses food insecurity was developed in the 1990s in the United States.⁷ Subsequently, it was modified and adapted in many countries.^{1,2,6,8} To aid studies of shorter duration and/or lower financial resources, Blumberg et al

developed a scale with six questions, based on the original North American version.⁴

Brazil also has an adaptation of the scale, known as *Escala Brasileira de Insegurança Alimentar* (EBIA – Brazilian Food Insecurity Scale), which has been duly validated for the population and broadly used.^{3,9,16} However, some surveys do not use the EBIA due to the large number of questions and to the cost involved in administering them. National surveys have proposed to use the North American scale with six questions to investigate the food insecurity situation,^{11,12} but a

^a 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. Brasília (DF); 2006. Artigo 3. [cited 2014 Jul 6]. Available from: http://www.planalto.gov.br/ccivil_03/_ato2004-2006/2006/Lei/L11346.htm

^b Bickel GW, Nord M, Price C, Hamilton W, Cook J. Measuring food security in the United States: guide to measuring household food security. Rev. ed. Alexandria: U. S. Department of Agriculture; 2000 [cited 2014 Jul 7]. Available from: <http://www.fns.usda.gov/fsec/files/fsguide.pdf>

study carried out in the city of Pelotas, RS, Southern Brazil, verified that there is no satisfactory concordance between the EBIA and this scale.¹³

This study aimed to propose a short version of the Brazilian Food Insecurity Scale.

METHODS

Two samples were used in this study. The first was composed of 230 low income families living in the city of Pelotas and the second was composed of 15,575 women of childbearing age, aged 15 to 49 years, whose data were obtained from the 2006 *Pesquisa Nacional de Demografia e Saúde* (PNDS – National Survey on Demography and Health).^c

The Pelotas sample is part of a cross-sectional study carried out between April and October 2011 in the catchment area of the *Unidade de Saúde da Família* (USF – Family Health Unit) of a neighborhood located on the periphery of the city.¹³ This study aimed to validate the short version of the food insecurity scale proposed by Bickel et al^b (2000) and it was targeted at the families that lived in that neighborhood. The second sample (PNDS) analyzed the health of women of reproductive age and of children younger than five years. Complementary information on the methodology can be obtained from the above-mentioned studies.^{13,c}

The two samples were used to test the results of the analysis in different scenarios, which made the conclusions more robust. In both samples, the EBIA was administered to the person responsible for food in the household. The questions referred to the period of three months prior to the interview. To each affirmative answer, the value “1” was assigned. The scale administered in PNDS was different from the original EBIA in terms of the number of questions: 16 in the PNDS and 15 in the original one. This did not influence the analysis, as this change originated from the division of question 5 in two questions, which were subsequently regrouped in the analysis.

In both studies, to classify food security/insecurity, the score was calculated by considering the number of positive answers in each item of the scale, according to the household's age composition. Only eight questions applied to households without individuals younger than 18 years. Therefore, the maximum score that could be achieved would be eight. For households with individuals younger than 18 years, the complete questionnaire was administered, with a maximum score of 15. The EBIA's score criterion and cut-off

point allows for the division in four categories and three levels of intensity – food security (FD), mild, moderate and severe food insecurity –, attributed according to the presence or absence of individuals younger than 18 years in the household.

As the short version proposed here must serve as a food insecurity tracker among families and must function in the same way for households with and without individuals younger than 18 years, the questions of the scale referring to this age group were excluded from the proposed scale. In the last Technical Workshop for the Analysis of the Household Measurement Scale of Food Insecurity,^d the exclusion of the association between weight loss and food insecurity was approved, as well as the exclusion of a repetitive item: question 9.

After these exclusions, seven questions remained from the original scale. Based on these seven questions, two short-scale models for food insecurity assessment were tested. The first contained the seven questions (Table 1A).

To construct the second model, a concordance analysis was performed with the full scale, that is, we investigated which questions had the highest proportions of positive answers among families with food insecurity. After the analysis, the second model was composed of the five questions that were considered most relevant regarding concordance with the full scale (Table 1B).

To compare the proposed models with the full version of the EBIA, initially, the concordance of positive answers of families with food insecurity was analyzed in each remaining question, so as to detect the most relevant questions in the identification of food insecurity. Subsequently, the models (of seven and five questions) were compared to the EBIA, which is considered the gold standard. The following parameters were calculated: sensitivity – proportion of individuals with food insecurity, through the EBIA, with a positive result in the short versions –, specificity – proportion of individuals without food insecurity and with a negative result in the short versions –, and accuracy – the proposed model's probability of being in accordance with the gold standard for all the studied individuals. In addition, an agreement test (kappa index) was performed.⁵

The analyses were carried out in the Stata program, version 12.0 (Stata Corp., College Station, United States). Due to the fact that the PNDS database has a complex sample design, all the estimates were weighted, considering the design effect and also the calibration according to estimates of the Brazilian population, by means of the “svy” command.

^c Ministério da Saúde, Centro Brasileiro de Análise e Planejamento. Pesquisa Nacional de Demografia e Saúde da Criança e da Mulher. Brasília (DF); 2008. Available from: http://bvsm.s.saude.gov.br/bvs/pnds/img/relatorio_final_pnds2006.pdf

^d Ministério do Desenvolvimento Social e Combate à Fome, Secretaria de Avaliação e Gestão da Informação. Relatório da Oficina Técnica para Análise da Escala de Medida Domiciliar da Insegurança Alimentar. Brasília (DF); 2010. (Nota Técnica, 128).

Table 1. Proposals for a food insecurity scale that is a reduced version of the Brazilian Food Insecurity Scale. Pelotas, RS, Southern Brazil, 2013.

| (A) Proposal with seven questions |
|---|
| 1) In the last 3 months, were you worried that the food in your home would end before you could buy, receive or produce more food? |
| 2) In the last 3 months, did the food end before you had money to buy more? |
| 3) In the last 3 months, did you run out of money and you could not have a healthy and varied diet? |
| 4) In the last 3 months, did you or an adult in your home reduce the amount of food in your meals, or skip meals, because there was not enough money to buy food? |
| 5) In the last 3 months, did you eat less than you thought you should because there was not enough money to buy food? |
| 6) In the last 3 months, did you feel hungry but did not eat because you could not buy enough food? |
| 7) In the last 3 months, did you or any other adult in your home spend one entire day without eating or had only one meal per day because there was no money to buy food? |
| (B) Proposal with five questions |
| 1) In the last 3 months, were you worried that the food in your home would end before you could buy, receive or produce more food? |
| 2) In the last 3 months, did the food end before you had money to buy more? |
| 3) In the last 3 months, did you run out of money and could not have a healthy and varied diet? |
| 4) In the last 3 months, did you or an adult in your home reduce the amount of food in your meals, or skip meals, because there was not enough money to buy food? |
| 5) In the last 3 months, did you eat less than you thought you should because there was not enough money to buy food? |

RESULTS

In the Pelotas sample, 58.3% of the heads of households who were interviewed were men. Less than 20.0% had nine or more years of schooling and almost 75.0% was younger than 60 years. In the PNDS sample, almost half lived in the Southeast of Brazil and approximately 40.0% had nine or more years of schooling. As for food insecurity measured by the EBIA, we observed a prevalence of more than 60.0% in the first sample and approximately 40.0% in the PNDS sample. Figure A shows the questions with the highest number of positive answers in families with food insecurity (questions 1, 2, 3, 5 and 6). When this analysis was performed in the PNDS database, the same result was obtained (Figure B). Based on these results, we arrived at the five-question version composed of questions 1, 2, 3, 5 and 6 of the EBIA. Table 1 shows the short version

based on seven questions of the EBIA (A) and the short version based on five questions (B).

When we compared the prevalence of food insecurity that was found using the two proposed models with the EBIA, we observed that, while the full scale found a prevalence of approximately 60.0% in the Pelotas sample, the short version with seven questions showed a prevalence of 59.0% and the version with five questions, 58.0%. In the PNDS sample, the following prevalences were found: 39.0% by the full scale, 38.8% by the one with seven questions and 38.1% by the version with five questions (Table 2).

In the sensitivity and specificity analysis, the short version with seven questions presented excellent results when the same cut-off point adopted by the EBIA to classify food insecurity was considered (one positive answer or more). Sensitivity was close to 98.0% for the Pelotas sample and almost 100% for the PNDS. In addition, the result with highest accuracy is the cut-off point equal to "1", which classified correctly almost 100% of the individuals in both samples (Table 3).

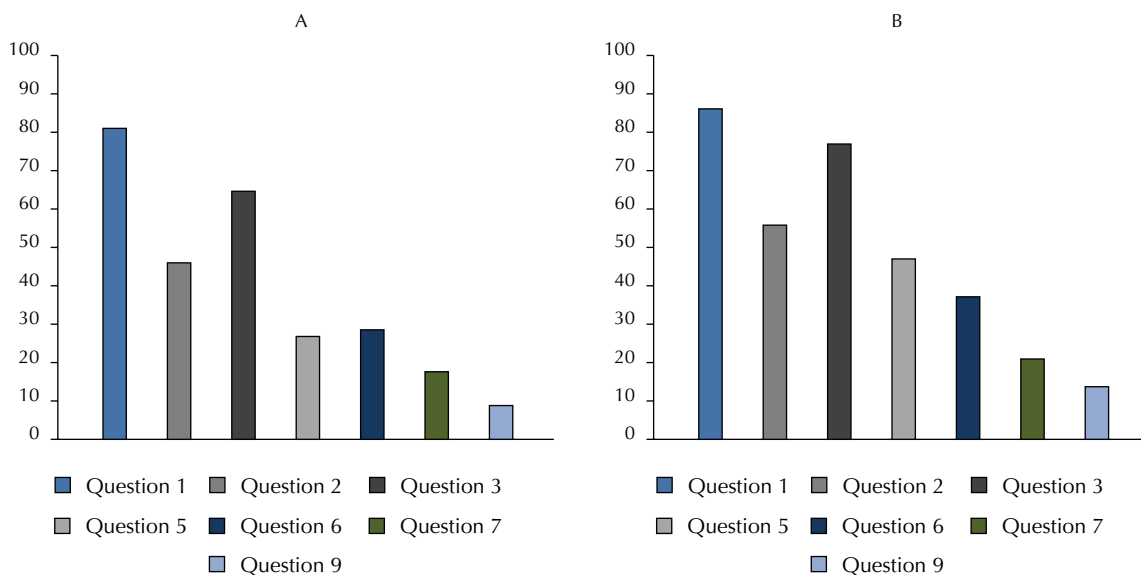
Similar results were found in the proposed model with five questions. The cut-off point with best results was, once again, the same recommended by the traditional version. Furthermore, it was verified that, for the Pelotas and the PNDS samples, sensitivity was 95.7% and 98.1%, respectively, and specificity was 100% in both. Once more, for this cut-off point, accuracy was very high: 97.0% for the Pelotas sample and close to 100% for the PNDS sample (Table 4).

In the kappa statistical analysis, both the proposed models presented high agreement with the full version of the food insecurity scale, both in the Pelotas sample and in the 2006 PNDS sample. In the former, the seven-question version presented an agreement of 97.0%, and the five-question version, of 95.0%. In the PNDS, both proposals presented an agreement of 99.0%.

DISCUSSION

Independently of the size of the proposed short version, both models showed high sensitivity and specificity when compared to the EBIA, a method that is considered the gold standard. In addition, the proposed models were accurate when they measured the prevalence of food insecurity, and their results were similar to those found by the original version. We highlight that this is the first study that proposes a short version to measure food insecurity based on the EBIA.

Since its validation in 2004, the EBIA has been used in national surveys to measure families' food insecurity level.^{15,c,e} This scale aids policies that fight hunger



^a See Table 1.

Figure. Percentage of positive answers among families with food insecurity in the questions^a that remained in the proposal for a short version based on the Brazilian Food Insecurity Scale; (A) Pelotas sample, (B) sample of the 2006 National Survey on Demography and Health. Pelotas, RS, Southern Brazil, 2013.

Tabela 2. Prevalence of food insecurity according to the Brazilian Food Insecurity Scale and to the two short version proposals in two samples. Pelotas, RS, Southern Brazil, 2013.

| Variable | Pelotas sample | | PNDS-2006 sample | |
|-------------------------|----------------|------|------------------|------|
| | n | % | n | % |
| EBIA^a | | | | |
| Food security | 91 | 39.6 | 8,998 | 61.0 |
| Food insecurity | 139 | 60.4 | 6,577 | 39.0 |
| EBIA^b | | | | |
| Food security | 94 | 40.9 | 9,034 | 61.2 |
| Food insecurity | 136 | 59.1 | 6,541 | 38.8 |
| EBIA^c | | | | |
| Food security | 97 | 42.2 | 9,121 | 61.9 |
| Food insecurity | 133 | 57.8 | 6,454 | 38.1 |

EBIA: *Escala Brasileira de Insegurança Alimentar* (Brazilian Food Insecurity Scale)

^a Full scale.

^b Seven questions (see Table 1).

^c Five questions (see Table 1).

and assesses people’s perception of foods and also the availability of foods in the household.^{14,15} Considering the importance of verifying and/or monitoring the food situation,¹⁴ using a shorter scale based on the EBIA itself and not on instruments that have not been validated for the Brazilian population can facilitate the measurement of food insecurity and the development of studies that have little time or insufficient resources to administer the full scale.

However, food insecurity is not easily measured, as diverse factors are associated with this condition, such as skin color, level of schooling and gender of the person of reference in the household,^{f,g} and must be considered in the assessment. The short version models proposed here do not aim to replace the EBIA, as they do not measure the degrees of intensity of food insecurity and do not detect families that live in hunger situation, which is characterized by a scenario of

^f Instituto Brasileiro de Geografia e Estatística. Pesquisa Nacional de Amostra de Domicílios 2009: Segurança Alimentar 2004/2009. Rio de Janeiro: IBGE; 2010.

^g Ministério do Desenvolvimento Social. Plano Nacional de Segurança Alimentar e Nutricional: 2012/2015. Brasília (DF): Câmara Interministerial de Segurança Alimentar e Nutricional; 2011.

Table 3. Sensitivity and specificity of the short version of the Brazilian Food Insecurity Scale, with seven questions.^a Pelotas, RS, Southern Brazil, 2013.

| Cut-off points | Sensitivity | Specificity | Accuracy |
|----------------|-------------|-------------|----------|
| | % | % | % |
| Pelotas sample | | | |
| ≥ 1 | 97.8 | 100 | 98.7 |
| ≥ 2 | 65.5 | 100 | 79.1 |
| ≥ 3 | 48.2 | 100 | 68.7 |
| ≥ 4 | 19.4 | 100 | 51.3 |
| ≥ 5 | 12.2 | 100 | 46.9 |
| ≥ 6 | 5.8 | 100 | 43.0 |
| 7 | 0 | 100 | 39.6 |
| PNDS | | | |
| ≥ 1 | 99.5 | 100 | 99.8 |
| ≥ 2 | 77.7 | 100 | 90.6 |
| ≥ 3 | 59.9 | 100 | 83.1 |
| ≥ 4 | 31.9 | 100 | 71.3 |
| ≥ 5 | 21.9 | 100 | 67.0 |
| ≥ 6 | 12.9 | 100 | 63.2 |
| 7 | 0 | 100 | 57.8 |

^a See Table 1.

severe food insecurity. The first scale that proposed to measure the household food insecurity level was created at the beginning of the 1990s in the United States of America.^h Constituted of 18 questions, it encompasses all the food insecurity severity levels observed in households with and without children.^f Subsequently, in 1999, a short version of the North American scale was developed containing six questions, with the aim of building a quicker and cheaper alternative to assess food insecurity.⁴

The differential of the present study was the use of two samples, one from a poor area of a medium-sized city in Brazil, and the other, representative of Brazilian women of childbearing age, which made the analysis become more robust. However, some limitations of the proposed instrument are: the impossibility of capturing other causes of food insecurity, such as the unavailability of adequate amounts of food in a certain community, neighborhood and/or region; the beliefs that restrict the consumption of available foods or some people's lower access to foods;⁴ incapacity for distinguishing between households with and without individuals younger than

Table 4. Sensitivity and specificity of the short version of the Brazilian Food Insecurity Scale, with five questions.^a Pelotas, RS, Southern Brazil, 2013.

| Cut-off points | Sensitivity | Specificity | Accuracy |
|----------------|-------------|-------------|----------|
| | % | % | % |
| Pelotas sample | | | |
| ≥ 1 | 95.7 | 100 | 97.4 |
| ≥ 2 | 58.9 | 100 | 75.2 |
| ≥ 3 | 29.5 | 100 | 57.4 |
| ≥ 4 | 12.2 | 100 | 46.9 |
| 5 | 0 | 100 | 39.6 |
| PNDS | | | |
| ≥ 1 | 99.5 | 100 | 99.7 |
| ≥ 2 | 77.5 | 100 | 90.5 |
| ≥ 3 | 59.2 | 100 | 82.8 |
| ≥ 4 | 25.7 | 100 | 68.6 |
| 5 | 0 | 100 | 57.8 |

^a See Table 1.

18 years; higher risk of food insecurity; and, like the EBIA, incapacity for capturing the food insecurity measure in an individual way, as it reflects a relative measure of the situation experienced by all the individuals in the same household.

Given the above-mentioned circumstances and reasons, we suggest the use of the proposed model with five questions, as its results were very similar to the original scale but with a lower number of questions compared to the proposed model with seven questions. In certain cases, like studies with very large samples, 14 questions increase the answering time; thus, the short version of the instrument will allow tracking the families in a food insecurity situation. If there is interest in verifying the food insecurity intensity degrees, the full scale can be subsequently administered only to the families classified with food insecurity by the short version. Furthermore, many studies have used food insecurity in a dichotomous way (presence or absence), and, along this line, the short version is also an option of instrument.

To conclude, it is necessary to apply the short version with five questions to population-based studies, in populations from different regions of Brazil, in order to attest its use as a food insecurity tracker and aid studies that investigate this condition, as well as the programs that aim to combat this problem.

^h Hamilton WL, Cook JT, Thompson WW, Buron LF, Frongillo EA, Olson CM, et al. Household food security in the United States in 1995: technical report of the Food Security Measurement Project. Alexandria (VA): US Department of Agriculture, Food and Consumer Service; 1997.

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