The Journal of Nutrition
Community and International Nutrition

Development and Validation of Measure of Household Food Insecurity in Urban Costa Rica Confirms Proposed Generic Questionnaire[1,2]

Wendy González,[3] Alicia Jiménez,[4] Graciela Madrigal,[4] Leda M. Muñoz,[4] and Edward A. Frongillo[3]*

[3]Department of Health Promotion, Education, and Behavior, University of South Carolina, Columbia, SC 29208
and [4]School of Nutrition, University of Costa Rica, 2060 San José, Costa Rica

Abstract

Interest in household food insecurity (FI) within scientific and policy groups has motivated efforts to develop methods for measuring it. Questionnaires asking about FI experiences have been shown to be valid in the contexts in which they were created. The issue has arisen as to whether such questionnaires need be developed from the ground up or if a generic questionnaire can be adapted to a particular context. This study aimed to gain an in-depth understanding of household FI in urban Costa Rica, develop and validate a questionnaire for its measurement, and inform the choice between the 2 methods of development. The study was conducting using qualitative and quantitative methods provided in the Food and Nutrition Technical Assistance (FANTA) guidelines. In-depth interviews were conducted with 49 low-middle-income urban women using a semistructured interview guide. A 14-item FI questionnaire was developed based on results from these interviews. A field study was conducted in 213 households. The results show that the developed questionnaire provides valid measurement of household FI in urban Costa Rica and is simple and quick to apply in the household setting. FANTA developed a guide during the period that this research was completed that provides a generic questionnaire that can be adapted for use in various countries, rather than building the questionnaire from the ground up. This study provides evidence that careful attention to the procedures in this guide will likely yield a questionnaire suitable for assessing household FI in middle-income countries. J. Nutr. 138: 587–592, 2008.

Introduction

Food security (FS)[5] "exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (1). It includes the availability of nutritionally adequate and safe foods and an assured availability to acquire acceptable foods in socially acceptable ways. (2). FS is, therefore, intimately related to the fulfillment of basic human rights (3). When family household conditions do not guarantee access to food, the household can be called food insecure. Food insecurity (FI) is experienced when there is: *1*) uncertainty about future food availability and access; *2*) insufficiency in the amount and kind of food required for a healthy lifestyle; or *3*) the need to use socially unacceptable ways to acquire food (2). FI is most prevalent in countries and populations subject to poverty and social exclusion, but it is also present in some of the most affluent societies (4–7). FI, therefore, seems to be related to the degree of equity and solidarity within a nation rather than its wealth.

In the last 10 y, a renewed interest in the concept of FI at the household level has emerged within scientific and policy groups. This interest has led to a better understanding of the determinants and consequences of the phenomenon as well as the development of better ways of measuring it. Measuring FI allows for information about nutrition, related consequences, and aspects of economic welfare to be more readily captured. Furthermore, FI can be measured through simple and short questionnaires, therefore with low cost and low respondent burden. Numerous countries, such as Brazil (8), Venezuela (9), Canada (10), and the United States (2), have elaborated country surveys to measure FI among their populations. The Food and Nutrition Technical Assistance (FANTA) Project recently summarized efforts to understand and measure household FI across multiple countries (11) and has published 2 technical guides to assist the timely development of a measurement instrument for household FI in particular countries (12,13). The first guide described how to develop a measure of FI from the ground up, whereas the second guide described how to develop a measure of FI by adapting a generic set of items understood to be universal. The choice between these 2 methods of development involves a trade-off between time, effort, and higher inter-country comparability on one hand and potential increased local sensitivity and specificity

[1] Supported by the Program of Integral Health Care, University of Costa Rica.
[2] Author disclosures: W. González, A. Jiménez, G. Madrigal, L. M. Muñoz, and E. A. Frongillo, no conflicts of interest.
[5] Abbreviations used: FANTA, Food and Nutrition Technical Assistance; FI, food insecurity; FS, food security; PLM, poverty line method; UBNM, unsatisfied basic needs method.
* To whom correspondence should be addressed. E-mail: efrongil@gwm.sc.edu.

Manuscript received 14 August 2007. Initial review completed 16 September 2007. Revision accepted 10 December 2007.

on the other. This study was motivated in part to inform this choice.

Costa Rica is an example of a transitional economy with increasing problems in the redistribution of the benefits of a modest but sustained economic growth experienced during the last 20 y. After reaching levels of social development far better than its neighboring Central America countries, with values for indicators such as the Human Development Index among the highest ranked countries for the Latin American region, poverty has remained stagnated in the last 20 y. Additionally, an ever-increasing Gini's coefficient, which measures the extent of income inequality, portrays a country in need of developing effective strategies to address poverty and to monitor vulnerable groups (14).

In Costa Rica, expensive nationwide surveys are conducted about every 10 y to monitor food and nutritional status (15). Annual nationwide surveys are conducted to determine the prevalence of poverty at the household level (16). These surveys have revealed a prevalence of poverty of ~20% for the last 20 y, affecting increasingly the urban areas, where >50% of the population concentrate and, therefore, where more people live under poverty. The methods used involve the use of rather long questionnaires, however, with items that respondents find difficult to answer. Additionally, some of the less formal sources of income are harder to capture for low-income groups, whereas for high-income groups, underreporting is common (17).

The measurement of FI in Costa Rica could provide important information related to the experience of poverty. A questionnaire quick to administer and analyze could potentially determine households at risk of undernutrition and/or suffering poverty in a simpler way. Furthermore, demonstration of the timely development and usefulness of measuring FI in Costa Rica provides an example that can be adapted in other transitional countries.

The aims of this study were to provide an in-depth understanding of FI in urban Costa Rica, develop and validate a questionnaire to measure this phenomenon, and test the ground-up approach of the first FANTA technical guideline (12).

Methods

A questionnaire to measure FI was developed based on the first FANTA guide (12) using both qualitative and quantitative methods. A detailed review of the scientific literature on FS was prepared.

Interviews with local informants to obtain a good understanding of the phenomenon of FI at the household level were conducted. A purposive sample of 49 mothers with children < 15 y of age were selected from 2 urban middle-low income communities in San Diego and Concepción de La Unión de Tres Ríos, in the province of Cartago, during the summer of 2005. Studies have shown that households with children are the most vulnerable to FI (18). These communities represent a wide variety of socioeconomic households and families; therefore, a range of FI experiences, perceptions, beliefs, attitudes, and behaviors were expected to be present. In each community, women attending the Community Health Center, typical of those in the community, were interviewed using a standard interview guide to ensure that similar information was obtained from all informants. The questionnaire consisted of general open-ended questions that allowed the interviewer to explore or detail issues that arose during conversation. Themes covered were related to the experience of individuals facing FI, determinants, consequences, coping, and management strategies. Special care was taken to use local terms when applicable in the questionnaire and to document the exact phrases and terminology used by the participants. Immediately after the interviews, field notes were revised and expanded where necessary.

A summary of each interview was created, highlighting the essential elements of the FI experience within each household. The causes, consequences, coping, and management strategies of FI described were presented in matrices to a panel of experts, which included the Minister of Health of Costa Rica, the national representative of FAO, and nutrition and economics researchers. This panel discussed the results, provided additional inputs, and helped define the constructs of the questionnaire. The interview data, the data from the panel of experts, and the literature were compared and it was concluded that the experience of FI in Costa Rica is similar to the experience seen elsewhere (4,19).

After reviewing the Radimer-Cornell instrument (19) and the U.S. Household Food Security Survey Module (2), specific items were designed to address each component of FI. The items were developed as a close-ended quantitative questionnaire designed to capture the severity of FI, trying to maintain as much as was possible the actual words used by the women interviewed. A total of 14 close-ended questions were created with 3 possible ordinal answers: "Never," "sometimes" and "many times." The questions were asked with reference to a 12-mo recall period.

The first draft of the questionnaire was presented to another expert panel of health professionals for their analysis and feedback. Inputs from the panel were used to guide adjustments and revision of the questionnaire.

The quality of the items developed for the questionnaire was assessed using cognitive interviewing (12,20) on a diverse group of 12 women from the population of interest. Cognitive interviewing allows for the identification of difficulties in terms of how the items are interpreted by respondents compared with their intended meaning (21). The results of this process guided additional adjustments in the phrasing of terms used in the questionnaire.

Validation of the resulting questionnaire was conducted according to 5 of the 6 criteria presented by Frongillo (20): *1*) construction of the instrument well grounded in the understanding of FI; *2*) performance of the instrument consistent with that understanding; *3*) precise; *4*) dependable; *5*) accurate; and *6*) accuracy of the instrument attributable to the well-grounded understanding for the purpose and context. Criterion 6 is difficult to meet unless there is another measure available that is more accurate than the questionnaire. Nevertheless, the accomplishment of the other criteria would provide reasonable evidence to establish its validity (12).

Criterion 1 was addressed through the qualitative method that provided understanding of FI, described above. To address the other 4 criteria, a field study was conducted in Concepción, 1 of the 2 communities selected for the study, during the summer and fall of 2005. Four sectors of the community were selected purposively to cover a large group of low-income households (the most vulnerable group). Households were selected using available community household maps elaborated by the Community Health Center and census data that identified households with children <15 y of age. Within each sector, 3 census segments displaying the largest number of households with children <15 y of age were selected for a total number of 1206 households across all sectors. Households were visited randomly and invited to participate in the study, refusals were thanked for their time, and study personnel proceeded to the next identified household. This process continued until a final sample size of 213 households was obtained (12). About 7% of households that were invited to participate refused. Refusals occurred because of reluctance to report income, lack of time, or disinterest.

Criterion 2 was assessed by examining the pattern of frequency of affirmative responses to the items in the questionnaire. The ordering of the frequency of affirmative answers to the questions was consistent with the ordering of expected severity of the items.

To assess the precision and dependability (i.e. reliability, criteria 3 and 4) of the questionnaire, the internal consistency of the set of items was examined using Cronbach's α (11,18) and factor analysis. Cronbach's α and factor analysis were calculated based on both the dichotomized responses and the 3-category responses. Although this analysis technically assesses the reliability of the FI items when combined into a continuous scale, it is informative about the internal consistency of the items in general. Cronbach's α is reported because it is a familiar statistic. Because the responses were 2 or 3 categories, it is biased downward and so provides a conservative assessment of the internal validity of the item set. Factor analysis yielded the same results for both 2- and 3-category responses.

There are multiple options for expressing the level of severity of FI from the questionnaire items (12,13). One option is to make cut-points on a continuous scale. Another option obtains the level of severity based on the specific meaning of the items, not using the scale. The first option has the advantage of being derived from the scale for which statistical reliability has been demonstrated, whereas the other option has the advantage of being more understandable and having higher face validity with policy officials and the general public. Levels of severity were obtained using both options, with a very high degree of association as measured by γ of 0.99. Furthermore, 83% of households were identically classified by the 2 options, with the other 17% of households classified as more severe by option 2 than by option 1. We used option 2 in which 3 levels of FI (mild, moderate, or severe, along with food secure) were created based on the specific meaning of the items, with a household being at a particular FI level if 1 or more items linked to that level were affirmed and no items from a more severe level were affirmed.

To assess the accuracy of the measurements obtained (criterion 5), FI expressed as levels of severity was compared with measures from traditional methods to evaluate poverty and exclusion conditions, expected to be associated with FI and consistent with its pattern. The methods selected for this comparison are used routinely by government institutions and the research community in Costa Rica and in many other countries (22) to estimate the prevalence of poverty in the population. Two instruments were used: the poverty line method (PLM) and the unsatisfied basic needs method (UBNM) (23,24). The questionnaires used for the comparison methods are an adaptation of those used by the National Home Survey for Multiple Purposes published by the National Institute of Statistics and Surveys (Instituto Nacional de Estadística y Censos) of Costa Rica (25).

The PLM was determined by quantifying the total income reported by each home and comparing it to the actual cost of a predefined "basic basket." This basket has a food and a nonalimentary component. The food basket includes the basic food products needed to cover the energy requirements of a typical Costa Rican family (26), whereas the nonalimentary component refers to the other necessary basic resources (24). Families whose income was below the cost of the basic basket were classified as poor; families whose income was below the cost of the food basket were classified as extremely poor.

The UBNM classifies families according to the level at which a group of critical basic needs are satisfied. This methodology evaluates 4 basic needs: access to an adequate household, a healthy life, knowledge, and other resources and services. A family is considered poor if it has at least 1 basic need unsatisfied. When all basic needs are satisfied, a household is classified as satisfied basic needs according to this methodology. Housing conditions, for example, are evaluated in terms of floor and ceiling conditions, by the number of people sleeping per bedroom available in the house, etc. Standard of living is evaluated by variables such as access to adequate feces disposal systems, potable water, and health insurance. Knowledge is classified by whether the members of the household between 7 and 17 y of age attend school regularly at the appropriate grade for their age group. Access to other resources and services is determined by the education and amount of income individuals living in the household contribute (23,25).

Finally, given the fact that the PLM and UBNM measure different aspects of the condition of poverty, an aggregation of the 2 methods, known as the Integrated Poverty Classification, was also used in this study. A household is considered to suffer recent poverty when it does not fulfill its basic needs but it has a higher income than the cost of the basic basket. It experiences inertial poverty when it has satisfied basic needs, but it is poor by the PLM. A chronic poor household is classified as poor by both PLM and UBNM (24).

Pearson chi-square and ANOVA were used to test for associations between household FI status and socioeconomic variables such as education, insurance coverage, and income. All analyses were conducted with SPSS software (v. 11.5).

This study was reviewed and approved by the Ethics Committee of the University of Costa Rica. Women interviewed were fully informed of the nature of the study and provided their written consent to participate.

Results

FI experience. The respondents considered that FI has multiple causes, most of them income related, such as unemployment, insufficient income, and bad administration of household income that is generally linked with social problems such as alcoholism and drug abuse. Another cause of FI cited is low level of education of the head of the household.

The respondents cited as management strategies against FI: borrowing money, working extra hours, selling or pawning personal belongings, and recurring to institutional aids. Food-related strategies included borrowing food from friends or family and improving management of food in the household (e.g. diminish food wastage, use low-cost food). The respondents also emphasized that parents protect the children's food intake, because it is considered a priority.

The experience of FI was linked with immediate psychological and biological outcomes. The respondents refer to distress, anxiety, and sadness as immediate manifestations of FI. These emotions may affect the family and social interactions. The respondents also cited malnutrition, health weakening, sickness, and negative changes in the appearance of a person as biological manifestations of FI.

Development and validation of questionnaire. **Table 1** presents the English version of the elaborated questionnaire and the percentage of households that responded "sometimes" or "many times" to each question. Most households (73.2%) affirmed that they have worried that there was not enough food and that they could not obtain more, whereas 28.6% established changes in the quality of the children's diet. Almost 11% of the households resorted to doing things that made them feel ashamed to acquire food and 6.1% of households reported having gone an entire day without eating due to a lack of food.

The frequency and order of participant's affirmative answers to each item of the questionnaire was consistent with the order of the components of severity established in the pattern of FI and responses, supporting the questionnaire's internal validity (criterion 2). Based on the specific meaning of the items and the frequency of affirmative responses, the phenomenon of FI can be expressed in 3 levels of severity. An initial level at which families feel uncertain and worry about their capacity to adequately satisfy their family's food needs and therefore begin to reduce the variety of the adult's diet (items 1, 2, 3, or 4 of the questionnaire), defined as mild FI. A 2nd level occurs when adults' eating patterns are disrupted and the quantity of adults' intake and quality of the children's diets are reduced; the number of meals and general food patterns are maintained (items 5, 6, 7, 9, or 10 of the questionnaire), defined as moderate FI. The 3rd level is reached when the children's eating patterns are disrupted and quantity of their intake reduced. Some members in the family group may engage in socially unacceptable, often perceived as shameful, practices to secure a minimum of food for the family (items 8, 11, 12, 13, or 14), defined as severe FI.

Only 16.4% of the sampled households were food secure (i.e. they answered "never" to all items). A total of 40.4% of the households experienced mild FI, 25.8% had a moderate level of FI, and 17.4% a severe level of FI (Table 1).

For the set of items, the values of 0.89 and 0.87 were obtained for the Cronbach's α based on 3-category and dichotomized responses, respectively. In a 1-factor model that explained 46% of the variation, the loadings of the items ranged from 0.58 to 0.81 for 13 of the items, with the loading for item on social acceptability being 0.47.

TABLE 1 English translation of the questionnaire developed to measure household FI in Costa Rica and responses to items obtained when applied to 213 women in the community of Concepción de La Unión[1]

Items ordered by frequency of responses	Those responding ``sometimes'' or ``many times''	Severity level (% of sample)
	%	
1. Have you worried that in your home there was not enough food and you could not obtain more?	73.2	Mild FI (40.4)
2. Did you or any adult in your home have to limit the variety of food because of lack of resources?	69.0	
3. Did you or any adult in your home have to eat the same for several days in a row because you didn't have food to prepare another different meal?	54.0	
4. Did you have to serve less food because there wasn't resources to obtain enough food?	50.7	
9. Did you have to stop giving the children the food they should have because you couldn't obtain it?	28.6	Moderate FI (25.8)
10. Because there was not enough food at home, did you have to serve less food to the children?	21.6	
5. Because there was not enough food at home, were you unable to prepare 1 of the meals of the day?	21.6	
6. Did you or any adult in your home have to skip 1 of the meals of the day because there was not enough food?	18.8	
7. Did you or any adult in your home have to go to sleep without eating because there was not enough food at home?	10.8	
14. In order to have food in your home, did you have to do things that make you feel ashamed?	10.8	Severe FI (17.4)
11. Did any of the children have to skip 1 of the meals of the day because there was not enough food at home?	9.9	
8. Did you or any adult in your home have to go a whole day without eating because there was not enough food?	6.1	
12. Did any of the children have to go to sleep without eating because there was not enough food at home?	2.8	
13. Did any of the children have to go a whole day without eating because there was not enough food?	1.9	

[1] Item numbers correspond to the order in the questionnaire. Cronbach's α reliability coefficient = 0.89.

Associations with other variables were used to assess the accuracy of the questionnaire to differentiate groups. There was an association between the levels of FI and the PLM ($\chi^2 = 18.3$; $P < 0.06$), UBNM ($\chi^2 = 12.9$; $P < 0.005$), and IPM ($\chi^2 = 31.2$; $P < 0.001$). There was an increased gradient of FI in households classified as poor with the PLM and UBNM (**Table 2**). Only 5.7% of extremely poor households were food secure, whereas 71.4% of nonpoor households were food secure. The IPM, which compiles both methods, also shows this behavior: 14.3% of chronic poor households were food secure, whereas 56.8% were severely food insecure. Only 17.1% of households without health insurance were food secure and 45.7% were severely food insecure. Mean income per capita of food-secure households was almost 2.5 times the mean income of households with severe FI. Heads of food-insecure households were less likely to have completed 9 y of schooling, although the relationship was not significant ($P < 0.170$).

Discussion

The aim of this study was to understand FI in Costa Rica, use this understanding to develop a valid questionnaire for measuring this phenomenon in this middle-income country, and inform the choice of method for questionnaire development. Qualitative

TABLE 2 Distribution of households according to FI severity within the different categories of the 3 methods used to estimate prevalence of poverty in the families (as well as other characteristics)

Household characteristics	FS	Mild FI	Moderate FI	Severe FI	Test statistic[1]	*P*-value
PLM, %						
Extreme poverty	5.7	14	14.5	18.9	18.3	<0.006
Poverty	22.9	36	54.5	48.6		
No poverty	71.4	50	30.9	32.4		
BNM, %						
UBN	25.7	44.2	43.6	67.6	12.9	<0.005
IPM, %						
Chronic poverty	14.3	26.7	40	56.8	31.2	<0.001
Recent poverty	14.3	23.3	29.1	10.8		
Inertial poverty	11.4	17.4	3.6	10.8		
No poverty	60	32.6	27.3	21.6		
Educational level of head of household, %						
<9 y of schooling	62.9	73.3	83.6	75.7	5	<0.170
Social security coverage (health insurance)						
Not covered	17.1	23.5	20.4	45.7	9.8	<0.021
Income per capita, *¢/mo* (Costa Rican colon)	93,078 ± 107,110	50,655 ± 33,709	39,448 ± 22,649	37,959 ± 19,649	9.8	<0.001

[1] Values are means ± SD or %.

and quantitative methods described in the FANTA guides were used for this purpose.

Consistent with previous studies (27–29), the causes of FI cited by respondents were income related. Economic resources are the principal determinant of access to food in urban Costa Rica (30).

From the interviews, the pattern of FI in Costa Rica was similar in many ways to that of Radimer et al. (19), although there were also important differences. FI in Costa Rica does not involve changes in food storage, in contrast to other studies that have reported this (4,31). The social component of FI also includes the use of socially acceptable ways to acquire food. Households rely on family or institutional support for food or money. This has also been described previously (32,33). Consistent with the findings of other studies, FI has immediate psychological (34–36) and physical (5,32,37) consequences.

The percentage of affirmative responses to the questionnaire items suggests that a pattern of FI can be described in terms of an evolution of experiences from less to more severe. This pattern begins with uncertainty and anxiety. As FI evolves, it progresses into decreased quality and diversity of the diet, soon afterward cutting back on the quantity of food eaten per meal and, finally, skipping meals and going hungry for $\geq$1 d (4). Because parents buffer their children from FI, at least in some cultures, the evolution to the final response level in the pattern is slower in children than in their parents (4).

The results provide strong evidence that the developed questionnaire provides valid measurement of household FI in urban Costa Rica. Its construction is well grounded in the understanding of FI in urban Costa Rica, its performance is consistent with that understanding, and it is reliable and accurate at least at the group level. The somewhat lower loading of the item on social acceptability was expected, given that this item addressed a component of FI that was not addressed by any of the other items.

The FI questionnaire is simple and quick to apply in the household setting. Although further research to validate this approach to the measurement of household FS in rural Costa Rica would be ideal, this questionnaire could be used in national surveys to measure families' vulnerability to the consequences of FI and to target related interventions.

The first FANTA guide (12) was a useful reference for developing the questionnaire from the ground up (38) based on interviews with respondents. The steps described in the guide were easy to follow and facilitated the development of the questionnaire suitable to the Costa Rican socioeconomic and cultural context.

The 2nd FANTA guide (13) was being developed during the period that this research was completed. Two international workshops were held in April 2004 and October 2005 to support and contribute to the development of this guide. The guide provides a generic questionnaire that can be adapted for use in various countries rather than building the questionnaire from the ground up. Of the 9 items in the FANTA generic questionnaire, 6 of them had a counterpart included in the Costa Rican questionnaire. The exceptions were that: *1*) in the FANTA questionnaire, 2 items asked about foods not eaten that are preferred and eaten that are not preferred, whereas the Costa Rica questionnaire instead asked about eating the same food for several days in a row; and *2*) the FANTA questionnaire asked whether there was ever no food at all in the household, whereas there was not a similar question in the Costa Rican questionnaire. The strong similarity between the 2 independently developed questionnaires from the 2nd FANTA guide and Costa Rica means that the latter confirms the constructs and items in the FANTA generic questionnaire. This study provides evidence that careful attention to following the procedures outlined in the 2nd FANTA guide will likely yield a questionnaire suitable for assessing household FI in middle-income countries.

Acknowledgments

The authors are grateful for the support of Mario León, Director, and Fernando Chavarría, Academic Coordinator, of the Program of Integral Health Care of the University of Costa Rica. We thank Juan Diego Trejos and Silvia Vargas of the University of Costa Rica for advice about the project.

Literature Cited

1. FAO. Food: a fundamental human right. Rome: FAO; 1996.
2. Committee on National Statistics. Food insecurity and hunger in the United States: an assessment of the measure. Washington, DC: National Academy Press; 2006.
3. Pelletier DL, Olson CM, Frongillo EA. Food insecurity, hunger and undernutrition. In: Bowman B, Russell R, editors. Present knowledge in nutrition. Washington, DC: International Life Science Institute Press; 2006. p. 906–22.
4. Habicht JP, Pelto G, Frongillo EA, Rose D. Conceptualization and instrumentation of food insecurity. Proceedings of the Workshop on the Measurement of Food Insecurity and Hunger; 2004 July 15; Washington, DC. Washington, DC: National Academy Press; 2004. p. 1–18.
5. Alaimo K, Olson CM, Frongillo EA, Briefel RR. Food insufficiency, family income and health in US preschool and school-aged children. Am J Public Health. 2001;91:781–6.
6. Melgar-Quiñonez HM, Kaiser LL, Martin AC, Metz D, Olivares A. Food insecurity among Latinos in California: a focal group study. Salud Publica Mex. 2003;45:198–205.
7. Olson CM, Rauschenbach BS, Frongillo EA, Kendall A. Factors contributing to household food insecurity in a rural upstate New York county. Fam Econ Nutr Rev. 1997;10:2–17.
8. Pérez-Escamilla R, Segall-Correa AM, Maranha LK, Archanjo Sampaio MF, Marín-León L, Panigassi G. An adapted version of the U.S. Department of Agriculture Food Insecurity Module is a valid instrument for assessing household food insecurity in Campinas, Brazil. J Nutr. 2004;134:1923–8.
9. Lorenzana P, Sanjur D. Abbreviated measures of food sufficiency validly estimate the food security level of poor households: measuring household food security. J Nutr. 1999;129:687–92.
10. Health Canada. Canadian Community Health Survey, Cycle 2.2, Nutrition (2004): income-related household food security in Canada. Ottawa, Ontario: Office of Nutrition Policy and Promotion; 2007.
11. Coates J, Frongillo EA, Rogers BL, Webb P, Wilde PE, Houser R. Commonalities in the experience of household food insecurity across cultures: what are measures missing? J Nutr. 2006;136:S1438–48.
12. Frongillo EA, Nanama S, Wolfe WS. Technical guide to developing a direct, experience-based measurement instrument for household food insecurity. Washington, DC: Food and Nutrition Technical Assistance Project, Academy for Educational Development; 2004.
13. Coates J, Swindale A, Bilinsky P. Household Food Insecurity Access Scale (HFIAS) for measurement of food access: indicator guide version 3. Washington, DC: Food and Nutrition Technical Assistance Project, Academy for Educational Development; 2007.
14. Programa Estado de la Nación. [Eleventh state of the nation in sustainable human development]. San José (Costa Rica): Consejo Nacional de Rectores; 2004.
15. Ministerio de Salud. [National nutrition survey]. San José (Costa Rica): Ministerio de Salud; 1996.
16. Instituto Nacional de Estadísticas y Censos. [National household survey for multiple purposes]. San José (Costa Rica): Instituto Nacional de Estadísticas y Censos; 2005.
17. Feres JC. Notes on the measurement of poverty by the income method. CEPAL Rev. 1997;61:119–33.

18. Nord, M, Andrews, M, Carlson S. Household food insecurity in the United States, 2005. USDA; 2006 Nov. Economic Research Report No.: ERR-29.
19. Radimer KL, Olson CM, Campbell CC. Development of indicators to assess hunger. J Nutr. 1990;120:1544–8.
20. Frongillo EA Jr. Validation of measures of food insecurity and hunger. J Nutr. 1999;129:506–9.
21. Alaimo K, Olson CM, Frongillo EA. Importance of cognitive testing for survey items: an example from food security questionnaires. J Nutr Educ. 1999;31:269–75.
22. Mendez F, Trejos JD. [Costa Rica: map of critical needs for the year 2009]. San José (Costa Rica): Universidad de Costa Rica; 2002.
23. Feres JC, Mancero X. [Basic needs method and its application in Latin America]. Serie estudios estadísticos y prospectivos. Santiago, Chile: CEPAL; 2001 Feb. Report No. 7.
24. Feres JC, Mancero X. [Approach to measure poverty: a literature review]. Serie estudios estadísticos y prospectivos. Santiago, Chile: CEPAL; 2001 Jan. Report No. 4.
25. Instituto Nacional de Estadísticas y Censos. [National survey for multiple purposes]. San José (Costa Rica): Instituto Nacional de Estadísticas y Censos; 2006.
26. Menchú M, Oseguera O, Zúñiga M. [Definition of the food basket in the Central American region]. Ciudad de Guatemala, Guatemala: INCAP/OPS; 1992.
27. Rose D. Economic determinants and dietary consequences of food insecurity in the United States. J Nutr. 1999;129:517–20.
28. Rose D, Gundersen C, Oliveira V. Socio-economic determinants of food insecurity in the United States: evidence from the SIPP and CSFII datasets. Washington, DC: USDA, Economic Research Service, Food and Rural Economics Division; 1998. Technical Bulletin No.: TB1869.
29. ANGLICARE. Food insecurity: a welfare agency perspective [monograph on the Internet]. Sydney: Anglicare; 2003 [cited 2005 Nov 28]. Available from: http://www.beanangel.com.au/downloads/Food%20Insecurity%20Final%20Draft%20@%20171103.pdf
30. Instituto Nacional de Estadística y Censos. [National survey of household's incomes and expenses 2004: principal results]. San José (Costa Rica): Instituto Nacional de Estadística y Censos; 2006.
31. Matheson D, Varady J, Varady A, Killen J. Household food security and nutritional status of Hispanic children in the fifth grade. Am J Clin Nutr. 2002;76:210–7.
32. Hamelin AM, Beaudry M, Habicht JP. Characterization of household food insecurity in Québec: food and feelings. Soc Sci Med. 2002;54:119–32.
33. Studdert LJ, Frongillo EA, Valois P. Measuring household food insecurity in Java during Indonesia's economic crisis. J Nutr. 2001;131:2685–91.
34. Alaimo K, Olson CM, Frongillo EA. Family food insufficiency, but not low family income, is positively associated with dysthymia and suicide symptoms in adolescents. J Nutr. 2002;132:719–25.
35. Alaimo K, Olson CM, Frongillo EA. Food insufficiency and American school-aged children's cognitive, academic and psychosocial development. Pediatrics. 2001;108:44–53.
36. Jyoti D, Frongillo EA, Jones S. Food insecurity affects school children's academic performance, weight gain, and social skills. J Nutr. 2005;135:2831–9.
37. Lee JS, Frongillo EA. Nutritional and health consequences are associated with food insecurity among U.S. elderly persons. J Nutr. 2001;131:1503–9.
38. Wolfe WS, Frongillo EA. Building household food security measurement tools from the ground up. Food Nutr Bull. 2001;22:5–12.