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ORIGINAL PAPER

An adapted Household Food Insecurity Access Scale is a valid tool as a proxy measure of food access for use in urban Iran

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Abstract We carried out this study to assess the validity and application of the Household Food Insecurity Access Scale (HFIAS) in measuring household food insecurity in the urban area of Varamin City, Iran, in 2009. In this cross-sectional descriptive study, 400 households from different parts of the urban areas of Varamin were selected by a multistage sampling scheme. Household food security was measured by the HFIAS 9-item questionnaire that asks whether a specific condition associated with the experience of food insecurity ever occurred during the previous 30 days. Based on their HFIAS questionnaire scores, households were classified into four groups: food secure, mildly, moderately and severely food insecure. In the second stage of the study, 30 households from each food security group were randomly selected to assess the validity and reliability of the HFIAS questionnaire. Food security was observed in 21 % of households. Mildly, moderately and severely food insecure households were 46.5, 25.0 and 7.5 %, respectively. In more than half the households (54.3 %) the ratio of calorie consumption to RDA was below 70 %. Poor food quality and insufficient food intake were the two factors that explained 77.5 % of the total variance. The HFIAS had good internal consistency (Cronbach's α=0.95).

Keywords Validity · Household food insecurity · Food access scale · Iran

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Introduction

Food Security occurs when "all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life" (FAO 2000). Therefore, a population has food security when there is a minimum risk of physical and economic lack of access to enough food (Nitzke and Phillips 1998). Food insecurity (FI) as a form of deprivation affects multiple dimensions of well-being (Reid 2000) and implies limited access to food and limited ability to secure adequate food (USDA 2006).

There are few analyses of risk factors for household food security in Iran but qualitative data show that the first and second income deciles of the population are the most at risk. In Iran, there is a considerable imbalance in food consumption

with low nutrient density characterizing diets at all income levels, over-consumption evident among more than a third of households, and food insecurity among 20 % of the population (Ghassemi et al. 2002).

Ethnographic assessment findings regarding food insecurity show that the response to insecure conditions varies from mild to severe. The pattern starts from anxiety and worrying and as food insecurity increases, the process is followed by decrease in the quality of food and food variety and then leads to decline in the quantity of food in each meal. Finally, missing meals and hunger in all or most of the day has been reported (FAO 2002).

Because of the complex, multi-dimensional nature of food security, methods are needed to assess each of the three elements underlying food security attainment i.e. adequate food availability, food access and food utilization (Ganapathy et al. 2005). Until recently, most household-level measures of food access, such as food consumption and caloric adequacy, have been technically difficult, data-intensive and costly to collect (Coates et al. 2007; Deitchler et al. 2010; Hoddinott 2007). In developing a tool to measure household food insecurity, researchers have most often either adapted the Cornell/Radimer questionnaire, which was initially developed for use in the USA, or developed a tool based on research into how households experience food insecurity in various countries (Frongillo and Nanama 2003).

In recent years, methods of measuring food insecurity have been developing quickly owing to the recognition of the subjective nature of food insecurity (Maxwell and Slater 2003). Displacement of quantitative food insecurity indices by qualitative and subjective indices indicates a major change in thinking about food insecurity. Recent studies of food access indices have generally been focused on household behaviors, which reflect not only the severity of food crises, but also the real experience of hunger (Webb et al. 2006).

The household food insecurity access scale (HFIAS), which was designed according to FAO and USAID's Food and Nutrition Technical Assistance (FANTA) project suggestions, is one of the simpler tools that have been introduced to measure food security. It is based on a household's experience of problems regarding access to food and reflects the feelings of the household supervisor and the family about food insecurity as conversational sentences. The HFIAS is a simple and quick solution to the problem of measuring the access component of food security and is based on the premise that it is a measurable, describable and analyzable experience. To evaluate the validity and applicability of this tool in developing countries, many studies have been carried out and the findings have been encouraging (Swindale and Bilinsky 2006). The data obtained from HFIAS are used to assess the incidence and severity of household food insecurity and to demonstrate changes over time. In HFIAS, the questions do not directly point to nutritional qualities; they cover the household's perception of the changes in the food quality regardless of the real food composition (Coates et al. 2007).

The purpose of this study was to assess the validity, performance, adaptability and use of the HFIAS questionnaire in urban areas of Varamin in 2009.

Materials and methods

Subjects

In this cross-sectional descriptive study, 400 households from different parts of Varamin, a city 30 km to the south of Tehran, were selected by the multi-stage cluster sampling method. In the first stage, using Varamin city health network directories, city regions and subsequently health centers were determined. In the second stage, random sampling was used to select the blocks in the centers' domain and in the third stage, using systematic sampling, households in each block were determined and selected. In order to select the households, different city locations of Varamin including Pishva, Javadabad, Varamin and Gharchak, all undercover health sites and centers were listed. Based on the population density of the health centers and sites, 40 clusters of 10 households were selected. The study was approved by the National Nutrition and Food Technology Research Institute Ethics Committee. Each participant signed a letter of informed consent.

Procedures

Household food security was measured by the HFIAS 9-item questionnaire, which asks whether a specific condition associated with the experience of food insecurity ever occurred during the previous 30 days. Prior to the survey, a pilot study was carried out to review the questionnaire in order to adapt the phrases and definitions to the local context by using semi-structured in-depth interviews with four key informants. The questionnaire started with anxiety of not having enough food and progressed through indicators of food insufficiency: these were decrease in the quality and variety of food, reduction in the amount of food in each meal and finally, skipping meals and spending some or all of the day being hungry. Questionnaires were completed by trained nutritionists during door-to-door interviews with household mothers. Based on the HFIAS questionnaire scores, households were grouped in four categories of food access insecurity: secure (0–1), mildly food insecure (2–7), moderately food insecure (8–14) and severely food insecure (15–27). In the second stage of the study, 30 households from each food security group (totaling 120 households) were randomly selected to assess the validity and reliability of the HFIAS questionnaire. Supplementary questionnaires concerning meal frequency, and demographics and socio-economics were also completed in the interviews

in order to assess the food used in the household and its socio-economic characteristics such as gender and age of the head of the household, household size, the number of children, the number of working members, level of education, the occupation of the head of the household and the interviewee, the residential status, the size of the residence, the number of rooms, living facilities and accessories and also the cost of food per month for the household.

Data were coded and entered into an Excel 2007 spreadsheet. To determine the validity of the questionnaire, the correlation of the household ranking, calculated on the scores obtained by the HFIAS questionnaire, with other customary quantitative measurements, such as food cost, finance and food frequency were acquired by Pearson's correlation coefficient (>0.6 was acceptable). To assess the reliability of the questionnaire, the answers to the questions were evaluated in stages one and two by Kappa and Kendal's coefficient. Internal consistency of the items was determined by Cronbach's alpha coefficient and the structural validity was determined by the rotated principal component factor analysis.

Results

As shown in Fig. 1, 21 % of households were food secure and 46.5 %, 25.0 % and 7.5 % had mild, moderate and severe food insecurity, respectively.

The most prevalent food insecurity experiences were that the food did not have sufficient diversity, nutritional adequacy and did not satisfy preferences (71.5 %) and that household members ate certain foods and foods that they did not like because of lack of resources (63.6 %). The greatest differences in the answers in the two assessment stages were in those to question 1 (being worried about inadequate food intake for household members-25 %); question 2, (family members could not eat the food they liked owing to lack of resources-10 %); and question 4, (family members ate food they did not like owing to lack of resources (9.1 %) (Table 1).

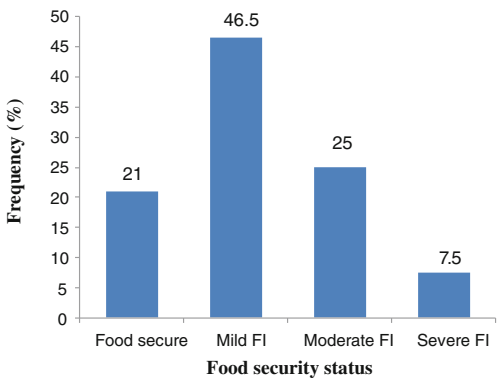

Fig. 1 Percent frequency of food security status among households in Varamin, 2009. *FI* Food Insecurity

The food frequency questionnaire (FFQ) showed that the weekly consumption by the food secure category was greatest for all food except ice cream, which was exceeded by the mildly food insecure. In aggregate, bread and cereals was the most frequently consumed group. Other frequently consumed groups were vegetables, dairy products, fats and sugar but here there were significant differences among the four categories of households (food secure and varying degrees of food insecurity). In general, frequency of consumption of the different food groups decreased in order from the food secure through the mildly and moderately food insecure to the severely food insecure Fig. 2).

Regarding the life facility indices, the mean residential size was statistically different among the food secure, mildly food insecure, moderately food insecure and severely food insecure groups (P=0.026; Fig. 3).

The mean cost of food was also significantly different among the four groups (P=0.033) as were some demographic characteristics of the evaluated households, such as occupation of the head of the household (P=0.007), education of the head of the household and the interviewee (P=0.0001). Number of household members, occupation of the interviewee and gender of household heads were not statistically different among the groups. The majority of household heads were male (97 %) and in the food secure group, 93 % of them had a job, while in the mildly, moderately and severely food insecure groups, the corresponding figures were 90 %, 77 % and 67 %, respectively. Household heads of the severely insecure group had the highest illiteracy level.

The daily calorie intake in 27.3 % of the evaluated households was above 90 %, in 9.5 % this was 80–90 %, in 8. 9 % it was 70–80 % and in 54.3 % it was less than 70 % of the recommended daily allowance (RDA; Table 2). Statistically, the daily calorie intake was different among the four mentioned groups (P=0.024).

Based on the rotated principal component factor, two components of quality and inadequate intake were extracted. Questions 1 to 4 for inadequate food quality were loaded with 0.67–0.81 load component and questions 5 to 9 for inadequate food intake were loaded with 0.67–0.79 load component. These two components explained 77.5 % of the variance; of which inadequate quality included 19.7 % and inadequate intake included 57.8 % of the variance. The Kendal tau-b (Kendal tau-b=0.627) showed a good correlation between the food security groups of the households in the two stages. The findings of this evaluation had a Cronbach's α of 0.95 which showed high internal consistency for the applied questionnaire indicating that this tool has an appropriate

Table 1 Frequency of the subjects' responses to the questions of the HFIAS questionnaire, Varamin, 2009

Questionnaire Items	No		Yes							
	N	%	Rarely		Sometimes		Often		Total yes	
			N	%	*N*	%	*N*	%	*N*	%
1-Did you worry that your household would not have enough food?	207	51.8	43	10.8	103	25.5	47	11.7	193	48.2
2-Were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	114	28.5	105	26.3	109	27.2	72	18	286	71.5
3-Did you or any household member eat a limited variety of foods due to a lack of resources?	127	31.8	108	27	109	27.2	56	14	273	68.2
4-Did you or any household member eat food that you preferred not to eat because of a lack of resources to obtain other types of food?	163	40.7	98	24.5	98	24.5	41	10.3	237	59.3
5-Did you or any household member eats a smaller meal than you felt you needed because there was not enough food?	246	61.5	78	19.5	50	12.5	26	6.5	154	38.5
6-Did you or any other household member eat fewer meals in a day because there was not enough food?	297	74.3	56	14	31	7.7	16	4	103	25.7
7-Was there ever no food at all in your household because there were not resources to get more?	350	87.5	34	8.5	11	2.8	5	1.2	50	12.5
8-Did you or any household member go to sleep at night hungry because there was not enough food?	374	93.5	13	3.2	9	2.3	4	1	26	6.5
9-Did you or any household member go a whole day without eating anything because there was not enough food?	385	96.3	8	2	4	1	3	0.7	15	3.7

validity and yields similar findings if used in comparable conditions.

Discussion

This study was performed to assess the validity of the household food insecurity access scale (HFIAS) in evaluating household food insecurity in urban areas of Varamin city in 2009. Households with mild food insecurity were anxious about obtaining adequate food and limitation of the type and amount of food intake; households with moderate food insecurity had fewer meals and households with severe food insecurity had experienced hunger. The findings were compared with the usual quantitative methods for determining household food insecurity such as food cost, assets and life styles, calorie intake and food frequency. In applying a valid index to evaluate food security, the first step is to ensure that the index is theoretically and practically understandable and acceptable (Riely et al. 1999). Although the HFIAS

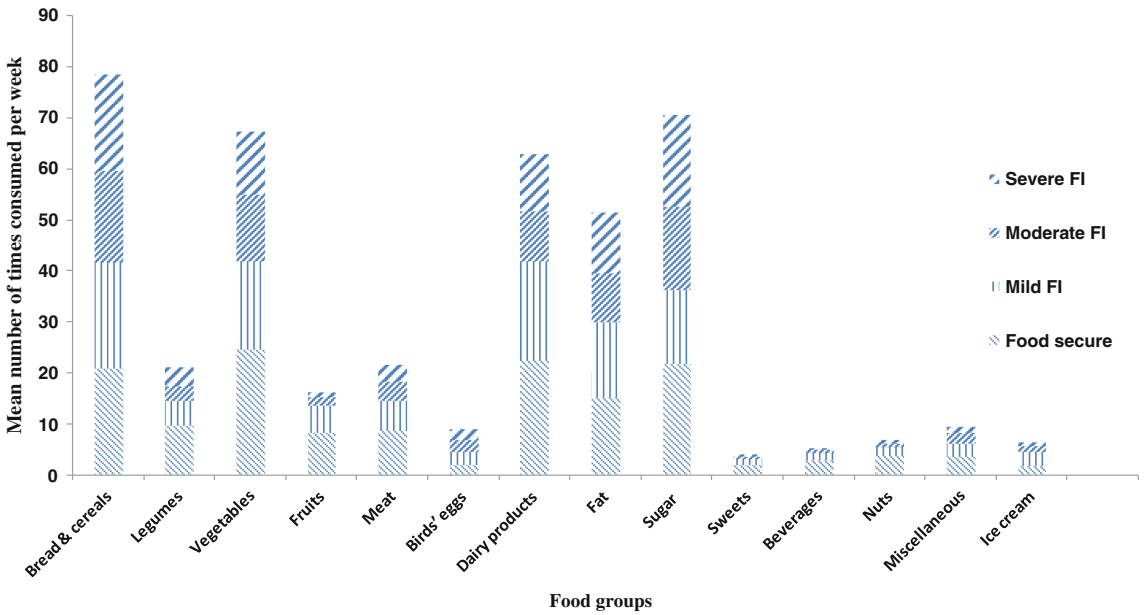

Fig. 2 The frequency of consumption per week by the four household food security categories, Varamin, 2009. *FI* Food Insecurity

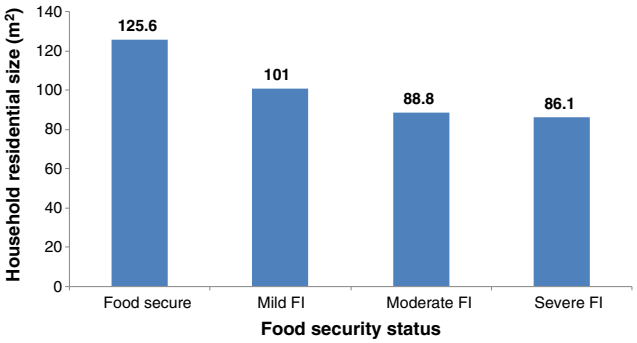

Fig. 3 Mean of residential size based on household food security categories, Varamin, 2009

questionnaire has been used in different countries, due to the various socio-economic and cultural backgrounds and also the cultural meaning of the questions, establishing how to use it in every society is necessary.

Based on the USDA report, in the next decade, the status of food security in 70 developing countries will decline (Shapouri et al. 2009; Nord et al. 1999). The frequency of food insecurity in the current study is close to studies carried out in Tanzania (Knueppel et al. 2010), Bangladesh (Benson 2007), areas of Sub-Saharan Africa, Gaza Strip (Deitchler et al. 2010) and Karachi, Pakistan (Hakeem et al. 2003). In a study performed by Melgar-Quinonez (2006), the frequency of food insecurity was 73 % in Burkina Faso, 70 % in Bolivia and 35 % in the Philippines. In a separate study in Indonesia by Studdert et al., (2001), the frequency of food insecurity in households obtained by the Radimer/Cornell questionnaire was 32 % . The frequency of food insecurity was higher in the present study compared with other studies performed in Iran (Karam Soltani et al. 2007 (USDA questionnaire); Dastgiri et al. 2006 (modified 6 item USDA questionnare); Ramesh et al. 2010 (Radimer Cornell); Ostadrahimi et al. 2006 (modified 6 item USDA questionnare)) which may have been due to the kind of tools or the questionnaire used based on the number and type of questions such as the 6-, 9- and 18-question USDA questionnaire.

In the present study, the daily calorie intake in more than half of the evaluated households was less than two thirds of the recommended RDA. Our study demonstrated that the frequency of mild food insecurity with 80 % to 90 % of the required calories and moderate food insecurity with 70 % to 80 % of the required calories was equal to the findings found in the national project for evaluating the pattern of food consumption (Kalantari et al. 2005). In another study, based on the consumption adequacy index of energy, protein, vitamin A and vitamin B2, food security ranged from complete insecurity (households who had consumed less than 90 % of the necessary amount of each of the nutrients) to complete security (households in which the consumption of each of the four nutrients was higher than 110 % of the necessary amount) (Ghassemi et al. 1996).

Similar studies conducted in Tanzania (Knueppel et al. 2010) and published by FANTA (Deitchler et al. 2010) showed that the tools used had appropriate validity and confidence in measuring household food insecurity. In addition, a study carried out in Burkina Faso showed that the HFIAS questionnaire allowed the acquisition of data useful in monitoring and assessing household food security (Becquey et al. 2010).

This study had a Cronbach's α of >0.7 that was congruent with studies conducted by Studdert et al.(2001), Radimer et al.(1992), Kendall et al. (1995) and Frongillo et al. (1997). In a previous study carried out by Radimer, using the Radimer-Cornell questionnaire, food insecurity was evaluated based on criteria such as the amount and quality of food, confidence in food access and the capability of food acceptance (Radimer et al. 1992). In a study conducted by Kendall, the validity of the Radimer-Cornell questionnaire in evaluating household food security was assessed. Construct validity was evaluated using factor analysis, consistency was assessed using Cronbach's α coefficient and criterion validity was determined by comparing food access, food consumption and the household population characteristics in food insecure households. The findings indicated the validity of the Radimer-Cornell questionnaire and its strength in differentiating food insecurity and hunger in each of the household members in the community (Kendall et al. 1995).

In the present study, comparable with a study performed by Lorenzana and Sanjur (1999), data such as household size, socio-economical indices, occupation, education of the head of the household and life style facilities were collected. The highest level of illiteracy was detected in the household heads of the severely food insecure group and they also had the smallest size of residence. The findings showed that calorie-

Table 2 Food security status in relation to recommended daily allowance in Varamin, 2009

Household food security	>90%RDA		80–90%RDA		70–80%RDA		<70%RDA	
	N	%	*N*	%	*N*	%	*N*	%
Food secure (*N*=30)	10	33.3	4	13.4	6	20	10	33.3
Mild food insecurity (*n*=30)	9	30	2	6.7	1	3.3	18	60.0
Moderate & Severe food insecurity (*n*=59)	11	18.5	5	8.5	2	3.3	41	69.7
Total (*n*=119)	30	27.3	11	9.5	9	8.9	69	54.3

supplying food together with the household understanding of food insecurity may be a reliable method to determine food insecurity in low-income city households (Lorenzana and Sanjur 1999). In a study carried out in Bangladesh by Webb et al. (2003), an 11-question food security questionnaire with a high confidence coefficient was used. This questionnaire had not only a powerful correlation with the interviewer's assessment of food security classification, but also a correlation with some comparative indexes such as household costs, poverty determinants (which are usually used to analyze poverty and food insecurity) and also access scales and food adequacy (including the proportion of food in the total cost and the number of units of food consumption). In another study, conducted to compare data from India, Bangladesh and Uganda, it was suggested that an 18-question USDA questionnaire, should be adapted to local conditions before its widespread use (Nord et al. 2003).

Regarding scoring and categorization of food security, the present study was similar to those conducted by Perez-Escamilla et al. in Brazil (2004), Leyna et al. in the Kilimanjaro area of East Africa (2008) and Gonzalez et al. in Costa Rica (2008), apart from the fact that in these studies the 18-question USDA questionnaire, the nine-question Radimer-Cornell questionnaire and the 14-question FANTA questionnaire were used, respectively. These studies suggested that the questionnaires were valid tools in evaluating household food insecurity and had the advantages of being simple and quick to administer. The questionnaire used in the present study has a high internal consistency and acceptable validity for evaluating household food insecurity and compares well with a similar study of Tehran households that was carried out to validate the adjusted version of the Radimer-Cornell questionnaire (Zerafati Shoae et al. 2007),

Conclusion

The findings showed that the questionnaire has acceptable validity and reliability for determining the frequency and severity of household food insecurity while being simple and quick to administer. Therefore, it may be recommended as a household vulnerability index related to a household's ability to access to food. The present study also showed that there is a relatively high prevalence of household food insecurity in Varamin city. These findings may help in the development of better food security policies and it is suggested that comprehensive studies in different areas and among different populations in Iran should be pursued.

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Conflict of interest We have no financial relationships relevant to this article nor do we have conflicts of interest to disclose.

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