

# Sensitivity and specificity of a short questionnaire for food insecurity surveillance in Iran

Saeed Dastgiri, Helda Tutunchi, Alireza Ostadrahimi, and Soltanali Mahboob

## Abstract

**Background.** Food insecurity is frequent in both developed and developing countries, affecting from 5% to 25% of the general population. It has considerable health impacts on the physical, social, and psychological status of individuals in communities suffering from food insecurity.

**Objective.** The aim of this study was to document the epidemiologic features of food insecurity in the northwest region of Iran and to evaluate the sensitivity and specificity of a short-form (six items) questionnaire for screening of food insecurity in the region.

**Methods.** This cross-sectional study was conducted on 300 subjects (132 male and 168 female) selected randomly in the Asadabadi area of the northwest of Iran. Information on food consumption was obtained by a 24-hour food-recall questionnaire for 3 days in a week. This information was compared with the data from the Household Food Security Scale (six-item short questionnaire) to assess the applicability of this short scale for the surveillance of food insecurity. Hunger was defined as inadequate intake of energy. Hidden hunger was defined as adequate intake of energy and inadequate intake of one (or more) of four key nutrients (protein, calcium, vitamin A, and vitamin B<sub>2</sub>).

**Results.** The prevalence of hunger and hidden hunger in the area according to the 24-hour food-recall questionnaire was 26% and 42%, respectively. Only 32% of the study population was secure in terms of having access to

all key nutrients. The sensitivity, specificity, and accuracy of the short questionnaire for screening for hunger in the population were 98.7%, 85.5%, and 89%, respectively; and the corresponding values for hidden hunger were 23.5%, 96.9%, and 56.3%.

**Conclusions.** Our findings indicate that food insecurity is prevalent in the northwest of Iran. The short questionnaire (six items) may be used as a simple, low-cost, rapid, and useful tool for the screening of food insecurity and energy intake in similar areas.

**Key words:** Food insecurity, Iran, nutritional epidemiology, short questionnaire

## Introduction

The concept of household food insecurity includes problems with the quantity of available food, uncertainty about food supply, and experience of hunger in life [1, 2]. Food insecurity is frequent in both developed and developing countries, affecting from 5% to 25% of the general population in different research reports [3–9]. It has considerable health impacts on the physical, social, and psychological status of individuals in communities suffering from food insecurity. It may also affect the quality of life of households [10]. Various techniques and methods have been used to measure food insecurity in many countries [11–13].

The aim of this study was to document the epidemiologic features of food insecurity in the northwest region of Iran, and to evaluate the sensitivity and specificity of a short-form (six items) questionnaire for screening for food insecurity in the region.

## Methods

This cross-sectional study was conducted on a total of 330 eligible individuals selected by simple random sampling from the study population using available

---

Saeed Dastgiri is affiliated with the Department of Community and Family Medicine and the National Public Health Management Center, Tabriz University of Medical Sciences, Tabriz; Helda Tutunchi and Alireza Ostadrahimi are affiliated with the School of Public Health and Nutrition, Tabriz University of Medical Sciences, Tabriz; Soltanali Mahboob is affiliated with the Centre for Nutritional Research, Tabriz University of Medical Sciences, Tabriz.

Please address queries to the corresponding author: Saeed Dastgiri, Department of Community and Family Medicine, School of Medicine, Tabriz University of Medical Sciences, Tabriz, Iran; e-mail: saeed.dastgiri@gmail.com.

records at the Asadabadi Medical Centre. Eligible individuals were followed and encouraged to come to the study setting for an interview, anthropometric measurements, and dietary assessment. The participation rate was 90%. Participants were required to sign an informed consent (showing the details of the study) to participate in the program. Approval for this study was obtained from the Research Committee of the Food and Nutrition Security Office of the Tabriz University of Medical Sciences.

Three hundred participants, including 132 males and 168 females, were eventually enrolled in the study. The setting of the study was the Asadabadi region of Tabriz, one of the major cities in the northwest of Iran. The area has previously been selected and described in detail as a reliable representative sample of the general population in terms of socioeconomic status, lifestyle, general health status, and population composition [14].

Information on food consumption was obtained with a validated 24-hour food-recall questionnaire over 3 non-consecutive days. These results were compared with data from the Household Food Security Scale [15, 16] to assess the applicability of this short scale for the surveillance of food insecurity. The short questionnaire had six questions (**table 1**). If the participants responded to two or more of the six items, they were considered food insecure. The questions were validated (in the local language) by a pilot study before starting

TABLE 1. Affirmative responses to individual items on the short questionnaire<sup>a</sup>

Question	No. (%)
1. Did you ever cut the size of meals or skip meals because of lack of money for food in the last 12 months? (Yes, No)	67 (22.3)
2. If yes, how often? (Almost every month, some months but not every month, only 1 or 2 months)	59 (19.6)
3. Did you ever eat less than you felt you should because there was not enough money to buy food in the last 12 months? (Yes, No)	62 (20.6)
4. Were you ever hungry but didn't eat because you couldn't afford enough food in the last 12 months? (Yes, No)	51 (17.0)
5. Food didn't last, and didn't have money to get more. (Was that often, sometimes, or never true for you in the last 12 months?)	56 (18.6)
6. Couldn't afford to eat balanced meals. (Was that often, sometimes, or never true for you in the last 12 months?)	178 (59.3)

a. "Yes" is the affirmative response to questions 1, 3, and 4; "almost every month" and "some months but not every month" are affirmative responses to question 2; "often" and "sometimes" are affirmative responses to questions 5 and 6. Two or more affirmative responses to the questions indicate food insecurity.

the main research. To do this, the questionnaire was distributed to 20 individuals with the same characteristics and from the same area as the main study participants. The pilot study was carried out on the first 20 subjects of the whole study group. After assessment and evaluation of the results of this pilot, the next individuals ( $n = 330$ ) were studied as the main part of the research. The results were then statistically analyzed to ensure that the short-scale questionnaire was valid for assessing household food insecurity in the main part of the research.

In this study, hunger was defined as inadequate intake of energy. Hidden hunger was defined as adequate intake of energy and inadequate intake of one (or more) of four key nutrients: protein, calcium, vitamin A, and vitamin B<sub>2</sub>. Thus in hidden hunger, dietary intake provides adequate energy but does not provide sufficient amounts of protein and micronutrients. Food insecurity was defined as uncertain or limited availability of adequate supplies of nutritional and safe food in a socially acceptable way [17].

Height and weight were measured by nutritionists. Body weight was measured with a calibrated beam scale and was recorded to the nearest 0.5 kg. The subjects were measured barefoot wearing light clothing. Height was measured with a mounted tape with the subjects' arms hanging freely at their sides and recorded to the nearest 0.5 cm. Body-mass index (BMI) was then calculated as the weight in kilograms divided by the square of the height in meters. As recommended by the Iranian Ministry of Health for the whole country, underweight, overweight, and obesity were defined as BMI less than 18.5, 25 to 29.9, and 30 or more, respectively [18]. Data were analyzed and presented by descriptive statistics (mean and SD) and some epidemiologic indicators, including prevalence rate, sensitivity, specificity, error rate, predictive value, and likelihood ratio. Confidence intervals (95%) were calculated where applicable.

## Results

**Table 2** shows the distribution of food security and insecurity according to BMI in the study subjects. Food insecurity significantly increased the risk of underweight in the study subjects (RR = 13.2, CI: 6.9–25.5), while it decreased the risk of overweight and obesity (RR = 0.30, CI: 0.18–0.49 and RR = 0.32, CI: 0.16–0.62, respectively). The prevalence rates of hunger and hidden hunger according to the 24-hour food-recall questionnaire were 26% (CI: 21–31) and 42% (CI: 37–48), respectively. Only 32% (CI: 27–38) of the study population was secure in terms of having access to all key nutrients (including protein, calcium, vitamin A, and vitamin B<sub>2</sub>).

The proportional distribution of the responses by

TABLE 2. Distribution of food security according to body-mass index (BMI)

Status	BMI category			
	< 18.5	18.5–24.9	25–29.9	≥ 30
Food secure—no. (%)	9 (4.7)	44 (23.0)	88 (46.0)	50 (26.1)
Food insecure—no. (%)	68 (62.3)	17 (15.5)	15 (13.9)	9 (8.2)
Total—no. (%)	77 (25.6)	61 (20.3)	103 (34.3)	59 (19.6)
Relative risk (95% CI)	13.2 (6.9–25.5)	0.68 (0.4–1.1)	0.30 (0.18–0.49)	0.32 (0.16–0.62)

CI, confidence interval

participants to the individual items on the Household Food Security Scale (six-item short questionnaire) is presented in **table 1**. Of the total respondents, 178 (59.3%) reported that they could not afford to eat balanced meals. At the same time, 109 (36.3%) of the respondents gave affirmative responses to two or more of the six items, indicating food insecurity.

**Table 3** shows some epidemiologic indicators of the short questionnaire in two groups identified as having hunger or hidden hunger. The sensitivity, specificity, and accuracy of the short questionnaire for screening for hunger in the population were 98.7% (CI: 93–99), 85.5% (CI: 80–90), and 89%, (CI: 85–92), respectively; the corresponding values for hidden hunger were 23.5% (CI: 17–32), 96.9% (CI: 92–99), and 56.3% (CI: 50–63).

## Discussion

This cross-sectional study was conducted to assess the applicability of a short questionnaire (six items) for screening for food insecurity in the northwest region of Iran. The findings showed that the epidemiologic indexes of the questionnaire, including sensitivity, specificity, and accuracy, were acceptably high for screening and surveillance of food insecurity and hunger in the area.

The prevalence of food insecurity according to this short questionnaire was about 36% in the study population. Gulliford and colleagues reported a similar figure

of 25% from Trinidad and Tobago [7]. The percentages of affirmative responses to the six questions in our study were 22%, 20%, 21%, 17%, 19%, and 59%, respectively. In comparison with similar figures from the United States, the current population survey and Caribbean studies showed that the prevalence of food insecurity based on the affirmative responses to six items of the food security measurement was relatively high in Iran [6, 7, 19].

Our findings showed an association of food insecurity and BMI in the study population. Food insecurity increased the rate of underweight and decreased the rates of overweight and obesity. Some studies have reported an association between food insecurity and BMI. In a nationally representative sample of 6,506 individuals from Finland, Sarlio-Lahteenkorva and Lahelma showed that underweight subjects were at higher risk for food insecurity than obese or normal subjects [20]. Townsend et al. found an association between food insecurity and overweight in the female population, whereas there was no such association in male subjects [21]. A study from the United States showed that although mild or moderate food insecurity was associated with a higher risk of obesity, severe food insecurity was associated with a lower risk of obesity [22, 23]. Another research study reported an association of food insecurity with underweight but not with obesity [7].

These studies indicate that food insecurity may be associated either with thinness or with obesity in different populations, depending on the household's

TABLE 3. Indicators of the questionnaire according to hunger status

Indicator	Hunger—% (95% CI)	Hidden hunger—% (95% CI)
Sensitivity	98.7 (93.1–99.8)	23.5 (16.9–31.8)
Specificity	85.5 (80.4–89.6)	96.9 (91.5–99.0)
Accuracy	89 (85–92.1)	56.3 (49.7–62.7)
False positive error rate	14.4 (10.4–19.6)	3.03 (1.0–8.5)
False negative error rate	1.2 (0.2–6.9)	76.4 (68.2–83.1)
Positive predictive value (pV+)	70.6 (61.5–78.4)	90.6 (75.8–96.8)
Negative predictive value (pV–)	99.5 (97.1–99.8)	50.5 (43.5–57.6)
Likelihood ratio positive (LR+)	6.8 (4.9–9.4)	7.66 (2.4–24.8)
Likelihood ratio negative (LR–)	0.01 (0.002–0.105)	0.78 (0.71–0.88)

CI, confidence interval

economic status, its eating habits, and the availability and accessibility of food. More local studies are needed to identify the key factors affecting the association between food insecurity and BMI. This will help health authorities in planning and developing strategies to prevent obesity and overweight in the population, considering the food insecurity status in the same community households and its influencing factors.

We conclude that food insecurity as a prevalent health problem in the study region can be detected by this six-item questionnaire. It may then be used as a simple, low-cost, rapid and useful tool for the screening and surveillance of food insecurity and energy intake in similar areas. It might not, however, be an appropriate

tool to measure sufficient nutrient intake. Twenty-four-hour food recall may alternatively be used to measure specific nutrient intake.

## Acknowledgments

We thank Miss Nazila Farrin and the staff of the Asadabadi Medical Centre of the Tabriz University of Medical Sciences for their assistance in this project. We also thank the Food and Nutrition Security Office of the Tabriz University of Medical Sciences for funding this project.

## References

- Alaimo K, Briefel RR, Frongillo EA Jr, Olson CM. Food insufficiency exists in the United States: Results from the third National Health and Nutrition Examination Survey (NHANES III). *Am J Public Health* 1998;88:419–26.
- Kendall A, Olson CM, Frongillo EA Jr. Relationship of hunger and food insecurity to food availability and consumption. *J Am Diet Assoc* 1996;96:1019–24.
- Carlson SJ, Andrews MS, Bickel GW. Measuring food insecurity and hunger in the United States: Development of a national benchmark measure and prevalence estimates. *J Nutr* 1999;129(2S suppl):510S–6S.
- Qasemi H. Food security programme in Islamic Republic of Iran. Tehran: Institute of Food and Nutrition Research, 1998 (in Persian).
- Zarafati Shoa N. Validity of Radimer-Cornell questionnaire in Tehran. MSc Thesis, Tehran Shahid Beheshti University of Medical Sciences, 2003 (in Persian).
- Hamilton WL, Cook JT, Thompson WW, Buron LF, Frongillo EA Jr, Olson CM, Wehler CA. Household food security in the United States in 1995: Summary report of the Food Security Measurement Project. Alexandria, VA, USA: US Department of Agriculture, Food and Consumer Service, September 1997.
- Gulliford MC, Mahabir D, Rocke B. Food insecurity, food choices, and body mass index in adults: Nutrition transition in Trinidad and Tobago. *Int J Epidemiol* 2003;32:508–16.
- Kaiser LL, Townsend MS, Melgar-Quinonez HR, Fujii ML, Crawford PB. Choice of instrument influences relations between food insecurity and obesity in Latino women. *Am J Clin Nutr* 2004;80:1372–8.
- Bickel G, Nord M, Price C, Hamilton W, Cook J. Measuring food security in the United States. Guide to measuring food security. Revised 2000. Washington, DC: US Department of Agriculture, Food and Nutrition Service, 2000.
- Campbell CC. Food insecurity: A nutritional outcome or a predictor variable? *J Nutr* 1991;121:408–15.
- 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;136:1438S–48S.
- Webb P, Coates J, Frongillo EA, Rogers BL, Swindale A, Bilinsky A. Measuring household food insecurity: Why it's so important and yet so difficult to do. *J Nutr* 2006;136:1404S–8S.
- Swindale A, Bilinsky P. Development of a universally applicable household food insecurity measurement tool: Process, current status, and outstanding issues. *J Nutr* 2006;136:1449S–52S.
- Asadabadi Population and Health Survey. *Tabriz Med J* 2003;suppl 59:1s–42s, 115s–120s.
- Blumberg SJ, Bialostosky K, Hamilton WL, Briefel RR. The effectiveness of a short form of the Household Food Security Scale. *Am J Public Health* 1999;89:12131–4.
- Gulliford MC, Nunes C, Rocke B. The 18 Household Food Security Survey items provide valid food security classifications for adults and children in the Caribbean. *BMC Public Health* 2006;6:26.
- Radimer KL, Olson CM, Campell CC. Development of indicators to assess hunger. *J Nutr* 1990;120(suppl 11):1544–8.
- Laquatra I. Nutrition for weight management In: Mahan K, Escot-Stump S, eds. *Krause's food, nutrition and diet therapy*, 11th ed. Philadelphia, PA, USA: Saunders, 2004:565.
- Gulliford MC, Mahabir D, Rocke B. Reliability and validity of a short form household food security scale in a Caribbean community. *BMC Public Health* 2004;4:22.
- Sarlio-Lahteenkorva S, Lahelma E. Food insecurity is associated with past and present economic disadvantage and body mass index. *J Nutr* 2001;131:2880–4.
- Townsend MS, Peerson J, Love B, Achterberg C, Murphy SP. Food insecurity is positively related to overweight in women. *J Nutr* 2001;131:1738–45.
- Olson CM. Nutrition and health outcomes associated with food insecurity and hunger. *J Nutr* 1999;129(2S suppl):521S–4S.
- Frongillo EA, Olson CM, Rauschenbach BA, Kendall A. Nutrition consequences of food insecurity in a rural New York State County. Institute for Research on Poverty Discussion Paper No. 1120-97. Madison, WI, USA: University of Wisconsin, 1997.