JOURNAL OF NUTRITION FASTING AND HEALTH

Prevalence of Food Insecurity and Its Association with Maternal and Child Anthropometric Indices and Socioeconomic Status and Dietary Intake in low- income Households in Golshahr District, Mashhad in 2014

Asieh AhmadiHosseini[1#], Ali Hadianfar [2#], Nasrin Omidvar[3], Golnaz Ranjbar[4], Asma ZadeAbasi[4], Mohammad Safarian[4], Mohsen Nematy[4, 5*]

1. Department of Nutrition, Ghaem Hospital, Mashhad University of Medical Sciences Mashhad, Iran.
2. Student Research Committee, Mashhad University of Medical Sciences, Mashhad, Iran.
3. Department of Community Nutrition, National Nutrition and Food Technology Research Institute, Faculty of Nutrition Sciences and Food Technology, Shahid Beheshti, University of Medical Sciences, Tehran, Iran.
4. Department of Nutrition, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran.
5. Metabolic Syndrome Research Center, Mashhad University of Medical Sciences, Mashhad, Iran.

Equal first author

ARTICLEINFO

Article type:
Research Paper

Article History:
Received: 10 Dec 2022
Accepted: 25 Feb 2023
Published: 07 Mar 2023

Keywords:
Children
Mother
Food insecurity
Anthropometric indices
Iran

ABSTRACT

Introduction: The relation between the anthropometric status of household members and food insecurity is complicated and not clearly defined. The current study aimed to examine the prevalence of food insecurity (FI) and its association with maternal and child anthropometric indices and dietary intake in a low-income district located in the northeast of Iran.

Methods: This cross-sectional survey was conducted on 400 representative households. The participants were mothers of children aged ≤6 years. Food security with 18-item USDA questionnaire, anthropometric status of mothers and children was measured by measuring weight and height dietary intake with food frequency questionnaire.

Results: Fifty-eight percent of households were food insecure. No correlation was denoted between food insecurity and anthropometric indices, except for maternal height (P=0.02). After adjustment for the other variables, food insecurity was inversely correlated with maternal age (OR: 1.12; 95% CI: 1.06-1.19), maternal education level (OR: 8.41; 95% CI: 1.89-37.46), the employment status of the spouse (OR: 4.28; 95% CI: 2.02-9.05), socioeconomic status (OR: 12.86; 95% CI: 4.84-34.16), and the number of children aged ≤6 years (OR: 2.83; 95% CI: 1.16-6.80). The mean carbohydrate, fat, energy and folic acid consumption were observed to be lower in the food insecure mothers (P<0.05), while the mean intake of fruits was higher in the food-secure mothers (P<0.001).

Conclusion: Women in households with a low socioeconomic status were at an elevated risk of food insecurity and micronutrient deficiencies.

▶ Please cite this paper as:
AhmadiHosseini A, Hadianfar A, Omidvar N, Ranjbar G, ZadeAbasi A, Safarian M, Nematy M. Prevalence of Food Insecurity and Its Association with Maternal and Child Anthropometric Indices and Socioeconomic Status and Dietary Intake in low- income Households in Golshahr District, Mashhad in 2014. J Nutr Fast Health. 2023; 11(1): 41-51. DOI: 10.22038/JNFH.2023.69475.1415.

Introduction

Food insecurity(FI) is a condition that exists when people cannot access adequate amounts of nutritious and safe food for sufficient development and growth for a healthy and active life due to lack of secure (1). Food insecurity does not cause starvation, but rather, starvation is a possible consequence of food insecurity.

According to the literature, FI is associated with the socioeconomic status of the household head/adult members, including low education levels, economic constraints, single-/female-headed households, and more children or crowded households (HHs) (2-4). Although FI may threaten individuals in all periods of life, recent evidence suggests a relation between FI and mother and child health status as two vulnerable members of every HH (5-7). In today's world, a growing number of female-headed HHs is affected by FI (8, 9). Studies show that women experience higher levels of FI compared to men (10) due to their poor economic status and

* *Corresponding author:* Mohsen Nematy, Department of Nutrition, Faculty of Medicine, Mashhad University of Medical Sciences, Azady Square, University Campus, Mashhad9177948564, Iran. Tel: +985138002361, Fax: +985138002421, Email: NematyM@mums.ac.ir.

limited purchasing power compared to male-headed HHs. Women when have limited economic condition and lower education are exclusively vulnerable to financial management strategies, especially. As such, they need special consideration in terms of FI (11).

In the FI pattern, women are the first member of the HH who sacrifice their food intake, while children's food pattern is affected only by severe FI status (12, 13). Limited access healthy foods may influence the quantity of the available food, as well as the nutritional value of dietary patterns and behaviors (14-17). HH FI is associated with lower intake of healthful food groups, such as vegetables, fruits and protein .Furthermore, higher intake of fulfilling food group (e.g., starchy and fatty foods) represent a dietary plan that may lead to the insufficiency of essential vitamins and minerals and cause overweight in adolescents, as well as other health complications in the long run (18, 19).

Children in FI HHs are at an elevated risk of health disorders such as developmental delay, higher hospitalization rates, depression, and susceptibility to chronic diseases in adulthood. However, the association of FI with children's anthropometric indices remains unclear (20). Studies conducted in the past two decades have proposed conflicting results about the effects of FI on children's anthropometric status, reporting positive or negative correlations and even no associations in this regard (20, 21). Therefore, the AAP has recommended that all pediatrics should routinely be screened for the correlation between FI and childhood anthropometric indices to help clinicians pay attention to pediatrics in populations with a poor socioeconomic status (22).

Despite the clear relation between FI and food access, the correlation among weight status and FI of HH members is more complex and not clearly defined (23). FI may affect weight status in two different manners; the first mechanism is excess weight gain due to the tendency to derive satiety, which urges the individual to consume energy-dense and nutrient-poor foods. This pattern is more prevalent in mildly food-insecure HHs (27, 28). In the second mechanism, severe FI may increase weight loss depending on starvation periods (24). The interactions between the body weight, dietary intake, and FI are complicated and may vary depending on the SES, demographic characteristics, and different coping mechanisms in response to FI (25). Overeating or starvation periods may occur when there is abundance or scarcity, and this repeating behavior could lead to anthropometrics issues, such as diabetes, obesity and also other mental health disorders later in life (11, 23).

Iran is experiencing drastic epidemiologic and accelerated nutrition transition and is also witnessing a rise in the outbreak of weight imbalances including overweight and obesity , therefore, this issue is converting into a major public health and nutritional concern (26, 27). Therefore, recognizing the effect of individual and HH FI on dietary patterns and health of HH members could contribute to designing proper interventions to prevent growing FI challenges. Due to the high vulnerability of females of childbearing age and children aged ≤6 years to undernutrition and micronutrient deficiencies and the limited document regarding the relation among FI, the anthropometric indices of females and their children and dietary intake in the northeast of Republic Islamic of Iran, the current survey aimed to:

(1) Examine the prevalence and also socioeconomic effects associated with food insecurity and anthropometric indices of children (aged ≤6 years) and their mothers in the Golshahr district in Mashhad city;

(2) Evaluate the effects of FI on maternal dietary intakes

Materials and Methods

Study Design

The current cross-sectional survey was carried out from June to November 2014 in Golshahr. Golshahr, is a slum and low-income district in Mashhad city, located in the northeast of Mashhad. The study protocol was approved by Mashhad University of Medical Sciences Ethics Committee. (Ethics code number: 930241).

Sample Population

Since no estimates of the outbreak of food insecurity in Mashhad or Khorasan province could be found, we considered the 44% estimated prevalence of food insecurity in Shiraz (4). A number of 400 HHs was calculated using the following equation:

$$n = \frac{(z_{1-\alpha/2})^2 pq}{d^2} = \frac{(4)(0.44)(0.56)}{0.05^2} = 394$$

Data Collection

A sample of 400 Iranian HHs who had at least one child aged less than six years and lived in Golshahr district were selected from three health centers via systematic cluster sampling.

The inclusion criteria were: 1) current residency in Golshahr; 2) belonging to any Persian ethnic groups; 3) absence of endocrine or metabolic disorders and 4) no pregnancy or lactation.

The number of the HHs in every single health center was specified based on the inhabitant ratio. The participants were selected from the mothers of children aged ≤6 years. Information were collected via direct interviews with the mothers after obtaining their written informed consent. The duration of the interviews was almost 45 minutes per HH, and two dietitian interviewers were involved in data collection.

Before conducting the main survey, an experimental study was conducted on thirty persons. Through this step, two MSc nutritionist students were trained on interviewing skills and measuring anthropometric indices. Finally, necessary modifications were made in the questionnaire.

SES and Demographic Characteristics

Population data included family size, age, number of children, and number of children aged ≤6 years. Socioeconomic data included the SES, education level, occupation status, house ownership status, and house size/capita. These data were collected using a valid questionnaire, which has been previously used in Iranian HHs (28). Occupation status was classified into different categories, including unemployed, seasonal laborer, and/or housekeeper (category one), employee (e.g., permanent laborer, government job; category two), and self-employed (e.g., freelancer, shopkeeper; category three).

The economic status of the HHs was evaluated by counting the HH assets (e.g., motorcycle/automobile, color TV/LCD TV, refrigerator/side-by-side refrigerator, simple washing machine/automatic washing machine, stove with/without oven, microwave oven, vacuum cleaner, mobile cell phone/smartphone, laptop/computer, internet connection). Based on the total sum of the facility score and the study by Eini Zinab (29), the SES was classified into tertiles; facility scores of ≤7 were defined as low SES, scores 8-14 indicated average SES, and scores 15-21 showed high SES.

Evaluation of FS Status

HH FS was measured using United States Department of Agriculture questionnaire (30) within the past 12 months prior to the study. The reliability and validity of the questionnaire were previously evaluated and confirmed for the urban Iranian population in Shiraz (4). The scale contains of 18 questions with four choices, which categorized households into food-insecure with severe hunger, food-insecure with moderate hunger,

food-insecure without hunger and food-secure (12).

Anthropometrics Measurements

The weight of each participant (mothers and children) was evaluated to the nearest 0.1 kilogram with barefoot and minimal clothing and using a calibrated Seca scale (813 Hamburg, Germany). Height of each participant (mothers and children) was also measured to the nearest one millimeter without shoes. The body mass index was evaluated as the weight divided by the squared height (31). The BMI index categorized as follows:

BMI <18.5 kg/m^2: underweight, BMI: 18.5-24.9 kg/m^2: normal weight, BMI: 25.0-29.9 kg/m^2: overweight and the Body mass index ≥30.0 kg/m^2: obesity.

Anthropometric indices of the children were calculated using the WHO AnthroPlus software included WAZ, HAZ, and BMIZ. HAZ<-1 was defined as short stature, WAZ<-1 was defined as underweight, the normal range of Z-score is between -1≤ Z-scores ≤1. In addition, Z-scores ≥1 were specifieds as tall/overweight. [1]

Assessment of Dietary Intake

In this survey , dietary intake was determined using the semi-quantitative FFQ with 160 food items, which has been created and validated in MUMS(32). The FFQ was filled during interviews, and two skillful dietitians asked the questions about the three sections of the questionnaire, including the food list, portion sizes, and the frequency of in taking several foods in the last 30 days. Moreover, an album of food photo was shown before completing the FFQ, which consisted of 10 photos to estimate the average consumption of the food items. The repetition of in taking each food item was also examined in various categories, including daily (once a day, two or three times a day, four or five times a day, six times a day), weekly (once per week, two or

four times a week, five or six times a week), monthly (one or three times a month) and never or less than once per month, Portion sizes were categorized in large (one and a half times more than the moderate use [or more]), medium (equal to specified average use and small (half of the persistent moderate use or less). The recorded repetition of in taking each food item was transformed into daily intake, and the consumed serving size was transformed into grams (g) based on the HH measures.

In order to examine the filled FFQs, a software designer's team collaborated with the researchers. In total, 400 FFQs were scanned completely then, and the first software (written with Delphi7 programming software) (33) was applied to select the items of the scanned pages, which were converted into an external file in the TXT format. Another software (written with Microsoft visual basic 2008 [VB 9.0] programming software) (32) exported the amount of the consumed food and the detailed analysis of each dietary intake into SPSS version 16.0, including macronutrient (e.g., energy, protein, carbohydrates) and micronutrients (e.g., fiber, vitamin A, folic acid).

Statistical Analysis

The analysis of data was done in SPSS version 16.0 (SPSS Inc USA) by using descriptive statistics for socioeconomic variables, proportions with percentages for the categorical variables, and mean and standard deviation (Mean ±SD) for the continuous variables. The mean nutrient intake of the mothers in FI and FS households was analyzed by using student's t-test and reported as Mean ±SD. ANOVA and Chi-square test were used to compare the FS status with the independent variables. In addition, to specify the correlations between FS status and other variables, a logistic regression model was applied and the crude and adjusted odds ratios (OR) were reported as well.

Table 1. Sociodemographic Characteristics Based on Household Food Security Status in Mashhad, Iran (n=400)

Socioeconomic Status	Classification	Household Food Security Status			P-value
		Food-secure N (%)	Food-insecure without Hunger N (%)	Food-insecure with hunger N (%)	
Maternal Education Level*	Middle school (or below)	31 (18.7)	35 (29.2)	43 (37.7)	<0.001
	High School or Technical Diploma	120 (72.3)	80 (66.7)	71 (62.3)	
	Academic	15 (9.0)	5 (4.2)	0 (0.0)	
Spouse's Education Level*	Middle school (or below)	31 (18.7)	30 (25.0)	43 (37.7)	<0.001
	High School or Technical Diploma	115 (69.3)	85 (70.8)	65 (57.0)	
	Academic	20 (12.0)	5 (4.2)	6 (5.3)	
Maternal Occupation Status	Category 1	161 (97.0)	119 (99.2)	110 (96.5)	0.35
	Category 2	5 (3.0)	1 (0.8)	3.5 (4.0)	
	Category 3	0 (0.0)	0 (0.0)	0 (0.0)	
Spouse's Occupation Status*	Category 1	14 (8.4)	29 (24.2)	55 (48.2)	<0.001
	Category 2	25 (15.1)	9 (7.5)	5 (4.4)	
	Category 3	127 (76.5)	82 (68.3)	54 (74.4)	
House Ownership*	Private Ownership	86 (51.8)	42 (35.0)	32 (28.1)	<0.001
	Rental	47 (28.3)	57 (47.5)	65 (57.0)	
	Free	33 (19.9)	21 (17.5)	17 (14.9)	
SES*	Low	2 (1.2)	38 (31.7)	51 (44.7)	p<0.001
	Medium	115 (69.3)	76 (63.3)	61 (53.5)	
	High	49 (29.5)	6 (5.0)	2 (1.8)	
		Mean±SD			
Protector age (Y)		32.92±6.8	33.64±6.76	33.89±6.13	0.44
Maternal Age* (Y)		28.49±6.06	30.16±6.14	30.71±6.02	0.006
Family Size* (N)		3.81±0.93	3.98±0.93	4.23±1.15	0.003
Number of Children*		79.91±1.0	1.94±0.88	2.28±1.16	<0.001
Number of Children Aged ≤6 Years*		1.06±0.27	1.12±0.33	1.20±0.44	0.006
House Size/Capita (m^2)*		23.33±8.83	21.87±11.04	18.8±7.56	<0.001

*Significant difference based on different levels of food insecurity status using ANOVA (P<0.05); SD: standard deviation. category 1: unemployed, seasonal laborer, and/or housekeeper. category 2: employee, permanent laborer, government job and self-employed). category 3: e.g., freelancer, shopkeeper. SES: Socioeconomic Status

Results

More than 58% HHs suffered from severe (7.8%), moderate (20.8%), and mild FI (30%), while only 41.5% were food-secure. In 95% of HH, men were the HH head Table 1 shows demographic features and SES of HHs according to FI status. The results of multivariate analyses showed that FI status of HHs was considerably associated with age and education level of mother, education level and occupation status of spouse, house size/ownership, the SES, family size, and the number of children (especially children aged ≤6 years) (P<0.001).

Table 2. Correlations between Demographic and Socioeconomic Factors and Food Security Status Based on Crude and Adjusted Models in Iranian Households in Mashhad (n=400)

Socioeconomic/Demographic Characteristics	Total n=400	Food-secure	Food-insecure N (%)	Crude OR (95% CI)	Adjusted OR (95% CI)
		58%	42%		
Maternal Education Level*					
Middle school (or below)	221 (55.3)	74(44.6)	147 (62.8)	5.95 (2.09-17.03)	8.41 (1.89-37.46)
High School or Technical Diploma	159 (39.8)	77 46.4)	82 (35.0)	3.19 (1.11-9.21)	3.32 (0.77-14.21)
Academic (reference)	20 (5.0)	15 (9.0)	5 (2.1)	-	-
Spouse's Education Level*					
Middle school (or below)	248 (62.0)	96(57.8)	152 (65.0)	2.88 (1.32-6.27)	0.69 (0.19-2.49)
High School or Technical Diploma	121 (30.3)	50(30.1)	71 (30.3)	2.58 (1.13-5.86)	1.34 (0.38-4.77)
Academic (reference)	31 (7.8)	20(12.0)	11 (4.7)	-	-
Maternal Occupation Status					
Category 1	390 (97.5)	161(97.0	229 (97.9)	1.42 (0.40-4.99)	
Category 2 (reference)	10 (2.5)	5 (3.0)	5 (2.1)	-	-
Spouse's Occupation Status*					
Category 1	98 (24.5)	14 (8.4)	84 (35.9)	5.69 (3.08-10.53)	4.28 (2.02 -9.05)
Category 2	37 (9.3)	23 (13.9)	14 (6.0)	0.58 (0.28-1.17)	0.87 (0.32-2.36)
Category 3 (reference)	265 (66.3)	129 (77.7)	136 (58.1)	-	-
House Ownership*					
Rental	240 (60.0)	80 (48.2)	160 (68.4)	0.43 (0.29-0.65)	1.17 (0.64-2.15)
Private (reference)	160 (40.0)	86 (51.8)	74 (31.6)	-	-
SES*					
Low	91 (22.8)	2 (1.2)	89 (38.0)	272.6 (55.7-1334.2)	651.87 (106.41-3993.41)
Medium	252 (63.0)	115 (69.3)	137 (58.5)	7.30 (3.32-16.03)	12.86 (4.84-34.16)
High (reference)	57 (14.2)	137 (58.5)	8 (3.4)	-	-
			Mean ± SD		
Protector age (Y)	33.41±6.60	32.92±6.80	33.76±6.44	1.02 (0.99-1.05)	
Maternal Age* (Y)	29.62±6.13	28.48±6.06	30.42±6.07	1.06 (1.02-1.09)	1.12 (1.06-1.19)
Family Size* (N)	3.98±1.01	3.81±0.93	4.11±1.05	1.06 (1.02-1.09)	1.24 (0.39-3.95)
Number of Children*	1.98±0.99	1.79±0.91	2.11±1.04	1.36 (1.09-1.6)	0.92 (0.28-3.0)
Number of Children Aged ≤6 Years*		1.07±0.27	1.16±0.39	2.47 (1.25-4.88)	2.83 (1.16-6.80)
House Size/Capita (m2)*	82.16±30.7	86.13±31.15	79.35±30.1	0.99 (0.98-0.99)	0.99 (0.98-1.0)

OR values as crude OR refer to unadjusted odds ratios of food insecurity among study samples; adjusted OR refers to odds ratio of food insecurity after adjusting for all other demographic and socioeconomic variables; CI: confidence interval; SES: socioeconomic status. category 1: unemployed, seasonal laborer, and/or housekeeper. category 2: employee, permanent laborer, government job and self-employed). category 3: e.g., freelancer, shopkeeper

Note: Bold indicates significant variables.

Factors Associated with FI

Adjusted and crude models were applied to report the associations between household FS and sociodemographic and economic factors (Table 2). In the crude model, higher odds of FI were observed in the lower education level of the spouse and mother ,possession of a house (renting as opposed to owning), the SES (low and average as opposed to high), age of mother, size of family, total number of children, number of children aged ≤6 years, and house size/capita. After adjusting for the other variables in the adjusted model, significantly higher odds of FI were observed with age of mother (OR:1.12; 95% CI: 1.06-1.19), maternal education level (OR: 8.41; 95% CI: 1.89-37.46), spouse's occupation status (OR: 4.28; 95% CI: 2.02-9.05), the SES (OR:12.86; 95% CI: 4.84-34.16), and the number of children aged ≤6 years (OR: 2.83; 95% CI: 1.16–6.80).

Table 3. Anthropometric Indices of Mothers Based on Food Security Status in Mashhad (n=400)

Anthropometrics	Food-secure	Food-insecure without hunger	Food-insecure with hunger	P-value
Height (cm) *	159.65±5.21	158.18±5.70	158.21±5.22	0.02
Weight (kg)	64.41±13.06	63.04±13.97	61.63±10.51	0.19

*Significant difference based on different levels of food insecurity status using ANOVA (P<0.05)

Table 4. Anthropometric Indices of Children Based on Food Security Status in Mashhad (n=400)

Anthropometric Indices		Food Security Status			P-value
		Food-secure	Food-insecure without hunger	Food-insecure with hunger	
		N (%)	N (%)	N (%)	
Weight Status Based on (BAZ)[1]	Underweight	63 (38.0)	42 (35.0)	44 (38.0)	0.89
	Normal	87 (52.4)	66 (55.0)	56 (49.1)	
	Over weight	16 (9.6)	12 (10.0)	14 (12.3)	
Height Status Based on (HAZ)[2]	Stunt	34 (20.5)	23 (19.2)	27 (23.7)	0.60
	Normal Stature	84 (50.6)	67 (55.8)	63 (55.3)	
	Tall	48 (28.9)	30 (25.0)	24 (21.1)	
Weight Status Based on (WAZ)[3]	Under weight	44 (26.5)	31 (25.8)	33 (28.9)	0.79
	Normal	98 (59.0)	75 (62.5)	70 (61.4)	
	Over weight	24 (14.5)	14 (11.7)	11 (9.6)	

*Significant difference based on different levels of food security status using ANOVA (P<0.05)
1. BMI-for-age Z Score, 2. Height-for-age Z-score, 3. Weight-for-age Z Score

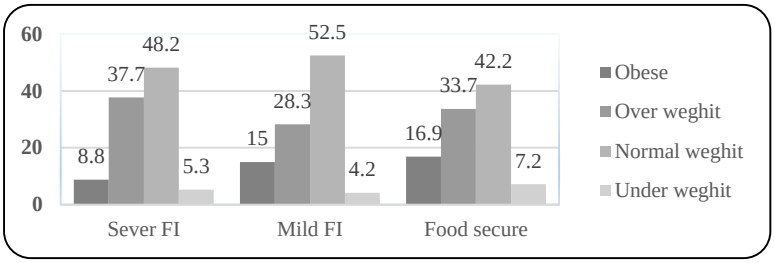

Figure 1. Prevalence of Underweight, Normal Weight, Overweight, and Obesity Based on Household Food Security Status in Mashhad, Iran (n=400)

Food Security (FS) and Weight Status of Children and Mothers

Among the studied women, 33% were overweight, and 14.0% were obese. Underweight was observed only in 5.8% of the women. Figure 1 illustrates the weight status of the mothers base on the BMI categories by the FI status of HH. Accordingly, mean height of women in the food-secure HHs was significantly higher (1.4 cm) compared to the women in the food-insecure HHs. Tables 3 and 4 show the relation of the anthropometric indices of the mothers and children by the FI status of the HH, respectively. Accordingly, except for the height status of the mother in the food-insecure HH, there was not any significant differences between the anthropometric measurement of the children and mothers in various levels of household FS.

Table 5. Maternal Mean (±SE) Daily Nutrient Intake by Household Food Security Status (n=400)

	Food Security Status			P-value
	Food-secure	Food-insecure without hunger	Food-insecure with hunger	
Energy (kcal/kg day)*	42.61±8.32	42.44±8.54	39.59±6.79	0.04
Protein (g/kg day)	1.49±0.38	1.46±0.37	1.42±0.32	0.47
Fat (g/day)*	110.02±24.5	104.05±23.9	98.3±21.4	0.007
Carbohydrate (g/day)*	330.7±70.9	321.8±72.8	289.6±51.2	0.001
Fiber (g/day)	20.6±7.2	19.3±6.2	18.8±6.5	0.24
Fruits (g/day)*	374.7±257.23	251.7±181.3	234.1±147.1	<0.001
Vegetables (g/day)	250.9±180.7	246.9±173.3	204.4±147.4	0.17
Micronutrients				
Vitamin A (µg/day)	934.8±379.8	896.8±377.9	829.5±324.5	0.18
Folate (µg/day)*	603.3±465.1	564.3±309.6	443.4±226.6	0.017

Using One-way ANOVA to Compare Mean Nutrient Intake per day (*significant difference at P<0.05)

Food Insecurity and Dietary Intake of Mothers

Table 5 shows the mean intake of macronutrients (protein, carbohydrates, and fat), other nutrients (e.g., energy and fiber), micronutrients (e.g., vitamin A and folic acid), and vegetable and fruit consumption according to food security status. There was a significant differences between food-secure and food-insecure mothers in terms of macronutrient intake, including energy intake (P=0.04), carbohydrates (P=0.001), fat (P=0.007), and folic acid (P=0.017). Similarly, the evaluation of macronutrient intake indicated that the mothers' mean daily intake of fruits (P<0.001) was considerably higher in the FS HHs compared to the food-insecure HHs. However, there was not any significant difference between vegetable consumption (P=0.17), fiber intake (P=0.24), and vitamin A consumption (P=0.18).

Discussion

The current study is the first survey conducted in Golshar district of Mashhad city to explore the prevalence and effective predictors of FI and investigate whether FI is related with the elevated risk of unbalanced anthropometric indices in mothers and their children concurrently. Furthermore, the correlation with maternal dietary deficiency was evaluated. According to the findings, the most significant predictors of FI were maternal age and education level, the SES, total number of children aged ≤6 years, and the spouse's occupation status.

Prevalence of FI and the Predictive Factors

According to the obtained results, FI was highly prevalent in the studied HHs, and 58% of the HHs showed some degree of FI. The overall abundance of FI in republic Islamic of Iran was reported approximately 49% in a systematic review (34). The higher rate of FI in the current survey could be due to the low level-income sample population and young HHs as having children aged ≤6 years makes HHs more prone to FI. Under such circumstances, HH heads are the only individuals who earn money, and the other members are only consumers. The percentage prevalence of FI observed in the present survey was higher than the rate reported by Ramesh et al. in Shiraz, Iran (44%) (4) and lower than a study conducted on the HHs covered by the Relief Committee in Bushehr, Iran (86%) (35). This discrepancy could be due to the difference in the economic status of the studied HHs, as well as the different questionnaires was applied to measure FS.

A survey by Payab et al in Ray aimed to investigate the influential factors in FI in mothers with elementary school children and the prevalence of FI was reported to be 50.2% in the mothers. The mentioned study also indicated that maternal education level, HH heads, family size, ownership/residential house, and a better SES were inversely associated with FI (36).

FI and Maternal Weight Status and Dietary Intake

In fact only a few studies have evaluated the association between FI and weight status of children and their mother, particularly in the Middle East. Although there was not any significant differences between maternal weight status with FI in the present study, the women of the food-secure HHs were 1.4 centimeters taller than those of food-insecure HHs. Furthermore, mothers of the food-insecure HHs had suffered from FI for a long time in their own families, living in unsafe HHs and receiving insufficient food while growing, which may have caused their stunted height growth. Only one study was found in this regard proposing a similar finding (37), which indicated that marginal FI in women was associated with 1.3 centimeters shorter height.

The only study to examine both mother and child anthropometric status at the same time has been performed in Shiraz, Iran (4), showing a significant difference between maternal weight status and FI. However, no correlation was reported between the weight status of children and FI, and more incidence rate of obesity in the mentioned study may be due to the higher mean age of the mothers compared to the current research. In the case of food deprivation, it is believed that mothers put children's needs first, which may lead to the normal weight of children. Meanwhile, inadequate food supply could cause a preoccupation with food, which has the potential to cause obesity and result in overeating when there is access to adequate food (28).

Several studies have evaluated the relation between FS and weight status around the world. For example, Townsend et al. (24) reported an unexpected and paradoxical association between the weight status of women and FI, and the incidence of overweight was observed to be

higher in the women of food-insecure HHs. In another research conducted in Trinidad and Tobago, Colombia (31), HH food deprivation was reported to be significantly related with maternal lower weight but not overweight. The higher prevalence of underweight in the mentioned study compared to our research could be attributed to the higher prevalence of severe FI in Colombia.

In the current research, a significant relation was observed between the daily dietary intake of two macronutrients (fat and carbohydrates), folic acid and energy. The mean variables were all higher in the FS HHs, while the mean intake of fruits was smaller in the food-insecure HHs in comparison to FS HHs. Although FI did not affect weight status in our study, it cannot be concluded that food-insecure women necessarily adopt a healthy and balanced diet. In food-insecure HHs, the quantity and nutritional value of food are compromised.

A few studies in Iran have demonstrated the correlation between obesity, FI, and dietary intake. For instance, Mohammadi et al. evaluated overweight and obesity in women living in Tehran, reporting that women in moderately FI HHs were less likely to become overweight in comparison to the women from food-secure HHs(28). Consistently, our findings indicated that the female from the FI HHs had lower intake of vegetable and fruit and a higher macronutrients intake.

In another study, Rezazadeh et al. assessed two different ethnic groups in the northwest of Iran, concluding that the better socioeconomic status decline the risk of central and general obesity in the ethnic women. Meanwhile, the women with a better SES living in moderately and severely food-insecure HHs had lower chance of central obesity and higher chance of overall obesity (38). In line with our findings, Payab et al. reported that the dietary intakes of all macronutrients (except fat) were significantly lower in food-insecure HHs (39). In the mentioned study, a 24-hour recall was used, and micronutrients were not investigated.

As a part of Azar cohort study, Faramarzi et al. presented that energy consumption in the FI group was more than the FS group, which is incompatible with the results of the current study. Unlike with our findings, the mentioned survey showed that the mean intakes of vitamin A were considerably smaller in the FI group probably due to high costs (40). In the present study, FI was measured using the 18-item USDA questionnaire, while Faramarzi et al. used the HFIAS, which is a 6 item questionnaire that determines energy consumption to assess food adequacy. The 18-item USDA questionnaire has higher accuracy compared to the HFIAS (40).

In a cross-sectional survey applied on 378 mothers in Beirut, Jomaa et al. revealed that FI mothers had higher chance of obesity and inadequate intake of dairy products, vegetables and fruits, which led to deficiencies in folic acid (not vitamin A) in the food-insecure women(41). The positive correlation between FI and obesity in the mentioned study could be due to the higher mean age of the mothers compared to our sample population, which increases the risk of obesity due to the decreased secretion of the growth hormone as a protective factor against obesity.

FI and the Weight Status of Children

Our findings indicated no association between FI and the anthropometric indices of the children aged ≤6 years. FI affects the anthropometric status of children in a different manner, such as excess weight gain, underweight, or no special effect. In the current research, the rate of severe FI in the children was estimated at 7.8%. In the FI pattern, mothers are the first members influenced by FI. If maternal weight status (children's food provider) is not influenced by FI, the anthropometric status of children does not change by FI through the mother's protection.

In Iran, a few studies have explored FI in children, reporting no significant association between FI and weight status, which is in line with our findings. Karam Soltani et al in Yazd. (42) applied a case-control survey province on 394 over weight students (cases) and normal (non-obese) students (controls) aged 9-11 years, reporting no significant differences in the prevalence rate of FI and weight status between the two different groups. Furthermore, in Farokhshahr Basirat et al. (43) conducted a cross-sectional studies on 314,6-11 years old students, in fact there was not any significant relation between HH FI and BMI of children.

As for the international studies in this regard, Nazaré Lucena et al. investigated 1,487 children of HHs with a poor SES, reporting that the children living in HHs with severe FI were less chance to develop overweight compared to those living in FS HHs (44). In Bogota (45), the rate of underweight in FI children was 3 times

higher than FS children, and the difference compare to our study could be due to the higher incidence of severe FI, which threatens the children' s weight status.

One of the strengths of current survey was the large sample size. Some of the limitations were the concurrence of the study with the initiation of the national targeted subsidies by the government, which might have made some participants reluctant to respond to our questions regarding their income due to their concerns about receiving the subsidies. In addition, we did not complete the FFQ for children and were not able to distinguish how mothers may change the adequacy of their diet for the sake of their children.

Conclusion

This current research supplies new intuition into the prevalence and important factors related with FI in low-income Iranian HHs. It is suggested that social policies be adopted regarding FI by policymakers in order to improve the condition by considering special facilities for HHs with children < eighteen years old to reduce the prevalence of FI. According to the results, a normal anthropometric status is not an exclusive outcome of health. Even with a normal weight status, the dietary intake may be influenced by food inadequacy and FI. Consequently, food deficiencies (e.g., folic acid) may cause considerable defects in the next generation of women of reproductive age. A healthy plate including fruits and vegetables as source of folic acid and vitamin A had no special consideration among the food-insecure HHs in this study due to financial difficulties, which may lead to non-communicable and also metabolic diseases later in life.

Acknowledgments

Hereby, we extend our gratitude to all the parents and Mashhad Education Organization for assisting us in this research project.

Conflicts of Interest

None declared.

Funding

This current survey was financially protected by MUMS in Mashhad, Iran (grant No. 930241) as part of an MSc thesis entitled the "Prevalence of food insecurity and its association with mother and child weight status in Iranian households in Golshahr district in Mashhad city". The first author was an MSc student, and the corresponding author was the supervisor.

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[1] **Abbreviation:**
BMI: Body Mass Index.
FFQ: Food Frequency Questionnaire.
ORs: Odds Ratios.
HH: Household.
FI: Food-Insecure.
SES: Socioeconomic Status.
BMIZ: BMI-for-age Z score.
WAZ: Weight-for-age Z score.
HAZ: height -for-age Z score.
AAP: American Academy of Pediatrics.
USDA: United States Department of Agriculture.
MUMS: Mashhad University of Medical Sciences.
HFIAS: Household Food Security Scale.