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Association of Food Insecurity with Nutrition Status, Food Diversity and Anthropometric Status in Iranian Elderlies: A Cross-Sectional Study

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A B S T R A C T

Background: Health and nutritional issues of the elderly are different from other age groups. The results of studies cannot be compared and concluded, because these studies have different operational definitions, such as considering food quality rather than the amount of food intake and also limiting some causes of food insecurity in the analysis and the presentation of results in others. Therefore, we investigated the effects of food insecurity on food diversity and the nutritional and anthropometric status of the elderly in Tehran.

Methods: This cross-sectional study was performed on 300 elderly residents in Tehran, with a mean age of 67.5 ± 5.74. Food insecurity was evaluated using the Household Food Insecurity Access Scale (HFIAS). The nutritional status and health of the elderlies were assessed using the Mini Nutritional Assessment (MNA). Waist circumference, weight, and height were measured and BMI was calculated. All statistical calculations were performed with the SPSS.

Results: The prevalence of malnourishment was significantly ($p < 0.001$) higher in the severely food-insecure group (62.5%). A significant inverse relationship was observed between the HFIAS scores and weight ($\beta = -4.38$, $p < 0.001$), body mass index ($\beta = -1.46$, $p < 0.001$), waist circumference ($\beta = -3.37$, $p = 0.002$), and dietary diversity score (DDS) ($\beta = -0.738$, $p < 0.001$). Moreover, we found a significant relationship between HFIAS and MNA scores ($\beta = 0.486$, $p < 0.001$). Participants in the food-insecure group had a greater risk of developing malnourishment (OR, 16.45; 95% CI, 8.55-31.66) and having poor dietary diversity (OR, 7.42; 95% CI, 2.87-19.16) compared with the food-secure group.

Conclusion: After adjusting for possible confounding factors, we found that food insecurity was associated with MNA score. We also found an inverse association between food insecurity and socioeconomic status, anthropometric measurements, and dietary diversity.

Introduction

Because of the increase in life expectancy, the number of elderly people is growing in the world and Iran. The necessity of paying attention to the nutritional status of this population in order to maintain the quality of their life and health is evident in the world [1]. It is projected that the population of 60-year-olds in Iran will reach 26 million by 2050 [2]. This remarkable increase highlights the importance of preparing health as well as social support systems. Food security, as one of the main issues, should be taken into account.

Older persons are potentially vulnerable to be malnourished [1]. Undernutrition, a type of malnutrition, results from an imbalanced intake of energy, protein, minerals, and vitamins that can lead to decreased quality of life. It causes reduced function, disability, and increased mortality in the elderly [1, 3]. The increased susceptibility of the elderly to illness and poor conditions may disrupt their ability to cook at home and receive adequate nutrition, which is

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important to their health. Food security is one of the prerequisites to the health of the elderly. Food insecurity threatens public health and nutritional status, especially in the elderly.

Food security is one of the major health, social, economic, and political issues in different countries, especially the third world countries [4]. Food security is defined as adequate access of all people to food, at all times, to have an active and healthy life [4]. Part of the relationship between food insecurity and noncommunicable diseases may be due to the impact of food insecurity on food patterns, because it makes the population consume calorie-dense food with low nutrients [5-6], go on diets poor in fruits, vegetables [7-8], milk, and dairy products [7], or consume unhealthy food [9]. The main reason for increased food insecurity is poverty due to such factors as unemployment, job insecurity and non-permanent employment, inadequate income, dependency on pension and social protection, and high housing costs relative to income [10].

Maintaining food diversity is also one of the most important ways to ensure the balance of nutrients in all age groups, including the elderly. Various studies on the diversity of the elderly's diet have shown that food diversity is associated with increased bioavailability of micronutrients and, consequently, adequate intake of nutrients. Dietary diversity is often defined as the "consumption of different foods in a specified time" [11]. Food security and diet diversity of family cannot be achieved through relying on a group of main foods. For example, a diet exclusively based on cereals such as corn or wheat will reduce the amount of micronutrient intake. Optimal nutrition, crucial for the mental and physical health of the elderly, necessitates diversifying the diet to achieve balanced nutrition [12].

Health and nutritional issues of the elderly are different from those of other age groups. Similarly, the status of food security and the factors affecting it in old people are unlike other groups in the society because they are more vulnerable to diseases and health conditions that may disrupt their normal function, such as living at home and cooking [13]. Among the various factors affecting the food security of the elderly, functional impairment and physical disability, independent of other factors, are the most effective ones [14].

So far, several studies on the food security of older people have been conducted in different parts of the world [15-16]. However, the results of such studies cannot be compared and concluded since these studies have different operational definitions, such as considering food quality rather than the amount of food intake and also limiting some causes of food insecurity in the analysis and the presentation of results in others [13, 17-18]. Therefore, we investigated the effects of food insecurity on food diversity and nutritional and anthropometric status in the elderly in Tehran.

Methods

This descriptive-analytic cross-sectional study was conducted on the elderly over 60 years of age in Tehran in 2013. The subjects were selected from the elderly visiting the health centers of the municipality of Tehran who had sufficient cognitive ability to answer the questions. The Ethics Committee of the Islamic Azad University Center approved the study (IR.IAU.SRB.REC.1396.28). A pilot study was initially conducted to identify possible problems of the study, how subjects respond to the questionnaires, and what changes were required to be made in the questionnaires. The sample size was considered 300 according to both the results of previous studies [19] in which a 30% prevalence of food insecurity was identified and the results of the pilot study via the formula of $N = [p1 (1-p1) + p2 (1-p2)] z 1-\alpha / 2 + z1-B) 2 / (P1-P2) 2$ with the type I error of 0.05 and the type II error of 0.2. We invited the elderly registered in 5 health houses of the municipality in the north, south, east, west, and center of Tehran city to participate in the study.

The objectives of the study were described to the participants, and informed consent was obtained. Using the Seca digital scale, weight was measured with minimum clothes and no shoes. Height was measured with an accuracy of 1 cm using the tape meter in the standing position beside the wall and without shoes while the shoulders were in normal position. Waist circumference was measured in the middle of the distance between the last rib and the iliac crest while exhaling. Also, information including age, marital status, occupational status, income, education, insurance, food aid, household size, homeownership, number of children, housemate, smoking, diabetes mellitus, hypertension, specific illness, and consumption of medication or supplement were taken through completing a general information questionnaire.

Food insecurity was evaluated using the

Household Food Insecurity Access Scale (HFIAS) containing 9 questions with 4 answers in the frequency of occurrence (including often, sometimes, rarely, and not). The questionnaire provides data on food access at the household level. The questions were about the anxiety and concern about lack of enough food, decrease in the quality and diversity of food, decrease in the amount of food consumed per meal, removing meals, and being hungry all or most of the day. This questionnaire was completed by trained nutrition experts through an interview with the elderly.

Nutritional status and health of the elderly were assessed using the Mini Nutritional Assessment (MNA). The MNA is a validated tool to assess the nutritional status of older people in different countries [20]. It includes 18 questions on anthropometric measurements, dietary intake, meal frequency, food groups and fluids intake, overall assessment of lifestyle, medication use, physical activity, acute stress, neuropsychological problems, self-assessment, and people's opinion on their health and nutrition. The MNA categorizes subjects as having normal nutritional status, being at risk of malnutrition, or being malnourished [21-22].

A food-frequency questionnaire (FFQ) consisting of 147 food items [23] was used to evaluate the dietary intake and food diversity of the participants. The FFQ included a list of food along with standard portion size. The participants were asked to report their frequency of intake of food items during last year as daily, weekly, or monthly. All food portions were converted to grams using the household scales guideline [24]. The total daily energy intake and macronutrient and micronutrient intakes were calculated with Excel, and the numbers of consumed units were calculated using SPSS. Based on the food pyramid, designed by the US Department of Agriculture (USDA-2005), five food groups including grains, fruits, vegetables, meat, and dairy products were considered. These food groups were selected to have a balanced and healthy diet recommended by the US Department of Agriculture. The main groups were then divided into 23 subgroups representing the food diversity of each pyramid food group.

Data were analyzed using SPSS, version 24. To describe the data, descriptive statistics (mean, standard deviation, minimum and maximum for quantitative data and frequency and percentage for qualitative data) were used. ANOVA and Chi-square tests were used to examine the relationships between the independent variable and the main outcomes. Multiple linear regression was used to predict the effects of food security on the nutritional and anthropometric status and food diversity.

Results

General characteristics of the participants are presented in (Table 1). Data were reported for participants divided into food secure (225), mildly food insecure (41), moderately food insecure (17), severely food insecure (17). The mean age of subjects was higher in food-insecure groups compared with the food-secure group ($p = 0.01$). Anthropometry measures such as weight, WC, and BMI were lower in the food-insecure groups compared with the food-secure group, with the severely food-insecure group having the lowest weight, WC, and BMI ($p < 0.001$). In addition, malnourishment was significantly ($p < 0.001$) more prevalent among people with severe food insecurity (62.5%) compared with subjects with mild food insecurity (16.7%), moderate food insecurity (12.5%), and food-secure subjects (8.3%). Moreover, peoples in food-insecure groups had poor economic status than the food-secure group ($p < 0.001$). Multiple linear regression analysis of the Household Food Insecurity Access Scale with weight, BMI, WC, Mini Nutritional Assessment score, and Dietary Diversity score after adjusted for age, sex, income, marital status were detailed in (Table 2). A significant inverse relationship between Household Food Insecurity Access Scale with weight ($\beta = -4.38$, $p < 0.001$), BMI ($\beta = -1.46$, $p < 0.001$), WC ($\beta = -3.37$, $p = 0.002$), and Dietary Diversity Score ($\beta = -0.738$, $p < 0.001$) was observed. Moreover, we found a significant relationship between the Household Food Insecurity Access Scale and the Mini Nutritional Assessment score ($\beta = 0.486$, $p < 0.001$). The multivariate-adjusted odds ratio was reported in Table 3. Participants in the food insecure group had more risk of Malnourished (OR 16.45; 95% CI 8.55, 31.66) and poor Dietary Diversity (OR 7.42; 95% CI 2.87, 19.16) compared with the food-secure group.

Table 1. General characteristics of the participants in the study by food security level

		Household Food Insecurity Access Scale				
		Food secure (225)	Mildly food insecure (41)	Moderately food insecure (17)	Severely food insecure (17)	P Value*
Age		67.03±5.72	68.83±6.22	68.65±5.24	69.41±4.55	0.01
Sex (%)	Male	75.8%	14.3%	5%	5%	0.868
	Female	74.1%	12.9%	6.5%	6.5%	
Weight (kg)		73.82±12.07	74.13±10.20	64.29±9.78	59.18±15.49	<0.001
BMI (kg/m^2)		26.59±4.14	28.51±4.64	23.12±1.45	20.69±4.59	<0.001
WC (cm^2)		92.30±9.35	93.95±10.10	80.17±4.75	82.76±9.41	<0.001
Mini Nutritional Assessment score (%)	Well nourished	92.3	7.1	0.0	0.5	<0.001
	At risk	52.5	28.8	17.5	1.3	
	Malnourished	8.3	16.7	12.5	62.5	
Dietary Diversity Groupings	Good	94%	2.4%	2.4%	1.2%	<0.001
	Average	88%	10.6%	0.0%	1.4%	
	Poor	29.3%	32%	20%	18.7%	
Economic status	Good	100%	0.0%	0.0%	0.0%	<0.001
	Average	88.4%	10.7%	0.0%	0.8%	
	Poor	27.4%	33.3	20.2	19%	

BMI, body mass index; WC, waist circumference
* Obtained from ANOVA for continuous variables and $\chi 2$ test for categorical variables

Table 2. Multiple linear regression analysis showing food insecure association with variables

	Household Food Insecurity Access Scale	
	β	P*
Weight(kg)	-4.38	<0.001
BMI (kg/m^2)	-1.46	<0.001
WC (cm^2)	-3.37	0.002
Mini Nutritional Assessment score	0.486	<0.001
Dietary Diversity score	-0.738	<0.001

*All variables were adjusted for age, sex, income, marital status

Table 3. Multivariate-adjusted OR and 95% CI for having abdominal adiposity, overweight, and obesity across categories of Household Food Insecurity Access Scale

Risk factors	categories of Household Food Insecurity Access Scale		P for trend
	Food secure (225)	food insecure (75)	
Obesity	1	0.56(0.33_0.94)	<0.001
Malnourished(MNA)	1	16.45 (8.55_31.66)	<0.001
Poor Dietary Diversity	1	7.42 (2.87_19.16)	<0.001

*All variables were adjusted for age, sex, income, marital status, and energy intake

Discussion

The results of this cross-sectional study of Iranian older persons provide further evidence regarding possible associations between food insecurity and anthropometric measurements, DDS, and MNA. Our findings revealed a favorable association for food insecurity with MNA score. We also found an inverse association between food insecurity, socioeconomic status, anthropometric measurements, and DDS.

The hypothesis that obesity and food insecurity might be associated was not confirmed in the cross-sectional study because food insecurity was common at higher levels of BMI, and there was no clear association between food insecurity and obesity. The suggestive association between food insecurity and weight status in our study is in line with a study by Gulliford et al. [25]. In that study, food insecurity was associated with underweight but not with obesity. Our findings were also similar to those of Sarlio et al. [26]. They indicated that thin people were most likely to food insecurity status and declared that the association between BMI and food insecurity is curvilinear. Also, in the mentioned study, due to fears or of running out of money and economic problems, obese people reported more buying cheaper food than normal-weight subjects. These findings are consistent with our results which showed that participants who were food insecure probably were less likely to consume vegetables, fruits, or salads frequently. In contrary to our study, several articles indicated that food insecurity was associated with an increased risk of overweight or obesity. For example, the analyses of data for 193 women in New York State revealed that the mean BMI of food insecure women was higher than for women living in food-secure households [27].

Interestingly, a previous study of American women showed that the food insecure group are at a higher risk of obesity compared to food-insecure women without children [28]. Besides, an association between food insecurity and overweight in women but not men was reported in another study by Townsend et al. [29]. These studies collect primary evidence that food insecurity may happen, surprisingly, in high- or middle-income countries, and may contribute either to underweight or obesity. Based on prior evidence, low income was strongly associated with food insecurity at the level of the individual. Furthermore, the economic situation and health status are the substantial problems of elderly subjects which restricted their food choices [25].

We found that the participants in food-insecure groups had poor dietary diversity compared with the food-secure group. Our results were in parallel with the study by Faber et al. [30]. They express that DDS is a promising indicator of food security. Moreover, Yuan-Ting et al. [31] found that there were significant associations between DDS and higher total food expenditure among the free-living elderly in Taiwan. One explanation for this is the economic conditions, which allow more dietary flexibility for older people [32]. Hence, this can affect the nutritional status of the elderly as seen in our study. Our findings on malnutrition are similar to several studies. For example, an investigation in Brazil showed that the food insecurity prevalence was 33.0% mild, 11.8% moderate, and 7.2% severe on a small sample. In another study conducted Turkey reported that Food insecurity was 21.7% in those aged 65 years and above [33]. Even though food insecurity was defined differently, in our study, food insecurity prevalence was lower than we expected, but this affects malnutrition risk significantly. Similar malnutrition rates were also found in several different studies held in Taiwan and Spain [34-37]. The differences between these studies reflect the difference in socio-economic conditions among the elderly. So that, in higher socio-economic countries, malnutrition rates were lower whereas, in Bangladesh, a lower socioeconomic country the malnutrition rates were found higher than our data [38-39].

To date, this is the first study to estimate associations between food security with DDS and MNA in elderly people. The main limitation of the current study is its cross-sectional design, which does not allow us to draw conclusions regarding cause and effect. Second, scoring by tertiles of food security scores could be prone to misclassification of data.

Conclusion

After adjusting for possible confounding factors, we found that food insecurity was associated with the MNA score. We also found an inverse association between food insecurity, socioeconomic status, anthropometric measurements, and DDS.

Conflict of interest

The authors declare that they have no conflicts of interest.

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