Original Article

Household Food Insecurity and Associated Factors among Iranian Patients with Esophageal and Gastric Cancers

Masoudreza Sohrabi[1] (ID), Ensiyeh Mollanoroozy[2], Hamid Abbasi[3], Shima Mehrabadi[4], Farhad Zamani[1], Hossein Ajdarkosh[1], Sare Hatamian[1], Atefeh Bahavar[1], Fahimeh Safarnezhad Tameshkel[1], Ali Gholami[5,6*]

[1]Gastrointestinal and Liver Disease Research Center (GILDRC), Firoozgar Hospital, Iran University of Medical Sciences, Tehran, Iran
[2]Epidemiology & Biostatistics Department, School of Public Health, Neyshabur University of Medical, Sciences, Neyshabur, Iran
[3]Department of Public Health, Neyshabur University of Medical Sciences, Neyshabur, Iran
[4]Student Research Committee, Neyshabur University of Medical Sciences, Neyshabur, Iran
[5]Noncommunicable Diseases Research Centre, Neyshabur University of Medical Sciences, Neyshabur, Iran
[6]Epidemiology & Biostatistics Department, School of Public Health, Neyshabur University of Medical, Sciences, Neyshabur, Iran

Abstract
Background: Household food insecurity (HFI) which has still been one of the major global public health issues is related to adverse health outcomes in individuals. Therefore, this study aimed to determine the prevalence of HFI and its associated factors in Iranian patients with esophageal and gastric cancers.
Methods: The data of this cross-sectional study was obtained from 315 patients with esophageal and gastric cancers who were selected from a gastrointestinal cancer-based cohort study conducted in Firoozgar hospital, in Tehran. Food insecurity (FI) was measured using the Iranian version of the HFI questionnaire that was completed by a trained interviewer. The multivariable logistic regression model was used to determine the independent association of each factor with HFI. A *P* value lower than 0.05 was considered statistically significant.
Results: The mean±SD of participants' age was 63.2±12.6 years and 65.4% were men. Most of the patients (75.8%) suffered from gastric cancer and 24.2% from esophageal cancer. The overall prevalence of FI among participants' households was 35.2%. There was an independent significant association between wealth index (WI) and HFI after the use of the multivariable logistic regression model, in such a way that the odds of FI in the poorest, poor, moderate, and rich patients' households were respectively, 6.41, 5.05, 2.74 and 2.04 times higher compared with the richest households.
Conclusion: More than a third of participants' households struggled with FI, which was found to have a higher prevalence in low-economic households. Therefore, health policymakers should intervene in food-insecure households by developing, establishing, and implementing strategies and control programs to improve affordable food access.
Keywords: Food insecurity, Gastrointestinal, Esophageal, Gastric, Cancer
Cite this article as: Sohrabi M, Mollanoroozy E, Abbasi H, Mehrabadi S, Zamani F, Ajdarkosh H, et al. Household food insecurity and associated factors among Iranian patients with esophageal and gastric cancers. *Middle East J Dig Dis* 2023;15(2):76-82. doi: 10.34172/mejdd.2023.326.

Introduction

From a nutritionist's standpoint, food is an important factor due to its potential for providing nutrients to supply energy for performing different body-based activities, boosting the immune system, and maintaining a healthy life.[1] Having considered the importance of poor nutrition and food scarcity as a global public health challenge, it was argued that food insecurity (FI) comes with several serious social, physical, and psychological consequences for individuals such as stigmatization, decreased life expectancy, cardiovascular disease, digestive disorders as well as a reduction in the disease tolerance.[2-5] Considering this issue, FI as defined by Food and Agriculture Organization refers to the concept of "limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways".[6] Household food insecurity (HFI) as a disability to provide sufficient food for a healthy lifestyle for all members of a household is affected by various factors such as race, unemployment, economic status, household size, presence of smokers, and patients with chronic diseases in the family (as diabetes, hypertension, and cancers), and so on.[5,7,8]

FI as an important consideration for family physicians and likely an emerging key issue for oncologists is found to be associated with impaired immune system and cognitive functions.[9,10] Furthermore, its adverse health outcome may contribute to the development of a group of cancers such as esophagus and gastric cancers.[11-14] On the other hand, FI is associated with cancer treatment which, in turn, imposes additional care expenses on households living with patients.[10,15] Because of this, it can be said that

FI plays an important role among households, especially those dealing with a person who is diagnosed with cancer. With this in mind thus the current study aimed at determining the prevalence of HFI and its associated factors in Iranian patients with esophageal and gastric cancers.

Materials and Methods
Participants
In this cross-sectional study, a total of 315 patients aged 18 to 93 years old who suffered from esophageal and gastric cancers were recruited from a gastrointestinal (GI) cancer-based cohort study conducted in Firoozgar hospital in Tehran, between 2015 and 2018. After explaining the aims of the study by researchers, informed consent was obtained from all patients. This study is restricted to the patients diagnosed with GI cancers, aged 18 years old at the time of diagnosis of cancer, had Iranian nationality, and agreed to participate in the study.

Procedure and Study Instrument
In order to gather the data, a questionnaire was filled out by a trained interviewer asking each respondent the study questions in person. To measure food insecurity(FI), the Six-Item short questionnaire of Household Food Security Scale (HFSS) which is an approach to evaluate the prevalence of FI in Iranian households, was used.[16] The questionnaire assessed FI with the following questions: "1- In the last 12 months, did you or any other in your household ever have to cut the size of your meals or skip meals entirely because there was not enough money for food?", "2- If yes, how often did this happen?", "3- In the last 12 months, did you ever eat less than you felt you should because there was not enough money to buy food?", "4- In the last 12 months, were you ever hungry, but did not eat because you could not afford enough food?", "5- The food that I/we bought just did not last, and I/we did not have money to get more. Was this often, sometimes, or never true for you or the other members of your household in the last 12 months?", "6- I/we could not afford to eat balanced meals. Was this often, sometimes, or never true for you or the other members of your household in the last 12 months?". If the patient answered two or more of the six household food safety questions, they would be classified as food insecure. In question 2, the answers "almost every" and "some months" were considered affirmative answers. Also, in questions 5 and 6, the answers "often" and "sometimes" were considered affirmative answers.[17]

Depending on the participants' responses to questions, the ranges of severity of FI were labeled as high food security (HFS) (when the households answered all items negatively or just a positive item), low food security (LFS) (the households that answered 2-4 positive items), and very low food security (VLFS) (the households that answered 5-6 positive items).

Variables
In this study, HFI was considered the dependent variable. The other variables, such as sex (female vs. male), cancer location or site (gastric or esophagus), local residence (urban vs. rural), household size (<4 vs. ≥ 4), house ownership (tenant vs. private), car ownership (no vs. yes), wealth index)WI) (poorest, poor, moderate, rich and richest), presence of chronic diseases in the household (no vs. yes), presence of a smoker in a household (no vs. yes), residential infrastructure (≤ 100 m² vs. >100 m²) and ethnicity (Fars vs. other) were measured as independent variables. In order to calculate the WI as a composite measurement of a household's cumulative living standard, easy-to-collect data on a household's ownership of assets and principal component analysis were used.[18] A detailed description of the calculation and categorization of WI is provided in a previously published article.[19]

Statistical Analyses
The data were analyzed using STATA version 15 (Stata Corp, College Station, TX). To summarize and describe the characteristics of the study population, descriptive analyses including frequencies, percentages, means, and standard deviations (SDs) were used. The Chi-square test was used to determine whether there is an association between independent variables and HFI in univariate analysis. The multivariable logistic regression model was used to determine the independent association of each factor with HFI. A P value < 0.05 was considered to be statistically significant.

Results
The characteristics of the total sample are highlighted in Table 1. The mean ± SD age of respondents was 63.2 ± 12.6 years and 65.4% were men. As seen in Table 1, among surveyed patients, 75.8% and 24.2% were diagnosed with gastric and esophageal cancers, respectively. Most of the participants (88.2%) were urban dwellers.

Among the participants, 34 (10.8%) refused to fill out the questionnaire. The overall prevalence of FI among participants' households was 35.2%. Of the total of participants with GI cancer, 56 (19.9%) households experienced VLFS, 43 (15.3%) households experienced LFS, and 182 (64.8%) households experienced HFS. Taking into account, the economic status of households in terms of WI, it was found that the prevalences of FI in poor and the poorest households were 44.0% and 53.4%, respectively (Table 2).

The results concerning the association of study variables and HFI showed that WI (OR = 7.05, 95% confidence interval [CI] = 2.73, 18.25 in poorest); OR = 4.83, 95% CI = 1.82, 12.79 in poor, and OR = 2.97, 95% CI = 1.08, 8.15 in moderate households and car ownership (OR = 0.44, 95% CI = 0.72, 5.15) were significantly associated with HFI in univariate analysis (Table 2). However, other factors were not statistically associated with HFI ($P > 0.05$). The multivariable logistic regression model revealed that

Table 1. Characteristics of study participants (n = 315)

Variables		Frequency	Percent
Gender	Female	109	34.6
	Male	206	65.4
Cancer site	Gastric	239	75.8
	Esophagus	78	24.2
Local residence	Urban	288	88.2
	Rural	37	11.8
Household size	<4 persons	172	54.6
	≥4 persons	143	45.4
House ownership	No	47	16.8
	Yes	232	83.2
Car ownership	No	167	59.9
	Yes	112	40.1
WI	Poorest	62	22.2
	Poor	60	21.5
	Moderate	54	19.3
	Rich	50	17.9
	Richest	53	19
presence of chronic diseases in household	No	123	39.1
	Yes	192	60.9
presence of a smoker in household	No	207	65.7
	Yes	108	34.3
Residential infrastructure	<100 m²	161	51.1
	≥100 m²	154	48.9
Ethnicity	Fars	116	36.8
	Other	199	63.1
FI	Yes	99	35.2
	No	182	64.8

Abbreviations: WI, wealth index; FI, food insecurity.

WI had a positive independent association with HFI (Table 3), as WI had the strongest association with HFI among all surveyed variables. Moreover, the study showed that the odds of the poorest households reporting being in FI were 6.41 times higher compared with the richest households ($P = 0.001$). Similarly, the chance of being FI in poor households seems to be 5.05 times higher than in the richest ones ($P = 0.004$, Table 3).

Discussion

In this study, we attempted to determine the prevalence of HFI and its factors in patients with esophageal and gastric cancers. To our knowledge, few studies mainly emphasized the prevalence of HFI in patients with GI cancers, especially among Iranian patients.[2,5,20] Based on the results of this study, 35.2% of household participants were food-insecure with 19.9% of VLFS and 15.3% of LFS. In a study by Daneshi-Maskooni and colleagues which was performed on 120 patients with cancer with the aim of determining the prevalence of FI and its associated factors, the prevalence was 44%.[2] Furthermore, the prevalence of FI among households in a study by Jomaa et al conducted

on Lebanese households was estimated 49.3% from which 7% of households were sub-categorized as mildly food-insecure, 23.3% as moderately food-insecure, and 18.9% as severely food-insecure.[21] In a study conducted on 188 women selected from Sardrood-Tabriz, the prevalence of FI was reported to be 71.7% with 26.6% of marginal food security, 11.7% of VLFS, and 33.0% of LFS.[22] Moreover, in a cross-sectional study on 2500 households, it was observed that HFI was prevalent in northwest Iran with 39.7% of VLFS and 20% LFS.[23] Likewise, Gholami and colleagues, in their study showed that the prevalence of HFI among rural households in the northeast of Iran was 40.9%.[24] In terms of HFI measures, they found that the rural households had portions of VLFS and LFS with 15.15% and 25.74%.[24] The overall prevalence of FI in a study conducted on rural patients with type 2 diabetes was reported more than 46%.[25] Among these households, 22.7% suffered from VLFS and 23.4% from LFS. Besides, in some other studies, the prevalence of FI among households was reported to be from 20.0% to 69.8%.[19,26-31] Having reviewed different studies in terms of the prevalence of FI in varying provinces, regions (rural and urban), and population groups across Iran, the difference in the prevalence of HFI can be justified because the provinces differ with regard to the condition of their economies and the households' income level, especially in marginal provinces. However, it is expected that most rural households which are food producers have enough access to food, it is possible that some of them encounter food insecurity for different reasons. Because rural households earn the majority of their income by doing agricultural activities, they cannot be expected to have a high level of income and thereby may be food-insecure. Additionally, rural households with the larger size may face lower economies and thus access to a lower level of sufficient food.[31] The rural households who shop at the small grocery have to experience lower quality and diverse selection of food. On the other hand, some rural regions are considered to be food deserts wherein the rural residents have the problems of the long drive to get to the nearest grocery store.

Given that FI may be linked to the development of many physical ailments, mental disorders, and cancers, food-insecure patients with cancer deal with the worse health consequences.[32] Economic disabilities as the strongest FI-associated factor can reduce the continuation of treatment and poor-quality food may aggravate these patients' medical conditions.[2] Our results unveiled that household economic status (based on WI classifications) was the most significant factor to be associated with HFI. Simply put, by classifying the household economic status to the poorest, poor, moderate, rich, and richest, we observed that the HFI would be at a worrying level by reducing the households' economic level. Depending on WI, it seems that low-income households are unable to cover their costs to pay, buy and provide food and this can affect their overall health, as was seen in the study

Table 2. Odds ratio estimates of HFI based on the univariate analysis in patients with esophageal and gastric cancers (n = 315)

Variables		HFI		OR	P value
		No (n = 182)	Yes (n = 99)		
Local residence	Urban	161 (64.1%)	90 (35.9%)	Ref	0.527
	Rural	21 (70.0%)	9 (30.0%)	0.77	
Household size	<4	102 (67.1%)	50 (32.9%)	Ref	0.374
	≥4	80 (62.0%)	49 (38.0%)	1.25	
House ownership	No	24 (66.7%)	12 (33.3%)	Ref	0.855
	Yes	138 (65.1%)	74 (34.9%)	1.07	
Car ownership	No	86 (58.1%)	62 (41.9%)	Ref	0.004
	Yes	76 (76.0%)	24 (24.0%)	0.44	
WI	Poorest	27 (46.6%)	31 (53.4%)	7.05	<0.001
	Poor	28 (56.0%)	22 (44.0%)	4.83	0.002
	Moderate	31 (67.4%)	15 (32.6%)	2.97	0.034
	Rich	33 (75.0%)	11 (25.0%)	2.05	0.181
	Richest	43 (86.0%)	7 (14.0%)	Ref	-
presence of chronic diseases in household	No	77 (67.0%)	38 (33.0%)	Ref	0.523
	Yes	105 (63.3%)	61 (36.7%)	1.18	
presence of a smoker in the household	No	124 (64.6%)	68 (35.4%)	Ref	0.924
	Yes	58 (65.2%)	31 (34.8%)	0.97	
Residential infrastructure	<100	87 (62.1%)	53 (37.9%)	Ref	0.359
	≥100	95 (67.4%)	46 (32.6%)	0.79	
Ethnicity	Fars	77 (70.0%)	31 (30.0%)	Ref	0.142
	Other	105 (61.4%)	66 (38.6%)	1.47	

Abbreviations: WI, wealth index; HFI, household food insecurity; FI, food insecurity; OR, odds ratio.

Table 3. The multivariable regression of the factors affecting food insecurity in patients with gastric and esophageal cancer (n = 315)

Variables	OR	Standard error	z	P value	95% CI
Local residence (Rural)	0.55	0.26	-1.26	0.209	0.22, 1.39
Household size (≥4)	1.48	0.45	1.29	0.198	081, 2.70
Car ownership (Yes)	0.84	0.29	-0.49	0.624	0.43, 1.67
WI					
Poorest	6.41	3.47	3.43	0.001	2.21, 18.55
Poor	5.05	2.81	2.91	0.004	1.70, 15.03
Moderate	2.74	1.48	1.86	0.063	0.95, 7.92
Rich	2.04	1.12	1.30	0.195	0.69, 6.00
presence of chronic diseases in the household (Yes)	1.44	0.44	1.19	0.235	0.79, 2.63
presence of a smoker in the household (Yes)	0.69	0.23	-1.13	0.259	0.37, 1.31
Residential infrastructure (>100)	0.80	0.24	-0.75	0.456	0.44, 1.45
Ethnicity (Other)	1.57	0.48	1.49	0.137	0.87, 2.85

Abbreviations: WI, wealth index; OR, odds ratio.

by Masa and colleagues.[33] Also, an inverse relationship between economic status and HFI was found in the results of studies which were conducted on Iranian households.[12,24,34,35] These findings are congruent with the results of Daneshi-Maskooni et al who investigated the prevalence of FI and some socioeconomic factors affecting patients with upper GI They concluded that there was a significant relationship between low economic cancers.[12] level and the prevalence of HFI. In like manner, Saraei et al who determined the prevalence of food insecurity in children admitted to Tabriz Children's Hospital found that the households' low income was an important factor affecting FI.[36]

A further point that deserves attention is that the findings of the present study pointed out that according to the households' WI classification, the poorest households had 6.4 times higher chance to be food-insecure than the richest ones. Also, compared to the richest households, the poor households had 5 times higher chance to be food-insecure. This finding provides support for the claim made

by Clay and Ross who found that economic instability was a risk factor for FI, and the households with economic instability had 2.4 times chance to be food insecure.[37] In a study by Kent and colleagues, households who lost some of their income were at high risk of FI.[38] The results of the study by Leroux and others showed that income was somewhat the strongest factor for FI; therefore, the odds of households with income < $20 000 becoming food insecure increased by 46.1 times compared with those with > $60 000.[39] Viewed in this way, Gholami and colleagues reported that household income was positively associated with HFI, thus the households with low income (< 4 000 000 Rials) had 3.91 times chance to face FI in comparison with those with moderate to high income (≥ 4 000 000 Rials).[24] The prevalence of FI among these studied populations is an important challenge that can be resulted from poverty, inequalities, and malnutrition. Therefore, it seems that economic status is one of the important factors in HFI and lack of insufficient income in households decreases the ability to access enough food and then results in FI. In other words, households who are economically weak cannot afford their expenditures and this may affect their overall health. All in all, making the best use of the food supply needs to maintain the economic stability of households.

As noted in the results of this paper, when adjusted for studied variables which were analyzed to understand their association with the prevalence of HFI, we found that the residential areas, household size, house ownership, car ownership, presence of chronic diseases in the household, presence of a smoker in the household, residential infrastructure, and ethnicity were not significantly associated with HFI. Ekhlaspour et al and Payab et al assessed the factors of household size, education level of household head, having a job, and economic status affecting HFI.[40,41] A positive association was reported between HFI and the factors of age, being a single parent, education level of the household head, having a stable occupation, ethnicity, household size, eating habits, and economic status in a study by Dave and colleagues on 184 low-socioeconomic status parents in San Antonio in 2006.[32] It was interesting to find out that, our results have indicated that 7.6% of food-insecure and 24% of food-secure individuals have had their own cars. In contrast to our results, car ownership has shown a positive association with HFI by reducing the likelihood of being food-insecure, which may be due to making grocery shopping easier.[42] In a study on farming productivity and its association with FS, it was observed that productivity gain was a strong factor that affected the FS; however, there was a positive association between the education of the household head, the presence of individuals under 18 in the family and economic status, as well.[43] Among HFI-associated factors, residential infrastructure was not reported to be an influential factor in FI.[23,24] Although we see a likely association between house ownership and HFI in the findings of some studies that they have expected owning houses to affect the households' economic status, meaning that they do not have to pay too much on rent for their homes,[44-46] these findings run counter of our results in which no significant association was found between HFI and house ownership. In studies conducted to evaluate FI in households with smokers, it was found that the presence of smokers in households would be an independent risk factor associated with FI.[47,48] In contrast with our results, households more likely to be food insecure include those with the presence of chronic diseases.[49-51] To support this idea, the association between HFI and non-communicable diseases was investigated in a study on Korean adults who suffered from asthma.[52] Having a job, having a child under 18, education level, being a single parent, savings, etc. were the other factors which their effects on FI in various studies were examined.[20,53-55] Based on a study by Mohsena et al who evaluated the seasonality of FI levels in Bangladesh, environmental changes were among the other influential factors which also might affect adversely HFI.[56]

Strengths and Limitations

Yet, the current paper was conducted with several limitations. For one, regarding the difficult and serious medical conditions of the patients and their disability to respond to the questions, a number of the questionnaires were completed by their accompaniments. Second, due to the nature of the study design, it was not possible to make a causal inference about the association between the HFI and studied factors. Since this study was a cross-sectional one and it just considered the association between the variables, future studies can be conducted to discover and confirm the association of HFI with different factors.

The strengths of this study were the use of the multivariable logistic regression model to investigate the independent association of various factors with HFI and selecting a particular sample of the population that reflected certain characteristics (a population of cancer patients). The participants involved in this study came from different parts of Iran.

Conclusion

According to the results of this study, we found that more than a third of participants' households were food-insecure. We observed that among the studied factors, WI had a strong association with HFI. This indicates that the poorest households had higher chances of FI than the richest ones. Therefore, it can be put forward that the interplay between FI and patients with GI cancers has led health policymakers to make fundamental decisions for managing the practices, strategies, and health control programs to improve the access to affordable food in Iran.

Authors' Contribution

Conceptualization: Masoudreza Sohrabi.
Data curation: Sare Hatamian, Atefeh Bahavar, Fahimeh Safarnezhad Tameshkel.
Formal analysis: Hamid Abbasi.

Investigation: Shima Mehrabadi.

Methodology: Masoudreza Sohrabi, Ali Gholami.

Project administration: Sare Hatamian, Atefeh Bahavar, Fahimeh Safarnezhad Tameshkel.

Supervision: Masoudreza Sohrabi, Farhad Zamani, Hossein Ajdarkosh, Ali Gholami.

Validation: Masoudreza Sohrabi, Ali Gholami.

Visualization: Farhad Zamani, Hossein Ajdarkosh.

Writing–original draft: Ensiyeh Mollanoroozy, Hamid Abbasi, Shima Mehrabadi.

Writing–review & editing: Masoudreza Sohrabi, Ali Gholami.

Competing Interests

The authors declare no conflict of interest related to this work.

Consent for Publication

All authors approve the publication of this manuscript. Also, the authors affirm that human research participants provided informed consent for publication.

Data Availability Statement

The data that support the results of the present study are available on request from the corresponding author.

Ethical Approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Neyshabur University of Medical Sciences (Date: 03.18.2020 /No: IR.NUMS.REC.1398.048). The participants agreed to participate in the study by confirming informed consent after being informed about the study objectives.

References

1. Hasler CM. Functional foods: benefits, concerns and challenges-a position paper from the American Council on Science and Health. *J Nutr* 2002;132(12):3772-81. doi: 10.1093/jn/132.12.3772

2. Daneshi-Maskooni M, Badri-Fariman M, Habibi N, Dorosty-Motlagh A, Yavari H, Kashani A, et al. The relationship between food insecurity and esophageal and gastric cancers: a case-control study. *J Res Health Sci* 2017;17(2):e00381.

3. Ahmadihoseini A, Omidvar N, Nematy M, Safarian M, Salehi M. The relationship between food insecurity and anthropometric measures at birth in low income households. *Iran J Pediatr* 2019;29(4):e88410. doi: 10.5812/ijp.88410

4. Mutisya M, Kandala NB, Ngware MW, Kabiru CW. Household food (in)security and nutritional status of urban poor children aged 6 to 23 months in Kenya. *BMC Public Health* 2015;15:1052. doi: 10.1186/s12889-015-2403-0

5. Fernandes SG, Rodrigues AM, Nunes C, Santos O, Gregório MJ, de Sousa RD, et al. Food insecurity in older adults: results from the epidemiology of chronic diseases cohort study 3. *Front Med (Lausanne)* 2018;5:203. doi: 10.3389/fmed.2018.00203

6. Food and Agriculture Organization of the United Nations (FAO). *The State of Food and Agriculture 2008: Biofuels: Prospects, Risks and Opportunities*. FAO; 2008. http://www.fao.org/tempref/docrep/fao/011/i0100e/i0100e.pdf.

7. Daneshi-Maskooni M, Dorosty-Motlagh A, Izadi A, Kashani A, Azizi S, Bahreini M, et al. Is food security associated to nutritional status among hospitalized cancer and non-cancer patients? *Int Res J Appl Basic Sci* 2013;5(6):801-4.

8. Kane K, Ilic S, Paden H, Lustberg M, Grenade C, Bhatt A, et al. An evaluation of factors predicting diet quality among cancer patients. *Nutrients* 2018;10(8):1019. doi: 10.3390/nu10081019

9. Brown JL, Pollitt E. Malnutrition, poverty and intellectual development. *Sci Am* 1996;274(2):38-43. doi: 10.1038/scientificamerican0296-38

10. Holben DH, Myles W. Food insecurity in the United States: its effect on our patients. *Am Fam Physician* 2004;69(5):1058-60.

11. Zarea K, Beiranvand S, Ghanbari S, Tuvesson H. Incidence of gastrointestinal cancers in Iran: a systematic review. *Jundishapur J Chronic Dis Care* 2017;6(1):e37224. doi: 10.17795/jjcdc-37224

12. Daneshi-Maskooni M, Dorosty-Motlagh A, Hosseini SM, Zendehdel K, Kashani A, Azizi S, et al. Prevalence of food insecurity and some associated socioeconomic factors among patients with upper gastrointestinal cancers. *Med J Mashhad Univ Med Sci* 2013;56(1):56-61. doi: 10.22038/mjms.2013.459

13. Najafi A. Effects of food insecurity on the women esophageal cancer in the Zanjan province. *J Cancer Res Ther* 2018;14(3):490-4. doi: 10.4103/0973-1482.206303

14. Daneshi-Maskooni M, Badri-Fariman M, Habibi N, Dorosty-Motlagh A, Yavari H, Kashani A, et al. The relationship between food insecurity and esophageal and gastric cancers: a case-control study. *J Res Health Sci* 2017;17(2):e00381.

15. Berkowitz SA, Basu S, Meigs JB, Seligman HK. Food insecurity and health care expenditures in the United States, 2011-2013. *Health Serv Res* 2018;53(3):1600-20. doi: 10.1111/1475-6773.12730

16. Dastgiri S, Tutunchi H, Ostadrahimi A, Mahboob S. Sensitivity and specificity of a short questionnaire for food insecurity surveillance in Iran. *Food Nutr Bull* 2007;28(1):55-8. doi: 10.1177/156482650702800106

17. 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(8):1231-4. doi: 10.2105/ajph.89.8.1231

18. Rutstein SO, Johnson K. *The DHS Wealth Index*. Calverton, MD: ORC Macro, 2004. p. 6.

19. Asadi-Lari M, Moosavi Jahromi L, Montazeri A, Rezaee N, Haeri Mehrizi AA, Shams-Beyranvand M, et al. Socio-economic risk factors of household food insecurity and their population attributable risk: a population-based study. *Med J Islam Repub Iran* 2019;33:119. doi: 10.34171/mjiri.33.119

20. Mortazavi Z, Dorosty AR, Eshraghian MR, Ghaffari M, Ansari-Moghaddam A. Household food insecurity and its association with self-reported infectious and parasitic diseases among household mothers in Southeast of Iran. *Health Scope* 2017;6(3):e15125. doi: 10.5812/jhealthscope.15125

21. Jomaa L, Naja F, Kharroubi S, Hwalla N. Prevalence and correlates of food insecurity among Lebanese households with children aged 4-18 years: findings from a national cross-sectional study. *Public Health Nutr* 2019;22(2):202-11. doi: 10.1017/s1368980018003245

22. Ebadi-Vanestanagh M, Azizi-Lalabadi M, Jahangiry L, Alizadeh M. Challenges of food insecurity indicators, diet quality and weight outcomes in women: a cross-sectional study. *Prev Nutr Food Sci* 2019;24(4):393-9. doi: 10.3746/pnf.2019.24.4.393

23. Sharafkhani R, Dastgiri S, Gharaaghaji Asl R, Ghavamzadeh S. Factors influencing household food security status. *Food Nutr Sci* 2011;2(1):31-4. doi: 10.4236/fns.2011.21004

24. Gholami A, Rezaei Sani T, Askari M, Mousavi Jahromi Z, Dehghan A. Food insecurity status and associated factors among rural households in North-East of Iran. *Int J Prev Med* 2013;4(9):1018-24.

25. Gholami A, Moradpour F, Khazaee-Pool M, Mousavi Jahromi Z, Vafa M, Abbasi-Ghahramanloo A, et al. Is household food insecurity a determinant of weight status in patients with type 2 diabetes in rural areas? *Med J Islam Repub Iran* 2017;31:138. doi: 10.14196/mjiri.31.138

26. Behzadifar M, Behzadifar M, Abdi S, Malekzadeh R, Arab Salmani M, Ghoreishinia G, et al. Prevalence of food insecurity in Iran: a systematic review and meta-analysis. *Arch Iran Med*

2016;19(4):288-94.

27. Ramesh T, Dorosty-Motlagh A, Abdollahi M. Prevalence of household food insecurity in the city of Shiraz and its association with socio-economic and demographic factors, 2008. *Iran J Nutr Sci Food Technol* 2010;4(4):53-64. [Persian].

28. Mazloom Z, Razmjouei N, Hejazi N, Sanjarian Dehaghani F. Food insecurity in patients with multiple sclerosis and its association with anthropometric measurements. *Int J Nutr Sci* 2017;2(2):80-4.

29. Hakim S, Dorosty AR, Eshraghian MR. Association of food insecurity and household socio-economic status with the body mass index among urban women in Dezful. *Journal of School of Public Health and Institute of Public Health Research* 2010;8(2):55-66. [Persian].

30. Karam Soltani Z, Dorosty-Motlagh A, Eshraghian MR, Siassi F, Jazayeri A. Obesity and food security in Yazd primary school students. *Tehran UniV Med J* 2007;65(7):68-76. [Persian].

31. Cordero-Ahiman OV, Vanegas JL, Franco-Crespo C, Beltrán-Romero P, Quinde-Lituma ME. Factors that determine the dietary diversity score in rural households: the case of the Paute River Basin of Azuay province, Ecuador. *Int J Environ Res Public Health* 2021;18(4):2059. doi: 10.3390/ijerph18042059

32. Dave JM, Evans AE, Saunders RP, Watkins KW, Pfeiffer KA. Associations among food insecurity, acculturation, demographic factors, and fruit and vegetable intake at home in Hispanic children. *J Am Diet Assoc* 2009;109(4):697-701. doi: 10.1016/j.jada.2008.12.017

33. Masa R, Chowa G, Nyirenda V. Prevalence and predictors of food insecurity among people living with HIV enrolled in antiretroviral therapy and livelihood programs in two rural Zambian hospitals. *Ecol Food Nutr* 2017;56(3):256-76. doi: 10.1080/03670244.2017.1311256

34. Najibi N, Firoozi R, Shahrezaee S, Eshraghian MR, Daneshi-Maskooni M, Dorosty-Motlagh A. Food insecurity is an important risk factor for type 2 diabetes: a case-control study of new referrals to the university clinics, Shiraz, Southern Iran. *BMC Public Health* 2019;19(1):885. doi: 10.1186/s12889-019-7236-9

35. Kolahdoozan S, Sadjadi A, Radmard AR, Khademi H. Five common cancers in Iran. *Arch Iran Med* 2010;13(2):143-6.

36. Saraei J, Esmaeli Z, Tajari Z, Khodayarnezhad S, Nekofar A, Abbasalizad Farhangi M. The prevalence of food insecurity and its association with socio-economic factors and nutritional status among hospitalized children in Tabriz pediatric hospital. *J Arak Uni Med Sci* 2016;18(10):55-63. [Persian].

37. Clay LA, Ross AD. Factors associated with food insecurity following Hurricane Harvey in Texas. *Int J Environ Res Public Health* 2020;17(3):762. doi: 10.3390/ijerph17030762

38. Kent K, Murray S, Penrose B, Auckland S, Visentin D, Godrich S, et al. Prevalence and socio-demographic predictors of food insecurity in Australia during the COVID-19 pandemic. *Nutrients* 2020;12(9):2682. doi: 10.3390/nu12092682

39. Leroux J, Morrison K, Rosenberg M. Prevalence and predictors of food insecurity among older people in Canada. *Int J Environ Res Public Health* 2018;15(11):2511. doi: 10.3390/ijerph15112511

40. Ekhlaspour P, Foroumandi E, Ebrahimi-Mameghani M, Jafari-Koshki T, Arefhosseini SR. Household food security status and its associated factors in Baft-Kerman, IRAN: a cross-sectional study. *Ecol Food Nutr* 2019;58(6):608-19. doi: 10.1080/03670244.2019.1652818

41. Payab M, Dorosty-Motlagh A, Eshraghian MR, Siassi F, Karimi T. The association between food insecurity, socio-economic factors and dietary intake in mothers having primary school children living in Ray 2010. *Iran J Nutr Sci Food Technol* 2012;7(1):75-84. [Persian].

42. Fitzpatrick K, Ver Ploeg M. On the road to food security? Vehicle ownership and access to food. Research on Connections between Health and SES Using Panel Study of Income Dynamics (PSID) Data Conference; 2010.

43. Lopes MS, Araújo ML, Lopes ACS. National general truck drivers' strike and food security in a Brazilian metropolis. *Public Health Nutr* 2019;22(17):3220-8. doi: 10.1017/s1368980019001939

44. Debebe S, Zekarias EH. Analysis of poverty, income inequality and their effects on food insecurity in southern Ethiopia. *Agric Food Secur* 2020;9(1):16. doi: 10.1186/s40066-020-00269-3

45. Rose D. Economic determinants and dietary consequences of food insecurity in the United States. *J Nutr* 1999;129(2S Suppl):517S-20S. doi: 10.1093/jn/129.2.517S

46. Tawodzera G. Vulnerability in crisis: urban household food insecurity in Epworth, Harare, Zimbabwe. *Food Secur* 2011;3(4):503-20. doi: 10.1007/s12571-011-0152-1

47. Cutler-Triggs C, Fryer GE, Miyoshi TJ, Weitzman M. Increased rates and severity of child and adult food insecurity in households with adult smokers. *Arch Pediatr Adolesc Med* 2008;162(11):1056-62. doi: 10.1001/archpediatrics.2008.2

48. John RM, Ross H, Blecher E. Tobacco expenditures and its implications for household resource allocation in Cambodia. *Tob Control* 2012;21(3):341-6. doi: 10.1136/tc.2010.042598

49. Gregório MJ, Rodrigues AM, Graça P, de Sousa RD, Dias SS, Branco JC, et al. Food insecurity is associated with low adherence to the Mediterranean diet and adverse health conditions in Portuguese adults. *Front Public Health* 2018;6:38. doi: 10.3389/fpubh.2018.00038

50. Hanson KL, Connor LM. Food insecurity and dietary quality in US adults and children: a systematic review. *Am J Clin Nutr* 2014;100(2):684-92. doi: 10.3945/ajcn.114.084525

51. Tarasuk V, Mitchell A, McLaren L, McIntyre L. Chronic physical and mental health conditions among adults may increase vulnerability to household food insecurity. *J Nutr* 2013;143(11):1785-93. doi: 10.3945/jn.113.178483

52. Park SH, Park BJ, Jung DH, Kwon YJ. Association between household food insecurity and asthma in Korean adults. *Int J Environ Res Public Health* 2019;16(12):2115. doi: 10.3390/ijerph16122115

53. Sharafkhani R, Dastgiri S, Gharaaghaji Asl R, Ghavamzadeh S, Didarloo A. The role of household structure on the prevalence of food insecurity. *Eur J Gen Med* 2010;7(4):385-8. doi: 10.29333/ejgm/82890

54. Mohammadzadeh A, Dorosty A, Eshraghian M. Household food security status and associated factors among high-school students in Esfahan, Iran. *Public Health Nutr* 2010;13(10):1609-13. doi: 10.1017/s1368980010000467

55. Yadegari L, Dolatian M, Mahmoodi Z, Shahsavari S, Sharifi N. The relationship between socioeconomic factors and food security in pregnant women. *Shiraz E-Med J* 2017;18(1):e41483. doi: 10.17795/semj41483

56. Mohsena M, Hossain M, Chakraborty B, Bayes A, Rahman ANM. Fragile environment, seasonality and maternal and childhood undernutrition in Bangladesh. *J Biosoc Sci* 2018;50(5):579-603. doi: 10.1017/s002193201700044x