International Journal of Drug Research in Clinics

Int J Drug Res Clin, 2024, 2, e15
10.34172/ijdrc.2024.e15
http://ijdrug.com

Original Article

Food Insecurity Prevalence and Its Demographic, Anthropometric, and Nutritional Determinants Among Overweight and Obese Patients with Diabetes and Coronary Artery Disease

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Article History:
Received: January 22, 2024
Accepted: March 10, 2024
ePublished: October 9, 2024

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Abstract

Background: Food insecurity is a common health problem in both developing and developed countries and is associated with various chronic diseases such as hyperlipidemia, heart disease, hypertension, and metabolic syndrome. This study aimed to investigate the demographic and nutritional factors influencing food insecurity among individuals with coronary artery disease (CAD) and type 2 diabetes mellitus (T2DM).

Methods: The current cross-sectional study included 647 patients from outpatient clinics at Tabriz University of Medical Sciences, Tabriz, Iran. Among them, 275 patients had T2DM, and 310 patients had CAD. Demographic data, including age, gender, employment status, household size, household income, and education, were collected by a questionnaire. Anthropometric assessments were carried out, and food insecurity was investigated using a validated questionnaire. Moreover, a food frequency questionnaire (FFQ) was used for dietary assessment. Statistical assays were performed using SPSS 16 software.

Results: The total prevalence of low food security among patients with T2DM and CAD was 69.81% and 32.58% respectively. The corresponding values for very low food insecurity were 19.27% and 36.45%, respectively. Among the CAD group, food-insecure patients were more likely to be male and belonged to low-income families ($P<0.05$). Moreover, 81.2% of food-insecure patients had low educational attainments compared to 57.5% of food-secure patients ($P<0.001$). Furthermore, stepwise multivariate linear regression analysis revealed that being male gender was a potent predictor of food insecurity among CAD patients. Higher body mass index (BMI) and higher income had protective roles against food insecurity in these patients. Additionally, no differences were found in demographic or anthropometric parameters among patients with diabetes.

Conclusion: The current study indicated the role of age, gender, income, and education in developing food insecurity in patients with cardiovascular disease (CVD). However, none of these parameters were determinants of food insecurity in our sample of diabetic patients. Further studies are needed to confirm these results.

Keywords: Food insecurity, Diabetes, Cardiovascular disease, Demographic parameters

Please cite this article as follows: Rahimi Mamaghani A, Abdi F, Abbasalizad Farhangi M. Food insecurity prevalence and its demographic, anthropometric, and nutritional determinants among overweight and obese patients with diabetes and coronary artery disease. Int J Drug Res Clin. 2024; 2: e15. doi: 10.34172/ijdrc.2024.e15

Introduction

Food security is defined as "access by all members at all times to enough food for an active, healthy life", and food insecurity occurs when people cannot access enough food.[1] This is a pressing issue worldwide, which can precipitate a myriad of health and nutritional complications. According to various research reports, it impacts an estimated 5%-25% of the global population.[2] The adverse effects of food insecurity on dietary habits include the over-consumption of high-calorie foods with high energy density and low nutrient density.[3] These detrimental health impacts are closely linked to

various chronic diseases, including hyperlipidemia, hypertension, cardiovascular disease (CVD), metabolic syndrome, and certain types of cancer.[4,5] Food insecurity is particularly relevant to diabetes, a prevalent health issue with significant economic costs. The global prevalence of type 2 diabetes mellitus (T2DM) will rise to 366 million people by 2030.[6] Moreover, several studies have found that food insecurity is associated with poor glycemic control and T2DM.[3,7,8] In a comprehensive analysis using data from the population-based National Health and Nutrition Examination Survey (NHANES), Seligman et al[9] found that severe food insecurity is correlated with a higher likelihood of having T2DM, and the major determinants of food insecurity among these patients were age, physical activity, race, educational attainment, and income. Another study also reported an association between food insecurity, poor T2DM self-management, and lower HbA1c levels.[7] A study by Jang SY identified race, age, nutritional and socioeconomic status, and body mass index (BMI) as major determinants of food insecurity among patients with T2DM.[10] Furthermore, coronary artery disease (CAD) is a significant adverse outcome of T2DM and is the primary cause of premature mortality in T2DM individuals. Approximately 65% of individuals with T2DM succumb to heart disease. The likelihood of adults with T2DM developing heart disease or experiencing a stroke is two to four times higher compared to those without T2DM.[11] These two chronic diseases occur alongside each other; therefore, it is necessary to assess the difference in food insecurity determinants among patients with CAD and T2DM. However, limited studies have evaluated the prevalence of food insecurity among patients with CAD and have studied the food insecurity determinants among these patients. Although more studies evaluated the association between food insecurity and some risk factors of CAD, Ford,[12] for example, showed that adults with very low food security had an increased ten-year risk of CVD.

The prevalence of food insecurity in Iran is relatively high, with 20% prevalence observed among Iranian households, and 11% categorized as very low food insecure individuals who had access to less than 80% of their usual dietary energy needs.[13] Numerous studies have evaluated the prevalence of food insecurity for different situations or disease statuses, including infectious disease,[14,15] cancer,[16,17] non-alcoholic fatty liver disease,[18] and obesity.[19,20] However, research specifically focusing on the prevalence of food insecurity among patients with chronic diseases such as T2DM and CAD is limited. One study by Hasan-Ghomi et al[3] evaluated food insecurity in patients with T2DM and found no difference in food insecurity scores between patients with T2DM and non-diabetic subjects. Therefore, the current study aimed to evaluate the prevalence of food insecurity and to evaluate its socioeconomic, nutritional, and anthropometric determinants among overweight or obese patients with T2DM and CAD.

Methods

Study Design

This cross-sectional study was conducted among T2DM and CAD patients, with a BMI of greater than 25 kg/m^2 or higher. Patients were referred to Sheykholrais Polyclinic and Shahid Madani Hospitals in Tabriz, Iran, between April and August 2022. Subjects were provided with information about the study objectives, and their written informed consent was obtained. Demographic information collected through interviewer-administered questionnaires included age, gender, household number, employment status, household income, and education. Participants under 20 years old, pregnant or lactating women, and individuals suffering from chronic diseases such as malignancies, autoimmune disorders, hepatic and renal failure, mental disorders, or those undergoing special or weight-reducing diets in the past 12 months were excluded. Patients were enrolled if they were newly diagnosed with T2DM or CAD or were under treatment for these diseases. Diabetes was defined based on the American Diabetes Association criteria.[21]

Anthropometric and Dietary Assessments

Weight was measured using a calibrated Seca scale (Itin Scale Co., Inc., Germany) with a precision of 0.1 kg, and height was measured via a wall-mounted tape with a precision of 0.5 cm. BMI was calculated as weight (kg) divided by height (m) squared and classified according to the World Health Organization (WHO) criteria.[22] Waist circumference was also measured using a tape measure at the midway between the lowest costal border and the iliac crest. The food frequency questionnaire (FFQ) used in this study, was previously validated. It consisted of 132 food items divided into 5 groups: fruits, vegetables, grains, meat, fish, poultry, and dairy products.[23] These food items were selected and grouped according to their frequency of consumption, with food items with the lowest intake being merged.[24]

Measurement of Food Insecurity

Food security status was assessed using a concise questionnaire consisting of six validated questions. This short-form food insecurity questionnaire was previously developed and validated for use in the Iranian population. The short questionnaire (6 items) was identified as a valid tool for screening food insecurity in the Iranian population with an acceptable range of sensitivity (98.7%), specificity (85.5%), and accuracy (89%).[25,26] The total score ranged from 0 (indicating no positive responses) to 6 (indicating positive responses to all 6 questions). Subsequently, the overall score was divided into three subgroups: high food security for subjects who responded negatively to all six items or only one positive response (0-1), low food security for those with 2-4 positive responses, and very low food security for those with 5-6 positive scores.[27]

Sample Size Calculation and Statistical Analysis

The sample size was calculated based on a previous

study on the prevalence of T2DM and CVD risk factors in Iran[28] using the G-Power software with α error = 0.05 and power = 90% (1-β). Accordingly, 275 subjects were included in the T2DM group and 310 participants in the CAD group. The normality of the data was determined by the Kolmogorov-Smirnov test. Statistical analysis was conducted using the Statistical Package for Social Sciences (SPSS for Windows, release 16, 2002, Chicago, IL, USA). Independent sample t-tests, chi-square tests, and stepwise multivariate linear regression were employed. The stepwise multivariate linear regression model was used to evaluate the determinants of food insecurity among patients considering the total score of food insecurity as a dependent variable and demographic or anthropometric variables as independent variables in the model.

Results

Demographic parameters, including gender distribution, household size, income, and education were almost similar among food-secure and insecure patients with T2DM (Table 1). However, among patients with CAD, food-insecure patients were mostly men and belonged to low-income families ($P < 0.05$). Moreover, 81.2% of food-insecure patients had low educational attainments compared to 57.5% of food-secure patients ($P < 0.001$). The prevalence of food insecurity levels among participants is presented in Table 2. The prevalence of low food security among patients with T2DM and CAD was 69.81 and 32.58%, respectively. The corresponding values for very low food insecurity were 19.27% and 36.45%, respectively. Furthermore, no differences were observed in anthropometric parameters and nutritional intakes among patients (Table 3).

Stepwise regression analysis in T2DM patients (Table 4) revealed no predictive value for anthropometric or demographic parameters, while in patients with CAD, male gender was a potent predictor of food insecurity. Additionally, higher BMI ($P = 0.01$) and higher income were protective factors against food insecurity in these patients ($P < 0.001$).

Discussion

The current study found that food insecurity among patients with T2DM was not affected by demographic or anthropometric variables. However, food insecurity among patients with CAD was more prevalent among males and individuals with lower income and educational attainment. Consistent with our findings, a previous report in Iran by Hasan-Ghomi et al [3] found no significant difference in food insecurity levels between diabetic and non-diabetic patients. They also reported no differences among these two groups in terms of gender distribution, educational attainment, and employment status. Another study by Parker et al[4] identified lower age, being female, and lower educational attainment as significant determinants of food insecurity among

Table 1. General Demographic and Socioeconomic Characteristics of Patients with T2DM and CAD Based on Food Security Status

Variable	T2DM (N = 275)			CAD (N = 310)		
	Food Secure (n = 31)	Food Insecure (n = 244)	*P*	Food Secure (n = 100)	Food Insecure (n = 210)	*P*
Gender, No. (%)						
Male	4 (14.54)	81 (33.19)	0.53	58 (58)	103 (49.05)	0.045
Female	27 (9.81)	163 (66.80)		42(42)	107 (50.95)	
Household size, No. (%)						
2-3	14 (44.1)	83 (34.01)		32 (32)	69 (32.85)	0.97
4-5	17 (54.83)	149 (61.06)	0.15	47 (47)	100 (47.61)	
≥6	0	12 (4.91)		21 (21)	41 (19.52)	
Household income (Rial*)						
≤5 000 000	0	7 (2.86)		0	18 (8.57)	
5 000 000-10 000 000	15 (48.38)	110 (45.08)	0.84	3 (3)	60 (28.57)	<0.001
10 000 000-20 000 000	13(41.93)	93 (38.11)		16 (16)	92 (43.80)	
>20 000 000	3 (9.67)	34 (13.93)		81 (81)	40 (19.04)	
Marital status, No. (%)						
Single	2 (6.45)	17 (6.96)	0.16	1 (1)	2 (1.00)	0.09
Married	28 (90.32)	208 (85.24)		84 (84)	156 (74.28)	
Deceased spouse	1 (3.22)	14 (5.73)		8 (8)	24 (11.42)	
Divorced	0 (0)	5 (2.04)		7 (7)	28 (13.33)	
Education (y)						
≤12	19 (61.29)	183 (75.00)		57 (57)	170 (80.95)	
>12	12 (38.70)	61 (25.00)	0.097	43 (43)	40 (19.04)	<0.001

Note. T2DM: Type 2 diabetes mellitus; CAD: Coronary artery disease.
P values derived from chi-squared test. * Iranian Currency

adolescents and adults in a population-based study, but they did not explore differences in metabolic syndrome components across different categories of food insecurity. Several previous reports reported food insecurity determinants among patients with T2DM. The NHANES results demonstrated that the major food insecurity determinants among patients with T2DM were age, race, income, educational attainment, and physical activity.[29] These conflicting results may be attributed to variations in participant characteristics such as residency, income, or even study sample size. Moreover, their study was performed among adults aged over 20 years, while the current study was performed among diabetic patients.

Table 2. Comparison of Food Security Status Among Patients

	T2DM [n (%)] (n = 275)	CAD [n (%)] (n = 310)	*P*
HFS	30 (10.90)	96 (30.96)	
LFS	192 (69.81)	101 (32.58)	0.65
VLFS	53 (19.27)	113 (36.45)	

Note. T2DM: Type 2 diabetes; CAD: Cardiovascular disease; HFS: High food security; LFS: Low food security; VLFS: Very low food security.
Independent t-test was used for continuous variables.

A comprehensive review of existing literature suggests that multi-dimensional strategies are required at both community and systemic levels to alleviate the impacts of food insecurity, including its implications on the management of T2DM.[30]

To our knowledge, there were no studies evaluating the food insecurity prevalence and determinants among patients with CVD. In the current study, being male, having low income, and having low educational attainment were potent determinants of food insecurity among patients with CAD. In a study by Seligman et al on NHANES participants, determinants of food insecurity including age, ethnicity, educational attainment, and income were different between food-secure and insecure participants. Moreover, CAD risk factors, including hypertension and hyperlipidemia, but not T2DM, were more prevalent among participants. The authors concluded that individuals residing in food-insecure households may have a higher propensity to underreport a diagnosis of T2DM.[8] Another study conducted by Morgenstern et al[31] yielded similar findings. Our study found that low food security was more prevalent among diabetic patients, whereas very low food security was more common among

Table 3. Nutritional Status and Dietary Intakes Among Patients With T2DM and CAD Based on Food Security Status

Variable	T2DM (N = 275)			CAD (N = 310)		
	Food Secure (n = 31)	Food Insecure (n = 244)	*P**	Food Secure (n = 100)	Food Insecure (n = 210)	*P**
Age (mean ± SD)	47.85 ± 11.13	48.56 ± 11.86	0.74	52.24 ± 10.87	51.89 ± 12.70	0.79
Weight (kg)	73.97 ± 9.36	74.40 ± 11.51	0.83	75.80 ± 15.98	78.57 ± 13.92	0.12
Height (cm)	169.85 ± 7.08	171.83 ± 29.90	0.31	163.18 ± 11.56	163.84 ± 8.89	0.60
BMI (kg/m^2)	25.84 ± 4.42	25.64 ± 4.63	0.81	28.83 ± 9.44	29.30 ± 4.84	0.54
WC (cm)	90.23 ± 8.03	88.91 ± 9.86	0.79	103.69 ± 6.32	107.42 ± 5.41	0.21
Food groups (g/wk)						
Grains/Cereals	494.25 ± 66.48	508.67 ± 25.28	0.84	612.12 ± 13.11	578.12 ± 31.12	0.12
Fruits/Vegetables	868.80 ± 26.44	913.85 ± 22.44	0.19	800.13 ± 35.23	789.45 ± 21.23	0.98
Meat/Fish/Legumes	148.83 ± 7.75	157.62 ± 11.46	0.52	153.23 ± 32.32	200.45 ± 30.12	0.78
Milk/Dairy products	313.06 ± 19.91	338.11 ± 10.76	0.27	300.14 ± 45.76	412.12 ± 30.12	0.67

Note. T2DM: Type 2 diabetes mellitus; CAD: Cardiovascular disease; SD: Standard deviation; BMI: Body mass index; WC: Waist circumference; **P* provided for the comparison of male and female participants.
**P* provided for the comparison of food secure and insecure groups; Independent t-test was used for continuous variables.

Table 4. Stepwise Multivariate Linear Regression Analysis in Patients with T2DM and CAD With Food Security Status Total Score as Dependent Variables and Anthropometric and Demographic Parameters as Independent Variables

Variable	T2DM (N = 275)				CAD (N = 310)			
	B	SE	β	*P* Value	B	SE	β	*P* Value
Age	0.004	0.29	1.00	0.78	0.22	0.29	1.25	0.46
Gender	-0.05	0.4	0.95	0.91	0.02	0.013	1.22	0.05
BMI (kg/m^2)	-0.014	0.04	0.98	0.72	0.007	0.01	0.70	0.01
Family size	0.14	0.2	1.15	0.48	0.07	0.08	1.08	0.35
Household income (Rial)*	-0.04	0.25	0.95	0.86	-2.30	0.27	0.1	< 0.001
Education	-0.3	0.21	0.74	0.14	0.11	0.10	1.11	0.31

Note. T2DM: Type 2 diabetes mellitus; CAD: Cardiovascular disease; SE: Standard error; BMI: Body mass index; B: Unstandardized coefficient; SE: Standard error; β: Standardized coefficient; *P*: Level of significance.
* Rial is the currency of Iran, 1 Rial is equal to 0.0000283502 euros.

CAD patients. As previously mentioned in a study by Castilo et al,[32] low food insecurity is more common in developed countries and is less affected by demographic and anthropometric parameters, while very low food security is most common in developing countries and is associated with severe malnutrition and starvation.

Numerous factors affect the relationship between food insecurity and CVD, including poor dietary patterns, selecting cheap foods with high energy content, low vegetable and fiber intake, and low socioeconomic status. These factors play a role in the biopsychosocial pathways that connect food insecurity to the risk of CVD.[33] In the current study, there was no significant difference between dietary group consumption among food-secure and insecure groups of patients with T2DM or CAD. The relationship between food insecurity and dietary intake is complex and strongly influenced by the specific dietary assessment tool used and the characteristics of the population being studied. Previous reports in this field have also revealed inconsistent results. Most studies reported nutrient inadequacies among food-insecure individuals. For example, in the study by Kirkpatrick and Tarasuk,[34] adults with food insecurity reported lower intakes of protein, riboflavin, B12, B6, folate, and magnesium. Other studies also indicated lower energy and nutrient intakes, whereas some studies reported higher energy and nutrient intakes and a higher prevalence of obesity among food-insecure households.[35] These inconsistencies might stem from differences in age, gender, geographical location, and socioeconomic differences between studied populations.

Although we did not evaluate macronutrient and micronutrient intake in our groups, this can be considered a limitation of our study. Other limitations of our study include not evaluating physical activity and not adjusting for its confounding effects in our analysis. Moreover, data on income, education, and age were self-reported, and their accuracy might be questionable. The study's cross-sectional design prevents making causal inferences about the relationship between food insecurity and other variables. However, the study is the first to evaluate the prevalence of food insecurity among CAD patients and compare it with T2DM in Iran. In conclusion, this study found that gender, household income, and educational attainment are potential predictors of food insecurity in patients with CAD. Nonetheless, none of these factors were determinants of food insecurity among patients with T2DM. Further research is thus necessary to provide a clearer and more definitive understanding of our findings.

Conclusion

In the current study indicated the role of some of demographic factors including age, gender, income, and education in developing food insecurity in patients with cardiovascular disease (CVD). However, none of these parameters were determinants of food insecurity in our sample of diabetic patients. Further studies are warranted to confirm our results.

Ethics statement

The work has been approved by ethics committee of Tabriz University of Medical Sciences (Code: IR.TBZMED.REC.1403.138).

Disclosure of funding source

The current work has been financially supported by Student Research Committee, Tabriz University of Medical Sciences (Grant number: 73942).

Conflict of interests declaration

None.

Acknowledgements

The current work has been financially supported by a grant from Student Research Committee, Tabriz University of Medical Sciences (Grant number: 73942).

Data availability statement

Data are available with reasonable request from corresponding author.

Author contributions

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Consent for publication

Not Applicable.

References

1. Alipour B, Abbasalizad Farhangi M, Asghari S, Amirkhizi F, Dahri M, Abedimanesh N, et al. Child-specific food insecurity and its sociodemographic and nutritional determinants among Iranian schoolchildren. Ecol Food Nutr. 2016;55(3):231-40. doi: 10.1080/03670244.2015.1129324.
2. Abbasalizad Farhangi M, Alipour B, Rezazadeh K, Ghaffary A, Eidi F, Saber Gharamaleki A, et al. Food insecurity and its related socioeconomic and nutritional factors: evidence from a sample of population in the northwest of Iran. Qual Assur Saf Crops Foods. 2015;7(2):109-13. doi: 10.3920/qas2013.0317.
3. Hasan-Ghomi M, Ejtahed HS, Mirmiran P, Hosseini-Esfahani F, Sarbazi N, Azizi F, et al. Relationship of food security with type 2 diabetes and its risk factors in Tehranian adults. Int J Prev Med. 2015;6:98. doi: 10.4103/2008-7802.167086.
4. Parker ED, Widome R, Nettleton JA, Pereira MA. Food security and metabolic syndrome in U.S. adults and adolescents: findings from the National Health and Nutrition Examination Survey, 1999-2006. Ann Epidemiol. 2010;20(5):364-70. doi:

10.1016/j.annepidem.2010.02.009.
5. Stuff JE, Casey PH, Connell CL, Champagne CM, Gossett JM, Harsha D, et al. Household food insecurity and obesity, chronic disease, and chronic disease risk factors. J Hunger Environ Nutr. 2007;1(2):43-62. doi: 10.1300/J477v01n02_04.
6. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabetes Care. 2004;27(5):1047-53. doi: 10.2337/diacare.27.5.1047.
7. Seligman HK, Davis TC, Schillinger D, Wolf MS. Food insecurity is associated with hypoglycemia and poor diabetes self-management in a low-income sample with diabetes. J Health Care Poor Underserved. 2010;21(4):1227-33. doi: 10.1353/hpu.2010.0921.
8. Seligman HK, Laraia BA, Kushel MB. Food insecurity is associated with chronic disease among low-income NHANES participants. J Nutr. 2010;140(2):304-10. doi: 10.3945/jn.109.112573.
9. Seligman HK, Bindman AB, Vittinghoff E, Kanaya AM, Kushel MB. Food insecurity is associated with diabetes mellitus: results from the National Health Examination and Nutrition Examination Survey (NHANES) 1999-2002. J Gen Intern Med. 2007;22(7):1018-23. doi: 10.1007/s11606-007-0192-6 .
10. Jang SY. Associations of Food Insecurity, Socioeconomic Status, and Type 2 Diabetes Among Mexican Americans and Non-Hispanic Whites in the United States [dissertation]. New Brunswick, New Jersey: Rutgers, The State University of New Jersey; 2009.
11. Nathan DM, Buse JB, Davidson MB, Ferrannini E, Holman RR, Sherwin R, et al. Medical management of hyperglycemia in type 2 diabetes: a consensus algorithm for the initiation and adjustment of therapy: a consensus statement of the American Diabetes Association and the European Association for the Study of Diabetes. Diabetes Care. 2009;32(1):193-203. doi: 10.2337/dc08-9025.
12. Ford ES. Food security and cardiovascular disease risk among adults in the United States: findings from the National Health and Nutrition Examination Survey, 2003-2008. Prev Chronic Dis. 2013;10:E202. doi: 10.5888/pcd10.130244.
13. Pajouyan J, Ghassemi H. Food and Nutrition Security in Iran: A National Study on Planning and Administration. Tehran: Plan and Budget Organization, Islamic Republic of Iran; 1998. [Persian].
14. Borji M, Moradi M, Otaghi M, Tartjoman A. Relationship between nutritional status, food insecurity, and causes of hospitalization of children with infectious diseases. J Compr Ped. 2018;9(2):e63870. doi: 10.5812/compreped.63870.
15. Ivers LC, Cullen KA, Freedberg KA, Block S, Coates J, Webb P. HIV/AIDS, undernutrition, and food insecurity. Clin Infect Dis. 2009;49(7):1096-102. doi: 10.1086/605573.
16. Patel KG, Borno HT, Seligman HK. Food insecurity screening: a missing piece in cancer management. Cancer. 2019;125(20):3494-501. doi: 10.1002/cncr.32291.
17. Trego ML, Baba ZM, DiSantis KI, Longacre ML. Food insecurity among adult cancer survivors in the United States. J Cancer Surviv. 2019;13(4):641-52. doi: 10.1007/s11764-019-00783-9.
18. Golovaty I, Tien PC, Price JC, Sheira L, Seligman H, Weiser SD. Food insecurity may be an independent risk factor associated with nonalcoholic fatty liver disease among low-income adults in the United States. J Nutr. 2020;150(1):91-8. doi: 10.1093/jn/nxz212.
19. Fleming MA, Kane WJ, Meneveau MO, Ballantyne CC, Levin DE. Food insecurity and obesity in US adolescents: a population-based analysis. Child Obes. 2021;17(2):110-5. doi: 10.1089/chi.2020.0158.
20. Li Y, Rosenthal SR. Food insecurity and obesity among US young adults: the moderating role of biological sex and the mediating role of diet healthfulness. Public Health Nutr. 2021;24(15):5058-65. doi: 10.1017/s1368980020004577.
21. American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care. 2006;29 Suppl 1:S43-8.
22. Weisell RC. Body mass index as an indicator of obesity. Asia Pac J Clin Nutr. 2002;11:S681-4. doi: 10.1046/j.1440-6047.11.s8.5.x.
23. Mahmoudinezhad M, Abbasalizad Farhangi M, Kahroba H. Hypothalamic-pituitary hormones will be affected by the interaction between 5q13-14-rs2239670 (CARTPT) gene variants and diet in different obesity phenotypes. BMC Res Notes. 2021;14(1):443. doi: 10.1186/s13104-021-05857-5.
24. Parvin S, Salehi S, Joshan M, Akbar Tabar Tori M, Malekzadeh J, Pirooz R, et al. The situation of food security and related factors in female teachers of Yasuj education school board. Armaghane Danesh. 2020;25(4):515-28. doi: 10.52547/armaghanj.25.4.515. [Persian].
25. 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 .
26. Dastgiri S, Mahboob S, Tutunchi H, Ostadrahimi A. Determinants of Food Insecurity: A Cross – Sectional Study in Tabriz. Journal of Ardabil University of Medical Sciences 2006;6(3):233-9.
27. Nord M, Andrews MS, Carlson S. Household Food Security in the United States, 2008. Washington, DC: ERR-83, US Department of Agriculture, Economic Research Service; 2009.
28. Esteghamati A, Abbasi M, Nakhjavani M, Yousefizadeh A, Basa AP, Afshar H. Prevalence of diabetes and other cardiovascular risk factors in an Iranian population with acute coronary syndrome. Cardiovasc Diabetol. 2006;5:15. doi: 10.1186/1475-2840-5-15.
29. Essien UR, Shahid NN, Berkowitz SA. Food Insecurity and Diabetes in Developed Societies. Curr Diab Rep 2016;16(9):79. doi: 10.1007/s11892-016-0774-y.
30. Gucciardi E, Vahabi M, Norris N, Del Monte JP, Farnum C. The intersection between food insecurity and diabetes: a review. Curr Nutr Rep. 2014;3(4):324-32. doi: 10.1007/s13668-014-0104-4.
31. Morgenstern M, Chen S, Aiello A, Morgenstern LB. Food Insecurity and Cardiovascular Disease in the US Population. In: 142nd APHA Annual Meeting and Exposition. APHA; 2014.
32. Castillo DC, Ramsey NL, Yu SS, Ricks M, Courville AB, Sumner AE. Inconsistent access to food and cardiometabolic disease: the effect of food insecurity. Curr Cardiovasc Risk Rep. 2012;6(3):245-50. doi: 10.1007/s12170-012-0236-2.
33. Allen AJ. Biopsychosocial Pathways Linking Food Insecurity to Cardiovascular Disease Risk: The Role of Race, Negative Affectivity, and Diet Quality [dissertation]. Baltimore County: University of Maryland; 2014.
34. Kirkpatrick SI, Tarasuk V. Food insecurity is associated with nutrient inadequacies among Canadian adults and adolescents. J Nutr. 2008;138(3):604-12. doi: 10.1093/jn/138.3.604.
35. Oh SY, Hong MJ. Food insecurity is associated with dietary intake and body size of Korean children from low-income families in urban areas. Eur J Clin Nutr. 2003;57(12):1598-604. doi: 10.1038/sj.ejcn.1601877.