Food insecurity is associated with food diversity, depression and blood pressure among rural and urban high school students in the Kurdish population of Iran

Pishva Arzhang[1], Bahram Pourghassem Gargari[2], Amir Bagheri[3], Elyas nattagh eshtivani[4], Abed Ghavami[5], Farzad Mohammadi[6], Alireza Rahmanabadi[7]

[1]Islamic Republic of Iran - ; [2]Nutrition Research Center, Department of Biochemistry and Diet Therapy, Faculty of Nutrition and Food Sciences, Tabriz University of Medical Sciences, Tabriz, Iran - E-mail: bahrampg@yahoo.com; [3]MSc in nutrition Sciences, Nutritional science department, School of Nutritional Science and Food Technology, Kermanshah University of Medical Sciences, Kermanshah, Iran Department of Nutrition, School of Nutrition, Tabriz University of Medical Sciences, Tabriz, Iran; [4]Students research committee,nutrition research center,school of nutrition,tabriz university of medical science,tabriz,iran; [5]Department of Community Nutrition, School of Nutritional Sciences and Dietetics, Tehran University of Medical Sciences (TUMS), Tehran, Iran. P.O.Box:14155-6117, Tehran, Iran; [6]MSc Students of Public Health Nutrition, Department of Biochemistry and Diet Therapy, Faculty of Nutrition and Food Sciences, Tabriz University of Medical Sciences, Tabriz, Iran

Summary. *Introduction:* Due to lack of data on the food insecurity and food diversity in the west of Iran, this study conducted to assay food insecurity and its association with food diversity, depression and blood pressure among Kurdish population focusing on high school students and their families. *Method:* This cross-sectional study was conducted between September and March, 2015-2016 on 364 high-school students (68.68% urban and 31.32% rural) and their families. Food security questionnaire, general socio-economic questionnaire (SEQ) and food frequency questionnaire (FFQ). Beck's Depression Inventory (BDI) test was used to assess depression condition. Data analysis was performed with SPSS22 and P value less than 0.05 was considered to be statistically significant. *Result:* Participants with food diversity less than the median (group2) had more associated to food insecurity in all participants (P=0.02). Moreover, in total population dairy diversity was negatively associated with food insecurity (p=0.05). No association was observed between food insecurity and depression among all participants (P=0.54) but after splitting to sex it was significant for female (P=0.02) but not male (P=0.48). *Conclusion:* food insecurity is associated with different complication in high-school students in the Kurdish population, west of Iran. Food insecurity which is related to low income is related also to low food diversity and other aspects of life such as mental problems, as mentioned depression.

Key words: Food insecurity, Mental disorder, blood pressure

Introduction

As a basic human need, limitation in the accessibility of food regarded as a violation of human rights (1). Food insecurity is a condition related to the supply of food and individuals' access to it and defined as uncertain or limited access to safe, nutritious, sufficient and healthy food to meet household dietary needs for an active, productive, and healthy life(2). So as an unstable condition, food insecurity affects many aspects of human life such as personal health, physical, the psychological and social condition of individuals (3-5). Recent studies have been reported the importance of food security particularly in young and school-age population(5).

Food insecurity in personal level is associated with insufficient intake of vitamins, less fruit and vegetable consumption, higher cholesterol intake and lower energy intake(6).

Dietary diversity is defined as "the number of different food's or food groups consumed over a given reference period" and can be regarded as a good indexes for dietary quality (7). Dietary diversity is regarded as an important problem experienced by most poor households worldwide(8). Previous studies have demonstrated a significant association between lack of food diversity and food insecurity in the different population(9).

Moreover, a positive significant association between food insecurity and the mental problem has been documented in previous studies. In a global investigation conducted in 2017 in 149 countries (10) results showed food insecurity is associated with more stress and poor mental health. Besides these, recently some investigations have demonstrated the association of food insecurity and blood pressure (11). According to the published documented from FAO in 2015, there are 800 million undernourished people worldwide (12), with different prevalence between states and countries (13). With attention to the lack of data on the food insecurity and food diversity in the west of Iran, particularly Kurdish population, the study was conducted to assay food insecurity and its association with food diversity, depression and blood pressure among Kurdish population focusing on high school students and their families.

Materials and methods

Participants

This cross-sectional study was conducted over a seven-month period between September and March, 2015-2016. The study population consisted of 364 high-school students (68.68% urban and 31.32% rural), and their families. The subjects were randomly selected from high schools located in the city and rural areas of Paveh, Kermanshah province in the western part of Iran. The students were in grades 9-12 (based on Iranian high school education system) and aged 14 to 18 years. Permission to conduct the research was obtained from the state Department of Education and the school authorities involved. Ethical approval for the research was granted from the ethical review committee of Tabriz University of Medical Sciences. Written consent was obtained from each student and their householder (father in most cases). The adolescents were given the opportunity to refuse participation, but none of them declined.

Data collection

Arrangements were made with the state Department of Education and schools. The investigators visited each participating school for data collection. The sampling technique used in the study was stratified random sampling with proportionate allocation. Schools and classes were selected randomly from a list of urban and rural high schools as strata. 6 high schools (3 girls, 3 boys) were selected by the mentioned method. Within each selected school, 60 students were selected randomly including 10 students from each grade (that is grades 4, 5, 6 and 7). Each student was familiarized with the study and any questions were answered by the investigator. Data were collected through a direct interview for food security questionnaire, general socio-economic questionnaire (SEQ) and food frequency questionnaire (FFQ), both by students. FFQ used to obtain frequency and portion size information about food and beverage consumption over the past year and SEQ used to determine socio-economic status of families. Household food insecurity was evaluated using the USDA (US Department of Agriculture) Food Security questionnaire and dietary intake was assessed with food frequency questionnaires. This 18-item questionnaire which examined household food security status in the last 12 months was completed by interviewing the mother(14). It should be mentioned that 18-item USDA household food security questionnaire has been validated of previous studies in Iran (15-18). Food Diversity defined as the number of different foods or food groups consumed over 12 past months. Rating of 18-item USDA household food security status questionnaire was: positive rate to answers "often true", "sometimes true", "almost every month", "some months", and "yes" and zero score to responses "not true", "does not know or refused", "only 1 or 2 months", and "no". Finally, scores 0-2 in food secure group, 3-7 in food insecure group without hunger, 8-12 in food insecure group with moderate hunger, and 13 and higher in food insecure group with severe hunger were situated (14). The reliability of the

food security questionnaire was calculated to be 0.84 by employing Cronbach's alpha coefficient. The socio-economic questionnaire was used to collect the demographic characteristics including 21 variables (age, sex, family size, birth rank, using of dietary supplements, having breakfast, parental education level, economic status or having living facilities, occupational status of mother and head of the family, size of home range, and residential property ownership status). About living facilities, mothers were asked that how many items of these 9 items they have (refrigerator, home, hand-sewn carpet, car, flat-screen color television, computer, dishwasher, washing machine, and microwave). Living facilities in the socioeconomic questionnaire were considered less than or equal to 3-item as low economic level, 4 to 6-item as moderate economic level, and more of 7-item as a good economic level (18). Also, the participants were asked to provide their last year's Grade Point Average (GPA). The GPA range was from 0.00 to 20.00 scores.

Body weight (BW) was measured while the participants were minimally clothed without shoes, using digital scales and recorded to 0.1 kg. Direct measures of height were taken with the subject in a relaxed and erect position. Measurements were taken to the nearest millimeter and are reported in centimeter. During the measurements, the student was without shoes and with minimal clothing. Body mass index (BMI as weight (kg)/height (m)^2 was then calculated. Height and BMI z-scores were calculated with the use of the WHO 2007 (BMI-for-age and height-for-age z-scores)(19). The Omron digital blood pressure monitor (Model MX3, Japan) was used for measuring blood pressure (BP). After a 5-minute rest period, BP was measured twice times in the right arm (sitting with the arms supported precisely at the right atrium level), at an interval of 30seconds and mean value of the two measurements were calculated. High blood pressure (HBP) was defined as average systolic and/or diastolic BP ≥95th percentile for age, sex, and height on 3 or more separate occasions. Blood pressure levels ≥90th percentile and <95th percentile were regarded as prehypertension (20).

Assessment of other variables

The five main groups of the food pyramid, which are divided into 23 subgroups, were used to determine the food diversity score. The total food diversity score represents the mean scores of five main groups. That is, each of the five groups had a maximum of 2 points out of a total of 10 food diversity points. In order for each individual to be considered a consumer for each food group, he should have consumed at least half the serving of the food (in accordance with the definitions of the quantitative index of the food pyramid) within 2 days. The adequacy ratio of some nutrients and their mean values were calculated using the recommended values of internationally accepted standards, taking into account age and sex. The BDI (Beck's Depression Inventory) test was used to assess depression condition. The BDI test included a 21 item self-report using a four-point scale ranging which ranges from 0 (symptom not present) to 3 (symptom very intense). The test takes approximately 50 to 10 minutes to complete. There is a shortened version of the test consisting of 7 items intended to used by primary care providers.

Data analysis

For evaluating the normal distribution of quantitative variables Kolmogorov–Smirnov test was conducted. Chi-square test conducted to examine population characteristics according to different study groups. To measure the odds ratio and 95% CIs for food insecurity according to dietary diversity and blood pressure logistic regression conducted. Data analysis was performed with SPSS22 and P value less than 0.05 was considered to be statistically significant.

Result

The population characteristics

As shown in table1, 42.9 percent of participants were female. The mean weight, height, BMI(Body mass index), SBP(systolic blood pressure), DBP(Diastolic blood pressure), mother age and father age was 61.39± 13.51, 166.31± 9.22, 22.11± 4.04, 116.34± 14.59, 76.14± 9.14, 41.49± 5.43and 47.86± 5.75, respectively. As the education level of parents is demonstrated, most of them were under diploma in both groups of the mother (61.8%) and father (65.1%) while 31.5% of mothers group and 4% of fathers were uneducated. Moreover, 14.7% of participants had a weak economic

Table 1. The population characteristics

Variables		Characteristics
gender	Male	156 (42.9)
	Female	208 (57.1)
Mother education	Uneducated	104 (31.5)
	Under diploma	204 (61.8)
	Academic	22 (6.7)
Father education	Uneducated	14 (4)
	Under diploma	229 (65.1)
	Academic	109 (31)
Father job	1	16 (4.5)
	2	185 (52.6)
	3	151 (42.9)
Mother job	1	323 (88.7)
	2	16 (4.4)
	3	25 (6.9)
economical group	Weak	53 (14.7)
	Moderate	226 (62.6)
	Good	82 (22.7)
Depression	1	210 (58.3)
	2	71 (19.7)
	3	31 (8.6)
	4	48 (13.3)
weight		61.39± 13.51
Height		166.31± 9.22
BMI		22.11± 4.04
Systolic blood pressure		116.34± 14.59
Diastolic blood pressure		76.14± 9.14
Mother age		41.49± 5.43
Father age		47.86± 5.75

condition, and 62.6% were in moderate economical condition, rest of them (22.7%) had a good economic condition.

Population characteristics according to food security in different sexes

As shown in table2, in both male and female participants mother (P=0.056 for males and P=0.03 for females) and father (P=0.01 for males and females) education was negatively associated with food security. Moreover, in both female (P=0.001) and male (P=0.001) groups families with better job condition were negatively associated with food insecurity. As it

was predictable, the better economic condition was strongly associated with lower household food insecurity in both males (P=0.001) and females (P=0.001). Moreover, no association was founded between food insecurity and depression among participants for all participants (P=0.54) but after splitting to sex it was significant for female (P=0.02) but not male (P=0.48).

Food insecurity according to food diversity scores

Association between food diversity and food security is demonstrated in table3. Participants with food diversity less than the median (group2) had more associated to food insecurity in all participants (P=0.02) and males (P=0.008), but not in female group (P=0.38), separately. When we divided food into subgroups included fruits, bread, vegetables, meat, and dairy to examine the association between food diversity and food insecurity significant association was found only between food insecurity and fruits diversity in males group. Moreover, in total population dairy diversity was negatively associated with food insecurity (p=0.05)

Association of food insecurity and blood pressure:

As shown in table4, we did not find any significant association between food insecurity and DBP. But a significant association between SBP and food insecurity was observed. Before adjusting to sex, higher HTN was significantly associated with food insecurity (P=0.003 and OR: 2.69) which remained stable after adjusting to sex (P=0.003 and OR: 2.71).

Discussion

Results of the current study showed **parent education and the job** was associated with food insecurity in the population. Moreover, household **economic condition** and food diversity were strongly associated with food security. Our analysis also showed a positive and strong association between food insecurity and **depression**.

The source of a household's income is strongly associated with food insecurity. The jobs with higher-paying and can cause the better economic condition, and providing better availability of the most important food resources. Generally, food insecurity reduces

Table 2. Population characteristics according to food security in different sexes

Variables		The study groups							P for sex × group**
		Male			Female				
		Secure	insecure	P*	Secure	insecure	P*		
Mother education	1	18 (21.4)	22 (38.6)		30 (26.3)	34 (45.3)			
	2	56 (66.7)	32 (56.1)	0.056	75 (65.8)	41 (54.7)	0.003	0.648	
	3	10 (11.9)	3 (5.3)		9 (7.9)	0 (0)			
Father education	1	0 (0)	4 (6.5)		5 (4.3)	5 (5.9)			
	2	51 (58)	47 (75.8)	0.001	64 (54.7)	67 (78.8)	<0.001	0.929	
	3	37 (42)	11 (17.7)		48 (41)	13 (15.3)			
Mother job	1	78 (85.7)	63 (96.9)		104 (86)	78 (89.7)			
	2	5 (5.5)	2 (3.1)	0.034	3 (2.5)	6 (6.9)	0.040	0.442	
	3	8 (8.8)	0 (0)		14 (11.6)	3 (3.4)			
Father job	1	1 (1.1)	3 (4.8)		3 (2.6)	9 (10.6)			
	2	37 (42)	42 (67.7)	0.001	52 (44.4)	54 (63.5)	<0.001	0.799	
	3	50 (56.8)	17 (27.4)		62 (53)	22 (25.9)			
Economical group	1	10 (11)	15 (23.8)		10 (8.3)	18 (20.7)			
	2	48 (52.7)	45 (71.4)	<0.001	71 (59.2)	62 (71.3)	<0.001	0.549	
	3	33 (36.3)	3 (4.8)		39 (32.5)	7 (8)			
depression	1	66 (72.5)	41 (67.2)		68 (56.2)	35 (40.2)			
	2	25 (27.5)	20 (32.8)	0.482	53 (43.8)	52 (59.8)	0.023	0.543	

* P-value was reported based on Chi-square test. ** P-value was reported based on Multivariate analysis of variances.

Table 3. Odds ratio and 95% CIs for food insecurity according to food diversity scores.

		Food insecurity								
		Male			Female			Total		
		OR	95% CI	Pᵃ	OR	95% CI	Pᵃ	OR	95% CI	Pᵃ
Total diversity	**Group 1**	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
	Group 2	**2.66**	**1.25; 5.48**	**0.008**	1.28	0.733; 2.26	0.380	**1.69**	**1.08; 2.62**	**0.020**
fruits diversity	**Group 1**	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
	Group 2	**2.27**	**1.02; 5.03**	**0.043**	1.09	0.534; 2.25	0.799	1.51	0.894; 2.56	0.122
bread diversity	**Group 1**	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
	Group 2	0.676	1.86; 2.46	0.553	1.70	0.670; 4.35	0.262	1.25	0.596; 2.65	0.547
vegetable diversity	**Group 1**	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
	Group 2	0.844	0.383; 1.86	0.676	1.46	0.783; 2.73	0.233	1.18	0.728; 1.93	0.490
meat diversity	**Group 1**	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
	Group 2	0.883	0.408; 1.91	0.752	0.587	0.333; 1.03	0.065	0.681	0.434; 1.06	0.095
dairy diversity	**Group 1**	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
	Group 2	0.521	0.232; 1.16	0.113	0.702	0.398; 1.23	0.220	0.643	0.407; 1.01	**0.05**

Data analysis was done by logestic regression. Group 1: more than median score. Group 2: less than med

with augment in education level. A large number of researches have demonstrated a strong association between education level and food security (21-24). We

showed a positive relationship between food security and economic status. Food insecurity had an increasing trend in the weak, moderate, and good economic

Table4. Odds ratio and 95% CIs for food insecurity according to Blood pressure.

		Model 1			Model 2		
		OR	95% CI	P^a	OR	95% CI	P^a
SBP	**Normal**	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
	Pre HTN	**0.159**	**0.036; 0.700**	**0.015**	**0.161**	**0.036; 0.703**	**0.016**
	HTN	**2.69**	**1.40; 5.16**	**0.003**	**2.71**	**1.39; 5.28**	**0.003**
DBP	**Normal**	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
	Pre HTN	0.701	0.350; 1.40	0.318	0.701	0.349; 1.40	0.317
	HTN	1.00	0.560; 1.81	0.977	1.01	0.561; 1.83	0.961

Data analysis was done by logistic regression. Model 1: crud model. Model 2: sex adjusted.

status groups. The results are in agreement with previous studies (25-28). (29). Based on the study findings, a strong relationship between the parent's job and food insecurity was observed**.** This is in agreement with the results of research performed by Kim et al. (2011) which conducted on household food insecurity in the Republic of Korea (30).

Our findings suggest that food insecurity is associated with systolic blood pressure. This is in agreement with the results of the research conducted by Irvin et al. (31). It showed that sufficient food accessing related stress in insecure households resulting in higher blood pressure in these households. Also, limitation in adherence to a healthy dietary pattern has been suggested as a reason for elevated blood pressure in food insecure individuals (11).

Study of food insecurity and food diversity have shown in previous studies (8, 32-34). Our results showed higher food diversity score is associated with lower food insecurity in a population. In a study in Bangladesh which enrolled 14600 women into an antenatal micronutrient supplementation trial, results showed dietary diversity, especially intakes of fruit, vegetables, and animal-source foods, decreased in higher food insecurity condition in rural Bangladesh (32). In a cross-sectional study in Mexico which conducted in 2014 among 955 participants, Mexican Children living in severe food insecurity had the higher proportion of low dietary diversity (53.6%) compared to those living in food security. Moreover, children, those suffering from moderate and severe food insecurity did not reach to recommended energy intake (35). In the same

line with our study, these studies recommend food diversity is a key factor to decrease food insecurity in the household with the lower economical condition.

As shown in previous studies, food insecurity is positively associated with depression (36, 37). As mentioned, a positive significant association between food insecurity and the mental problem has been documented in previous studies(10). In agreement with these studies, our study showed a positive association between food insecurity and depression. Results point to the need to address the psychosocial issue in conjunction with economic issues to reduce food insecurity related depression in the population.

Limitations

It is important to consider the current findings are in the context of the cross-sectional data and causal relationships cannot be drawn. It is also necessary to highlight that the data rely on the reliability and accuracy of self-report, which may be subject to recall or interviewer bias. With all of these, the present study is one of the first attempts to understanding of food and nutrition status of high-school students with attention to the association of food insecurity and its associated factors among Iranian Kurdish population.

Conclusion

According to the result of the present study, it can be concluded that food insecurity is associated with different complication in high-school students in the Kurdish population, west of Iran. Food insecurity

which is related to low income is related also to low food diversity and other aspects of life such as mental problems, as mentioned depression.

References

1. Gucciardi, E., et al., The Intersection between Food Insecurity and Diabetes: A Review. Curr Nutr Rep, 2014. 3(4): p. 324-332.

2. Smith, S., et al., Addressing Food Insecurity in Family Medicine and Medical Education. Fam Med, 2017. 49(10): p. 765-771.

3. Motbainor, A., A. Worku, and A. Kumie, Level and determinants of food insecurity in East and West Gojjam zones of Amhara Region, Ethiopia: a community based comparative cross-sectional study. BMC public health, 2016. 16.

4. Keino, S., G. Plasqui, and B. van den Borne, Household food insecurity access: a predictor of overweight and underweight among Kenyan women. Agriculture & Food Security, 2014. 3(1): p. 2.

5. Poole-Di Salvo, E., E.J. Silver, and R.E. Stein, Household Food Insecurity and Mental Health Problems Among Adolescents: What Do Parents Report? Academic pediatrics, 2016. 16(1): p. 90-96.

6. Kirkpatrick, S.I. and V. Tarasuk, Food insecurity is associated with nutrient inadequacies among Canadian adults and adolescents. The Journal of nutrition, 2008. 138(3): p. 604-612.

7. Ruel, M.T., Operationalizing dietary diversity: a review of measurement issues and research priorities. The Journal of nutrition, 2003. 133(11): p. 3911S-3926S.

8. Chakona, G. and C. Shackleton, Minimum Dietary Diversity Scores for Women Indicate Micronutrient Adequacy and Food Insecurity Status in South African Towns. Nutrients, 2017. 9(8).

9. Chakona, G. and C. Shackleton, Minimum dietary diversity scores for women indicate micronutrient adequacy and food insecurity status in South African Towns. Nutrients, 2017. 9(8): p. 812.

10. Jones, A.D., Food Insecurity and Mental Health Status: A Global Analysis of 149 Countries. Am J Prev Med, 2017. 53(2): p. 264-273.

11. Grilo, S.A., et al., Food insecurity and effectiveness of behavioral interventions to reduce blood pressure, New York City, 2012-2013. Prev Chronic Dis, 2015. 12: p. E16.

12. Pereira, R.A. and A. Hodge, Food insecurity: a critical public health nutrition concern. Public health nutr, 2015. 18(16): p. 2893-2894.

13. Borch, A. and U. Kjærnes, Food security and food insecurity in Europe: An analysis of the academic discourse (1975–2013). Appetite, 2016. 103: p. 137-147.

14. Bickel, G., et al., Guide to measuring household food security. US Department of Agriculture, Food and Nutrition Service, Office of Analysis, Nutrition, and Evaluation http://www fns usda gov/fsec/FILES/Guide% 20to% 20Measuring% 20Household% 20Food% 20Security (3-23-00) pdf, 2000.

15. Rafiei, M., et al., Assessing the internal validity of a household survey-based food security measure adapted for use in Iran. J. Nutr., 2009. 8(1): p. 1.

16. Hakim, S., A. Dorosty, and M. Eshraqian, Relationship between food insecurity and some of socioeconomic factors with BMI among women in Dezfoul. Iran J Public Health, 2011. 2: p. 55-66.

17. Mohammadzadeh, A., A. Dorosty, and M. Eshraghian, Household food security status and associated factors among high-school students in Esfahan, Iran. Public health nutr, 2010. 13(10): p. 1609-1613.

18. Ramesh, T., A. Dorosty, and M. Abdollahi, Prevalence of food insecurity in household of Shiraz and association with some of socioeconomic and population factors. Iranian Journal of Nutrition Sciences and Food Technology, 2010. 4(4): p. 53-64.

19. Onis, M.d., et al., Development of a WHO growth reference for school-aged children and adolescents. Bull. World Health Organ., 2007. 85(9): p. 660-667.

20. Falkner, B. and S.R. Daniels, Summary of the fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. Hypertension, 2004. 44(4): p. 387-388.

21. Willows, N.D., et al., Prevalence and sociodemographic risk factors related to household food security in Aboriginal peoples in Canada. Public health nutrition, 2009. 12(08): p. 1150-1156.

22. Chinnakali, P., et al., Prevalence of household-level food insecurity and its determinants in an urban resettlement colony in north India. J Health Popul Nutr, 2014. 32(2): p. 227.

23. Foley, W., et al., An ecological analysis of factors associated with food insecurity in South Australia, 2002–7. Nutr Today., 2010. 13(02): p. 215-221.

24. Shariff, Z.M. and K.G. Lin, Indicators and nutritional outcomes of household food insecurity among a sample of rural Malaysian women. J Nutr, 2004. 30: p. 50-55.

25. Sharkey, J.R., W.R. Dean, and C.M. Johnson, Association of household and community characteristics with adult and child food insecurity among Mexican-origin households in colonias along the Texas-Mexico border. Int J Equity Health, 2011. 10(1): p. 1.

26. Furness, B.W., et al., Prevalence and predictors of food insecurity among low-income households in Los Angeles County. Public Health Nutr, 2004. 7(06): p. 791-794.

27. Sarlio-Lähteenkorva, S. and E. Lahelma, Food insecurity is associated with past and present economic disadvantage and body mass index. J. Nutr., 2001. 131(11): p. 2880-2884.

28. Dean, W.R. and J.R. Sharkey, Food insecurity, social capital and perceived personal disparity in a predominantly rural region of Texas: an individual-level analysis. Soc Sci Med 2011. 72(9): p. 1454-1462.

29. Jyoti, D.F., E.A. Frongillo, and S.J. Jones, Food insecurity affects school children's academic performance, weight gain,

and social skills. J Nutr, 2005. 135(12): p. 2831-9.

30. Kim, K., et al., Factors related to household food insecurity in the Republic of Korea. Public health nutr, 2011. 14(06): p. 1080-1087.

31. Irving, S.M., R.S. Njai, and P.Z. Siegel, Peer Reviewed: Food Insecurity and Self-Reported Hypertension Among Hispanic, Black, and White Adults in 12 States, Behavioral Risk Factor Surveillance System, 2009. Prev Chronic Dis, 2014. 11.

32. Na, M., et al., Maternal Dietary Diversity Decreases with Household Food Insecurity in Rural Bangladesh: A Longitudinal Analysis. J Nutr, 2016. 146(10): p. 2109-2116.

33. Harris-Fry, H., et al., Socio-economic determinants of household food security and women's dietary diversity in rural Bangladesh: a cross-sectional study. J Health Popul Nutr, 2015. 33: p. 2.

34. M'Kaibi, F.K., et al., The relationship between agricultural biodiversity, dietary diversity, household food security, and stunting of children in rural Kenya. Food Sci Nutr, 2017. 5(2): p. 243-254.

35. Mundo-Rosas, V., et al., (Dietary diversity and nutrient intake in children 24 to 59 months old and their association with food insecurity). Salud Publica Mex, 2014. 56 Suppl 1: p. s39-46.

36. Montgomery, J., et al., Food Insecurity and Depression Among Adults With Diabetes: Results From the National Health and Nutrition Examination Survey (NHANES). Diabetes Educ, 2017. 43(3): p. 260-271.

37. Munger, A.L., S.L. Hofferth, and S.K. Grutzmacher, The Role of the Supplemental Nutrition Assistance Program in the Relationship between Food Insecurity and Probability of Maternal Depression. J Hunger Environ Nutr, 2016. 11(2): p. 147-161.

———

Correspondence:
Bahram Pourghassem Gargari
Nutrition Research Center, Department of Biochemistry and Diet Therapy, Faculty of Nutrition and Food Sciences, Tabriz University of Medical Sciences, Tabriz, Iran
E-mail: bahrampg@yahoo.com