www.jnsd.tums.ac.ir

Original Article Open Access

Food security status, intelligence quotients and associated factors in village of Qehi, Esfahan

Elaheh Honarkar Shafie[1,2], Fatemeh Taheri[3], Ahmad R. Dorosty-Motlagh[1*], Shima Abdollahi[4], Omid Toupchian[5]

[1] Department of Community Nutrition, School of Nutritional Sciences and Dietetics, Tehran University of Medical Sciences, Tehran, Iran
[2] Students' Scientific Research Center and Exceptional Talents Development Center, Tehran, Iran
[3] Department of Clinical Biochemistry, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, Iran
[4] School of Public Health, Shahid Sadoughi University of Medical Sciences and Health Services, Yazd, Iran
[5] Department of cellular and molecular nutrition, School of Nutritional Sciences and Dietetics, Tehran University of Medical Sciences, Tehran, Iran

Article History
Received:
17/05/2015
Revised:
11/06/2015
Accepted:
20/06/2015

Keywords:
Food insecurity, Intelligence quotients, Socioeconomic status

A B S T R A C T

Background: Food insecurity is a global problem with considerable health impacts. It is especially important in children as it can affect their learning ability. The present study was designed to determine household food insecurity status, intelligence quotients (IQ) and their associations with some relevant factors in village of Qehi, Esfahan.

Methods: This study was conducted on all of the children under the age of seven years in village of Qehi in 2016. The nutritional status of participants was determined by measuring their heights and weights. General information, FFQ and USDA questionnaires were used to collect data about households socio-economic and food security status during interviews with mothers. Good enough Draw-A-Person test was used to assess the participants' IQ.

Results: The prevalence of household food insecurity was 50%. There were significant associations between food insecurity and children sex and mother's job status. Food insecurity was positively associated with number of household members ($p<0.05$) and negatively associated with children's IQ, parental educational level, and household economic status. In addition, students living in food-insecure households less frequently consumed meat, fruits and vegetables and had less number of meals and snacks intake ($p<0.05$). Children's IQ was only associated with sex.

Conclusion: Food insecurity was prevalent among households in the studied population and it was associated inversely with children's IQ. Based on these associations, food assistance programs and education is necessary in the studied population.

Introduction

Food insecurity is defined as limited access to adequate and safe food to have an active life or uncertain ability to access acceptable food in socially acceptable ways [1-3]. Food insecurity is a global prevalent problem which can affect quality of life [4,5]. Various methods have been used to measure food insecurity [6-8].

Food insecurity has considerable health impacts especially in children since their

Corresponding author:
Ahmad R. Dorosty-Motlagh
Department of Community Nutrition, School of Nutritional Sciences and Dietetics, Tehran University of Medical Sciences, Tehran, Iran.
Email: dorostim@tums.ac.ir

nutrition affects not only their current health, but also involves their future. Food deprivation in children under the age of two, can lead to learning disability and IQ reduction [9]. The intelligence of the population in some of developed countries has increased over the last half century and nutrition improvement is proposed as one of the main factors for this increase [10]. Few studies have been assessed the effect of nutrition on children's IQ in Iran.

The aim of this study was to determine household food security status, children's IQ and their relationships with some associated factors including sex, BMI, number of children in the household or family size, household economic level, parental educational level and job status and frequency of different food groups intake in village of Qehi, Esfahan.

Methods

This cross-sectional study was conducted in 2016 on all of the children under the age of seven years in a village of Esfahan, Iran. Since the previous experience of drawing can remarkably affect the result of Draw-A-Person test, it is noteworthy to mention that no painting or drawing training courses was held before the study in this village which is the reason why we chose this village. Informed consent was obtained from all participants before the study.

Assessment of socio-economic and nutritional status

Socio-economic questionnaire was used to collect information about parental educational level and job status, numbers of children in the household and economic status which was defined via the ownership of some living facilities like personal home, personal car, refrigerator, washing machine etc. Households having three or less facilities were categorized as low economic status, those with four to six were considered as average and those with seven or more were categorized as good economic status [11-13]. A validated 168-item FFQ [14] was applied to estimate the mean intake of different food groups. To facilitate FFQ analysis, the food items were grouped into five main groups according to their nutrient content (grains, dairy products, meats, vegetables and fruits) and weekly intake of each food group was obtained. All of the questionnaires were filled out through face-to-face interview with mothers.

Anthropometric measures

Standing height and body weight of the children were measured with a portable direct reading stadiometer and calibrated digital scale while they were wearing light clothes and no shoes and BMI was calculated as Kg/m^2.

Assessment of food security status

The USDA (US Department of Agriculture) food security module was used in order to assess the food security status which measures the households' experiences with food insufficiency during the previous 12-month period by 18 questions [15]. After the interviews, households were divided to four categories: food secure, food insecure without hunger, food insecure with moderate hunger and food insecure with severe hunger. In Iran, the validity of USDA module in measuring adult and child food insecurity was approved in a study in Shiraz [16] which was used in the present study.

Assessment of intelligence quotients

Goodenough Draw-A-Person test was used to evaluate children's IQ. Children were provided with a paper, a pencil and enough time to draw a person. To score the drawings, presence or absence, detail and proportion of different aspects of the drawing such as specific body parts, clothing, etc. were analysed and one score was recorded for each item. Then, final score was obtained and mental age was appointed based on a table which determines mental age equivalent to the total score. Finally, IQ was calculated according to the mental and chronological ages of the children [17,18]. Children were categorized into three groups: subnormal ($IQ \leq 89$), normal (IQ: 90-109) and clever ($IQ \geq 110$).

Statistical analysis

Data were analysed using SPSS 16.0. First, normality of data was checked by Kolmogorov-Smirnov test and then, χ^2 and Pearson's correlation tests were used. Significance was measured at $P<0.05$. Food insecurity status in different groups of children in terms of IQ, sex, parental educational level and job status and other qualitative variables was analysed by χ^2 test. The relationship between food security score with IQ score and other quantitative variables including mean food groups intakes was assessed by Pearson's correlation test.

Results

In the studied village, there were 92 children under the age of seven and all of them were included in the study (46 boys and 46 girls). The average age of the children was 3.7±2.2 years. Children under the age of 3 were not be able to participate in the drawing test because of test limitation. Therefore, only 52 children completed the drawing test. The mean IQ in the studied group was 105.5±15.7. The mean intake of different food groups is shown in Table 1.

The prevalence of household food insecurity in the studied population was 50%: 27.2% of the households were food insecure without hunger and 22.8% were food insecure with moderate hunger (Table 2).

Associations between food security status and studied variables are shown in Table 3. Food insecurity in boys was more than girls (p=0.01). The results showed that 63% of girls were food secure and 10.9% had food insecurity with moderate hunger while 37% of boys were food secure and 34.7% had food insecurity with moderate hunger.

There was a strong association between mother's job and food security status. Children in the households that the mother was employed, experienced food insecurity more than the

Table 1. Mean intake of different food groups

Food group intake (per week)	Mean ± SD
Grains	18.4±6.8
Dairy products	8.3±4.6
Vegetables	2.2±1.1
Fruits	8.2±4.5
Meats	6.7±3.6

Table 2. Frequency of household food insecurity

Food security status	n	%
Food secure	46	50
Food insecure without hunger	25	27.2
Food insecure with moderate hunger	21	22.8

Table 3. Associations between food security status and studied variables

	Food secure	Food insecure without hunger	Food insecure with moderate hunger		P value*
Sex	N (percent)	N (percent)	N (percent)	Total	
Girl	29 (63)	12 (26.1)	5 (10.9)	46 (50)	0.01
Boy	17 (37)	13 (28.3)	16 (34.7)	46 (50)	
Father job					
Worker	31 (44.3)	21 (30)	18 (25.7)	70 (76.1)	0.179
Clerk	7 (70)	3 (30)	0 (0)	10 (10.9)	
Self-employed	8 (66.7)	1 (8.3)	3 (25)	12 (13)	
Mother job					
Housewife	44 (53)	23 (27.7)	16 (19.3)	83 (90.2)	0.043
Employed	2 (22.2)	2 (22.2)	5 (55.6)	9 (9.8)	
Father educational					
Primary	9 (25)	15 (41.7)	12 (33.3)	36 (39.1)	0.003
Diploma	35 (64.8)	10 (18.5)	9 (16.7)	54 (58.7)	
Higher-educational	2 (100)	0 (0)	0 (0)	2 (2.2)	
Mother educational					
Primary	27 (42.2)	23 (35.9)	14 (21.9)	64 (69.6)	0.023
Diploma	16 (72.7)	2 (9.1)	4 (18.2)	22 (23.9)	
Higher-educational	3 (50)	0 (0)	3 (50)	6 (6.5)	
Family size					
<4	36 (52.2)	17 (24.6)	16 (23.2)	69 (75)	0.628
≥5	10 (43.5)	8 (34.8)	5 (21.7)	23 (25)	
BMI					
Low	4 (50)	1 (12.5)	3 (37.5)	8 (8.7)	0.5
Normal	42 (51.2)	23 (28)	17 (20.8)	82 (89.1)	
Over-weight	0 (0)	1 (50)	1 (50)	2 (2.2)	
Economical level					
Low	12 (35.3)	13 (38.2)	9 (26.5)	34 (36.9)	0.042
Average	34 (61.8)	10 (18.2)	11 (20)	55 (59.8)	
Good	0 (0)	2 (66.7)	1 (33.3)	3 (3.3)	
IQ					
Subnormal	0(0)	5(62.5)	3(37.5)	8(15.4)	0.009
Normal	17(68)	3(12)	5(20)	25(48.1)	
Clever	8(42.1)	8(42.1)	3(15.8)	19(36.5)	

* χ^2 test

Table 4. Associations between IQ level and children sex

	Subnormal IQ	Normal IQ	Clever	Total	P value*
Sex					
Girl	3(9.4)	20(62.5)	9(28.1)	32(61.5)	0.02
Boy	5(25)	5(25)	10(50)	20(38.5)	

* χ^2 test

Table 5. Correlation of food security score with studied variables

Variables	Pearson's correlation coefficient (R)	P value*
Height	-0.081	0.238
Weight	0.109	0.169
IQ	-0.235	0.045
Family size	0.199	0.029
Numbers of consumed meals	-0.257	0.01
Numbers of consumed snacks	-0.188	0.045
Frequency of grains intake	-0.071	0.298
Frequency of dairy product intake	-0.107	0.168
Frequency of fruits intake	-0.294	0.003
Frequency of vegetables intake	-0.296	0.003
Frequency of meats intake	-0.285	0.004

* Regression test

children whom their mothers were housewives (p=0.043). Fifty three percent and 19.3% of the children whose mothers were housewives belonged to food secure and food insecure with moderate hunger households respectively, whereas these proportions were respectively 22.2 and 55.6% in children whose mothers were employed.

Significant associations were observed between parental educational level and food security status. The results illustrated that 64.8% and 72.7% of the children whose their fathers and mothers had diploma belonged to food-secure households, whereas 75% and 57.8% of the children whose respectively their father's and mother's educational level was primary school belonged to food insecure groups.

There was significant reverse association between food insecurity and economic status (p=0.042). The results showed that 61.8% of the children who lived in households with average economic status were food-secure, while only 35.3% of the children lived in households with weak economic status were food secure.

We observed a strong association between food security status and IQ level (p=0.009). Sixty eight percent of the children with normal IQ and 42.1% of clever children were food secure, while all of the children with subnormal IQ were food insecure (62.5% food insecure without hunger and 37.5% food insecure with moderate hunger).

We did not observe significant associations between food security status and father's job and BMI.

Our results showed that 15.4% of the children had subnormal IQ, 48.1% were normal and 36.5% were clever. There were no significant associations between IQ level and parental educational level and job status, family size, BMI and households' economic status. Only a strong association was observed between IQ level and children sex. The results showed that 62.5% and 9.4% of girls had normal and subnormal IQ respectively, whereas these figure in boys was 25% in both equivalent groups (Table 4).

Table 5 depicts Pearson's correlation between food security score and quantitative studied variables. Students who belonged to food-insecure households had less mean intakes for meats, fruits, vegetables and less numbers of consumed meals and snacks ($p<0.05$). In addition, food security score was higher in the households who had more children ($p<0.05$).

Also, there was a strong reverse correlation between IQ score and food security score ($p<0.05$). In other words, children belonged to food insecure households obtained lower IQ score in the test.

The results of Pearson's correlation test between IQ score and quantitative studied variables showed no significant associations.

Discussion

The prevalence of household food insecurity in the studied households was 50%: 27.2% of the households were food insecure without hunger and 22.8% were food insecure with moderate hunger. The prevalence of food insecurity

measured by direct method in Tabriz and Yazd was reported 36.3% and 30.5% respectively [19, 20]. It is important to mention that in these studies, food insecurity was measured by USDA 6-item questionnaire which has less precision compare to USDA 18-item questionnaire [21]. According to the results of researches in Shiraz and Rey et al., which used the same module as our study to measure food insecurity, the prevalence of food insecurity was 44% and 50.2% respectively [16,22]. The difference between these results could be explained as a result of timing of studies, different communities with different cultural and economic factors and different instruments used to assess food insecurity.

Conforming to the findings of other studies [11, 23, 24], in the present study we observed a negative association between food insecurity and parental educational level. Food insecurity prevalence decreased in the households whose parents had higher educational degree. It is obvious that an increase in parental educational would increase their knowledge and awareness about the importance of their children nutritional status effect on their growth and performance which could result in taking necessary actions by them to prevent food insecurity.

Conforming those of other studies [16, 25, 26], our results revealed that food insecurity is negatively associated with households' economic status. Household economic status has a great important role in household purchasing power and food availability which are the main factors determining household food security.

The results of the present study showed that food insecurity score was positively correlated with number of household members which is in consistent with the results of studies conducted in Malaysia and Canada [27, 28]. The findings of other studies in Iran have indicated different results in this regard. While some studies have reported a positive association, the others have reported no significant association [11, 19, 29]. Households with more members need more food. Therefore, in low income households, the food content each member received reduced by increasing the number of members which can lead to food insecurity.

This study showed that food insecurity in boys was more prevalent than girls which is conflicting with the results of studies in other areas [26, 30-32]. It seems that the old culture of paying more attention to boys as work force in rural areas has changed and girls' nutrition is much more considered due to increase of parents' knowledge.

Unlike other studies, we did not observe a reverse relationship between father's job status and food insecurity in this research [19, 29], but mother's job status was significantly associated with household food insecurity and more employed mothers belonged to food insecure households which is not in consistent with the results of other studies [26,33]. These studies suggested that employed mothers can help fathers to provide enough food for their children, but the fact is that in this situation, mothers will have less time and practice to monitor their children nutrition which could result in increasing food insecurity.

A significant reverse correlation between food security score and mean intake of meats, fruits and vegetables was observed in this study. Our results showed that children belonged to food insecure households, consumed lower numbers of meals and snacks and less servings of meats, fruits and vegetables per week which is completely in accordance with researches conducted in different parts of Iran [8, 19, 26] and also researches conducted in other countries [4, 30, 34]. There were not correlations between food security score and mean intake of dairy products and grains which could be due to more availability of these foods in the studied area.

We observed that children's IQ score is remarkably associated with household food security status and children with subnormal IQ belonged to food insecure households which is in consistent with previous studies [35]. A study in Iran, also reported a significant association between food insecurity and primary school students intelligence quotients [36]. The study conducted by Theodore et al. depicted that children with higher IQ, consumed more frequently cereals and legumes and children who consumed fish at least once a week, had higher IQ at the age of seven [37]. Although our study did not show a direct association between IQ and frequency intake of food groups, this could be regarded as an indirect influence of food insecurity which consequently affects IQ as it is shown in our study.

Limitations

The drawing test used in this study is applicable when there is no previous experience of drawing in children. We found only Qehi village with this situation which made us to limit our study in this village.

Conclusion

Food insecurity was prevalent among households in the studied population and it was associated inversely with children's IQ. According to the associations between food insecurity and parental educational level and economic status which can consequently influence children's IQ, it is of great importance to provide food insecure households with support and education which can be feasible through food assistance programs.

Acknowledgements

This article is the result of the research project No. 95-01-61-31374 approved by Students' Scientific Research Center and Exceptional Talents Development Center. We appreciate this organization for supporting the funds of this study.

Conflict of interest

All authors declare that they have no conflict of interest.

Funding

The funding of this study was supported by Students' Scientific Research Center and Exceptional Talents Development Center.

References

1. Furness BW, Simon PA, Wold CM, Asarian-Anderson J. Prevalence and predictors of food insecurity among low-income households in Los Angeles County. Public Health Nutr. 2004;7(06):791-4.
2. Quandt SA, Shoaf JI, Tapia J, Hernández-Pelletier M, Clark HM, Arcury TA. Experiences of Latino immigrant families in North Carolina help explain elevated levels of food insecurity and hunger. J Nutr 2006;136(10):2638-44.
3. Frongillo EA, Nanama S. Development and validation of an experience-based measure of household food insecurity within and across seasons in northern Burkina Faso. J Nutr. 2006;136(5):1409S-19S.
4. Kendall A, Olson CM, Frongillo Jr EA. Validation of the Radimer/Cornell measures of hunger and food insecurity. J Nutr. 1995;125(11):2793.
5. Ghassemi H. Food and nutrition security in Iran: a national study on planning and administration. Tehran: Plan and Budget Organization. 1998.p.120-8.
6. Djazayeri A, Pourmoghim M, Omidvar N, Dorosty A. Evaluation and comparison the food security and nutrients intake in high school girls in two region in the north and south of Tehran. Iran J Public Health. 1999;4:1-10.
7. Ghassemi H, Kimiagar M, Koupahi M. Food and nutrition security in Tehran Province. Tehran: National Nutrition and Food Technology Research Institute. 1996.
8. Zerafati_Shoae N, Omidvar N, Ghazi-Tabatabaie M, Houshiar_Rad A, Fallah H, Mehrabi Y. Is the adapted Radimer/Cornell questionnaire valid to measure food insecurity of urban households in Tehran, Iran? Public Health Nutr. 2007;10(08):855-61.
9. UNICEF. Tracking progress on child and maternal nutrition. 2009. UNICEF, New York. 2009.
10. Lynn R. The role of nutrition in secular increases in intelligence. Pers Individ Dif. 1990;11(3):273-85.
11. Hakim S, Dorosty AR, Eshraghian M. 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 & Institute of Public Health Research. 2010;8(2).
12. Najibi N, Dorosty Motlagh AR, Sadrzadeh Yeganeh H, Eshraghian MR, Daneshi M, Azizi S. Food Insecurity Status and Some Associated Socioeconomic Factors Among Newly Diagnosed Patients With Type 2 Diabetes in Shiraz, 2012. Arak University of Medical Sciences Journal. 2013;16(1):98-106.
13. Mohammadzadeh A, Dorosty Motlagh A, Eshraghian M. The association of food security with socio-economic factors and weight status among adolescents. Iranian Journal of Nutrition Sciences & Food Technology. 2010;5(1):55-62.
14. Hosseini Esfahani F, Asghari G, Mirmiran P, Azizi F. Reproducibility and relative validity of food group intake in a food frequency questionnaire developed for the Tehran Lipid and Glucose Study. J Epidemiol. 2010; 20(2):150-8.
15. Bickel G, Nord M, Price C, Hamilton W, Cook J. Guide to measuring household food security. US Department of Agriculture, Food and Nutrition Service, Alexandria VA. 2000:1-82.
16. 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. Iranian Journal of Nutrition Sciences & Food Technology. 2010;4(4):53-64.
17. Harris DB. Children's Drawings as Measures of Intellectual Maturity: Revision of Goodenough Draw-a-man Test1963.
18. Naglieri JA. DAP: Draw a Person, a Quantitative Scoring System Manual: Psychological Corporation; 1988.p.12-9.
19. 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.
20. Eshraghian M, Siassi F, Jazayeri G. Obesity and food security in Yazd primary school students. Tehran University Medical Journal. 2007;65(7): 68-76.
21. Keenan DP, Olson C, Hersey JC, Parmer SM. Measures of food insecurity/security. J Nutr Educ. 2001;33:S49-S58.
22. Payab M, Motlagh A, Eshraghian M, Rostami R, Siassi F. The association of family food security and depression in mothers having primary school children in Ray-Iran. J Diabetes Metab Disord. 2014;13(1):65.
23. Usfar AA, Fahmida U, Februhartanty J. Household food security status measured by the US-Household Food Security/Hunger Survey Module (US-FSSM) is in line with coping strategy indicators found in urban and rural Indonesia. Asia Pac J Clin Nutr. 2007;16(2):368.
24. Panigassi G, Segall-Corrêa AM, Marin-León L, Pérez-Escamilla R, Sampaio MdFA, Maranha LK. Food insecurity as an indicator of inequity: analysis of a population survey. Cadernos de Saude Publica. 2008;24(10):2376-84.
25. Smith C, Richards R. Dietary intake, overweight status, and perceptions of food insecurity among homeless Minnesotan youth. Am J Hum Biol. 2008;20(5):550-63.
26. 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.
27. Shariff ZM, Khor G. Obesity and household food insecurity: evidence from a sample of rural households in Malaysia. Eur J Clin Nutr. 2005;59(9):1049-58.
28. Willows ND, Veugelers P, Raine K, Kuhle S. Prevalence and sociodemographic risk factors related to household food security in Aboriginal peoples in Canada. Public Health Nutr. 2009;12(08):1150-6.
29. Ali Hosseini J, Ghazi Tabatabaii M. Related demographic and social factors on food insecurity: supported household of Emam Khomeini Emdad Committee in Tehran's distict 20 [Unpublished dissertation]. Tehran: Tehran University. 2006.
30. Gulliford MC, Mahabir D, Rocke B. Food insecurity, food choices, and body mass index in adults: nutrition transition in Trinidad and Tobago. Int J Epidemiol. 2003;32(4):508-16.
31. Jimenez-Cruz A, Bacardi-Gascon M, Spindler A. Obesity and hunger among Mexican-Indian migrant children on the US–Mexico border. Int J Obes (Lond). 2003;27(6):740-7.
32. 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. Arak Medical University Journal. 2016;18(10):55-63.
33. Safarpour M, Dorosty Motlagh AR, Hosseini SM, Ranjbar Noshari F, Safarpour M, Daneshi Maskooni M, et al. Prevalence and Outcomes of Food Insecurity and Its Relationship with Some Socioeconomic Factors Knowledge & Health. 2014;8(4):193-8.
34. Tarasuk VS. Household food insecurity with hunger is associated with women's food intakes, health and household circumstances. J Nutr. 2001;131(10):2670-6.
35. Alaimo K, Olson CM, Frongillo EA. Food insufficiency and American school-aged children's cognitive, academic, and psychosocial development. Pediatrics. 2001;108(1):44-53.
36. Safarpour P, Dorosty MA, Hosseini M. Food insecurity and primary school students intelligence quotients. Nutrition and Food Science Research. 2014;1(1):231.
37. Theodore RF, Thompson JM, Waldie KE, Wall C, Becroft DM, Robinson E, et al. Dietary patterns and intelligence in early and middle childhood. Intelligence. 2009;37(5):506-13.