

Relationship between Food Security with Sugar Level and Blood Pressure in Diabetes Type 2 in TehranSeyed Amir Hossein Zehni Moghadam¹, Maryam Javadi^{2,3}, Asghar Mohammadpooral⁴

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Type of article: Original**Abstract**

Introduction: Food security has been defined as the “availability, stability, access and utilization of safe foods”. Diabetes has been known as one of the biggest health and medical problems throughout the world and is clearly related to lifestyle, and particularly, improper food consumption. The aim of this study was to determine the relationship between food security with sugar and blood pressure in patients suffering from type 2 diabetes who refer to diabetes centers in Tehran.

Methods: This cross-sectional study was conducted in 2015 on type 2 diabetes patients in Tehran, Iran. From two diabetes centers in the eastern and southern parts of Tehran, 243 type 2 diabetes patients were selected. Necessary information (demographic and food security information) about all the studied persons was collected using the standard questionnaire verified by US Department of Agriculture (USDA). The data was analyzed by SPSS version 16, statistical comparisons were made using analysis of variance (ANOVA) and Chi-square and Tukey tests and a significant level of <0.05.

Results: Most subjects were female (68.7%). There was no significant relationship between gender and food security ($p=0.372$). No significant relation was observed between food security and fasting blood pressure, HbA1C, and systolic blood pressure ($p>0.05$), but there was a significant relationship between food security and diastolic blood pressure ($p=0.030$).

Conclusions: According to the relationship between diastolic blood pressure and food security and the role of blood pressure in the irreparable diabetic complications, it is recommended to perform appropriate food advice.

Keywords: Food security; Type 2 diabetes, Blood pressure, Blood Glucose

1. Introduction

Food and nutrition are basic human needs and providing them is directly related to food security. Food security refers to peoples' access to enough food at all times, in order to have a healthy and active life, which includes availability of enough healthy and nutritious food, and capability and assurance of obtaining suitable foods via acceptable ways (1, 2). Studies of global organizations also indicate that more than 800 million people in developing countries do not have enough food and 34 million people in developed countries suffer from food insecurity (3). A study in Iran also explains the concern that 20% of people in society do not have the necessary financial capability for feeding themselves and about 50% have problems in terms of supplying their cell nutrition. In other words, one fifth of people suffer from lack of energy and half of them suffer from lack of micronutrients (4). Researchers

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believe that people suffering from food insecurity are exposed to its negative effects on their health level (5). Different studies have also reported a higher prevalence of some risk factors of non-communicable diseases such as overweightness, obesity, diabetes, hypertension (6), and smoking (7) in the populations with low food security. Type 2 diabetes is a kind of common metabolic disorder which is characterized by having disorders in glucose homeostasis and the insulin discharge and operation. In addition to decreasing life quality and imposing medical expenses, type 2 diabetes, which constitutes more than 90% of cases suffering from diabetes, increases mortality by 2-4 times (8). The prevalence of this disease is increasing in both developed and developing countries (9). More than 230 million people around the world suffer from diabetes and the highest spread of this disease is in the eastern Mediterranean and Middle Eastern regions with 592 million people (10). Iran, as one of the countries in the Middle East, has 3.5 million diabetic patients (11). Diabetes is clearly related to lifestyle, especially unsuitable food consumption and low body activity (12, 13). By reason of a most extensive spread of food insecurity (14, 15) and growing spread of type 2 diabetes in Iranian society (16) and the direct relationship between this disease and the quality and quantity of food diet (food security) together with the point that, in Iran, there have been few studies on food security among diabetic patients, this study was conducted to determine the relationship between food security with blood sugar and blood pressure among diabetic patients.

2. Material and Methods

2.1. Research design and eligibility criteria

This cross-sectional study was conducted in eastern and southern diabetes centers of Tehran, capital city of Iran in 2015. To determine the sample size, initially, a pilot study was carried out on 30 diabetic patients. Based on this pilot study, the correlation coefficient and food security score were obtained as -0.18. The first type error and test power were respectively obtained as 5% and 80% and sample size of 243 people. The inclusion criteria were being older than 25 years old, consent for entering the study, and tendency for continuing the cooperation during the questioning process. In scoring the 18-item family food security questionnaire, a positive score (1 score) was given to the responses "Often correct", "Sometimes correct", "Almost every month", "Some months", and "Yes", and a zero score was given to the responses "Incorrect", "I do not know", "Only one or two months", and "No".

2.2. Instrument

The 18- item food security questionnaire of US Department of Agriculture (USDA) (17) has been translated and validated in Iran (15, 18). Also, after 12 hours of fasting, 3 cc venous blood samples were taken from each patient using a 3cc syringe. All the samples were gathered during 7-9 a.m. and analyzed in the laboratory of the diabetes center. Fasting blood glucose was estimated using the enzymatic colorimetric GOD-PAP method. Blood pressure (BP) was measured on the left arm, in the sitting position, using appropriate sized cuffs by using a calibrated electronic BP device (Welch-Allyn®). Hb A1C was measured by Ion Exchange Chromatograph method with Clinitek- 100. Circumferences were measured using a plastic tape measure at the following levels: smallest waist circumference, umbilicus level, widest hip circumference, hips at the level of the anterior superior iliac spine of the iliac crest, and the highest thigh circumference.

2.3. Data collection and analysis

Data were collected through questionnaires, biochemical and anthropometric ways to determine the relationship between food security with sugar level and blood pressure in diabetes type 2. Statistical analyses of the data were done with SPSS software version 16 (SPSS Inc., Chicago, IL, USA). The data were statistically analyzed with Chi-square, one-way analysis of variance (ANOVA) and post-hoc analysis of variance. $P < 0.05$ was considered as significant.

2.4. Research ethics

The Research Ethics Committee of Qazvin University of Medical Sciences approved this study. No. QUMS.REC.1394.27. Informed consent had been obtained from all subjects before the study and patients' names were omitted.

3. Results

Out of 243 studied diabetic patients, 167 (68.7%) were female and 76 (31.3%) were male with an average age of 59 ± 11.2 years old. In the present study, out of 167 women, 50 (29.9%) were in the food secure group, 100 (59.9%) were in the food insecure group without hunger, and 67 (10.2%) were classified in the food insecure group with hunger. Also, out of 76 studied men, 27 (35.5%) were in the food secure group, 45 (59.2%) were in the food insecure group without hunger, and 4 (5.3%) were categorized in the food insecure group with hunger. Chi-square

statistical analysis showed no significant relationship between gender and food security ($p=0.372$). Although waist and hip circumference, diastolic and systolic blood pressures, and glycosylated hemoglobin were higher in the insecure food group than the secure food group, analysis of variance on age, waist circumference, hip circumference, average number of family members, duration of suffering from disease, blood sugar, and blood pressure showed a significant relationship between food security score and diastolic blood pressure ($p=0.03$) (Table 1). In Table 2, Tukey's post-hoc analysis of variance is done which shows a significant difference in terms of systolic blood pressure between the food secure group and food insecure group without hunger.

Table 1. Mean and standard deviation of quantitative independent variables based on food security in type 2 diabetic patients. Data are presented as Mean (standard deviation).

Variables	Food secure	Insecure without hunger (145)	Insecure with hunger (21)	Total (243)	p-value
Age (years)	58.33 (11.14)	59.95 (11.55)	56.95 (9.48)	59.18 (11.26)	0.382
Waist circumference (cm)	100.37 (11.86)	102.07 (10.87)	102.95 (12.83)	101.61 (11.35)	0.487
Hips circumference (cm)	106.72 (13.15)	108.73 (9.27)	106.95 (8.54)	107.94 (10.60)	0.368
Mean number of family members	6.23 (1.76)	6.44 (1.84)	5.57 (1.85)	6.30 (1.82)	0.111
Mean duration of suffering from disease(years)	7.85 (4.99)	6.37 (4.71)	7.90 (6.50)	6.97 (5.01)	0.075
Systolic blood pressure (mmHg)	122.20 (16.57)	124.03 (14.09)	126.90 (19)	123.70 (15)	0.427
Diastolic blood pressure (mmHg)	78.11 (11.75)	81.86 (9.20)	81.42 (9.10)	80.63 (10)	0.030
Fasting blood sugar (mg/dl)	167.96 (77.76)	165.15 (57.77)	160.71 (90.55)	165.66 (67.57)	0.901
Glycosylated hemoglobin (HbA _{1c}) (percent)	7.52 (1.32)	7.58 (1.61)	7.77 (2.40)	7.58 (1.6)	0.827

Table 2. Comparison of diastolic blood pressure in the food groups

Food security groups		Difference mean	Statistical results
Food secure	Insecure with hunger	-3.74	$p=0.024$
	Insecure without hunger	-3.31	$p=0.37$
Insecure without hunger	Food secure	3.74	$p=0.024$
	Insecure with hunger	0.043	$p=0.98$
Insecure with hunger	Food insecure	3.31	$p=0.37$
	Insecure without hunger	-0.43	$p=0.98$

4. Discussion

In this study, waist and hip circumference, diastolic and systolic blood pressures, and glycosylated hemoglobin in the food insecure group were more than those of the food secure group, but this difference was significant only in terms of diastolic blood pressure. A part of the relationship between food insecurity and non-communicable diseases is probably due to the effects of food insecurity on food patterns, because it leads the suffering population toward consumption of cheap foods which have high density and low value in terms of micronutrients (19) and having a food pattern with low health level. This pattern can lead to the appearance of metabolic diseases such as diabetes (14). A study by Gucciardi et al. showed that food insecurity had 9.3% higher prevalence among diabetic patients than those not suffering from diabetes (6.8%) (20). In another study, the prevalence of diabetes in the food secure, slightly insecure, and extremely insecure groups was respectively reported as 11.7%, 10%, and 16.1%, which showed that its prevalence was higher among the people with extreme food insecurity (21). In 2012, a study was performed on 711 diabetic patients, among whom the spread of food insecurity was 46%. Furthermore, among these people, weaker HbA_{1c} and blood sugar control were reported (22). In the study done by David et al., the relationship between systolic blood pressure, TC, fasting blood sugar, HbA_{1c}, and food insecurity was investigated. This study showed that the above cases had no relationship with food insecurity, but body mass index (BMI) was

related. It also represented that 48% of food insecure people were obese, but only 35% of people with food security were obese. The study revealed that changing the nutrition pattern could probably cause obesity in people with food insecurity (6). Therefore, the results of Holben et al.'s study did not verify the results of the present work. In the present study, the blood pressure of diabetic persons was related to food security, but food security had no significant relationship with the body mass index (BMI) of the patients, which demonstrated that increased pressure in such patients was not because of their weight gain. In the cross-sectional study carried out on 135 diabetic patients in Shiraz, the spread of food insecurity in the studied population was 66.7%. In this study, food insecurity showed a significantly direct relationship between high BMI, overweight, and obesity, but the variables of family background of disease, height, age, and gender had no relationship with food insecurity (18). Similar to the present study, it showed that the spread of food insecurity among the diabetic patients was high; but in the present study, it was shown that food security had no relationship with BMI. All over the world, studies related to food security have been typically related to obesity. A study has shown that food insecurity has a significantly positive relationship with obesity (23). Whereas another work has demonstrated that food and weight insecurity have no correlation (18). In the study in Malaysia, carried out on the women of families suffering from food insecurity in rural regions, a probable relationship was found between waist circumference and food security; which was not true about obesity (24). In the study by Morales et al. about food security among Mexican women, the relationship between insecurity and obesity was studied and obesity in women with food insecurity was found to be higher than that among the secure women (25). In contrast, a study done in Columbia showed that food insecurity could be only a predictor of low weight in adults and it had no relationship with overweightness (26).

5. Conclusions

In sum, the results showed a significant relationship between food insecurity and hypertension in the diabetic patients. According to the high spread of food insecurity among diabetic persons, food insecurity must be considered one of the effective factors for the food pattern and prevention of irreparable diabetes complications. Also, it is recommended to present suitable food advice for the prevention from diabetes complications.

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Conflict of Interest:

There is no conflict of interest to be declared.

Authors' contributions:

All authors contributed to this project and article equally. All authors read and approved the final manuscript.

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