Original Article

Household Food Insecurity is Associated with Health-Related Quality of Life in Rural Type 2 Diabetic Patients

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Abstract

Background: Health-related quality of life (HRQOL) is associated with household food insecurity (HFI). However, the studies examining the relationship between HFI and HRQOL in patients with type 2 diabetes are scarce. Thus, this study was designed to examine the relationship between HFI and HRQOL in rural type 2 diabetic patients.

Methods: In this cross-sectional study, we included 1847 rural patients with type 2 diabetes in Neyshabur from April to July 2012. HRQOL and HFI were measured with 36-item HRQOL (SF-36) and 6-item version of Household Food Security questionnaires, respectively. HRQOL was divided into eight dimensions and two summary components. We categorized households as high food secure (HFS), low food secure (LFS), and very low food secure (VLFS). Multiple linear regression model was applied to assess the independent effect of food insecurity on HRQOL.

Results: The mean age of participants was 59.65 ± 12.3 years (range: 30–97) with 69.8% women. The overall prevalence of HFI was 46.1%, and the total mean score of HRQOL was 51.11. Multiple linear regression model showed that HFI was significantly associated with the total mean score of HRQOL and its eight dimensions. One-way ANOVA test also showed that HRQOL (in all dimensions) was significantly different between 3 groups of household food security status (HFS, LFS, and VLFS) ($P < 0.05$).

Conclusions: The results of this study showed that HFI was associated with all dimensions of HRQOL and it is one of the strongest variables, in association with HRQOL among rural patients with type 2 diabetes.

Keywords: Diabetes, Household Food Insecurity, Quality of life, SF-36

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Introduction

Diabetes is one of the most frequent metabolic diseases, and a common cause of death reported in recent years.[1] The risk of diabetes in very low food secure households is about 2.5 times higher than food secure households.[2] Low-quality diet and food insecurity have potential impacts on chronic diseases, like diabetes.[1] Food insecurity is a multidimensional issue, including food quantity and quality decline with various associated factors (such as environmental, social, and economic factors) in different population.[3–5] Food insecurity in diabetic patients may make it difficult to follow a suitable diet. People living in food-insecure households may be unable to have a balanced diet, because they change their dietary intake toward cheap foods, which commonly include a high proportion of sugar and fat, lower fruit and vegetable consumption, and lower intake of dairy products.[6] These dietary regimens have negative effects on the individual's health and induce the development of chronic diseases, like diabetes.[7,8]

There have been only a few studies assessing the link between food insecurity and poor perceived well-being in chronic diseases among adults.[9,10] Most studies evaluated household food insecurity and QOL in diabetic patients, separately.[11–15] Considering that general well-being, mentioned as HRQOL with different dimensions of general, physical, and mental health, may impact the development of chronic diseases and poor health status, household food insecurity may serve as a risk factor for reduced quality of life followed by poor health issues.[16] Since there is scarcely any documented study regarding the relationship between HRQOL and food insecurity in patients with type 2 diabetes, and due to the high rates of food insecurity and the burden of type 2 diabetes, the present study was designed to examine the relationship between food insecurity and HRQOL in rural patients with type 2 diabetes. We hypothesized that the HRQOL scores would be negatively associated with food insecurity. We also examined whether age, gender, marital status, educational level, or household income would moderate this relationship. Finally,

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we examined the association between food insecurity levels and HRQOL outcomes.

Materials and Methods

Design and sample

This is a cross-sectional study. Based on data from rural health care centers, all rural patients with type 2 diabetes in Neyshabur, Iran, were recruited from April to July 2012. The purpose of the study was described to all the patients, and verbal consent was obtained from all of them to participate in the present study. Patient inclusion eligibility criteria included diagnosis of type 2 diabetes; age 30 years or more at the time of data detection; living in Neyshabur rural regions (six months prior to interview); having no audio-visual difficulties; having no simultaneous chronic debilitating diseases (i.e., stroke, or epilepsy) and agreement to participate in the study. This study was approved by the Ethics Committee of Neyshabur University of Medical Sciences.

Measures

Data was collected using a set of instruments, including a socio-demographic questionnaire (i.e. age, gender, marital status, educational level, and household income), the Iranian version of household food security short questionnaire, and the Iranian versions of 36-Item Short Form Survey (SF-36) questionnaire. In this study, diabetic patients were identified based on the available lists in the Neyshabur rural health care centers. These patients were detected in diabetes screening programs that were conducted in rural regions. Then, the questionnaires were completed through home interviews by trained interviewers who contributed to the project.

Household food security short questionnaire

Household food security was measured using an Iranian version of household food security short questionnaire (6-items). The reliability and validity of this instrument were well established in Iran by Dastgiri *et al*.[17] This questionnaire is a "standard instrument" for evaluating and determining the magnitude and severity of food insecurity in Iran. The food security questionnaire consists of 6items which assess food security condition over the past 12 months. Food security is categorized into 3 levels: high food security (HFS), low food security (LFS), and very low food security (VLFS). Households in the last two categories are defined as food insecure.

SF-36 HRQOL questionnaire

HRQOL was assessed with the Iranian version of SF-36 questionnaire. The SF-36 is a standardized instrument consisting of 36 statements transformed to a 0 and 100 scale, with greater scores demonstrating better health. Sub-scale scores on eight dimensions (physical functioning (PF), role limitations due to physical problems (RP), bodily pain (BP), vitality (VT), general health (GH), social functioning (SF), role limitations due to emotional problems (RE), and mental health (MH) are generated. Three-dimensions of SF-36 (MH, RE, and SF) are most highly related to the mental facet of HRQOL and VT dimension contributes to the scoring of Mental Component Summery (MCS) measure.[18] PF, RP, and BP dimensions are most highly associated with the physical facet of HRQOL, which beside GH dimension, contribute to the scoring of physical component summary measure. High reliability and good validity have been reported for the Iranian version.[19]

Statistical analysis

Statistical analyses were applied using SPSS for Windows (Version 20. Chicago, SPSS Inc). Descriptive statistics included frequencies, percentages, ranges, means, and standard deviations (SD). The t-independent test was used to investigate the relationship between patients' HRQOL and their characteristics, including age, gender, education level, household income, marital status, distance from the city and HFI. The effect of all factors (with statistical significance in univariate tests) on HRQOL (measured by the total scores of the SF-36 and its sub-scales) was assessed by multiple linear regression models with the backward method. One-way analyses of variance were applied to investigate the overall mean differences of HRQOL dimensions by food security classifications (HFS, LFS, VLFS), and Tukey's Post-Hoc test was used to compare HFS, LFS, and VLFS two by two. For statistical analyses, transformed scores were used in all dimensions of HRQOL. The significance level was set at $P < 0.2$ in univariate analyses and $P < 0.05$ for multiple analyses.

Results

The patients' demographic characteristics are displayed in Table 1. Of all diabetic patients in the rural area of Neyshabur (n = 2224), 377 patients or 16.95% refused to participate in this study. The mean age of participating patients was 59.65 ± 12.3 years (range: 30–97), and the majority of them were women (69.8%).

The overall prevalence of household food insecurity was 46.1% (HFS = 53.9%, LFS = 23.4%, and VLFS = 22.7%). The total mean score of SF-36 was 51.11; among its different dimensions, SF had the highest (62.19 ± 18.13), and GH had the lowest (39.89 ± 21.02) scores. The MCS (53.64 ± 20.28) score was higher than the PCS (48.58 ± 22.46) score. Table 2 summarizes the association between the demographic characteristics of participants and their HRQOL according to the t-independent test. Age, gender, educational level, marital status, household income, and distance from the city and food insecurity were all associated with total and eight dimensions of SF36 in these patients ($P < 0.2$) (Table 2).

Table 3 shows the multiple linear regression models of the total mean score of SF-36 and each dimension. According to these models, food insecurity was significantly associated with HRQOL in total and its eight dimensions after adjustment for other variables. Based on Table 3, food insecurity had a strong association with the total mean score of SF-36 and its eight dimensions (especially in RE and RP dimensions).

One-way ANOVA test showed that mean scores of all HRQOL dimensions were significantly different among three levels of household food security status (HFS, LFS, and VLFS) ($P < 0.05$). Mean scores of all HRQOL dimensions were also significantly different between every two levels of household food security status, after performing LSD's Post-Hoc test (Table 4).

Discussion

Even though the importance of quality of life (QOL) is well-established,[16] only a few studies have investigated the link between food insecurity and HRQOL. It is important to consider the effects of household food insecurity on HRQOL.[10,20,21] This

Table 1. Characteristics of study population (n = 1847).

Characteristics	*n*	%
Sex		
Male	558	30.2
Female	1289	69.8
Age*		
<60 yr	922	50
≥ 60 yr	921	50
Education Level*		
Illiterate	1203	66.2
≥ Elementary	613	33.8
Marital Status		
Single/ Divorced	1480	80.1
Married	367	19.9
Household Income (per month)*		
< 200 $	1272	86.9
≥ 200 $	192	13.1
Household Food Insecurity		
No	995	53.9
Yes	852	46.1
*Some data were missing		

Table 2. Comparison of the mean scores in the PCS, MCS, eight dimensions and total of SF36 according to participants' characteristics.

	Dimensions								PCS	MCS	Total
	PF	RP	RE	VT	MH	SF	BP	GH			
	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)	Mean(SD)
Total	54.3(28.3)	45.7(43.2)	49.5(45.1)	47.9(18.8)	54.9(17.7)	62.2(21)	54.4(23.2)	39.9(18.1)	48.6(22.5)	53.6(20.3)	51.1(19.9)
Sex											
Male	58.5(29.1)	47.9(43.6)	54.1(45.3)	50(20.3)	56.9(18.7)	63.8(21.6)	57.7(24.6)	42.4(19.3)	51.6(23.6)	56.2(21.3)	53.9 (21.2)
Female	52.5(27.7)	44.8(43)	47.6(44.9)	46(17)	54.1(17.2)	61.5(20.7)	52(22.5)	38.8(17.5)	47.3(21.8)	52.5(19.7)	49.9 (19.2)
P-value	<0.001	0.156	0.004	0.002	0.002	0.028	<0.001	<0.001	<0.001	<0.001	<0.001
Age											
≤60 yr	61.5(27.1)	51.4(44.1)	54.8(45.3)	51.4(18.6)	56.6(18.3)	64.8(21.2)	57.8(23.6)	42.8(18.3)	53.4(22.8)	56.9(20.7)	55.1 (20.3)
>60 yr	47.2(27.6)	40.2(41.6)	44.2(44.3)	44.4(8.2)	53.3(17)	59.6(20.6)	51(22.3)	37(17.5)	43.8(21)	50.4(19.4)	47.1 (18.7)
P-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Education Level											
Illiterate	50.1(27.6)	42.1(42.5)	46.6(45.1)	45.7(17)	53.9(17.4)	61.2(21.1)	52.3(22.4)	37.9(17.4)	45.6(21.5)	51.8(19.7)	48.7 (19)
≥ Elementary	62.6(27.9)	53.5(43.7)	56.3(44.4)	56.3(19.5)	57.3(18.2)	64.3(20.8)	58.9(24.2)	43.8(18.6)	54.7(23.2)	57.6(20.9)	56.1 (20.8)
P-value	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001
Marital Status											
Single/Divorced	56.5(27.9)	47.5(43.5)	52.3(45.1)	49.2(18.8)	56(17.8)	63.5(20.8)	55.7(23.3)	40.9(18.3)	50.2(22.5)	55.2(20.2)	52.7 (19.8)
Married	45.4(28.1)	38.5(41.3)	38.4(43.6)	42.8(17.8)	50.7(16.8)	56.8(21.6)	49.2(22.1)	35.8(16.8)	42.3(21.1)	47.2(19.3)	44.7 (18.8)
P-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Household Income (per month)											
< 200 $	53.7(28.2)	44.4(42.9)	49.3(44.7)	47 (18.7)	54.4(18)	60.9(21.4)	53.5(23)	39.4(18)	47.8(22.1)	52.9(20.3)	50.3 (19.8)
≥ 200 $	59.9(28.9)	65.6(40.7)	66.7(41.6)	55(18.6)	60.7(16.7)	69(18)	64(22.5)	45.7(18)	58.8(21.8)	62.8(18.7)	60.8 (18.9)
P-value	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Household Food Insecurity											
No	58.8(28.5)	55.8(43)	58.7(44.6)	52.2(18.1)	59 (16.5)	64.3(20.8)	58.8(22.7)	43.3(17.7)	54.2(22.6)	58.5 (20)	56.3 (19.9)
Yes	49.1(27.1)	34 (40.5)	38.8(43.4)	42.9(18.3)	50.1(17.9)	59.7(21)	49.3(22.8)	35.9(17.8)	42.1(20.5)	47.9(19.1)	45 (18.1)
P-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Table 3. Adjusted analysis[1] of household food insecurity based on Backward multiple linear regression model.

Variables	Un-standardized Coefficients		standardized Coefficients	t	*P*-Value
	B	SE	Beta		
PF Dimension					
Household Food Insecurity	-9.55	1.41	-0.168	-6.76	<0.001
RP Dimension					
Household Food Insecurity	- 19.55	2.21	- 0.226	- 8.84	<0.001
RE Dimension					
Household Food Insecurity	- 17.58	2.31	- 0.196	- 7.61	<0.001
VT Dimension					
Household Food Insecurity	-8.38	0.96	0.022	-8.73	<0.001
MH Dimension					
Household Food Insecurity	- 8.01	0.93	- 0.22	- 8.63	<0.001
SF Dimension					
Household Food Insecurity	-4.58	1.11	-0.108	-4.13	<0.001
BP Dimension					
Household Food Insecurity	-8.12	1.20	-0.174	-6.77	<0.001
GH Dimension					
Household Food Insecurity	-6.55	0.935	-0.180	-7.01	<0.001
MCS					
Household Food Insecurity	-9.66	1.03	-0.236	-9.38	<0.001
PCS					
Household Food Insecurity	-10.80	1.12	-0.240	-9.64	<0.001
Total QOL					
Household Food Insecurity	-10.22	0.995	-0.255	-10.27	<0.001

[1] Adjusted for sex, age, education level, marital status and household income.

Table 4. Comparison of the participants HRQOL mean scores in different classifications of household food security.

Dimensions of QOL	Household Food security status	Mean	95% CI for Mean	*P*-value
PF	HFS	58.78	(57.01 , 60.56)	<0.001
	LFS	52.27	(49.80 , 54.75)	
	VLFS	45.81	(43.16 , 48.46)	
RP	HFS	55.75	(53.08 , 58.43)	<0.001
	LFS	38.34	(34.50 , 42.18)	
	VLFS	29.53	(25.70 , 33.37)	
RE	HFS	58.69	(55.92 , 61.47)	<0.001
	LFS	42.88	(38.80 , 46.96)	
	VLFS	34.69	(30.54 , 38.83)	
VT	HFS	52.15	(51.03 , 52.28)	<0.001
	LFS	45.87	(44.19 , 47.54)	
	VLFS	39.84	(38.08 , 41.61)	
MH	HFS	58.97	(57.95 , 60.01)	<0.001
	LFS	52.89	(51.29 , 54.48)	
	VLFS	47.42	(45.65 , 49.19)	
SF	HFS	64.33	(63.04 , 65.63)	<0.001
	LFS	61.52	(59.65 , 63.39)	
	VLFS	57.79	(55.68 , 59.90)	
BP	HFS	58.80	(57.39 , 60.21)	<0.001
	LFS	53.23	(51.19 , 55.27)	
	VLFS	45.16	(42.93 , 47.39)	
GH	HFS	43.28	(42.17 , 44.38)	<0.001
	LFS	38.19	(36.51 , 39.86)	
	VLFS	33.60	(31.91 , 35.29)	
PCS	HFS	54.15	(52.74 , 55.56)	<0.001
	LFS	45.51	(43.65 , 47.37)	
	VLFS	38.53	(36.54 , 40.52)	
MCS	HFS	58.54	(57.29 , 59.78)	<0.001
	LFS	50.79	(49.04 , 52.53)	
	VLFS	44.93	(43.09 , 46.78)	
Total	HFS	56.35	(55.11 , 57.58)	<0.001
	LFS	48.15	(46.52 , 49.78)	
	VLFS	41.73	(39.96 , 43.50)	

is the first study in the rural health care centers to examine the relationship between food insecurity and HRQOL among Iranian patients with type 2 diabetes.

We observed a significant negative association between HRQOL and food insecurity in rural patients with type 2 diabetes. The prevalence of food insecurity in the study population was remarkably high (45%) and more than the national reports in low-income populations. As in 2012, about 12.41% of households with low- incomes were food insecure.[22]

Food insecurity was still significantly associated with lower HRQOL even after adjustment for patients' age, sex, education level, marital status and household income. Although some studies failed to find a single cause association between food insecurity and health consequences,[10,23,24] others have stated that food insufficiency is related to poor general, mental, and physical health.[9,20,20,21] Given that well-being could be affected by non-communicable diseases, food insecurity may be a risk factor for reduced QOL and subsequent health status.[10]

The results of multiple linear regression analyses emphasized that enhanced household food security status improved each dimension of HRQOL, after adjusting for other studied variables. The different health burden of type 2 diabetes in rural people may be the result of financial and social situations in rural regions. Several conditions aggravate food insecurity for rural people, including extreme poverty, low health literacy, lack of economic opportunity, low household income, long distance to food supermarkets, few food stores, and higher food prices.

However, the effect of food insecurity on the health consequences of patients with type 2 diabetes has been neglected by health experts and remains an understudied determinant of health situations. It is vital to boost awareness among the medical society and policy makers regarding the harmful prevalence of food insecurity among poor and underserved patients. More detailed studies are needed to explore the impact of food insecurity and other confounding elements on health issues. Comprehensive knowledge of the relationship between food insecurity and low HRQOL can help policy makers develop programs for improving HRQOL among diabetic patients.

Strengths and Limitations

The present study has some notable strengths, including use of a large sample size of diabetic patients, use of linear regression model, and a response rate more than 83%. Nevertheless, this study also has a few limitations. First, given the cross-sectional nature of the present study, it is not possible to make a causal conclusion about the relationship between food insecurity and HRQOL. Other factors not included in the present study might influence this association. More longitudinal studies are required for a better understanding of the causal relationship between food insecurity and HRQOL in diabetic patients. Second, the Food Security Survey questionnaire includes six questions that reflect the food security status in the past 12 months. So, the answers of recently diagnosed patients might reflect their food security status before the disease diagnosis. More studies are needed on the existence or stability of food insecurity after the diagnosis of diabetes. Third, some facets of self-reported HRQOL instrument might be affected by factors which are not related to food security but yet affect the respondents' mood and possibly their answers. Finally, in this study, patients were recruited from rural health care centers, and thus the results may not be generalizable to other people.

In conclusion, the findings of the current study show a strong relationship between household food insecurity and HRQOL in rural patients with type 2 diabetes. This confirms the necessity to consider household food accessibility as part of programs to improve healthy food choices and good health among the rural diabetic patients. Moreover, HRQOL could be recommended as an ideal marker to assess comprehensive programs regarding food security improvement among type 2 diabetic patients.

Competing interests

The authors declare that they have no competing interests.

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