

Nutritional knowledge, family income, and blood sugar level among diabetic patients

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ABSTRACT

Nutritional literacy related to diabetes control can play an important role in glycemic control and the reduction of complications of type 2 diabetes. This study aimed to investigate the relationship between nutritional knowledge and hemoglobin A1c (HbA1c). In this study, nutritional literacy and its components (food portion, nutritional content, healthier food choice, and food label reading skill) were evaluated by a valid and reliable questionnaire designed in Singapore for the evaluation of diabetes-related nutrition knowledge. Furthermore, family income, level of education, type of ethnicity, having a smartphone, as well as access to social media of 64 type 2 diabetic patients were assessed. Pearson's Correlation coefficient between HbA1c and total nutritional knowledge score was calculated at -0.58, which was significant ($p < 0.001$). Participants scored 48%, 55%, 51%, 52%, and 52% of total score for food portion and sizes, nutrition content of food, healthier food choices and safety, food label reading, and overall, respectively. After controlling for possible confounding, regression model results suggested nutritional knowledge and family income were two potential predictors of HbA1c. Improving nutrition and media literacy may help reduce blood sugar levels and treatment costs.

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1. INTRODUCTION

Type 2 diabetes is specified by a relative absence of insulin caused by dysfunction of the pancreatic β -cells and resistance to insulin in the target organs [1], [2]. Complications of type 2 diabetes include macrovascular disorders such as cardiovascular disease as well as microvascular disorders such as kidney, retina, and immune system disturbance [3], [4]. The ninth factor of life expectancy reduction in 2013 was diabetes, this disease and its complications were responsible for about 7% of all registered deaths worldwide. In addition, high fasting sugar was reported as the third leading cause of disability in 2015; It has also been shown that diabetes plays a significant role in decreased life quality and premature death [3]–[5].

Type 2 diabetes is one of the most common metabolic disorders in the world [6]. Globally, an estimated 451 million people (aged 18-99) were diagnosed with type 2 diabetes in 2017. The number of people affected by this disease is expected to reach 693 million in 2045 [7]. In a study conducted in 2017,

China and India had the highest number of people (aged 20-79) with diabetes among Asian countries. In addition, the number of people with diabetes in Iran was similar to most countries in the Middle East [3], [8], [9]. In a 2017 meta-analysis study, it was found that insulin resistance and obesity, which are the main risk factors for diabetes, are higher than the national average in Zahedan, southeastern Iran [10].

Research is increasingly showing that medical nutritional therapy (MNT) administered by a dietitian is an important part of controlling diabetes [11], [12]. Self-care behaviors such as healthy eating, physical activity, blood sugar control, follow-up medication, good problem-solving skills, healthy coping skills, and reducing high-risk behaviors positively correlated with reducing complications, better glycemic control, and improving the quality of life [13], [14]. The results of a study showed that the majority of patients with type 2 diabetes had low levels of diabetes-related knowledge, poor self-care behaviors, and low adherence to medications [15].

Effective diet education for patients can prevent diabetes and its complications [16], [17]. Also, the results of a study conducted on patients with type 2 diabetes showed that improving nutritional knowledge and skills, especially for patients with lower economic and social status, will play an important role in managing their diabetes. Furthermore, results of a study conducted on patients with type 2 diabetes showed that improving nutritional knowledge and skills will play a significant role in management of their diabetes [18]. However, discrepancies are reported in this field [19].

Based on our knowledge, there have been few studies on the relationship between nutritional literacy and type 2 diabetes, especially in Iran [20]–[22]. Besides, access to smartphones and social media has rarely been investigated in Iran [23], [24]. Thus, investigating the association between nutritional knowledge and HbA1c levels in type 2 diabetes patients was the purpose of this study.

2. METHOD

2.1. Study design and population

This cross-sectional study was performed between November and December 2021 among patients with type 2 diabetes admitted to diabetes clinics of Zahedan city, the center of Sistan-and-Baluchestan province in southeast Iran. The protocol of this study was approved by Vice Chancellor for Research and Information Technology (approval ID: IR.ZAUMS.REC.1400.268; <https://ethics.research.ac.ir/EthicsProposalViewEn.php?id=229575>). Hence, written knowledgeable consent was taken from all eligible subjects. Participants who have been recognized for their type 2 diabetes for less than a year were included in the study.

Using the formula of estimation correlation coefficient (r) with a significance level of 5%, power of the statistical tests of 90%, and estimated r of -0.61 [25] the sample size was computed to be 64 patients with type 2 diabetes. Participants were selected by judgmental non-random sampling method from both genders. A trained expert completed the questionnaires in a face-to-face interview.

2.2. Assessment of variables

Demographic variables such as income, education level, access to smartphones, and social networks were assessed. A standard questionnaire that was developed in Singapore was used for measurement of nutritional literacy level [26], content validity and reliability of the localized version of this questionnaire were done and confirmed. To this, the content validity index (CVI) and content validity ratio (CVR) were estimated at 0.81 and 0.77, respectively. For reliability assessment, Cronbach's alpha index and intra-class correlation coefficient were also computed at 0.92 and 0.80, respectively. This questionnaire has four different dimensions. The first part evaluates the knowledge of people about serving size and the allowance amount of food in diabetic diets and has eight questions. The second part is related to the nutritional value of food that has eight questions. The third part is about food selection and has six questions. Finally, the last part relates to food labels and the level of awareness of individuals in the interpretation of nutritional labels which has five questions. All questions were multiple choice and scored as follows, correct choice: 2; I do not know: 1; incorrect choice: 0.

2.3. Statistical analyses

Frequency and percentage were reported for categorical variables. Mean and standard deviation (SD) were computed. The comparisons between the two groups were performed using independent samples t-tests. One-way ANOVA was employed to compare three or more independent groups. Pearson's correlation coefficient was employed for estimation of the relationship between two quantitative variables. Nonparametric statistical tests were employed for non-normal data. We also were used multiple linear regression model for determining effective predictors of HbA1c, adjusting for possible confounders. All tests considered two-tailed hypotheses with a significance level of 5%. The statistical analyses were performed using SPSS software (version 22, IBM corp. USA).

3. RESULTS AND DISCUSSION

3.1. Findings

The total number of participants was 64, the mean age of patients was 44.1±6.8 years (range: 32-60), 52% of them were male, about 84% had a diploma and under diploma, and all of them had income less or equal to their expenses, 47% of them were Baluch race. About 42% of them did not have a smartphone mobile, and 56% did not have access to social networks. Table 1 compares nutritional literacy level and HbA1c by demographic characteristics of the subjects.

Table 2 shows the range, mean, SD, and percent of nutritional literacy scores in four dimensions and overall. The results indicated that patients had gained the highest score (%) in the “nutrition content of food” dimension on average. “Food label reading”, “healthier food choices and safety”, and “food portion and sizes” dimensions were in the next ranks. Generally, patients had gained about 52% of the total nutritional literacy scores, which can be categorized as moderate literacy level.

Pearson’s Correlation coefficient (r) was -0.58 between HbA1c and total nutritional knowledge scores, which was statistically significant (p<0.001). It means that while the nutritional literacy of type 2 diabetic patients increases, the HbA1c decreases. Multiple linear regression modeling results using the stepwise variable selection method suggested level of nutritional knowledge and family income were two effective factors in HbA1c of type 2 diabetic patients. The findings revealed that, on average, with increasing nutritional literacy levels and family income, the value of HbA1c decreases. Nutritional literacy also has more effect on outcomes than family income. Table 3 shows the details.

Table 1. Summary statistics of nutritional literacy and HbA1c by demographic characteristics

	N (%)	Nutritional literacy		HbA1c	
		Mean±SD*	p-value	Mean±SD	p-value
Age (Yrs)					
< 40	17 (26.56)	29.24±5.27	0.27	8±1.36	0.45
>= 40	47 (73.43)	27.74±4.58		8.46±1.74	
Gender					
Female	31 (48.43)	28.87±4.58	0.24	8.19±1.56	0.42
Male	33 (51.56)	27.45±4.91		8.49±1.75	
Education					
Uneducated	3 (4.68)	24.67±1.15	<0.001	9.33±1.86	<0.001
Under-Diploma	21 (32.81)	25.24±2.84		9.41±1.48	
Diploma	30 (46.87)	28.80±4.78		7.77±1.49	
Academic	10 (15.62)	33.30±3.62		7.51±1.22	
Family income					
Cost>Income	46 (71.87)	27.39±4.83	0.04	8.71±1.71	0.004
Cost=Income	18 (28.12)	30.06±4.15		7.40±1.03	
Cost<Income	0 (0.00)	-		-	
Ethnic					
Zaboli	19 (29.68)	30.79±4.02	<0.001	7.50±1.08	<0.001
Baluch	30 (46.87)	25.53±3.75		9.40±1.65	
Other	15 (23.43)	30.4±0.98		7.30±0.79	
Intelligent mobile					
Has	37 (57.81)	29.70±5.26	0.001	7.95±1.61	0.005
Has Not	27 (42.18)	26.00±2.90		8.88±1.57	
Access to social media					
Yes	28 (43.75)	31.46±4.20	<0.001	7.57±1.32	<0.001
No	36 (56.25)	25.56±3.42		8.95±1.65	
Total	64 (100)	28.14±4.77		8.34±1.65	

*SD: standard deviation

Table 2. Descriptive characteristics of nutritional literacy scores and their dimensions

	Range	Score	% of total
Food portions and sizes	0-16	7.7±2.4*	48.12
Nutrition content of food	0-16	8.9±2.6	55.63
Healthier food choices and safety	0-12	6.1±1.5	50.83
Food label reading	0-10	5.3±1.3	53.00
Overall	0-54	28.1±4.7	52.04

* Mean ± SD

Table 3. The results of multiple linear regression modeling

Variables	Estimates	Unstandardized coefficients		Standardized coefficients	p-value
	B	Std. error	Beta		
Nutritional literacy	-0.18	0.04	-0.53		< 0.001
Family income	-0.82	0.38	-0.23		0.03

3.2. Discussion

Bivariate analyses of this study showed that education, family income, ethnicity, having an intelligent mobile phone, and access to the internet and social networks affect both the level of nutritional literacy and blood sugar levels of diabetic patients. Our findings showed that patients older than 40 years had lower mean nutritional literacy and higher HbA1c levels. It was also shown that increasing the level of education and income significantly decreases the level of nutritional literacy and HbA1c. It was found that people of Baluch ethnicity had significantly lower nutritional literacy and higher HbA1c levels in compare with Zaboli patients and other ethnicities. Patients who used smartphones had substantially higher nutritional literacy scores and lower blood sugar levels compared to those who did not have smartphones. In addition, participants who had access to the Internet and social media had significantly higher levels of nutrition literacy and lower HbA1c. Multivariate modeling also indicated that nutritional literacy and family income are significant factors in the HbA1c level. Our bivariate and multivariate results are in line with other related studies. Michou *et al.* have also shown that better socioeconomic status plays an effective role in increasing the level of nutritional literacy of Individuals [27]. In a meta-analysis study conducted in 2018, it was shown that social networks play an effective role in improving nutritional interventions in adults and most studies have shown positive results in this regard [28]. Social media plays an important role in disseminating food information and potentially serves as a policy action to improve food literacy, healthy nutrition, and well-being. However, some authors warn about the lack of control over the quality of information shared and the dangers of knowledge distortion [29]. Also, results of another study showed a paradoxical relationship between social media and food. Social media play a significant role in increasing consumer knowledge; on the other hand, it causes a change in individual behavior toward consumption of unhealthy foods [30].

Our results indicated that patients with type 2 diabetes have moderate nutritional literacy levels in general and in all dimensions. We also found that the correlation between HbA1c and overall nutritional literacy was negative and highly important. It means that while increasing the nutritional literacy of type 2 diabetic patients, the HbA1c decreases. Our results are in the same line with another related research [11], [16], [27]. In Hashim *et al.* study, teaching the correct principles of nutrition improves blood sugar and other outcomes related to diabetes in diabetic patients [31]. Studies have shown that improving nutritional knowledge and skills in the community, especially for patients with lower economic and social status, will play a potential role in type 2 diabetes management [11], [18], [26]–[32]. In results of Ruszkiewicz *et al.* study, it was shown that the level of nutritional literacy was generally not satisfactory [33]. Nutrition training and promotion of nutritional knowledge in diabetic patients help them to control their blood sugar effectively [34].

Considering that limited studies in Iran have examined the level of nutritional knowledge in type 2 diabetic patients, such studies can be very effective in terms of health policy and reducing treatment costs. Because our study included only participants who were referred to hospitals affiliated with Zahedan University of Medical Sciences, there are limitations to generalizing the results to the community. It is also better to conduct such studies with a larger sample size perform on patients with poor glycemic control.

4. CONCLUSION

The nutrition knowledge of the participants is at a moderate level that needs improvement. Enhancement of family income and nutritional literacy level, as two effective factors for controlling HbA1c, might pay more attention to policymakers and health managers. In addition, since patients who had access to social media had higher nutritional knowledge; Therefore, we recommend encouraging patients to use smart phone and social media. Due to misinformation and disinformation in social media, it is necessary to work on patient's media literacy to distinguish the right things from the wrong. It might have an impact on reducing health costs, and increasing empowerment and life expectancy in patients.

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