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Factors influencing the consumption of fruits and vegetables in diabetic patients based on Pender's health promotion model

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Abstract:

BACKGROUND: To control blood sugar and prevent complications related to diabetes, eating fruits and vegetables in standard amounts is recommended. The aim of this study was to investigate the factors affecting the consumption of fruits and vegetables in diabetic patients based on the Pender health promotion model.

MATERIALS AND METHODS: This cross-sectional study was conducted on 260 diabetic patients in Sirjan; one of the cities of Kerman in Iran in 2020. To collect data, a researcher-made questionnaire of Pender's Health Promotion Model and a standard Behavioral Risk Factor Surveillance System questionnaire were used to measure fruit and vegetable consumption. Data were analyzed using SPSS24 software. Data were analyzed using *t*-test, Pearson correlation coefficient, linear regression, and path analysis. Significance level <0.05 was considered.

RESULTS: The study showed that 71.5% of patients consumed fruits three or more times and 52.3% consumed vegetables per week. Employment, income, education, and gender were significantly associated with fruit and vegetable consumption ($P < 0.05$). Perceived barriers ($P < 0.0001$, $\beta = 0.23$), self-efficacy ($P < 0.0001$, $\beta = 0.32$), and commitment to action plan ($P = 0.002$, $\beta = 0.20$) were the main predictors of fruit and vegetable consumption.

CONCLUSION: In this study, self-efficacy was the strongest predictor of fruit and vegetable consumption in diabetic patients. Therefore, it is necessary to consider health education as well as health promotion interventions based on these variables is considered to increase the consumption of fruits and vegetables for diabetic patients.

Keywords:

Diabetes, fruit, health promotion model, Pender's, perceived barriers, self-efficacy, vegetable

Introduction

Type 2 diabetes (T2D) is a complex multifactorial disease afflicting an increasing number of patients worldwide and put a huge burden on health-care systems and poses a serious threat to human health.[1] One of the public health concerns in the world, in addition to the high prevalence and incidence of diabetes, is its serious complications.[2,3] This disease has serious effects on many parts of the body including the eyes, the heart, the limbs as well as nervous system, and if not controlled, it can lead to some complications such as cardiovascular disease, impaired vision, renal failure, foot ulcer, and also nerve damage.[4,5]

Currently, the projection of having diabetes will rise from one in 11 adults in 2015 to one in 10 adults by 2040, of which 90% have T2D.[6] Issued in 2015, the International

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Diabetes Federation estimated that the number of global diabetes individuals aged 20–79 was 415 million and will increase to 642 million by 2040, of which 75% are in low-to-middle-income countries.[7,8]

Asia continent has been considered as the main area of the global T2D epidemic, which is spreading rapidly.[6] In the National Non-Communicable Diseases Surveillance Survey in 2016, the prevalence of T2D in Iran (all ages studied) was 10.58%, of which 9.72% were male and 11.30% were female.[9] It is estimated that the annual incidence rate of diabetes in Iran by 2030 ranks second in the region following Pakistan.[5] Besides this, The World Health Organization statistics show that the number of diabetic patients in Iran in 2030 will be more than 6.4 million.[10] The 2016 Iranian National Survey showed that the prevalence of diabetes in Kerman province was 11.53% and with a prevalence of 9.28% in men as well as 13.39% in women.[11]

Researchers believe that T2D reduces life expectancy in people with diabetes by about 15 years.[12] In Iran like many other countries, diabetes is considered as one of the leading causes of mortality and also with high economic costs. Studies have shown that the direct and non direct costs of a diabetic patient in Iran are about 2.5 times more than a healthy person in the same condition.[10] Many non communicable diseases; especially diabetes, are directly associated with nutrition, in a way that food imbalances helped to the high prevalence of diabetes in communities.[1]

For the purpose of controlling diabetes as well as prevent from its complications, diabetic patients are advised to consume high-fiber foods such as vegetables and fruits.[8] In a study in 2018, the consumption rate of fruits and vegetables was less than the recommended. For example, in 52 low-middle income countries, more than 75% of people consumed less than recommended.[13] In Iran, the mean consumption of fruits is 142 g a day, and the mean per capita consumption of vegetables is 286 g a day.[14] Moreover, this is a case where the WHO has advised people to consume 400 g or more portion of fruits and vegetables a day.[15]

In a study in the USA on diabetic patients, the consumption rates of fruits and vegetables were 1.08 units a day and 3.09 units a day, respectively.[16] In a study in Iran on diabetic patients, 24% consumed <2 units of fruits and 59% consumed <3 units of vegetables a day.[1] Some studies have shown that the consumption of fruits and vegetables is inversely associated with the risk of diabetes, while others found no relation.[17]

Pender's Health Promotion Model introduced in 1996 by Pender is a model for determining the health-promoting behaviors because it is a high comprehensiveness and application in recognizing the psychological factors determining the behavior Including the the consumption of fruit and vegetable behavior.[18]

Predictive constructs of health-promoting behavior in the Pender model are personal experiences and characteristics (including personal factors and previous behaviors), behavior-specific feelings and cognitions (including structures such as perceived benefits and barriers and perceived self-efficacy), as well as behavioral consequences.[19]

According to the Pender's model structures, diabetics can consume fruits and vegetables when they know the benefits of doing so and also understand the barriers preventing them from the consumption of fruits and vegetables in a way that the ability to overcome the barriers to consume fruits and vegetables is positively and significantly associated with the increased consumption of fruits and vegetables. In addition, interpersonal influencers and the most important of which are family, friends, and health practitioners, can have a positive effect on fruit and vegetable consumption. Along with this, self-efficacy is a determining factor in changing the health-related behaviors.[18] Mohammadipour *et al*. in their study confirmed the positive effect of Pender's health promotion model on the improvement of the proper nutrition methods in diabetic patients.[20]

Given the lack of sufficient studies in this field, the present study investigates the factors influencing the consumption of fruits and vegetables based on the Pender's health promotion model in diabetic patients.[21]

Materials and Methods

Study design and setting

The present study was a cross-sectional descriptive-analytical study that was performed on Type 2 diabetic patients in 2020 in Sirjan, one of the southeastern cities of Iran. This study was approved by the Research and Technology Council of Kerman University of Medical Sciences with the ethics code of IR.KMU.REC.1399.381.

Study participants and sampling

Given that a main objective of this study was to determine the relationship between the Pender's structures with fruit and vegetable consumption, therefore, considering the correlation coefficient of 0.18 between situational influencers with nutritional behavior based on the findings of relatively similar studies[22] as well as considering the following parameters; according to the following formula, the sample size was determined as 260 people.

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$C = 0.5 \times \ln([1 + r]/[1 - r]) = 0.18$ total sample size $= N = ([Z\alpha + Z\beta]/C)^2 + 3$

Sampling was performed in the outpatient specialized diabetes clinic as well as from diabetic patients with records in comprehensive health service centers in Sirjan. Initially, 130 diabetic patients with a daily referral to the clinic (until the sample size was completed) were included in the study. According to the last census conducted in 2016, almost all the entire urban population of Sirjan was covered by the comprehensive health service.

Therefore, out of six comprehensive health service centers, two centers were randomly selected. In the following, among diabetic patients with records, 130 of them were selected randomly and were invited to the centers by telephone. In this regard, telephone calls were made to invite them to participate in the study in case of their conditions and desire. They were requested to refer to the centers on a specific day for their height and weight to be measured as well as to complete a questionnaire. In this study, we considered some criteria. Inclusion criteria were willingness to participate in and the least literacy, and exclusion criteria were reluctance to continue.

Data collection tool and technique

Two questionnaires were used to collect data. The first questionnaire was the Standard Behavioral Risk Factor Surveillance System, running in the United States since 1984. This tool has 22 parts, of which part 12 has six questions related to the consumption of fruits and vegetables. Reducing the gap between health knowledge, policymaking, and implementation is from the benefits of this questionnaire.[23]

The second questionnaire was a researcher-made questionnaire consisting of two parts, the first part with eight questions related to age, sex, body mass index (BMI), education, duration of diabetes diagnosis, marital status, employment, and income, and the second part was based on Pender's model structures. The validity and reliability were confirmed as follows:

For the validity of the content of the questionnaire, the two methods of quantitative and qualitative were used. For the qualitative validation, initially, the questionnaire along with the explanation of the objectives of the test as well as operational definitions associated with the content of the questions was sent to four experts in the field of questionnaire design and their qualitative feedbacks in terms of grammar, use of appropriate words, importance of items, and placement of items in their proper place were applied.[2]

In the following, two methods of content validity ration (CVR) and content validity index (CVI) for the quantitative validation.

CVR questionnaire had three items of "it is necessary," "it is useful but not necessary," and "it is not necessary." After removing some items and correcting the specified items, the scientific validity of the questionnaire was determined by 86%. To determine the CVI index on the three criteria of relevance, simplicity, and clarity based on a four-point Likert scale, the experts commented that the CVI of all questions was above 80% and hence was accepted.

Reliability was determined using Cronbach's alpha coefficient, test and retest, and intraclass correlation coefficient (ICC) test. For this purpose, a questionnaire was sent to twenty people. Cronbach's alpha coefficient of each section of the self-efficacy questionnaire was confirmed by 89%, perceived benefits by 92%, perceived barriers by 91%, interpersonal norms by 85%, interpersonal patterns by 84%, behavior-related emotions by 94%, and finally, commitment to action plan approved by 80% approved. In test and retest, at intervals of 15 days, questions were presented to 22 diabetics (not included in the study) on the same conditions.

The ICC of the perceived benefits approved by 96%, perceived barriers by 62%, self-efficacy by 67%, interpersonal patterns as well as interpersonal norms by 88%, behavior-related emotions by 91%, and commitment to action plan by 89%. For example, the self-efficacy variable of diabetics was measured with some questions such as "I am confident that can consume fruits and vegetables even if my family members do not consume" based on the five-point Likert scale (1 = not at all up to 5 = so much).

To measure the perceived benefits for the measurement of the intake of fruits and vegetables in diabetics, some questions such as "Regular consumption of fruits and vegetables prevents the progression of diabetes" based on the five-point Likert scale (1 = not at all up to 5 = so much) were used. The structure of perceived barriers was measured using questions such as "I use less vegetables because it needs to be cleaned," based on Five-point Likert scale (1 = strongly disagree to 5 = strongly agree).

The structure of behavior-related emotions was measured using questions such as "I enjoy consuming fruits daily" based on a five-point Likert scale (1 = not at all to 5 = so much). The structure of interpersonal norms was measured using questions such as "How much do family members expect you to consume fruits and vegetables on a daily basis and encourage you to consume them?" based on the five-point Likert scale (1 = not at all to 5 = so

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much). Furthermore, the interpersonal patterns were measured using questions like "How is the consumption of fruits and vegetables among physicians?" based on the five-point Likert scale (1 = not at all to 5 = so much).

The structure of situational influencers was measured using questions such as, "Have you ever read about the daily consumption of fruits and vegetables in diabetics on the Internet?" based on a two choice of "Yes/no" response.

The structure of commitment to action plan was measured using questions such as "I plan to always have a bowl of fruits available," based on a two-choice of "Yes/no" response. After receiving a letter of introduction from Sirjan School of Medical Sciences to a specialized diabetes clinic and comprehensive health centers, initially and at the time of referral, researchers introduced themselves and stated the objectives of the study and in case of willingness of people to participate in, measured the weight and height of people with the Digital scales Seca Germany and obtained their BMI. In the following, they completed the questionnaire anonymously with ethical standards and ensured the confidentiality of information.

The collected data were entered into IBM.SPSS. Statistics 24. Descriptive information was determined using central indices (mean) and dispersion index (standard deviation) in the form of tables. In the section of the relationship between fruit and vegetable consumption with Pender's health promotion model, the consumption of each person was summed in a questionnaire, and the consumption of fruits and vegetables of each person was classified as once a week and less, twice, three times, and more. Data were analyzed using *t*-test, Pearson correlation coefficient, linear regression, and path analysis. Significance level <0.05 was considered.

Ethical consideration

Ethical principles considered in this research including assuring research groups to keep personal information confidential, free participation of the research group in research and confidentiality of public opinion by preparing an anonymous questionnaire, free exit of samples during the study, scientific and reliable assurance in recording information obtained from research about the time of data collection and analysis, and observance of ethical principles in the use of all sources and research.

Results

In the present study, 71.9% of the participants were women and the others were men. The mean age was 48.8 ± 0. 9.4 years, and the mean duration of diagnosis of diabetes was 5.9 ± 7.5 years. Nearly 26.9% of patients were obese and 41.9% were overweight. The descriptive characteristics are shown in Table 1.

The findings of fruit and vegetable consumption of our population showed that 71.5% consumed fruit three or more times a week. Furthermore, 79.2% of them consumed natural juice once or less a week. In addition, 52.3% consumed vegetables three or more times a week and 43.8% consumed salad three or more times a week. The condition is shown in Table 2.

Table 3 shows, there was a significant relationship between employment status and fruit consumption. In fact, employee and unemployed diabetics had the highest and lowest level of fruit consumption. In addition, there was a significant relationship between fruit and vegetable consumption and level of income in a way that the lower the level of income, the lower the level of fruit and vegetable consumption.

Table 4 shows that the mean constructs of perceived barriers, self-efficacy, and commitment to action plan

Table 1: Demographic variables in diabetic patients participating in the study in Sirjan

Variable	*n* (%)
Age (years), mean±SD	48.8±9.4
Sex	
Man	73 (28.1)
Woman	187 (71.9)
Education	
Primary school	70 (26.9)
Guidance school	66 (25.4)
High school and diploma	76 (29.2)
University	48 (18.5)
Marital status	
Single	9 (3.5)
Married	243 (93.5)
Others	8 (3.1)
Diabetes diagnosis (years), mean±SD	7.56±5.9
Employment status	
Unemployed	12 (4.6)
Employee	23 (8.8)
Free	42 (16.2)
Retired	27 (10.4)
House wife	156 (60.0)
Level of income (million)	
Under 2	80 (30.8)
2-3	40 (15.4)
3-4	78 (30.0)
Over 4	62 (23.6)
BMI index	
<18.5	4 (1.5)
18-24.9	77 (29.6)
25-29.9	109 (41.9)
More than 30	70 (26.9)

SD=Standard deviation, BMI=Body mass index

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Table 2: Weekly fruit and vegetable consumption in subjects

Variable	*n* (%)
Fruit	40 (15.4)
Less than once	
Twice	34 (13.1)
Three times and more	186 (71.5)
Fruit juice	
Less than once	206 (79.2)
Twice	25 (9.6)
Three times and more	29 (11.2)
Vegetable	
Less than once	71 (27.3)
Twice	53 (20.4)
Three times and more	146 (52.3)
Salad	
Less than once	82 (31.5)
Twice	64 (24.6)
Three times and more	114 (43.8)

had a significant relationship with weekly consumption of fruits in diabetic patients participating in the study. Furthermore, there was a significant relationship between the mean of Pender's model structures except interpersonal norms and situational influencers had a significant relationship with weekly vegetable consumption status in diabetic patients.

The results of regression analysis showed that the structure of perceived obstacles had an inverse and significant relationship with fruit and vegetable consumption behavior ($P < 0.0001$, $\beta = 0.23$), while self-efficacy ($P = 0.0001$, $\beta = 0.32$) and commitment to action ($P = 0.002$, $\beta = 0.20$) were directly related to fruit and vegetable consumption behavior. Overall, 37.6% of the variance related to fruit and vegetable consumption is predictable with the variables entered in the model [Table 5].

The Path analysis diagram [Figure 1] confirmed the results of regression test between Pender's model structures and fruit and vegetable consumption behavior in diabetic patients. The diagram showed a direct and inverse relationship between fruit and vegetable consumption with perceived barrier structures ($P < 0.0001$, $\beta = 0.23$). Furthermore, self-efficacy ($P < 0.0001$, $\beta = 0.32$) and commitment to action plan ($P < 0.002$). ($\beta = 0.2$) showed a direct relationship with the behavior of fruit and vegetable consumption behavior. In addition, an inverse and direct relationship between perceived barriers and self-efficacy structure was observed, and perceived benefit, behavior-related emotions, and commitment to action plan were directly and significantly associated with self-efficacy. As shown, the relationship between interpersonal norms and behavior-related emotions was direct and significant. The results also showed that the relationship between perceived benefit, behavior-related emotions, and interpersonal norms as well as patterns is indirectly associated with fruit and vegetable consumption behavior.

Discussion

This study investigated the factors affecting the consumption of fruits and vegetables in a number of diabetic patients in Sirjan based on Pender health promotion model. Clearly, 71.5% of subjects consumed fruit three or more times, whereas 15.4% consumed fruit once or less a week, 52.3% of them consumed vegetables three or more times, while 27.3% consumed vegetables once or less a week.

These results are consistent with the findings of the Tabesh study that vegetable consumption in diabetics is lower than fruit consumption.[24] In another study on diabetic patients, the average consumption of fruits and vegetables was almost the same and even vegetables slightly more.[21]

The results also showed that results of the consumption of vegetables in diabetic patients in this study are less than the consumption of fruits. Low consumption of vegetables can indicate barriers such as lack of time, lack of access, and time consuming which can be modified by appropriate interventions and planning.

The results indicate no significant relationship between demographic variables of age, marital status, BMI, and duration of diabetes with fruit and vegetable consumption which is in line with the results of the Ismaili's study.[21]

Another study confirms the effect of age and duration of diabetes.[2] The findings of this study showed that there is a positive and significant relationship between income and job. Employees had the highest fruit consumption and unemployed as well as low-income people had the lowest fruit consumption, which was consistent with the results of Taheri's.[4,22]

In the study of Barzegar Nazari *et al*., consumption of health-oriented foods including fruits and vegetables in patients with T2D was observed more in patients with university education and to a lesser extent in patients with high school education. This indicates that they are more aware of the benefits of these nutrients than the less educated group.[25]

The present study confirms the findings of previous studies[4] that educated people consume more servings of fruits and vegetables. It see, ms that in most studies, consumption of fruits and vegetables increases with the

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Table 3: Relationship between demographic variables and fruit and vegetable consumption in the our population

Variables	Fruit consumption (weekly)				Vegetable consumption (weekly)			
	Once and less	Two times	Three times or more	*P*	Once and less	Two times	Three times or more	*P*
Age	48.1±10.2	47.7±9.7	49.1±9.2	0.620	48.7±8.9	47.7±9.3	49.2±9.8	0.553
Sex								
Man	15.1	12.3	72.6	0.967	35.6	20.5	43.8	0.138
Woman	15.5	13.4	71.1		24.1	20.3	55.6	
Education								
Elementary	21.4	18.6	60	0.184	32.9	20	47.1	0.269
Middle	16.7	9.1	74.2		24.2	22.7	53	
High school and diplamo	9.2	14.5	76.3		32.9	19.7	47.4	
University	14.6	8.3	77.1		35.2	28.3	26.5	
Marital status								
Single	44.4	11.1	44.4	0.113	33.3	33.3	33.3	0.792
Married	14.8	13.2	72		27.2	19.8	53.1	
Others	0	12.5	87.5		25	25	50	
Employment status								
Unemployed	25	41.7	33.3	0.021	33.3	8.3	58.3	0.797
Employee	8.7	0	91.3		21.7	21.7	56.5	
Free	19	16.7	64.3		31	26.2	42.9	
Retired	11.1	7.4	81.5		29.6	11.1	59.3	
Housewife	15.4	12.8	71.8		26.3	21.2	52.6	
Income (million)								
Under 2	30	15	55	<0.001	36.3	23.8	40	<0.001
2-3	20	25	55		47.5	17.5	35	
3-4	9	14.1	76.9		23.1	23.1	53.8	
More than 4	1.6	1.6	96.8		8.1	14.5	77.4	
BMI								
<18.5	50	0	50	0.136	50	25	25	0.557
18-24.9	16.9	6.5	76.6		33.8	18.2	48.1	
25-29.9	12.8	18.3	68.8		24.8	22.9	52.3	
More than 30	15.7	12.9	71.4		22.9	18.6	58.6	

BMI=Body mass index

Table 4: Mean of Pender's health promotion model structures based on fruit and vegetable consumption

Structures	Mean±SD of fruit consumption (weekly)				Mean±SD of vegetable consumption (weekly)			
	Once and less	Two times	Three times and more	*P*	Once and less	Two times	Three times and more	*P*
Perceived benefits	81.6±17.3	83.2±13.9	86±15.3	0.133	82.1±17.4	81.8±15.7	87.5±14.1	0.017
Perceived obstacles	47.8±16.8	44.8±18.9	31.1±21.05	<0.001	46.3±19.5	39.3±18.4	28.4±20.5	<0.001
Self-efficacy	43.3±21.6	44.4±19.4	64.7±21.8	<0.001	43.1±20.01	51.4±19.4	69.8±20.6	<0.001
Interpersonal norms	64.9±18.7	64.07±17.8	65.7±19.7	0.886	62.8±21.8	60.6±19.04	68.5±17.5	0.886
Interpersonal patterns	67.2±17.1	61.2±13.6	66.2±15.07	0.165	65.3±18.1	61.05±14.01	67.6±13.8	0.035
Situational influencers	51.4±34.2	39.9±27.1	50.4±31.4	0.182	46.07±34.8	47.1±29.7	51.6±30.2	0.410
Emotions related to behavior	64.4±14.9	67.3±11.9	68.3±11.8	0.313	63.5±15.4	65.6±14.2	70.5±8.5	0.011
Commitment to action	47.8±16.8	32.7±31.2	65.9±31.3	<0.0001	35.5±30.7	35.1±29.01	63.8±27.9	<0.0001

SD=Standard deviation

rise of education and income. Limited studies have found education to be an ineffective factor.

In this study, for the relationship between Pender model constructs and fruit and vegetable consumption status in the studied diabetic patients, 37.6% of variance related to fruit and vegetable consumption behavior can be predicted with Pender's health promotion model variables confirmed by path analysis. In a study in Iran in diabetic patients, the predictability of Pender model variables was consistent with the results of this study.[26]

In the study by Kurnia *et al*. on diabetic patients, 20.8% of variance could be predicted with self-efficacy and situational influencers variables.[27]

It seems that, in this study, Pender model structures predicted fruit and vegetable consumption with less

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Table 5: Linear regression analysis of Pender's model structures with fruit and vegetable consumption

Variables	β	Standard β	Regression coefficient	Lower bound	Upper bound	*P*	Coefficient of determination R^2
Perceived benefits	0.006	0.039	0.645	−0.012	0.023	0.520	0.376
Perceived barriers	−0.025	−0.235	−4.18	−0.03	−0.013	<0.001	
Self-efficacy	0.032	0.329	4.46	0.018	0.046	<0.001	
Interpersonal norms	0.005	0.043	0.716	−0.009	0.019	0.475	
Interpersonal patterns	−0.008	−0.055	−0.963	−0.025	0.009	0.336	
Situational influencers	0.002	0.024	0.466	−0.006	0.009	0.642	
Emotions related to behavior	−0.009	−0.046	−0.748	0.031	0.014	0.445	
Commitment to action	0.015	0.2007	3.16	0.006	0.024	0.002	

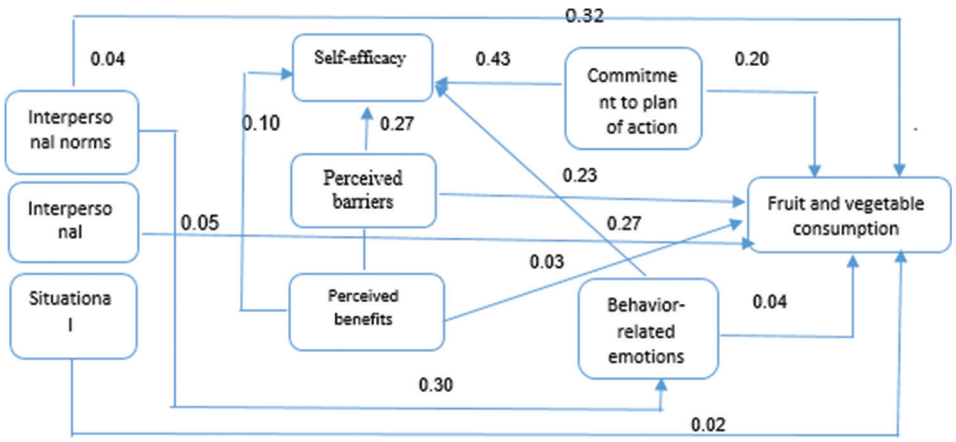

Figure 1: Diagram of path analysis between Pender model structures and fruit and vegetable consumption in subjects

variance that probably the most effect is related to the demographic variables of the subjects and the nutrition culture of the people in the study area. However, Mohammedi's study indicated that self-efficacy and commitment to action were significant predictors in diabetic patients.[26] In the present study, self-efficacy was the strongest predictor of fruit and vegetable consumption in diabetics and along with this, Rahimi *et al*.'s study indicated that self-efficacy was an important and positive predictor in the rise of fruit and vegetable consumption.[28] The higher effectiveness of self-efficacy in patients with diabetes decreased perception of barriers to fruit and vegetable consumption and grounded the maintenance and implementation of the desired health behavior.

Herr, perceived barriers and commitment to action were other predictors of fruit and vegetable consumption behavior. In Bahmanpour *et al*.'s study, self-efficacy and commitment to action were the strongest main predictors of Pender model, which was consistent with our study.[29] Most studies have shown that self-efficacy and perceived barriers were effective factors and involved in behaviors.

The results of the study by Faroughi *et al*. showed that the use of the powder model has been effective in various components, including diet, and has an important role in controlling the disease of a diabetic and is effective in controlling the costs imposed on health.[30]

Apparently, barriers such as price, lack of access, time consuming, and not having enough time have been important barriers for the consumption of fruits and vegetables among our subjects. Therefore, planning for reducing the perceived barriers and increasing the interventions of health education and health promotion promoters can have a positive effect on the rise of fruit and vegetable consumption in diabetic patients.

The results of a study by Goodarzi-Khoigani *et al*. showed that Pender's HPM-based nutrition education intervention in improving dietary patterns was associated with perceived benefits, self-efficacy, behavioral emotions, and interpersonal influences.[31]

In this study, interpersonal norms and patterns as well as situational influencers did not affect the consumption of fruits and vegetables in diabetic patients, which was consistent with the results of Mohammadi *el al*.'s.[26] The results of the present study in diabetic patients showed that the possibility of weak, interpersonal norms and patterns as well as situational influencers indicate the lack of emphasis and encouragement of important people such as doctors and health practitioners to consume for the consumption of fruits and vegetables in diabetic participants as well as low media influences. This study had some strengths including the use of a comprehensive model to explain and estimate the consumption of fruits

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and vegetables for the first time in diabetic patients in the southeast of the country.

Limitations of the study were the small sample size, sampling of the urban population, and the absence of the rural population, which reduces the generalization of the study, and the limitations of data collection were self-reported. Another limitation of this study was the cross-sectional study.

Conclusion

The findings of this study provide useful information for health education as well as health promotion professionals to gain a more accurate understanding of the factors influencing the consumption of fruits and vegetables in diabetic patients. Based on these findings, health planners can provide interventions to increase the consumption of fruits and vegetables in diabetics. Given that self-efficacy and perceived barriers have been the strongest predictors of fruit and vegetable consumption in diabetics, it is important that these determinants are considered for the purpose of the rise of fruit and vegetable consumption in the design of health education interventions and health promotion in the target group.

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Conflicts of interest

There are no conflicts of interest.

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