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, β =0.23), self-efficacy (P < 0.0001, β =0.32), and commitment to action plan (P = 0.002, β =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 Three of these complications are retinopathy, nephropathy, and neuropathy, and any one of them 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.³,⁴

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...
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.\[13\]

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.\[11\] 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 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.
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 much).
m 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, 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 ± 0.94 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
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

Table 2: Weekly fruit and vegetable consumption in subjects

| Variable      | n (%)  |
|---------------|--------|
| Fruit         |        |
| Less than once| 40 (15.4) |
| 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) |
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.\[20\]

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

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         | 19.7       | 47.4               | 0.269|
| Middle          | 16.7          | 9.1       | 74.2               |      | 24.2         | 22.7       | 53                 |      |
| High school and diploma | 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 or more | P    | Once and less | Two times | Three times or 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±20.1 | 51.4±19.4 | 68.9±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
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. 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. 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. 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. 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.

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 Mohammedi et al.’s. 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

### 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
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.

**References**

1. Farvid MS, Rabiee S, Homayoni S, Rashidkhani B, Arian V. Determinants of fruit and vegetable consumption in type 2 diabetics in Tehran. Iran J Endocrinol Metab 2010;12:89-98.
2. Hadipour M, Abolhasani F, Molavi Vardanjani H, Eybpoosh S. Individual and environmental determinants of health related quality of life in Iranian patients with type II diabetes. ISMJ 2014;16:428-35.
3. The introduction of self-management in type 2 diabetes care: A narrative review. J Educ Health Promot 2012;1:35.
4. Moeini B, Taheri M, Roshanaei G, Lahidinia AA. High school girl’s adherence to 5-a-day serving’s fruits and vegetables: An application theory of planned behavior. J Educ Community Health 2014;1:10-9.
5. Global aetiology and epidemiology of type 2 diabetes mellitus and its complications. Nat Rev Endocrinol 2018;14:88-98.
6. Fallahzadeh H, Mahmoudabad SS. Application of Bayesian method in validation of TTM decisional balance and self-efficacy constructs to improve nutritional behavior in yezdian prediabetes. Tolooehbehdasht 2017;16:110-22.
7. Development and evaluation of a risk score for type 2 diabetes mellitus among middle-aged Chinese rural population based on the RuralDiab Study. Sci Rep 2017;7:42685.
8. How to promote fruits, vegetables, and berries intake among patients with type 2 diabetes in primary care? A self-determination theory perspective. Health Psychol Open 2019;6: e1:2055102919854977.
9. Kaveh R. Non-communicable disease prevention and control document and related risk factors-Kerman visitreport 2016, ISBN 978-600-8056-60-7, Page(s) 27-36.
10. Baridkazemi S, MosaFarkhani E, Effekhahri Gol R, Taghipour A, Bahonar A, Emami O, et al. Validity of self-reported diabetes in a Mashhad population. Iran J Epidemiol 2018;14:265-71.
11. Rafieipour K. Non-Communicable Disease Prevention and Control Document and Related Risk Factors. Kerman: Lantern Publications; 2016.
12. Relationship between perceived social support and self-care behavior in type 2 diabetics: A cross-sectional study. J Educ Health Promot 2018;7:48.
13. Nature’s bountiful gift to humankind: Vegetables and fruits and their role in cardiovascular disease and diabetes. Indian J Med Res 2018;148:569-95.
14. Abdi F, Atarodi KZ, Mirmiran P, Esteki T. Surveying global and Iranian food consumption patterns: A review of the literature. Journal Of Fasa University Of Medical Sciences Summer 2015, Volume 5, Number 2, Page(s) 159 To 167.
15. Fruit and vegetable intake and risk of type 2 diabetes mellitus: Meta-analysis of prospective cohort studies. BMJ Open 2014;4:e005497.
16. Intake of fruit, vegetables, and fruit juices and risk of diabetes in women. Diabetes Care 2008;31:1311-7.
17. Daily fruit and vegetable consumption and diabetes status in middle-aged females in the general US population. SAGE Open Med 2019;7:2050312119865116.
18. Mansourizadeh M, Aoooshesh M, Kazemnejad A. The effect of physical activity program based on pender health promotion model on type 2 diabetic middle-aged women’s mental health. Iran J Health Educ Health Promot 2018;6:159-67.
19. Impact of Short Message Service (SMS) education based on a health promotion model on the physical activity of patients with type II diabetes. Malays J Med Sci 2018;25:67-77.
20. Mohammadipour F, Izadi Tameh A, Sepahvand N, Naderifar M. The impact of an educational intervention based on Pender’s health promotion model on the lifestyle of patients with type II diabetes. J Diabetes Nurs 2015;2:25-35.
21. Davtalab Esmaili  E, Azizi H, Haghiri L, Soleimani A. The association between fruits and vegetables intake and prevention of diabetes complications in patients with type 2 diabetes. Med J Tabriz Uni Med Sci Health Serv 2017;38:18-25.
22. Factors associated with fruit and vegetable consumption among adults. J Hum Nutr Diet 2011;24:128-34.
23. Ansariar F, Soori H, Bagheban A. Validity and reliability assessment of Persian version of core section of the behavioral risk factor surveillance system (BRFSS) questionnaire. Iran J Epidemiol 2013;9:1-10.
24. Tabesh M, Ghasvand R, Yadegarfar G. Prevalence of Underweight, Overweight and Obesity in Isfahan High School Girls in 2006. Health System Research Fall 2010, Volume 6, Number 3; Page(s) 465 To 472.
25. Barzegar Nazari S, Tabarei R, Hozooori M, Amirkhanian F, Vahedian M. Relationship between food consumption and its influencing factors among patients with type 2 diabetes. Qom Univ Med Sci J 2020;14:1-3.
26. Mohammadi ZI, Alijanzadeh M, Pakpour HA. Factors predicting oral health-related behaviors in diabetic patients using pender’s oral health promotion model. Journal Of Isfahan Dental School Summer 2016, Volume 12, Number 2; Page(s) 183 To 198.

27. Kurnia AD, Amatayakul A, Karuncharernpanit S. Predictors of diabetes self-management among type 2 diabetics in Indonesia: Application theory of the health promotion model. Int J Nurs Sci 2017;4:260-5.

28. Rahimi T, Dehdari T, Ariaian N, Gohari M. Survey of breakfast consumption status and its predictors among Qom students based on the Pender’s health promotion model constructs. Iran J Nutr Sci Food Technol 2012;7:75-84.

29. Bahmanpour K, Nouri R, Nadrian H, Salehi B. Determinants of oral health behavior among high school students in Marivan County, Iran based on the Pender’s Health Promotion Model. Journal of School of Public Health and Institute of Public Health Research. 2011, Vol. 9 Issue 2, p93-106. 15p.

30. Faroughi F, Shahriari M, Keshvari M, Shirani F. The effect of an educational intervention based on pender’s health promotion model on treatment adherence in the patients with coronary artery disease. Iran J Nurs Midwifery Res 2021;26:216.

31. Goodarzi-Khoigani M, Moghadam MH, Nadjarzadeh A, Mardanian F, Fallahzadeh H, Mazloomy-Mahmoodabad S. Impact of nutrition education in improving dietary pattern during pregnancy based on pender’s health promotion model: A randomized clinical trial. Iran J Nurs Midwifery Res 2018;23:18.