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The Effectiveness of Educational Intervention Using Pender Health Promotion Model for Disease Management in Patients with Type 2 Diabetes

Abstract

Diabetes control is a challenge to achieving successful self-management, so disease management is essential to prevent the complications of diabetes. This study aimed to determine the effectiveness of educational intervention using Pender health promotion model for disease management in patients with type 2 diabetes. This study is an experimental clinical trial. The statistical population includes 100 patients with type 2 diabetes referred to the diabetes clinic of Imam Ali Complex in Karaj in 2o20-202. Based on the results, a total of 100 people were selected and divided into two parts.50 people in the control group and 50 people in the intervention group were distributed and completed by both blocks by four-block random sampling method, two-part questionnaires including HPM structures, and self-management questionnaires before the intervention. The intervention group based on the results of the self-management questionnaire was held for 7 weeks and one session per week for the training group for 60 to 90 minutes. These sessions included lectures, questions, and answers, group discussions, plays educational clips, and pamphlets. Patients in the training group were also given individual training and telephone counseling on self-management behaviors, problems, and barriers. The content of self-management behaviors was also texted to patients. Six months after the intervention, the questionnaires were completed again by the two groups. Data were analyzed using SPSS software and the research findings showed that no significant difference was observed between the two groups in terms of HPM structures and self-management behaviors (P <0.05). But six months after the intervention, in all model constructs, except for the structure of previous related behavior(p = 0.84), but in other structures and self-management behaviors (P <0.001), statistically significant differences were observed between the two groups. This study emphasizes the fact that health care professionals need to understand the variables of self-management behaviors. This study suggests that interpersonal, situational, and cultural effects as a tool to facilitate and reinforce the self-management behaviors be done in patients with type 2 diabetes in future studies.

Keywords: *Educational intervention, Pender health promotion model, Disease management, Type 2 Diabetes patients, Barriers*

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Introduction

Diabetes is increasing worldwide. Due to aging, urbanization, and increased prevalence of obesity, and physical inactivity, the global burden of diabetes type II is increasing (1). Diabetes affects over 180 million people (2). According to estimates, the number of patients with diabetes will double by 2030, with about half the diabetes population being in Oceania and Asia (3). By 2025, there will be a predicted 122% increase in the number of adults with type II diabetes (4).

In addition to the high prevalence of this disorder, the cost of diabetes is significant. In many countries, at least 10% of the total cost of health care is spent on diabetes (5). Diabetes control depends on self-management behaviors (6), including nutrition control, sufficient physical activity (7), adherence to medication, and blood sugar monitoring to avoid serious complications and mortality (8). Despite the importance of physical activity in diabetes control, in the U.K., 68% of type II diabetic patients and 61% of patients with type I diabetes have been classified as inactive and sedentary (9). The American Diabetes Association recommends that patients with type II diabetes should have at least 150 min of aerobic activity of moderate intensity each week or 90 min of intensive aerobic exercise each week (10).

Monitoring of physical activity is important in diabetic patients, and this activity can be monitored via a training intervention (11). However, the impact of any training depends on the appropriate application of behavioral theories and appropriate training methods (12). The basis of diabetes control is self-management(13). The main emphasis of health promotion models (HPMs) is self-regulation (i.e., using internal standards and self-assessment as a means of motivation, adjustment of behavior, and adjustment of the external environment) (14). Thus, HPMs seem to be effective in inducing a behavioral change in diabetic patients. The revised model includes the following concepts of health-promoting behaviour: i) individual characteristics and experiences, ii) behavior-specific cognition and effects, and iii) behavioral outcomes(15). The concept of individual characteristics and experiences includes personal factors and prior related behaviors. The concept of behavior-specific

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cognitions and affects includes constructs, such as perceived benefits and barriers, perceived self-efficacy(16), activity-related affect, interpersonal influences, and situational influences(17). Pender et al. tested their HPM in multiple studies and identified constructs, such as personal factors (perceived health status), perceived benefits and barriers, perceived self-efficacy, and interpersonal influences (social support) as the best predictors of a health-promoting lifestyle (18).

According to the statistics, the prevalence of diabetes in Iran varies between 5.5-7.5%(Abazari et al., 2012). In general, diabetes is a chronic disease with different clinical manifestations and progression and is classified clinically into three types insulin-dependent (type 1 diabetes), non-insulin-dependent (type 2 diabetes), and diabetes mellitus (Park, 2002). *Type 2 diabetes is the most common form* of *diabetes* around the world. It can cause significant changes *in many* systems, organs, and tissues of the body, resulting in immediate or delayed complications, including cardiovascular complications, nephropathy, retinopathy, disability, increased medical costs, and high mortality (Azizi et al., 2000; Shahbazian et al., 2006). Without proper management, these complications can lead to some disabilities such as blindness, renal failure, coronary artery thrombosis, and amputation (Park, 2002; Azizi et al., 2000).In addition, some evidence suggests that there is a direct correlation between the prevalence of diabetes and depression, social issues, smoking, lack of mobility, exercise, and obesity (Roupa et al., 2009). Given the short and long-term diabetes-related health complications and *direct* and indirect medical expenditures spent on *treating these* complications, the concept of self-care is considered essential in the optimal management of complications in *patients* with *diabetes* (Moini et al., 2012). *Health-promoting self-management behaviors* refer to measures undertaken to increase or maintain the well-being and self-esteem of a person or group (Hatam Louie Sadabadi et al., 2011). Given the rising cost of health care, it seems essential to shift our focus away from the treatment approach toward disease prevention methods. It is believed that education and health promotion behaviors can help people modify their health care behaviors, gain a better understanding of their disease, as well as prevent or *delay* the *onset* of disease-related *complications* (Kashfi et al., 2009). The purpose of *educational interventions* in *diabetes* care is to familiarize these patients with preventive, therapeutic, and disease management measures to prevent the complications of the chronic illness (Khani Kuihooni and Hazavehi, 2010). There are plenty of tools designed to measure health promotion, including the Health-Promoting Lifestyle Profile (HPLP) questionnaire, which has been developed by Chen et al. and has a high level of acceptability. The questionnaire comprised a set of 40 items of health promotion behaviors encompassing six dimensions (6D): health responsibility, physical activity, spiritual growth, stress management, proper nutrition, and social support (Ayyoubi et al., 2012).

The Pender's Health Promotion Model (HPM) is comprehensive and applied in recognizing behavioral determinants to predict health-promoting behaviors in the field of lifestyle, exercise, and eating habits.[19] The predictive and explanatory structures of health behavior in this model include perceived benefits, perceived barriers, feelings related to behavior, perceived self-efficacy, and interpersonal and situational influences.[20] Pender's HPM tries to promote health status by benefiting from an individual's experiences and characteristics, emotions, specific cognition, and behavioral outcomes.[21]

Considering the importance of self and Pender's Health Promotion Model (HPM) in type 2 diabetic patients and the high prevalence of the disease in Iran, especially in major metropolitan regions, as well as the lack of a comprehensive survey and analysis in this regard, this study aimed to research the effectiveness of educational intervention using Pender health promotion model for disease management in patients with type 2 diabetes in patients referred to the diabetes clinic of Imam Ali Complex under the auspices of Alborz University of Medical Sciences in Karaj, Iran during 2020 to 2021.

Material and Methods

This was an Experimental clinical trial study Using a random method specific to the quadruple block that was carried out from October 2020 to February 2021. The effectiveness of educational intervention using Pender health promotion model for disease management in patients with type II diabetes who were referred to two diabetes clinics of Imam Ali Complex in the city of Karaj, Alborz province in Iran.

The inclusion criteria were the ability to read and write, having no other disease, a willingness to participate in the study, and having type II diabetes for one or more years. The exclusion criteria included functional inability to walk without a cane, and having other diseases.

Sample volume calculation method

The main purpose of the study was to compare the mean scores of health in two training and control groups to determine the effect of training on the degree of disease management. For this purpose, a sample size formula (confidence level of 0.95 and test power of 80%) was used to compare the mean of the two groups to determine the number of subjects required for the study. According to this formula, if the mean difference is statistically 10 or larger, the range of the score lies between 0-152, and the standard deviation of 25.3, the number of samples

required will be calculated based on the following formulas(22):

$$\sigma = \frac{152}{6} = 25.3$$

$$D = \frac{\mu 2 - \mu 1}{\sigma\sqrt{2}} = \frac{10}{25.3 \times 1.2} = 0.28$$

$$N = \frac{\left(Z_{1-\beta} + Z_{1-\alpha/2}\right)^2}{d^2} = \frac{(1.96 + 0.84)^2}{(0.28)^2} = 100$$

Statistical population:

The statistical population consisted of 100 patients with type 2 diabetes referred to the diabetes clinic of Imam Ali Complex Clinic in Karaj, Iran in 2021.

According to the results, a total of 100 people were selected, then divided into two training (n=*50*)and control (n=*50*)groups each group into two parts 25 males and 25 *females* by four-block allocation random sampling method (Table 1). we used before and after the test (Through questionnaires). The inclusion criteria were the ability to read and write, a diagnosis of diabetes confirmed by the clinic's physician, having no formal training, and willingness to participate in the study. The exclusion criteria included: unable to read and write, a diagnosis of mental illness confirmed by the clinic's physician, having no formal training, and unwillingness to participate in the study.

Table 1. Classification of participants in the diabetes clinic of Imam Ali Complex of Karaj

the diabetes clinic of Imam Ali Complex			
training		control	
50		50	
male	female	male	female
25	25	25	25

2.2. Instruments

1. A two-section questionnaire including demographic characteristics (such as age, gender, marital status, occupation, educational level, economic and employment status; Body Mass Index (BMI), Ejection fraction (EF), history of re-hospitalization, and medical information (including records of diabetes mellitus, hypertension, high cholesterol levels, and smoking), and questions based on HPM constructs (97 items) to adopt self-management behaviors was distributed among the patients to collect data.

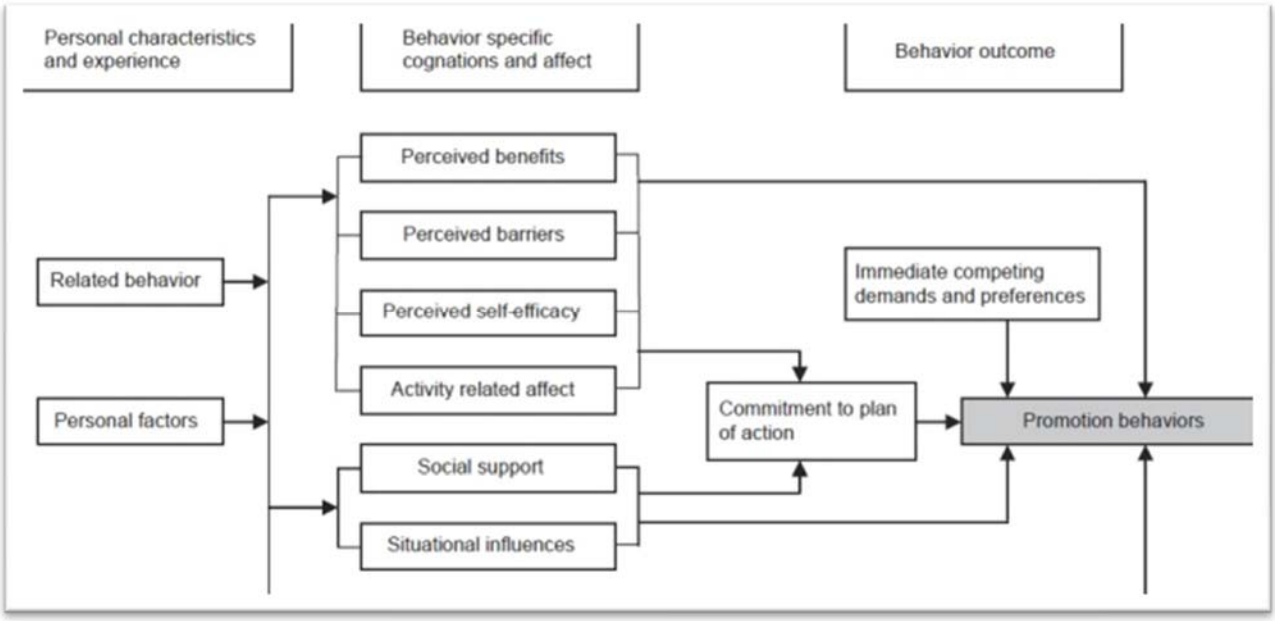
1. Prior related behavior: the evaluation of qualitative and quantitative scales of self-care in the past (40 items in 9 sections: nutrition and diet therapy, wound care, physical activity, daily activities, sleep and rest, the removal of harmful habits, medication orders, sexual activity, and visits to the doctor).
2. Perceived self-efficacy: the perceived ability to care for the self (20 items, 9 sections).
3. Behavioral feelings: the subject's feelings are based on the proportion of the stimulating factor concerning the behavioral event (5 items).
4. Perceived benefits: (4 items).
5. Perceived barriers: the subject's perceptions of what hinders self-care (e.g., lack of time, cost, and lack of facilities) (9 items).
6. Interpersonal influences: the subject's comments about the emotional and practical support they receive from family members and intimate friends (13 items in two sections: individual norms and social support).
7. Situational influences: include perceiving the current options, the characteristics of the request, and the environment before enacting a special behavior (4 items).
8. Commitment to a plan of action: (2 items). (22)

Each item was presented in five incremental levels. The content validity of the instrument was CVI=0.90 and CVR=0.84, with the Cronbach's alpha coefficient being 0.77 for the total scale and 0.72 to 0.82 for the subscales (23).

2. A self-management (Health promotion behaviors) questionnaire (Chen et al., 2013) was used to collect data. This questionnaire consists of two sections. The first section includes demographic information (age, sex, duration of illness, occupation, marital status, family history, educational level, family income, type of diabetes treatment, height and weight, HbA1C, and smoking). The second section includes 28 items of health promotion behaviors encompassing six dimensions: physical activity (7 items), risk reduction (7items), life satisfaction (3 items), stress management (5 items), and health responsibility (3 items), and healthy nutrition (3 items). Items were scored based on a *5-point Likert scale* from 4 (always) to 0 (never). The highest score was 112 indicating *greater health promotion* behaviors. Additionally, to manage diabetes, the HbA1C index of all subjects was measured. The *Cronbach's alpha* of Health promotion behaviors questionnaire (Chen et al., 2013) and

each dimension was calculated at 0.90, 0.63, and 0.88, respectively in figure1 (Gallegos et al., 2006) (25).

Figure 1**Pender's health promotion model**(24)



2.3. **Method and intervention**

Before the intervention, questionnaires were completed by both groups then the control group proceeded to receive the most commonly used training at the center according to the previous procedure. The initial data collection was done by visiting the patients at their homes. The participants of the intervention group were trained based on the results of the self-management questionnaire (15). The educational intervention was carried out over 7 weeks, one session each week. For group support, the experimental group was divided into three educational groups, and each week, one session was held for one educational group which lasted 60 to 90 minutes. These sessions included lectures, questions and answers, group discussions, shows, educational video clips, and pamphlets for patients with Type 2 Diabetes which were offered to the patients of the experimental group free of charge. For each educational session, a specific topic (The first week: Training about physical activity and control blood sugar and the impact of physical activity on diabetes, Second-week Training about risk-taking reduction, Third week: Training about life satisfaction, Fourth week: Training about healthy diet control blood sugar, Fifth week: Training about health responsibility, and Sixth Week: Stress Management and Coping with Stress) and Seventh Week: foot examination wound care was prepared and presented based on the health promotion model and was developed by the researchers, based on the latest resources, scientific texts and the headlines of the Ministry of Health and Medical Education. Also, pamphlets were given to the patients in the experimental group at the end of the educational sessions. The patients were trained constantly for 3 months, and the patients in the experimental group were also instructed and consulted individually on the phone about self-management behaviors(health-promotion behaviors) problems, and barriers. Meanwhile, the content of self-management behaviors was texted to the patients. And six months after this period, the questionnaires were once again filled with the researcher being present and the results of the two groups were compared. To observe ethical considerations, educational materials after the post-test were provided to the control group.

2.4. Statistical methods

To analyze the data, IBM© SPSS© Statistics version 25 (IBM© Corp) and descriptive statistics including mean and standard deviation were utilized. In addition, inferential statistics and Chi-square, t-test, Mann-Whitney, and ANCOVA were used to assess the intervention of the experimental and control (not trained) groups.

2.5. Ethical Considerations

All necessary permissions were obtained from the Vice-Chancellor in Research Affairs at Alborz University of Medical Sciences, as well as Imam Ali Complex in Karaj to undertake the study. Each participant was informed verbally about the aims of the study and written consent was obtained from each participant. They were assured that the data would be treated confidentially.

3. Results

In the present study, 100 diabetics participated. The participants' mean [Standard Deviation (SD)] Most of the participants had the mean (SD) of Body Mass Index (BMI) 25–29.9 was 57.271% in control and 51.81% in an intervention (p = 0.05), respectively. Most of the participants had a high school diploma (76.60), were housewives (24%), and married (90.60%) in control and (92.20)an intervention. (64.54%) were men (64.54) in control and (65.46%) in intervention and (34.54%) were women in the intervention and (35.46%) in control patients' age average were 60.32±8.94in the intervention group and 54.7 ± 9.7in the control group (p = 0.11). *adjusted for demographic factors (Age, Sex, Marital status, Education level, Occupation, Geographic location, Income level)also for health-related factors (EF, BMI, Diabetes history, Hypertension, Dyslipidemia, and smoking);

There was no statistically significant difference between the two groups in terms of demographic information [Table 2].

Variable		**Groups**		χ^2	**df**	p*
		Control (n=50) n (%)	**Intervention (n=50) n (%)**			
Marital status	Married	90.60	92.20	0.99	1	0.75
	Single	9.40	7.80	0.03	1	0.86
Level of education	Diploma	23.40	14.10			
	Pre-diploma	76.60	85.90			
age	Mean±SD	54.7 ± 9.7	60.32±8.94	0.89	1	0.11
Income	>100.000.000 Iranian Rial	0	3.10	4.01	3	0.26
	50.000.000-100.000.000 Iranian Rial	4.69	1.60			
	20.000.000-50.000.000 Iranian Rial	93.75	95.30			
	<20.000.000 Iranian Rial	1.56	0			
Occupation	Employee	4	3	4.50	1	0.34
	Housewife	24	25			
	worker	14	15			
	Retired	36	32			
	Freelance	22	25			
Duration of medication (year)	1-5	46.90	32.80	5.16	2	0.07
	6-10	45.30	46.90			
	11-15	7.80	20.30			
Smoking	Yes	22	20	0.04	1	0.83
	no	88	80			
Family history of diabetes	Yes	93.80	96.90	0.69	1	0.40
	No	6.20	3.10			
	1-5	43.80	31.30	3.96	2	0.13
	6-10	39.10	37.50			

Variable		Groups		χ^2	df	*p**
		Control (*n*=50) *n* (%)	**Intervention (*n*=50) *n* (%)**			
Duration of morbidity (year)	< 10	17.20	31.30			
Sex	Male	64.54	65.46	0.69	1	0.88
	Female	35.46	34.54			
EF	≤40%	16.36	17.27	5.16	2	0.85
	>40%	83.63	82.72			
Hypertension	Yes	37.27	32.72	0.04	1	0.64
	No	62.72	67.27			
BMI *(kg/m^2)	18.5–24.9	21.81	25.45	3.96	2	0.39
	25–29.9	57.27	51.81			
	30 and more	20	22.72			

BMI=Body mass index
Chi-squared test,
Mann-Whitney test,
Independent sample *t*-test,
SD=Standard deviation,

According to the findings of the study, no significant differences were found between the two groups in terms of HPM constructs before the intervention. However, six months after the intervention, in all model constructs, except for the previous related behavior construct (p = 0.84), But in other structures (p <0.001), statistically significant differences were found between the two groups [Table 3].

Table 3
Comparison of the mean (standard deviation) of the Health Promotion Model constructs between the control and intervention groups

Variable		Groups		*z*	*p**
		Intervention (*n*=50) Mean (SD)	**Control (*n*=50) Mean (SD)**		
Feelings related to behavior	Before the intervention	31.56 (4.20)	31.71 (4.02)	-0.27	0.78
	six months after the intervention	35.89 (1.79)	31.73 (4.03)	-7.33	<0.001
	z	-5.97	-0.44		
	F(df_1, df_2)	0.34 (2, 72)	0.03 (2, 70)		
	*p***	<0.001	0.65		
Perceived benefits	Before the intervention	52.39 (6.42)	52.17 (8.88)	-0.36	0.71
	six months after the intervention	64.89 (0.64)	52.18 (8.87)	-10.01	<0.001
	z	-6.79	-1.00		

Variable		Groups		*z*	*p**
		Intervention (*n*=50) Mean (SD)	**Control (*n*=50) Mean (SD)**		
	$F(df_1, df_2)$	0.39 (2, 72)	0.14 (2, 70)		
	*p***	<0.001	0.31		
Perceived barriers	Before the intervention	25.87 (12.40)	27.23 (88.11)	-0.75	0.44
	Six months after the intervention	48.59 (3.10)	27.26 (11.67)	-9.27	<0.001
	z	-6.61	-1.00		
	$F(df_1, df_2)$	28.20 (2, 72)	1.39 (2, 70)		
	*p***	<0.001	0.31		
Self-efficacy	Before the intervention	14.01 (4.93)	67.13 (5.01)	-0.86	0.38
	six months after the intervention	49.40 (3.01)	15.17 (7.68)	-10.14	<0.001
	z	-6.93	-1.82		
	$F(df_1, df_2)$	9.25 (2, 72)	2.24 (2, 70)		
	*p***	<0.001	0.06		
Interpersonal influences	Before the intervention	24.40 (4.77)	24.32 (4.80)	-0.39	0.69
	six months after the intervention	29.87 (0.48)	24.37 (4.13)	-9.34	<0.001
	z	-6.16	-1.00		
	$F(df_1, df_2)$	0.34 (2, 72)	0.03 (2, 70)		
	*p***	<0.001	0.31		
Family support	Before the intervention	3.03 (0.73)	3.30 (0.82)	-0.39	0.69
	six months after the intervention	3.13 (0.72)	3.24 (0.69)	-9.34	<0.001
	z	-6.16	-1.00		
	$F(df_1, df_2)$	1.05 (2, 72)	0.04 (2, 70)		
	*p***	<0.001	0.31		
Friends support	Before the intervention	2.75 (1.23)	2.78 (1.05)	-0.39	0.69
	six months after the intervention	2.78 (0.98)	2.80 (0.97)	-9.34	<0.001
	z	2.88 (1.16)	2.82 (1.02)		
	$F(df_1, df_2)$	0.34 (2, 72)	0.03 (2, 70)		
	*p***	<0.001	0.31		
Situational influences	Before the intervention	14.37 (2.12)	13.96 (2.46)	-1.16	0.39
	six months after the intervention	16.20 (0.81)	13.90 (2.33)	-6.60	<0.001

Variable		Groups		*z*	*p**
		Intervention (*n*=50) Mean (SD)	**Control (*n*=50) Mean (SD)**		
	z	-5.10	-1.00		
	$F(df_1, df_2)$	9.01 (2, 72)	1.23 (2, 70)		
	*p***	<0.001	0.31		
Immediate demands and preferences	Before the intervention	8.45 (2.40)	13.84 (3.83)	-1.78	0.07
	six months after the intervention	8.45 (2.40)	16.15 (3.83)	-9.12	<0.001
	z	-6.85	-1.06		
	$F(df_1, df_2)$	0.34 (2, 72)	0.03 (2, 70)		
	*p***	<0.001	0.28		
Commitment to action	Before the intervention	11.03 (2.80)	10.75 (3.38)	-0.90	0.36
	six months after the intervention	39.54 (2.40)	11.34 (5.04)	-10.04	<0.001
	z	-6.92	-1.34		
	$F(df_1, df_2)$	0.34 (2, 72)	0.03 (2, 70)		
	*p***	<0.001	0.18		
Previous related behaviors	Before the intervention	11.51 (3.66)	11.39 (3.48)	-0.05	0.95
	six months after the intervention	11.59 (2.40)	11.59 (3.48)	-0.19	0.84
	z	-1.63	0.00		
	$F(df_1, df_2)$	0.34 (2, 72)	0.03 (2, 70)		
	*p***	0.10	0.99		

*Mann-Whitney test **Wilcoxon Signed Ranks test

The results of the t-independent test showed that there was no statistically significant difference between the two groups of control and intervention in the preintervention stage in terms of the average score of Spiritual growth structures, Health responsibility, Interpersonal relationship, Stress management, Physical Activity, Nutrition, Blood sugar control, Foot control, and total disease management (P<0.05)

A repeated measurement test was used in the group to investigate the effect of the intervention on the status of each structure. The results showed that the difference in the average score in the intervention group was significantly reduced in all structures. However, no statistically significant difference was observed in any of the structures in the control group (p <0.0) [Table 4].

Table 4- Average and standard deviation of disease management structures in the two control and intervention groups in the measurement process

variables	stages	Intervention group (*n*=50)		Control group (*n*=50)		P.value
		Mean	standard deviation	Mean	standard deviation	
Total self-management	Before the intervention	152.24	38.60	142.81	31.48	0.50[a]

variables	stages	Intervention group (*n*=50)		Control group (*n*=50)		P.value
		Mean	standard deviation	Mean	standard deviation	
	six months after the intervention	145.90	35.24	144.04	31.86	0.02[b]
	p	0.001		0.57		
Spiritual growth	Before the intervention	25.92	5.57	20.51	6.31	0.11[a]
	six months after the intervention	21.04	5.26	21.09	6.48	0.04[b]
	p	0.001		0.33		
Health responsibility	Before the intervention	21.18	5.27	17.79	4.23	0.84[a]
	six months after the intervention	17.98	4.76	17.98	4.48	0.01[b]
	p	0.04		0.63		
Interpersonal relationship	Before the intervention	24.65	4.87	21.06	4.27	0.98[a]
	six months after the intervention	21.04	4.76	21.67	4.33	0.03[b]
	p	0.001		0.71		
Stress management	Before the intervention	17.33	3.52	12.08	3.38	0.87[a]
	six months after the intervention	12.18	2.81	12.31	3.65	0.04[b]
	p	0.01		0.42		
Physical activity	Before the intervention	24.92	5.68	20.50	6.32	0.11[a]
	six months after the intervention	20.05	5.27	21.07	6.49	0.04[b]
	p	0.001		0.32		
Nutrition	Before the intervention	21.17	5.28	17.79	4.27	0.98[a]
	six months after the intervention	17.97	4.79	17.98	4.32	0.03[b]
	p	0.04		0.62		
Blood sugar control	Before the intervention	24.64	4.88	21.07	4.28	0.97[a]
	six months after the intervention	21.03	4.77	21.68	4.32	0.04[b]
	p	0.001		0.71		
Foot control	Before the intervention	17.32	3.53	12.07	3.35	0.87[a]
	six months after the intervention	12.17	2.82	12.30	3.66	0.04[b]
	p	0.01		0.42		

a: Independent T-test b: ANCOVA test c: Repeated Measurements ANOVA test

4. Discussion

In the present study, The effectiveness of educational intervention using Pender health promotion model for disease management in patients with type 2 diabetes According to the

findings of the study, no significant differences were found between the two groups in terms of HPM constructs before the intervention. However, Six months after the intervention, in all model constructs, except for the previous related behavior construct ($p = 0.84$), statistically significant differences were found between the two groups

These findings indicate the effectiveness of the educational intervention designed based on HPM in increasing the level of disease management

Findings showed that perceived benefits of disease management increased six months after the intervention in the intervention group, which means that education based on HPM has been able to make patients' viewpoints about the benefits of disease management more positive. Ghavami *et al*.[26] and in Rahimian *et al*.[27]'s in studies also reported similar results regarding the positive impact of model-based education on improving the attitudes of the study population toward expected behaviors.

In this study, the perceived barriers to disease management decreased significantly after the intervention. In other words, six months after the intervention, they believed that there were fewer obstacles in their path to disease management. This may have contributed to the increase in disease management in the patients in the intervention group six months after the intervention. Amanda *et al*., in their study, reported that perceived barriers are an important factor in the adherence of patients with DM to health promotion behaviors.[28]

In this study, self-efficacy, commitment to action, improved interpersonal and situational influences, and immediate demands and preferences decreased in the intervention group compared to the control group after the intervention. In a study conducted by Kurnia *et al*., situational influences, social support, self-efficacy, and perceived benefits showed significant correlations with self-management of DM, and self-efficacy was reported as an effective factor in DM self-management.[29] Taymoori *et al*. also stated that educational intervention based on HPM had a significant effect on decreasing immediate demands and preferences.[30] Interpersonal influence such as family has a major impact on the process of social education, sports activities,[31] and other behavioral tendencies; the level of family support for disease management, family attitudes toward disease management, and the rate of acceptance of disease management among family members directly affect society as a whole.[32] In the study by Khalkhali *et al*., which was conducted to investigate the effect of family education on self-care in patients with type 2 DM, it was found that interpersonal influences, in particular the family, have the most impact on self-care and its dimensions in patients with DM.[33]

In this study, health-promoting behaviors for Disease management were performed in patients with type II diabetes and the average of health promotion behaviors in diabetic patients is good. In other studies on health-promoting behaviors of patients with type II diabetes in Isfahan, [34] patients with chronic diseases such as diabetes, and hypertension reported the health-promoting behaviors level of their participants as a medium. It seems that the difference in the results of health-promoting behaviors would be due to the use of different tools in these studies. Although in the mentioned studies, [34] the Health-Promoting Lifestyle Profile II (HPLPII) was used as a measuring tool, in this study due to the non-specificity of this tool for diabetic patients, we had to use a researcher-made tool to measure the health-promoting behaviors of diabetic patients, This study showed that educational intervention improved perceptions of self-efficacy and family support and reduced barriers to physical activity among diabetic patients, subsequently increasing their level of self-management. [35]

There were some limitations in this study including the respondents' understanding of the questions, individual-cultural specifications and differences, and emotional state of the respondents upon answering the questions, which were beyond the control of the researchers. In this study, willingness to participate in the study was considered an inclusion criterion. So, there is a possibility that people who were inclined to participate in this study enjoyed high health literacy.

5. Conclusions

Overall, the results of this study showed that educational intervention based on the health promotion model has been effective in improving management in diabetic patients. These interventions can be useful in convincing patients to make behavioral changes and adhere to diet and medication, and by changing the behavioral and psychological patterns of the subjects, significantly reduced stress in these people and caused them to develop their disease. Manage more and prevent and prevent complications of the disease. In addition, people strive to achieve results that are valuable and achievable in the activities they pursue to achieve their goals. To correct and change people's behavior, it is necessary to understand their way of thinking and correct it. Considering the role of health education professionals in promoting patients' health and teaching them health promotion behaviors, these behaviors can be identified. To be considered in these patients.

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Conflict of interest

None.

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Ethics Statement

All Permissions to conducting this research has been approved.

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