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Original Article

Self-care behaviors in patients with type 2 diabetes: Education intervention base on social cognitive theory

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ABSTRACT

Aim: This study aimed to determine the effect of education intervention, based on social cognitive theory, on self-care behaviors in patients with type 2 diabetes.
Methods: This study was conducted in descriptive and interventional stages. The effective factors and constructs of social cognitive theory were identified in a descriptive study (n = 320). After that, a quasi-experimental study was conducted to determine the effect of intervention on 120 diabetic patients whom were randomly assigned to experimental and control groups. The educational intervention was implemented in six 40 -minute sessions for the experimental group. The questionnaires were completed before, immediately after and three months after the intervention.
Results: The results of regression showed that emotional adaptation ($P < 0.05$), self-efficacy to overcome barriers ($P < 0.05$) and self-regulation ($P < 0.05$) could predict self-care. There was no significant difference between the experimental and control groups before the educational intervention, however, after the intervention, there was a significant difference in self-care ($p < 0.001$), knowledge ($p < 0.001$), outcome expectations ($p < 0.001$), outcome value ($p < 0.001$), self-efficacy ($p < 0.001$), self-efficacy to overcome barriers($P < 0.001$) p), environment ($p < 0.001$), observational learning ($P < 0.05$), situational perception ($p < 0.001$), self-regulation ($p < 0.001$) and emotional adaptation ($p < 0.001$)) in the intervention group.
Conclusion: The results of this study showed that intervention, based on social cognitive model, has a positive effect on diabetes self-care in the patients. Emotional adaptation, self-efficacy to overcome barriers and self-regulation have the biggest impact on diabetes self-care.

1. Introduction

Diabetes is one of the most significant health problems and the most common chronic metabolic disease in the world and it is expected to be the seventh leading cause of death worldwide by 2030 [1].

People with diabetes die from complications of this disease including cardiovascular disease, neuropathy and high blood pressure. About one quarter of deaths from diabetes results from complications of the disease [2]. Diabetic complications are the causes for 91% of lower extremity amputations, 60% of hospitalizations due to cardiovascular disease and 50% of hospitalizations due to stroke [3]. About 80% of diabetes deaths occur in low and middle - income countries. Almost 35 million people have diabetes in the Middle East and North Africa half of whom are unaware of their diseases [4].

The results of a national survey in Iran have shown that about 11% (4.5 million people) of Iranian adult population have diabetes and it is estimated that about 9.2 million Iranian individuals will have diabetes by 2030 [5]. According to MOH (Ministry of Health) Statistics, in Iran, more than 40 billion Rails (funded by the Ministry of Health) are spent a year on controlling diabetes. Moreover, a shortening of life expectancy by 5–15 years is observed in people with diabetes and the hospitalization rate for these patients is 2.4

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times higher than that for others [5].

According to the World Health Organization (WHO), education provides the basis and foundation for treatment of diabetes and key objectives of diabetes education are to raise awareness of diabetes, to change individuals' attitudes and behaviors and to promote self-care for disease management [6,7]. Lack of awareness of diabetes besides lack of proper access to medicine and health care services can lead to blindness, amputation and kidney failure [8]. Up to 8% of diabetes-related complications can be reduced through appropriate diabetes education; therefore, people with diabetes need to undergo self-care education since the patient is the most important factor in health care and treatment of diabetes [9,10]. knowledge of good nutrition principles, food selection, adhere to the exact pattern of treatment, foot care, exercise and physical activity along with changing lifestyle and mental health are among the factors that regulate and control metabolism and Prevent short-term diabetes complications; Compliance with these considerations will also delay progression of long-term diabetes complications [11].

Researchers and health professionals have proposed theories and social-cognitive models for effective intervention in health promotion behaviors [12]. Social cognitive variables can predict behavior and can also be changed (through effective interventions) for behavior change. Most health promotion models just predict health behavior and cannot explain how health behavior changes. Social cognitive theory (SCT) has tried to introduce the predictors and the principles that shape those behaviors as well as how to motivate, lead and enable people to comply with health promotion behaviors and reduce their inability [13].

This theory examines personal factors (self-efficacy, self-regulation, outcome expectations, etc.) in environmental context and their effects on behavior. The constructs of social cognitive theory include knowledge, task self-efficacy, self-efficacy to overcome barriers, self-regulation, outcome expectations, outcome values, observational learning (modeling), emotional adaptation, environment and situational perception [14].

Therefore, given the increasing prevalence of diabetes, it is a major health issue and self-care plays a crucial role in the promotion of health and quality of life among diabetic patients. Considering the effectiveness of social cognitive theory in self-care behaviors among diabetic patients, the present study investigated the effect of education on self-care behaviors in patients with type 2 diabetes in Mashhad based on social cognitive theory.

2. Materials and methods

2.1. Study design

This research had descriptive and quasi- -experimental stages. In the first stage, a descriptive study was conducted to determine the effective constructs of social cognitive theory in predicting self-care behavior among people with type 2 diabetes. In this stage, 320 diabetic patients were selected. Eighty patients were randomly selected from each of the four health care centers in the city. Then, the participants were provided with the standard diabetes self-management questionnaire as well as the self-made diabetes self-care activities questionnaire (based on social cognitive theory) which were completed using self-report data.

After identifying the predictive and effective factors in the first stage of the study (descriptive), a quasi-experimental study was conducted in the second stage on 120 diabetic patients who were randomly assigned to experimental and control groups to determine the effect of educational intervention using social cognitive theory. In the second stage, the sample size for each group was considered to be 60 people based on a similar study [15] and the following formula.

$$n = \left(\frac{\left(z_1 - \frac{\infty}{2} + z_1 - \beta\right)^2 \left(s_1^2 + s_2^2\right)}{\left(\bar{x}_1 - \bar{x}_2\right)^2} \right)$$

Two centers were selected from among the 4 health care centers as the intervention group and 2 centers were selected as the control group through simple random sampling. Thirty people from each center (a total of 120 people) entered the study. It should be noted that the health care centers in the control group were the same as the health care centers in the intervention group in terms of social situation and geographical location. Then, an educational program was executed for the intervention group based on the effective constructs of social cognitive theory in performing self-care behaviors, to promote self-care levels (Fig. 1).

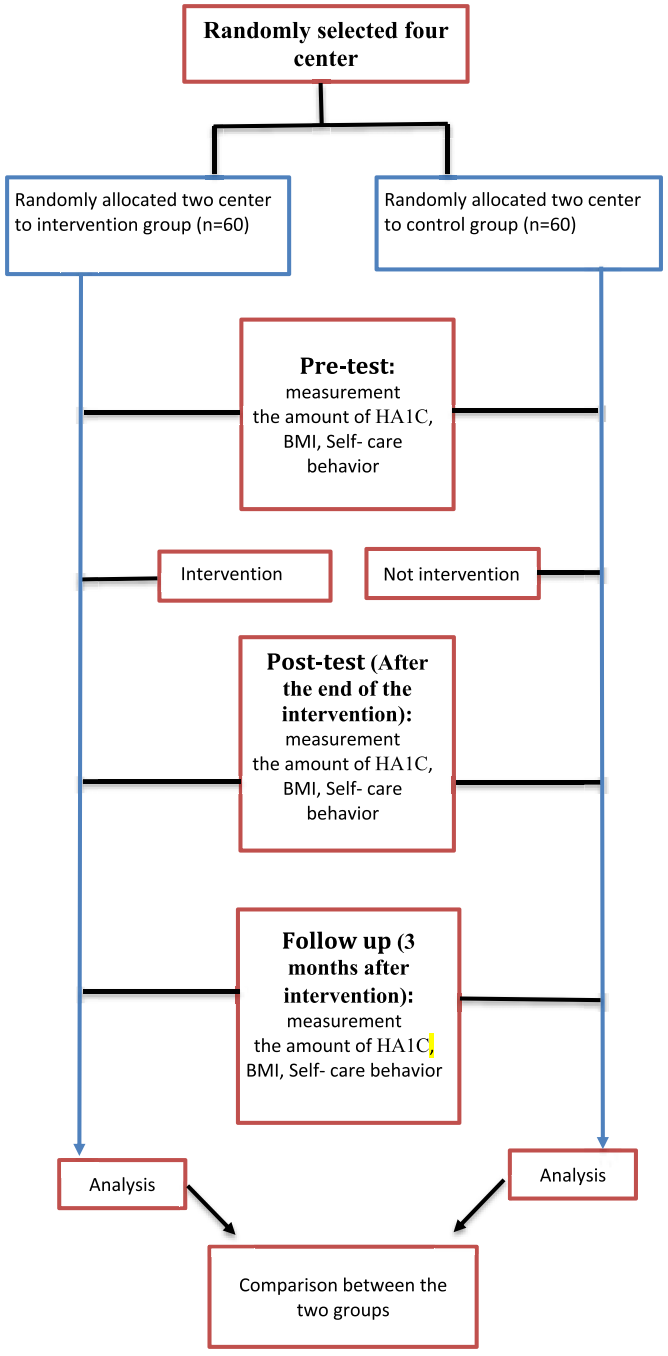

Fig. 1. Flowchart of the study.

2.2. Inclusion and exclusion criteria

The inclusion criteria were: 1- willingness to participate in the study and completion of a written consent form; 2- having type 2 diabetes based on laboratory results available in health records in the health care centers; 3- having had diabetes since at least one month ago. The exclusion criteria included: unwillingness to continue cooperation during the study and absence from more than two class sessions.

2.3. Data collection tools

In this study, data was gathered using 3 demographic questionnaires, a standard diabetes self-management questionnaire and a researcher-made questionnaire based on social cognitive theory.

2.3.1. Demographic questionnaire

This questionnaire included 14 questions on age, gender, marital status, occupation, level of education, weight, height and so on.

2.3.2. Self-management questionnaire

This questionnaire consisted of 15 questions on the patients' self-care criteria over the previous 7 days and included questions on various aspects of dietary treatment of diabetes including 5 questions on nutrition therapy: (a score of 0–35), 2 questions on exercise: (a score of 0–14), two questions on blood glucose test (a score of 0–14), one question on insulin injections or oral anti diabetic drugs: (a score of 0–7), four questions on foot care: (a score of 0–28), and 1 question on smoking: (a score of 0–1) (16). The total score of the questions was between zero and 99. In order to determine the self-care status among diabetic patients, they were classified into 3 categories: low levels of self-care (a score of 0–33), moderate self-care (a score of 34–67) and high levels of self-care (a score of 68–99) (15).

2.3.3. The researcher-made diabetes self-care questionnaire (based on social cognitive theory)

This questionnaire was prepared using valid sources according to the study subject. Face validity (qualitative and quantitative) and content validity (qualitative and quantitative) were used to determine the validity of the questionnaire. The qualitative face & content validity of the questionnaire was assessed by health education specialists & physicians and the required corrections were made. The quantitative face validity was assessed by 15 members of the target group and required corrections were made. The quantitative content validity was assessed by 10 health education & health promotion specialists and 5 physicians and the required corrections were made. Accordingly, the Content Validity Ratio (CVR) and Content Validity Index (CVI) of the instrument were obtained 0.96 and 0.90, respectively.

This questionnaire contained 44 questions. The **diabetes** knowledge test consisted of five multiple choice questions (such as: which of the following are the early complications of diabetes?). the outcome expectation test consisted of 4 questions (such as diabetic foot can be prevented by daily examination of own feet), the outcome value test consisted of 4 questions (such as: being aware of my diseases is very important to me), the task self-efficacy test consisted of 5 questions(such as: I can control my blood sugar level by eating a healthful diet.), self-efficacy to overcome barriers: 5 questions (like "I can refuse eating sweets, cakes, chocolate and ice cream, even if available"), environmental factors: 4 questions (such as: It is difficult to stick to a healthy diet on a journey or party); observational learning: 4 questions (such as "my tendency to do physical activities increases when I see diabetic patients doing physical activities"), situational perception:4 questions (such as: my wife and children cannot cooperate with me since they do not have enough information), self-regulation: 6 questions (such as: I refer to an eye specialist at least once a year), emotional adaptation: 3 questions (such as: I check my blood sugar daily to maintain my health and well-being). The questions were scored on a four-point Likert scale (ranging from totally disagree to fully agree).

The test-retest method was used to calculate the reliability of the instrument. The questionnaire was distributed to 30 patients with type 2 diabetes in two stages with a time interval of one week (these individuals did not enter the sample size). The correlation coefficients were 1.0, 0.92, 0.95, 0.96, 0.92, 0.92, 0.99, 0.80, 0.99, 0.99 for knowledge, outcome expectations, outcome value, task self-efficacy, self-efficacy to overcome barriers, environment, observational learning, situational perception, self-regulation, and emotional adaptation, respectively. Also, the Cronbach's alpha coefficients were obtained 0.80, 0.88, 0.81, 0.80, 0.81, 0.80, 0.98, 0.80, 0.96 and 80 for knowledge, outcome expectation, outcome value, task self-efficacy, self-efficacy to overcome barriers, environment, observational learning, situational perception, self-regulation, and emotional adaptation, respectively. To ensure that the questionnaire would be comprehensible, the difficulty level of all questions was examined by ten personnel of the health care center and proposed modifications were made.

2.4. Educational intervention

In this study, 60 subjects were randomly assigned to the intervention groups (30 people in each) and 60 subjects were randomly assigned to the control groups (30 people in each group). Then, the selected subjects were asked over the phone to attend the health care center at the arranged time to participate in the study. The patients in the control and intervention groups had their HbA1C in the electronic records. These HbA1C levels were re-measured in laboratories three months after the intervention. The participants' BMI was determined (In addition to HbA1C levels), before the intervention, based on their height and weight. The questionnaires used in this study were assessed before the intervention, after the intervention, and three months after the last educational session. Also during the introductory session, the schedule of theoretical sessions was set considering the participants' demands and educational facilities at the health care center and the subjects were informed of their tasks. For the intervention group, the educational package, designed based on theoretical predictive constructs in the descriptive stage, was prepared by the researcher and used for presentation by the physician, the psychologist, the nurse and the nutrition expert. The educational content was presented in six 45-min sessions for 30 days. Based on the descriptive study, emotional adaptation, self-efficacy to overcome barriers and self-regulation were the best predictors of adherence to diabetes self-care behaviors, hence, the intervention program was designed and implemented focusing on these constructs. It should be noted that the number of sessions was considered based on the objectives of the training course (Table 1).

2.5. Data analysis method

After entering data into SPSS statistics version 22, data normality was assessed using Kolmogorov-Smirnov test. Then, the mean and standard deviation of data related to the intervention and control groups were described using descriptive statistics such as frequency distribution of variables. Descriptive statistics were used to compare the mean of variables in two groups according to the distribution of variables. Chi-square test was used for homogeneity of variables with more than two categories. The Paired and Independent t-tests were used to compare pre and post - test

Table 1
The scheme for intervention implementation stage.

The First strategy: promotion of emotional adaptation in the target group. In order to promote emotional adaptation, information on health maintenance and diabetes coping skills was presented and a clinical psychologist (MSc) held training sessions on stress management, self-efficacy and relaxation methods. Lecture, brainstorming, questions and answers as well as practical methods of relaxation were used for information transfer and knowledge promotion.
The Second strategy: Promotion of self-efficacy to overcome barriers: To this end, awareness of diabetes self-care and its advantages should first be increased among the individuals. The learners will have better performance if they have adequate knowledge about the advantages of diabetes self-care and how to perform it. Lecture, questions and answers and pamphlet presentation were used for information transfer and knowledge promotion. Educational materials were also presented in the form of pamphlets to enhance learning. Pamphlet, as a learning medium, is a learning enhancement tool for group and individual education and serves as a reminder of the main points of educational sessions (17).
Moreover, the learners were asked to list the barriers to self-care and the barriers were discussed through brainstorming to set up and implement a self-care program. Given that, in the descriptive stage, physicians and nurses of the health care centers had been introduced by most of the participants as preferred sources of information, they were asked to encourage the subjects to perform self-care behaviors. The learners who were performing self-care behaviors in accordance with the plan were encouraged verbally by the teacher while the learners who were unable to overcome barriers were encouraged focusing on the goal. To this end, the perceived comprehensive barrier was examined via individual counseling and the learner was asked to provide a suitable solution to overcome it and then re-plan his/her program in smaller and more accessible stages. The subject would be next encouraged in the presence of other learners if he/ she successfully completed part of the program.
The Third Strategy: Self-Regulation promotion process: Given the importance of recognizing the positive and negative consequences of behaviors in motivating targeted behavior and its continuity & moderation, the training session were guided by brainstorming about the expected outcomes of self-care for learners to change the subjects' beliefs before describing how to determine goals and set plans for self-regulation promotion. For this purpose, the training sessions were organized in such a way that individuals were encouraged to express the advantages of and barriers to self-care for achieving therapeutic goals. To facilitate acquisition of positive beliefs, the positive and negative comments resulted from brainstorming were summarized by the researcher and presented on the board, emphasizing that the learner's belief in the advantages of self-care was effective in improving blood sugar control as well as physical, mental and emotional health. So, for long-term and short-term goal setting, the learners were asked to deliver their self-care program performed in the previous week to the instructor in the next training session. This assignment was aimed at: 1. The subjects' awareness of their self-care and self-monitoring levels. 2. Finding the right time in their daily life. Thus, they could determine their achievable, highly applicable goals. Since if their goals were perceived as too difficult or inaccessible, their motivation would be reduced and their sense of self-efficacy would also be weakened due to failure in implementing the plan. The subjects were provided with a set plan as a template to help them set up a plan in accordance with their goals. Therefore, in addition to goal setting and planning for learners' self-regulation promotion, self-monitoring pervasive behavior as well as judging and evaluating their own behaviors and examining what they had done during the previous last week were possible. Moreover, these could motivate the learners to follow the self-care program. At the end of the sessions, there was also an opportunity for the learners to express their feelings about performing diabetes self-care. They said that they had a good feeling resulted from performing diabetes self-care. They were more relaxed, had better sleep and a better sense of well-being and improved blood sugar. This opportunity was provided to focus on self-reflective perceptions for strengthening self-regulation.

survey (and follow up) with normal variables while Wilcoxon and Mann-Whitney tests were used with abnormal variables. A significance level of 0.05 was considered for all tests.

2.6. Ethical consideration

The research process began in coordination with the health care centers after getting approval from the research vice president, obtaining the code from ethics committee (IR.MUMS.REC.1395.155) and recording it in the clinical trial Information System (IRCT20160619028529N6). At first, the subjects were explained about the goals of the research project. After obtaining informed consent, the questionnaires were completed using self-report data. Those who did not want to cooperate could leave.

3. Results

In the present study, 65% of the participants were men and 35% of them were women. Most of the subjects in the intervention group (N = 40, 66.07%) and in the test group (N = 46, 76.7%) were 35–59 years old. The majority of subjects (N = 109, 91%) were married. Most of the subjects had or even didn't have a high school diploma (N = 59, 49.16%), most of them were housewives (N = 50, 41.67), the majority of subjects (N = 102, 85%) stated that they received their health-related information from health care providers. Other demographic information can be seen in Table 2.

The results of linear regression showed that the constructs of social cognitive model can predict 30% of the variances for self-care behavior. Among the constructs of social cognitive model, emotional adaptability, self-efficacy to overcome barriers and self-regulation had a significant effect on the prediction of self-care behavior ($p < 0.001$) (Table 3).

The results of Mann-Whitney test showed that before intervention, there was no significant difference between intervention and control groups in demographic variables, BMI, hemoglobin A1C, knowledge, outcome expectations, outcome value, self-efficacy to overcome barriers, environment, observational learning, situational perception, self-regulation, emotional adaptability,self-care, diet, exercise, blood glucose test, taking diabetes pills or insulin injections, foot care, and smoking ($p < 0.05$).

The results of the paired *t*-test (Table 4) showed a significant difference between the two groups in changes in the mean score of self-care compared to those before the intervention ($p < 0.001$). Also, the difference in changes were significant between three months after the intervention and before the intervention ($p < 0.001$). Additionally, based on the results, in both intervention and control groups, the changes in the mean scores of BMI and HbA1C, self-efficacy, self-efficacy to overcome barriers, situational perception and self-regulation were also significant immediately after the intervention and three months after the intervention compared to those before intervention. ($p < 0.001$). (Figs. 2 and 3). No significant change in the mean score of environments was observed after the intervention compared to that before the intervention ($p = 0.06$) However, this change was significant three months after the intervention compared to that before intervention in both intervention and control groups ($p < 0.001$). Analysis of variance of repeated data showed a significant difference between control and intervention groups in self-care, self-efficacy, self-efficacy to overcome barriers and self-regulation. Based on the significance level of time and time/group, the difference between two groups was also significant in change procedure ($p < 0.001$) (Table 3).

Based on the results of the Mann-Whitney test (Table 4), the changes in median and interquartile ranges of knowledge, outcome expectations, outcome value, observational learning and emotional adaptation were significant immediately after the intervention and three months after the intervention compared to those before the intervention in both intervention and test groups ($p < 0.001$). The results of the Friedman test showed statistically significant changes in knowledge, outcome expectations, outcome value, observational learning and emotional adaptation during the study. Educational intervention increased the score of these constructs in the

Table 2
Frequency distribution of demographic variables(n = 120).

Variable		Intervention		Control		All	P[a]
		N	%	N	%	N (%)	
Age Categories	35–59	40	66.7	46	76.7	86(71.66)	0.311
	60–74	19	31.7	14	23.3	33(27.5)	
	75–90	1	1.7	0	0	1(0.84)	
Sex	Female	19	31.7	23	38.3	42(35)	0.444
	Male	41	68.3	37	61.7	78(65)	
Marital status	Single	8	3.13	3	5	11(9)	0.114
	Married	52	86.7	57	95	109(91)	
Occupation	Elementary	24	40	21	35	45(37.5)	0.505
	Diploma and Under diploma	30	50	29	48.4	59(49.16)	
	Academic	6	10	10	16.7	16(13.34)	
Education level	Employee	5	8.3	6	10	11(9.17)	0.457
	Retired	18	30	17	28.3	35(29.16)	
	Self-employee	9	15	15	25	24(20)	
	housewife	28	46.7	22	36.7	50(41.67)	
Blood pressure	Yes	24	40	25	41.7	49(41)	1.00
	No	36	60	35	58.3	71(59)	
Smoking	Yes	5	8.3	2	3.3	7(6)	0.439
	No	55	91.7	58	96.7	113(94)	
Duration of diabetes	< one year	4	6.7	4	6.7	8(6.72)	0.609
	1–10 year	48	82.9	52	86.7	100(84.03)	
	>10 year	7	11.7	4	6.7	11(9.25)	
Participate in a training class	Yes	31	51.7	23	38.3	54(45)	0.142
	No	29	48.3	37	61.7	66(55)	
The source of health information	health care personnel	51	86.4	51	85	102(85)	0.522
	TV, Radio	4	6.8	2	3.3	6(0.5)	
	Other	4	6.8	7	11.7	11(10)	

[a] Chi-square

Table 3
Results of Multiple Linear Regression before intervention to determine the most important influential constructs of the Social Cognitive Theory(n = 320).

Dependent variable	independent variable	B	Std. Error	Beta	t	Confidence interval		P	F	Adjusted R Square
						Lower bound	Upper bound			
Self-care Behavior	knowledge	−0.538	1.027	−0.032	−0.524	−2.561	1.486	0.601	11.383	0.304
	Outcome Expectation	0.566	0.475	0.083	−0.370	−0.370	4.502	0.235		
	Outcome Experience	0.526	0.547	−0.067	−1.605	−1.605	0.552	0.337		
	Task Self-efficacy	0.224	0.308	0.056	−0.373	−0.373	0.842	0.448		
	Barrier self-efficacy	1.160	0.397	0.236	0.378	0.378	1.942	0.004		
	Environment	0.183	0.257	0.039	−0.324	−0.324	0.690	0.477		
	Modeling	−0.112	0.198	−0.036	−0.503	−0.503	0.278	0.571		
	Situation	0.441	0.287	0.091	−0.125	−0.125	1.007	0.126		
	Self-Regulation/Self Control	0.494	0.288	0.141	−0.074	−0.074	1.062	0.008		
	Emotional Coping	1.671	0.403	0.283	0.878	0.878	2.464	0.001		

intervention group (0.001 > p) (Table 4).

4. Discussion and conclusion

The results of this study showed that the patients' emotional adaptation significantly increased immediately after the intervention and three months later, compared to that before the intervention. The results indicated that the educational program, designed based on the emotional adaptation strategy including stress control, self-efficacy and relaxation methods, has improved emotional adaptation.

Shapiro also showed in his study that teaching self-care behaviors could reduce stress in psychology students [16]. A randomized controlled trial which van Son et al. conducted to evaluate the effect of educational intervention on emotional problems of patients with type 2 diabetes after two weeks of training, showed a significant reduction in perceived stress, anxiety and depression symptoms in patients with type 2 diabetes. Also, after the educational intervention, the patients' quality of life and self-care behaviors were improved compared to those in the control group. Moreover, the patients' blood pressure and glycosylated hemoglobin levels decreased [17].

The results of this study showed a significant difference between the two groups in changes in the mean scores of self-efficacy to overcome barriers immediately after the intervention and three months later. The most commonly reported barriers were boredom and reluctance and the second and third most common barriers were fatigue and physical problems. It seems to be reasonable due to the nature of diabetes. The results of the study indicated the effect of education on removing the barriers that prevent promotion of self-efficacy to overcome barriers and adoption & continuation of self-care behavior in the intervention group. The results of the present study are consistent with most of the studies and it is reasonable that reducing the barriers that prevent us from performing a behavior will increase the use of that behavior.

The results of this study showed a significant difference between pre-intervention and post intervention (after the intervention and three months later) mean scores of self-regulations in both intervention and control groups. These results indicated that the educational intervention, based on self-regulation strategies such as goal setting, planning and behavior self-monitoring, has led to an increase in the mean score of self-regulation. The results of Rayan

Table 4
Comparison of the mean and the moderate constructs of the theory of Social Cognitive and Self-care behavior, before, immediately after intervention, and three months later, in two groups of intervention and control.

Variable	Group	Before intervention		After intervention		Follow up stage (3 months after intervention)		Test (Friedman Test)	
		Median	IQR	Median	IQR	Median	IQR	X^2	P
knowledge	Control	4	1	4	1.25	4	1.22	62.960	<0.001
	Intervention	4	1	5	0.49	5	0.59		
	P*	0.253		<0.001		<0.001			
	(Z)	1.144		6.219		5.085			
Outcome Expectation	Control	16	2.45	17	2.22	17	2.04	130.836	<0.001
	Intervention	17	2.23	19	1.28	19	1.38		
	P*	0.458		<0.001		<0.001			
	(Z)	0.742		5.190		3.888			
Outcome Experience	Control	18	1.88	18	1.87	8	1.78	48.602	<0.001
	Intervention	19	1.89	20	1.40	20	1.41		
	P*	0.110		<0.001		<0.001			
	(Z)	1.598		4.231		3.859			
Modeling	Control	16	3.38	16	3.15	17	3.08	73.471	<0.001
	Intervention	16	3.48	18	2.11	18	2.18		
	P*	0.317		<0.001		0.008			
	(Z)	1		3.662		2.656			
Emotional Coping	Control	12	2.54	12	2.32	12	2.32	142.307	<0.001
	Intervention	11	2.49	14	1.47	14	1.24		
	P*	0.863		<0.001		<0.001			
	(Z)	0.172		5.138		4.741			

Variable	**Group**	**Before intervention**		**After intervention**		**Follow up stage** (3 months after intervention)		**Test (Repeated measure ANOVA)**		
		Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Tim/group**	**Time**	**Group**
Task Self-efficacy	Control	17.70	3.89	17.63	3.79	17.73	3.64	F = 24.366,	F = 22.932,	F = 5.173,
	Intervention	18.15	3.68	19.63	2.81	19.53	2.99	P < 0.001	P < 0.001	P = 0.025
	P**	0.517		<0.001		0.004				
	(t)	0.650		3.275		2.956				
Barrier self-efficacy	Control	17.23	2.91	17.56	2.70	17.95	2.63	F = 36.731,	F = 83.787,	F = 12.663,
	Intervention	17.70	3.08	20.15	2.20	19.85	2.32	P < 0.001	P < 0.001	P = 0.001
	P**	0.396		<0.001		<0.001				
	(t)	0.851		5.743		4.188				
Environment	Control	13.58	2.32	12.88	2.55	13.75	2.34	F = 12.073,	F = 29.705,	F = 2.313,
	Intervention	13.25	2.30	13.36	1.99	15.28	2.55	P < 0.001	P < 0.001	P = 0.131
	P**	0.432		0.250		<0.001				
	(t)	0.789		1.157		3.425				
Situation	Control	13.16	3.77	13.21	3.73	13.40	3.57	F = 25.460,	F = 35.511,	F = 3.484,
	Intervention	13.26	3.42	14.96	3.05	14.98	3.07	P < 0.001	P < 0.001	P = 0.064
	P**	0.880		0.006		0.011				
	(t)	0.152		2.809		2.599				
Self-Regulation/Self Control	Control	18.78	5.49	18.93	5.05	19.06	4.95	F = 20.031,	F = 32.251,	F = 5.902,
	Intervention	19.78	5.48	21.58	3.94	21.76	4.03	P < 0.001	P < 0.001	P = 0.017
	P**	0.320		0.002		<0.001				
	(t)	0.998		3.201		3.272				
Self- care	Control	46.55	20.16	48.18	19.32	49.01	19.33	F = 208.381,	F = 290.236,	F = 30.231,
	Intervention	48.48	9.19	73.40	43.11	72.58	12.09	P < 0.001	P < 0.001	P=<0.001
	P**	0.592		<0.001		<0.001				
	(t)	0.538		8.699		8.006				
HA1C	Control	8.00	0.62	–		7.99	0.60			
	Intervention	8.13	0.57			7.51	0.84			
	P**	0.251				<0.001				
	(t)	1.154				3.601				
BMI	Control	28.37	3.42	28.37	3.42	28.39	3.40	F = 29.273,	F = 27.345,	F = 0.207,
	Intervention	28.27	3.89	28.03	3.85	27.88	3.82	P < 0.001	P < 0.001	P = 0.650
	P**	0.883		0.608		0.443				
	(t)	0.148		0.151		0.770				

* Mann-Whitney Test, **Independent Samples T-test.

study showed that an increase in self-regulation will lead to better health behaviors [18]. Park also revealed that self-regulation (including self-observation, goal setting and reinforcement) plays an important role in performing (continuously) exercises for prevention of osteoporosis in elderly women [19].

The results of this study showed that educational intervention did not significantly change the mean score of environmental factors immediately after the intervention, however, the mean score of this construct significantly changed three months after the intervention in the test group. Environmental factors such as family support and physician-patient relationship can facilitate or hinder performing self-care behavior. The studies have shown that diabetic patients' family support will prompt the patients to perform self-care behaviors [20]. In addition to family support, physician-patient close relationship is also effective in promoting self-care in diabetic patients [21,22]. In Strachan's study, educational

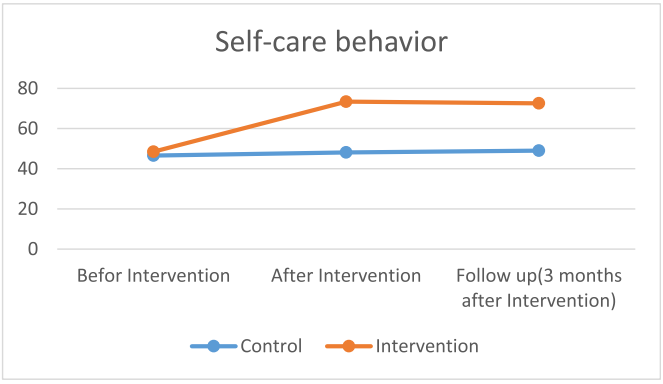

Fig. 2. Mean of self-care behavior before and after Intervention in Control and intervention Groups.

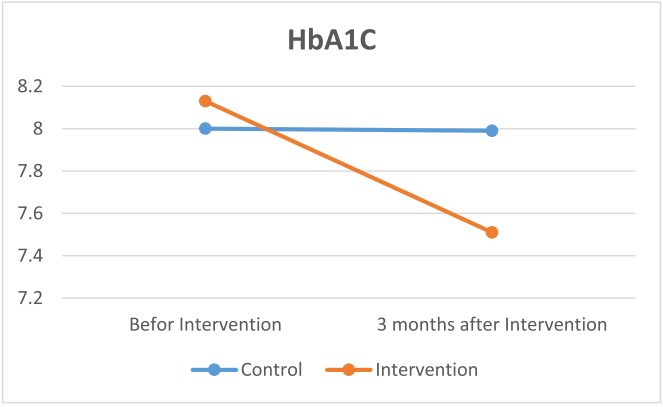

Fig. 3. Mean of HbA1c and after Intervention in Control and intervention Groups.

intervention based on social cognitive theory led to an increase in the mean score of perceived social environment and moderate physical activity [23], which is consistent with the findings of the present study. The strategies used in Strachan's study for promoting perceived social support included participation of peers and family members in setting the patients' goals and encouraging them to achieve their goals. The effectiveness of educational intervention in this study was due to these strategies. Diabetes is a chronic disease that requires behavioral changes and adherence to a complex care plan. Social support is one of the most important and effective factors in treatment adherence in the patients and can facilitate self-care behaviors and adjustment to the disease [24].

In the present study, a significant difference was observed in changes in the mean scores of situational perceptions between the two groups immediately after the intervention compared to those before the intervention. Each individual is an important source of better understanding of behaviors, hence, the success and failure of any curriculum depends on the individual's attitudes and beliefs [25]. Based on the social learning theory, in addition to external factors, internal determinants such as values, beliefs and motivation are effective in performing and maintaining healthy behaviors [26]. Ball et al. investigated the effect of perceived environment on physical activity and walking among adults and stated that the less perceived environmental aesthetics and safety were, the less often walking behavior was observed among the subjects [27]. Sallis et al. Also showed that the neighborhood environment perception is associated with changes in the intensity of physical activity (31).

After educational intervention, there was a statistically significant difference between the two groups in changes in the mean scores of self-efficacy. This indicated the effectiveness of educational intervention in the intervention group.Mc wheel et al. who investigated diabetes dietary behaviors, reported a significant association between self-efficacy and self-care behaviors [28]. Miller et al. indicated that after an educational intervention (based on the principles of SCT), self-efficacy of the experimental group increased compared to that in the control group [29].

In this study, the difference in changes in the mean scores of outcome expectations was statistically significant between the test and control groups immediately after the intervention and three months later. The results of the study indicated that the implemented educational program could improve the expected outcomes of self-care in the intervention group. Farahani et al. conducted a study entitled "the effect of walking education on blood glucose control in women with type 2 diabetes, based on Health Belief Model" and they showed a significant difference between the two groups in perceived advantages of walking after intervention [30]. The findings of this study confirm the results of the present study.

Implementation of the educational intervention program significantly increased the scores of outcome value after the intervention and three months later in the test group compared to those in the control group. The outcome value is the value a person places on the probable outcomes that result from performing a behavior. Individuals perform behaviors that are satisfactory& valuable and avoid performing behaviors in that are not satisfactory or are of little value [31]. Agha Moulaie et al. [32] proved that there is a statistically significant association between health beliefs and diabetes self-management behavior in elderly patients with type 2 diabetes. Aalto [33], Brownlee [34] and Koch [35] also reported a significant association between the advantages of and adherence to diabetes care guidelines which is consistent with the results of this study.

Based on the results, educational intervention increased the mean score of self-care in the test group after the intervention and three months later, which shows that interventional program has increased self-care in patients. Agha Moulaie et al. [36] reported a significant increase in the levels of blood glucose control, weight control, exercise and adherence to dietary regimens. Dunn et al. in Australia showed that the implementation of a formal educational program on diabetes improved the patients' performance within 2 days [37].

4.1. Study limitations

This study had some limitations. One of these limitations was using self-report questionnaires probably completed inaccurately. Another limitation of the study was the large number of questions of the questionnaire due to the large number of constructs of this theory, and people may not have completed the questionnaire with sufficient accuracy and patience. The participants in the intervention and control groups may also have been affected by other sources of information related to self-care.

5. Conclusion

Based on the findings of this study, emotional adaptation, self-efficacy to overcome barriers and self-regulation are important determinants of self-care which will be more efficient if educational interventions are designed and implemented (using social cognitive theory focusing on personal, cognitive, environmental and behavioral factors) for adherence to healthy lifestyle behaviors including self-care. These educational interventions will increase self-care in patients with type 2 diabetes and improve their physical and mental health and blood glucose control through making

changes in the constructs of this theory.

Conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Appendix A. Supplementary data

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