Int J Physiol Pathophysiol Pharmacol 2022;14(5):281-288
www.ijppp.org /ISSN:1944-8171/IJPPP0144759

Original Article

Effect of self-efficacy-based training on metabolic control of patients with type 2 diabetes

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Received June 14, 2022; Accepted September 13, 2022; Epub October 15, 2022; Published October 30, 2022

Abstract: Background: Type 2 diabetes is a significant problem in today's society. Considering the possible effect of self-efficacy training on diabetes control, we aimed to investigate its impact on type 2 diabetes control. Methods: This randomized controlled clinical trial was performed in 2018 in Isfahan city. Iranian Registry of Clinical Trials (IRCT) code for this study is IRCT20190219042762N1 (https://en.irct.ir/trial/37677). In so doing, 161 patients with diabetes were divided into two groups: intervention and control. The intervention group received six self-efficacy and healthy lifestyle training sessions, and self-efficacy strategies were taught in all sessions. Metabolic indices and the data collected by Diabetes Management Self-Efficacy Scale (DMSES) were analyzed before and three months after training by descriptive and inferential statistics. Results: The self-efficacy score of the intervention group was significantly higher after training (175.7±18 vs. 163.7±26, P = 0.001). Also, the cholesterol level, LDL, and systolic blood pressure reduced significantly in this group after the intervention (167±39 vs. 179±43.7 mg/dl, 94.2±31 vs. 102.6±39 mg/dl, 115.6±1.4 vs. 120.1±1.8 mmHg, respectively. P<0.05). Conclusion: Generally, self-efficacy training effectively improved metabolic control in patients with type 2 diabetes.

Keywords: Diabetes, self-efficacy, education, metabolic indices

Introduction

Type 2 diabetes is the most prevalent type of diabetes characterized by insulin resistance and beta-cell dysfunction, so the target tissue cannot use insulin properly [1]. Diabetes is the most common disease caused by metabolic disorders with increasing prevalence and is a major global challenge [2]. According to the latest studies, the diabetes prevalence in Iran was around 11.37% in 2020, mainly affecting individuals aged between 25 and 70. This trend increased by 35.1% from 2015 to 2021. It is estimated that the number of patients with diabetes will reach more than six million by 2030 [3]. Global statistics on diabetes prevalence in Iran show that by 2030, Iran will be one of the countries with the highest prevalence of diabetes, whose prevalence will reach about 9.3% [4].

According to the World Health Organization, education is the basis of diabetes treatment [5, 6]. Educating patients with diabetes about the nature of diabetes, caring for and controlling the disease, and its treatment is essential [7]. Self-efficacy is the individuals' belief about their ability to organize and take the necessary actions in future situations. In other words, self-efficacy means individuals' confidence in their ability to succeed in a given position; it is also a prerequisite for behavior change [8]. Studies have shown that individuals with low self-efficacy are less likely to try a new health behavior or change their habits [9]. Researchers believe self-efficacy is a good framework for understanding and predicting the disease and ensuring patients' commitment to self-care behavior. Problems with lifestyle changes such as eating habits, smoking, and exercise necessitate high levels of self-confidence and self-efficacy [10, 11]. Self-efficacy entails spontaneous activities that enable patients to understand the conditions and factors affecting their health and implement them to improve their health; it ultimately leads to self-care [12, 13].

Regarding the treatment trend of chronic diseases, several studies have been conducted on the importance and relationship between self-

efficacy and performing health-related behaviors and the influential factors. For instance, self-efficacy was investigated in studies focusing on chronic diseases such as hypertension [14]. Based on the previous data, type 2 diabetes is essential and has a high prevalence in different communities. The role of self-efficacy in diabetes has been less discussed than in other diseases, and it is required to study and create effective methods to control chronic conditions. Therefore, in this study, we aimed to investigate the effect of self-efficacy-based training on managing type 2 diabetes in these patients.

Methods and material

Study design

This study was a randomized controlled clinical trial conducted on 180 patients with type 2 diabetes referred to Ibn-e-Sina health care center in Isfahan. The present study was approved by the ethics committee of Isfahan University of Medical Sciences with the ethics code IR.MUI.MED.REC.1397.213. Also, the registration code in the Iranian Registry of Clinical Trials is IRCT20190219042762N1.

Inclusion and exclusion criteria

Inclusion criteria were having type 2 diabetes diagnosed by a physician, regular visits to the Comprehensive Health Care Center in the last six months, patients with 30 to 70 years of age, basic literacy, and consent to participate in the study. Exclusion criteria were experiencing severe complications of diabetes, lack of follow-up, and voluntarily leaving the study.

Sample size

The sample included 180 patients whose number was determined according to previous studies in this field. From the list of patients with diabetes referred to Ibn-e-Sina Comprehensive Health Center in Isfahan, 180 patients were non-randomly selected based on inclusion criteria and then randomly assigned to intervention and control groups of 90 patients using online randomization software. To ensure ethical considerations, the researcher explained the research aimed to the participants and assured them that their data would be kept confidential and no name would be mentioned. Furthermore, all participants could withdraw from or leave the study without feeling obligated to continue.

Data gathering and self efficacy score calculation

The Demographic Questionnaire and the Diabetes Management Self-Efficacy Scale (DMSES), the diabetes self-efficacy questionnaire, were completed before the intervention [15]. This scale consists of 20 items that assess the patient's ability to follow self-care behaviors. The responses are rated on an 11-point Likert scale ranging from 0 (I can never do it) to 10 (I can definitely do it). The total score ranges between 0 and 200, showing the patient's self-efficacy level. The validity and reliability of this scale were confirmed in previous studies [16] and Iran [17]. This study calculated and compared the mean self-efficacy score before and after the intervention. The higher the self-efficacy score, the higher the self-efficacy level of the patients.

Laboratory analysis

Preliminary tests included measuring body mass index, recording HbA1C, triglyceride, total cholesterol, LDL and HDL, and blood pressure were taken by a health care provider who did not know whether the individuals were assigned to the intervention or control group. Then, the intervention group received self-efficacy-based training in general classes of 15 patients during six one-hour weekly sessions with a specific lesson plan based on the National Diabetes Instruction, the IraPEN Instruction, and the Diabetes Education Package.

Self-efficacy strategies

The training was conducted through lectures and small group discussions, which included five general and one face-to-face session to set goals for each patient. The patient's questions were answered during the sessions, and they were allowed to call the researcher after the end of the sessions. The self-efficacy methods used in this study included four strategies of performance success, vicarious experiences, verbal persuasion, and physiological/emotional arousal used in previous studies, including Reisi and colleagues [18].

Performance success: To create successful experiences that effectively promote a sense of self-efficacy, researchers should adopt a goal-setting approach and design and implement an operational program to initiate change. In other words, by setting small goals with the patient's cooperation and helping them achieve them, patients are guided to bigger ones. Patients have a better sense of self-efficiency after successfully attaining the established goals.

Vicarious experiences: Observing the successful behavioral performance of others is a source of self-efficacy enhancement for an individual. They become a role model for the individual. Vicarious experiences were used as a strategy for increasing self-efficacy in this study. For the present study, the researcher identified successful participants in the project and training sessions and asked them to share their experiences with others. Verbal persuasion: Because verbal persuasion can increase self-efficacy, this technique encourages individuals by emphasizing their capabilities and increasing their self-confidence.

Physiological/emotional arousal: Information about the physiological states of individuals, which is the result of assessing the physical and psychological effects of performing a particular behavior on them, affects their judgment about their abilities and competencies to achieve specific behavior. For example, to negative feedback, high stress and anxiety levels reduce individuals' self-confidence, performance, and self-efficacy. By setting small goals, attempting to enhance capabilities, and reinforcing the belief that they can achieve their goals without being challenged, we helped the patients withstand the negative impact of emotional states and reduce their unwillingness to follow instructions.

Training sessions

The training sessions were as follows: In the first session, diabetes, its symptoms, acute and chronic complications of diabetes, and diabetic foot were defined, and patients were taught performance success and vicarious experiences strategies. In the second session, patients were trained to control blood sugar, fat, and blood pressure, follow therapeutic goals, recognize the importance of self-care and SMBG training, and prevent diabetic foot. Vicarious experiences and verbal persuasion strategies were used in this session. Nutrition in diabetes, eating healthy food while traveling, stress, illness, increased physical activity, the importance of normal weight, and optimal weight control were taught in the third session. Performance success and verbal persuasion strategies were used in this session. Training on adequate exercise, medical care to engage in and promote physical activity, proper sleep, and smoking cessation were provided in the fourth session; furthermore, physiological/emotional arousal strategies were taught to patients in this session.

Data assessments

Appropriate pharmacotherapy, insulin therapy, hypoglycemia, and prevention and treatment were taught in the fifth session. Verbal persuasion and physiological/emotional arousal strategies were taught to patients in this session. Finally, in the sixth session, patients received face-to-face training according to their individual needs and training on performance success and vicarious experiences' strategies. The control group was also under routine care. The regular maintenance for patients with diabetes includes consultation sessions for diet modification, increasing physical activity, and increasing drug compliance. After three months, the participants were re-assessed, including re-filling the self-efficacy scale and estimating the mean self-efficacy score in both groups. Finally, the means of body mass index, HbA1C values, triglyceride, total cholesterol, LDL and HDL, and blood pressure were compared in the intervention and control groups.

Statistical analysis

The data were analyzed by descriptive statistics, chi-square test, independent samples t-test, paired samples t-test, and MANCOVA using SPSS software version 16 (Chicago: SPSS Inc. IBM Corp.) A confidence level of 5% was considered for statistical significance. Concerning the observance of ethical principles, the control group received one session of face-to-face self-efficacy training with printed content at the end of the project.

Findings

Study population

From the list of patients with type 2 diabetes referred to the centers, 180 were randomly

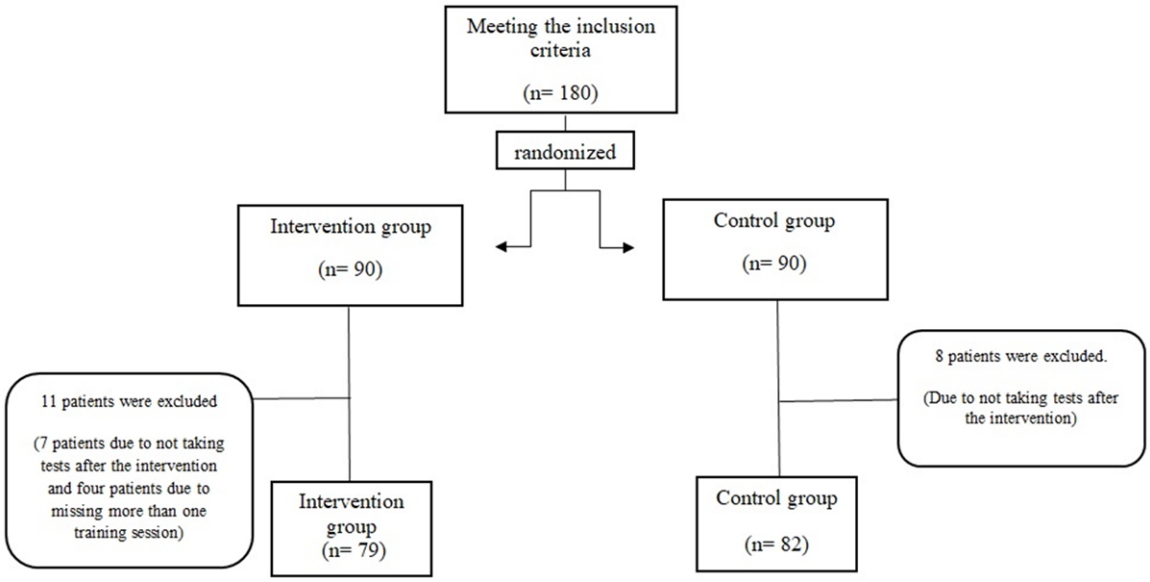

Figure 1. CONSORT diagram of patients.

Table 1. Demographic information of the participants

	Intervention Frequency (%) n = 79	Control Frequency (%) n = 82	*p*-value
Gender	53 (67.1)	51 (62.2)	0.31
	26 (32.9)	31 (37.8)	
Marital status	64 (81.1)	66 (80.4)	0.72
	15 (18.9)	16 (19.6)	
Hypertension history	34 (43.1)	29 (35.3)	0.41
Level of education	53 (67.1)	57 (69.5)	0.5
	26 (32.9)	25 (30.5)	

selected and equally divided into intervention and control groups. The consort diagram in **Figure 1** shows the way patients entered the study.

The mean ages of patients in the intervention and control groups were 60.7±8.3 and 59.8± 10.1 years, respectively, whose difference was not statistically significant (P = 0.54). **Table 1** shows the demographic information of the participants in the study.

Comparison of scores

A comparison of self-efficacy score, HbA1C, lipid profile, blood pressure, and BMI of the two groups before and three months after the intervention is shown in **Table 2**. As indicated, the mean scores of self-efficacy, HbA1C, fat profile, blood pressure, and BMI of the two groups were not significantly different before the intervention (P>0.05). Still, the mean score of the intervention group's self-efficacy was considerably higher than the control group three months after the intervention (P = 0.001). Also, the mean of the intervention group's cholesterol (P = 0.04) and LDL (P = 0.02) were significantly lower than the control group three months after the intervention. Comparing other indices measured three months after the intervention did not reveal a significant difference between the two groups (P>0.05). The results of paired samples t-test showed significant differences in the mean scores of self-efficacy (P = 0.001), cholesterol (P = 0.015), LDL (P = 0.02), and systolic blood pressure (P = 0.012) of the intervention group three months after the intervention. However, the changes in HbA1C, TG, HDL, diastolic blood pressure, and BMI were not statistically significant in this group during the study (P>0.05). Also, the differences in the cholesterol (P = 0.04) and LDL (P = 0.015) means before the intervention and three months after it was not statistically significant in the control group and changes in other indices in this group were not statistically significant during the study (P>0.05).

Discussion

The findings revealed that the self-efficacy score was higher in the intervention than in the

Table 2. Comparison of mean scores of self-efficacy, HbA1C, fat profile, blood pressure, and BMI before and three months after intervention in intervention and control groups

	Intervention M (SD)	Control M (SD)	*p*-value*	*p*-value***
Self-efficacy				
Before intervention	163.7 (26)	156 (26)	0.06	<0.001***
Three months after intervention	175.7 (18)	157 (24)	0.001*	
p-value**	0.001**	0.4		
HbA1C				
Before intervention	7.8 (1.9)	7.7 (1.9)	0.6	0.104
Three months after intervention	7.9 (2)	8 (1.5)	0.8	
p-value**	0.7	0.06		
Triglyceride				
Before intervention	172.6 (70.3)	154 (68)	0.09	0.118
Three months after intervention	158 (68)	158 (65)	0.9	
p-value**	0.052	0.4		
Cholesterol				
Before intervention	179 (43.7)	187 (37)	0.2	0.125
Three months after intervention	167 (39)	180 (43)	0.04*	
p-value**	0.015**	0.046		
LDL				
Before intervention	102.6 (39)	111 (34)	0.7	0.023***
Three months after intervention	94.2 (31)	105 (34)	0.02*	
p-value**	0.02**	0.015		
HDL				
Before intervention	44.2 (15)	45 (15)	0.8	0.519
Three months after intervention	41 (10)	42 (8)	0.49	
p-value**	0.1	0.051		
BMI				
Before intervention	29.3 (4)	28.5 (4)	0.58	0.284
Three months after intervention	29.3 (4)	28.5 (4)	0.31	
p-value**	0.6	0.9		
Systolic blood pressure				
Before intervention	120.1 (18)	115.2 (17)	0.07	0.779
Three months after intervention	115.6 (14)	112.5 (18)	0.2	
p-value**	0.012**	0.2		
Diastolic blood pressure				
Before intervention	72.3 (8.7)	72.4 (9)	0.9	0.994
Three months after intervention	71.9 (8.9)	72 (10)	0.9	
p-value**	0.7	0.6		

*independent sample t-test results. **paired sample t-test results. ***MANCOVA test results by controlling pre-intervention values.

control group three months after training. Furthermore, sessions of self-efficacy training lowered blood cholesterol, LDL, and systolic blood pressure in the intervention group.

Some studies have been conducted on training and increasing self-efficacy among patients and its impact on care and disease prognosis. Firooz and colleagues demonstrated that the self-efficacy of patients with type 2 diabetes was low, which imposed additional costs on these patients [19]. Lee and colleagues studied 175 patients with type 2 diabetes in Korea. They examined the effect of self-efficacy on gly-

cemic control and concluded that patients trained by specialists had higher self-efficacy and lowered HbA1C levels than other patients [20]. The findings of this study are consistent with our research as we also emphasized the importance of training and supporting patients with diabetes and corroborated the effectiveness of support and training.

As our findings showed, self-efficacy training was associated with a significant decrease in HbA1C in the first three months. Sloan and colleagues investigated the effect of self-efficacy on controlling type 2 diabetes. For this purpose, they reviewed ten years of data. They concluded that beliefs and training positively increased self-efficacy in individuals, but the training did not decrease in HbA1C [21, 22]. The findings of this study are in line with our research. Training did not influence the HbA1C in our study. It might be because of the duration of the study. We studied patients and controls for three months, while it might take longer to see dramatic changes such as a decrease in HbA1C. Reisi and colleagues showed that self-efficacy training for patients with diabetes positively influenced controlling blood sugar [18]. They showed that HbA1C modification was ineffective in the first three months, but HbA1C control improved six months after training, indicating the importance of continuous training.

In addition, other factors can enhance the effectiveness of training. Factors such as family and social support, especially in women, might influence the results of studies on self-efficacy and self-care, as shown in Golshiri and colleagues [23]. It is noteworthy that these factors were not examined in this study, which could be one of the limitations of our research. Saeidinejat and colleagues studied 950 patients with type 2 diabetes and examined the impact of family care and self-efficacy on controlling type 2 diabetes. They reported that married individuals, small families, men, urban dwellers, individuals with higher education, and patients diagnosed long ago enjoyed higher self-efficacy [24].

Most previous studies emphasized that self-efficacy-based training for patients with diabetes can help control their disease, which is consistent with the findings of our study. Using self-efficacy strategies and training, Burke and colleagues and Gans demonstrated that patients' blood cholesterol levels decreased after training [25, 26]. Consistent with our findings, these findings emphasize the reduction of blood cholesterol through self-efficacy training. The effectiveness of self-efficacy training can be due to its effect on increasing patients' self-care, which, in turn, leads to effectively controlling the diseases.

In the present study, we found a significant reduction in the cholesterol and LDL levels of the control and intervention groups, which could be due to the routine care of the centers and the recommendations of health care providers. Moreover, we observed that cholesterol and LDL levels of the intervention group were significantly lower than the control group after the end of the study. Therefore, we believe that self-help training has consequences beyond routine care. However, no significant difference was found between the two groups regarding HbA1C and BMI due to the limited study time. As reported, training can be effective if it is continuous and accompanied by follow-up. Also, the trainees should be appropriately informed about the positive effect of that training and be followed up for a long time [27]. Therefore, holding more sessions with more active and longer follow-ups is recommended to increase the self-efficacy of patients with diabetes, especially the elderly.

We might refer to the limited study time among the study's limitations. It is recommended to have a longer follow-up time in future studies to measure the durability of the training effect. On the other hand, the participants were selected non-randomly from a relatively deprived area, which might affect the generalizability of the findings.

Conclusion

Self-efficacy-based training can effectively improve metabolic indices in individuals with diabetes, although it is recommended to do longitudinal studies with larger populations.

Acknowledgements

The article's authors thank the esteemed research and health deputies of Isfahan University of Medical Sciences for their financial and executive support and the Ibn Sina Comprehensive Health Services Center staff for their assistance in conducting the research.

Disclosure of conflict of interest

None.

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