ORIGINAL ARTICLE

Effect of Diabetes Self-management Education in Diabetics after Myocardial Infarction: A Randomized Controlled Trial

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Abstract

Objective: This study aimed to investigate the impact of an education program on diabetes self-management among individuals with type 2 diabetes (T2D) who had experienced an acute myocardial infarction (AMI).

Methods: This randomized controlled trial was conducted at a training and research hospital in Turkey, which also functions as a cardiology specialty center. The hospital features two coronary intensive care units and three cardiology departments. Data collection took place between January 15 and June 15, 2023. In total, 102 patients with T2D who had undergone AMI were selected and randomly assigned to either the intervention and control groups. The intervention group received individualized diabetes education through two sessions, each lasting approximately 15 minutes. Diabetes self-management levels were assessed at baseline and again one month after the educational intervention. This study followed the consolidated standards of reporting trials reporting guidelines.

Results: At the 1-month follow-up, the intervention group demonstrated significantly higher diabetes self-management scores compared with the control group (p<0.001). Intra-group analysis further indicated a substantial improvement in the intervention group's post-education self-management scores compared with their pre-education scores (p<0.001).

Conclusion: The educational program significantly improved diabetes self-management among patients with T2D following AMI. Nurse-led educational intervention is an effective approach that can be seamlessly integrated into routine patient care for this population.

Keywords: Diabetes, education, myocardial infarction, patient, self-management

INTRODUCTION

Type 2 diabetes (T2D) is a metabolic and chronic disorder (1). T2D is a significant and important health problem with an increasing prevalence worldwide (2). It is estimated that there are 537 million adults with diabetes globally, and this number may rise to 783 million by 2045 (3). High health expenditures and productivity losses due to diabetes and its complications can negatively impact national economies (4). To reduce these losses, it is crucial to control blood glucose levels in patients with diabetes and prevent complications (5).

Cardiovascular complications can develop in individuals with T2D if glycemic control is not achieved (6). Insulin resistance and insulin deficiency contribute to the development of atherosclerosis in blood vessels (7), and prolonged high blood sugar levels accelerate this process (8). Consequently, atherosclerosis in coronary vessels can lead to acute myocardial infarction (AMI) (9). Therefore, T2D is considered a significant risk factor for AMI (10,11).

AMI is the most serious and fatal cardiovascular disease (CVD) (12,13). Myocardial infarction (MI) is the primary cause of death

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among patients with T2D (14). It has been reported that the risk of AMI is individuals with T2D is twice as high as in those without diabetes (15). Diabetes is commonly found among patients hospitalized due to AMI, with approximately 30% of treated cases being patients with diabetes (10). The rate of patients hospitalized with suspected MI who present to the emergency department again with a suspicion of MI within 1 year was reported to be 0.059 (16). The risk of MI recurrence at some point in their lives for patients with T2D who have a history of MI is greater than 40% (10,17). Diabetes self-management is a crucial concept for ensuring glycemic control and reducing the risk of complications in individuals with T2D (5). Diabetes self-management strategies can help lower the risk of long-term complications for people with diabetes (18). Through these strategies, individuals with diabetes can make informed decisions about their treatment and care and incorporate these decisions into their daily lives (19). There is a significant relationship between T2D management level and the occurrence of cardiovascular events (20). Diabetes self-management is known to be effective in reducing the risk of cardiovascular complications in individuals with T2D (21-23). Current guidelines recommend that individuals with T2D receive diabetes education to improve their self-management (5,10). It has been reported that structured patient education improves diabetes self-management compared to routine information (24,25). The literature indicates that diabetes self-management education supports blood sugar control, utilization of health services, and implementation and maintenance of healthy lifestyle behaviors (19,21). However, no study has examined the effect of patient education on diabetes self-management in individuals with T2D who have experienced AMI.

METHODS

Aim and Design

The aim of this study was to examine the effects of a patient education program on diabetes self-management in patients with T2D who have experienced AMI. The impact of the patient education program on diabetes self-management was evaluated during a 1-month follow-up period (0-1 month). The study hypotheses were as follows:

H0: The patient education program does not affect the diabetes self-management of patients with T2D who have experienced AMI.

H1: The patient education program increases the diabetes self-management of patients with T2D who have experienced AMI.

This study was a prospective, randomized controlled trial. It recruited 102 patients with T2D who had experienced AMI

between January and June 2023. Patients in the intervention group received approximately 30 minutes of individual diabetes education, delivered in two sessions, each lasting about 15 minutes. The patient information form was administered at baseline. The T2D self-management scale was administered to the patients as a pretest and again 1 month later as a posttest. The relevant EQUATOR guideline, the CONSORT checklist, was used to report this study, and the ClinicalTrials.gov registration number was obtained (NCT05954819 registered).

Study Setting

The study was carried out in a training and research hospital that also serves as a cardiology specialty hospital, with 2 coronary intensive care units (ICUs) and 3 cardiology services. The ICUs and services are located close together. The coronary ICUs have a total capacity of 66 beds, while the cardiology services have a total capacity of 72 beds. Each unit features a central corridor, with single rooms on both sides equipped with automatic doors. The units are equipped with a central monitoring system that allows nurses to monitor each patient. Each patient receives treatment in a single room. The hospital is a cardiology specialty facility, and the admission rate of patients to ICUs due to heart attacks is high. To reduce patient admission to the coronary ICUs, patients who received treatment and stabilized after AMI were transferred to the cardiology services.

Participants

The sample of the study consisted of 465 patients with T2D who received AMI treatment at a hospital in İstanbul, Turkey. Inclusion criterias were being voluntary and 18 years and older, being patients with T2D and hospitalized for AMI, and no psychiatric or communication problems. Patients treated with sedative or narcotic analgesics or who were intubated were excluded.

Sample Size and Randomization

Power analysis was performed using G*Power 3.1.7 software. The sample size was determined based on data from a comparable study in the literature (26). Drawing on findings from a study that examined the impact of an educational intervention on diabetes self-management, the required sample size was estimated to be 34 participants per group (assuming a two-tailed alpha of 0.05, a power of 0.80, and a medium effect size of 0.40). To account for potential dropouts, we aimed to include at least 51 participants in each group. A total of 102 eligible and willing participants were randomly assigned to groups using an online random number generator. Block randomization was applied, with participants grouped into blocks based on age and gender and then randomly allocated to each block. No participants

withdrew from the study, and the final sample consisted of 51 participants in each group (Figure 1).

Data Collection Tools

The patient information form and the T2D self-management scale were used for data collection.

Patient Information Form

This form was created by researchers to determine patients' personal and disease-related characteristics. It consisted of 11 items covering demographic features (e.g., educational levels, marital status, employment status) and clinical characteristics (e.g., history of AMI, duration of diabetes, treatment methods).

T2D Self-Management Scale

The T2D Self-management scale, developed by Koc (27), consists of 19 items and 3 subscales: Healthy lifestyle behaviors (11 items), blood sugar management (4 items), and use of health services (4 items). The scale has a 5-point likert-type rating system ranging from "Never-1 point" to "Always-5 points". All items are

positive. A high score on the scale indicates high-level diabetes self-management (26). In our study, the internal consistency coefficient of the scale was found to be 0.96.

Diabetes Self-management Education Program

The program was developed by researchers through a literature review and in accordance with Pender's health promotion model (Table 1). The training program was structured under three headings: "T2D and diabetes management", "the relationship between diabetes and MI", and "healthy lifestyle behaviors and their importance for improving health". During the training, written and visual materials were used to enhance patient motivation.

Study Procedures

Researchers visited the coronary ICUs daily to identify patients. We informed the patients about the aim and scope of the study and obtained their informed consent. Next, the patients were randomly assigned to the intervention and control groups. Patients in the control group also participated in the diabetes self-management education program (DSMEP) after the study was concluded. Interviews were conducted with each patient without interrupting treatment or follow-up. First, the demographic and clinical information of all patients were obtained. The control group received routine clinical information provided by physicians and clinical nurses. DSMEP
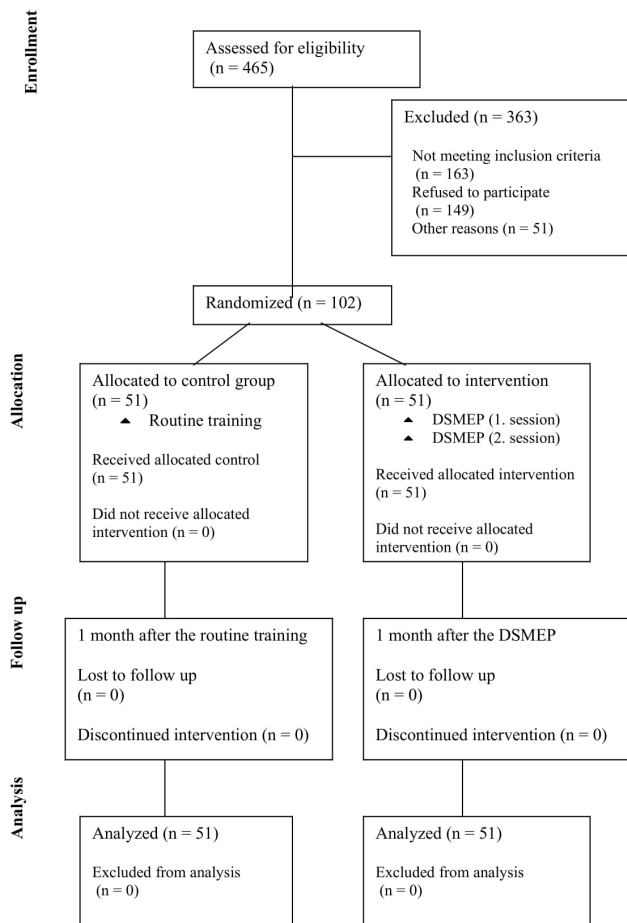

Figure 1. CONSORT participant flow diagram
DSMEP: Diabetes self-management education program

Table 1. Content of the educational intervention	
Content	**Explanation**
Meeting patients and entering the training program	- The content of the training program was introduced. - The patients' current health status and needs, personal characteristics, experiences, and beliefs about health behaviors were evaluated.
Diabetes and self-management	- Information was given about diabetes, symptoms, complications and prevention of diabetes, healthy nutrition, regular exercise, blood sugar monitoring, drug treatment, and the importance of diabetes management.
Diabetes and myocardial infarction relationship	- Information was given about the macrovascular effects of diabetes, definition, symptoms, and risk factors of myocardial infarction, which is a macrovascular chronic complication of diabetes.
Healthy lifestyle behaviors and their importance for improving health	- Information about healthy nutrition, regular exercise, blood sugar and blood pressure monitoring, compliance with medication, adequate sleep, avoiding smoking/tobacco use, avoiding stress, and regular health check-ups. - Patients were allowed to evaluate themselves (perception of their health status, values, beliefs). - Health goals were explained to the patients.

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was administered to the intervention group patients by one of the researchers on the day of the first interview. This program was carried out in 2 sessions with intervals of 3-4 hours. The total training duration was 30 to 40 minutes. After the first meeting, each patient was contacted during the discharge process, and an appointment date was scheduled for outpatient clinic check-up one month later, in accordance with the hospital's routine procedures. A second interview was held with each patient who arrived on the appointment date in a predetermined outpatient clinic room following their routine checkup. In this interview, posttest data from the study were collected using the diabetes self-management scale.

Statistical Analysis

Data were analyzed using SPSS version 21.0. The chi-square test was used to compare the frequency distribution between the two groups and the homogeneity of categorical variables. The independent t-test was used to compare the mean scores obtained from the T2D self-management scale. The data were analyzed with a significance level of $p<0.05$ and a 95% confidence interval.

Ethical Considerations

Institutional permission was obtained from the İstanbul Provincial Health Directorate Mehmet Akif Ersoy Thoracic and Cardiovascular Surgery Training Research Hospital. Ethical approval was granted by the Social and Human Sciences Research Ethics Board of İstanbul University-Cerrahpaşa (decision number: 2022/476, date: 06.12.2022). Permission to use the scales was obtained from their authors all participants were informed about the objectives of the study and specific requirements for their involvement. In accordance with ethical principles, written informed consent was obtained from patients who voluntarily agreed to participate. Anonymity and confidentiality were strictly maintained. Data were collected in accordance with the principles of the Declaration of Helsinki.

RESULTS

The mean age of patients was 58.68 ± 9.76 years , ranging from 33 to 75 years. The proportion of male patients (80.4%) was greater than that of female patients (19.6%). Approximately 80.5% of patients had graduated from primary and secondary school. Most patients (87.3%) were married. Most patients were receiving oral antidiabetic drug therapy (71.6%) and had not received diabetes education (85.3%). There was no statistically significant difference between the intervention and control groups in terms of demographic and clinical characteristics ($p>0.05$) (Table 2). The pretest T2DSMS scores of the intervention (48.35 ± 11.94) and control (49.86 ± 12.66) groups were similar. The posttest score of the intervention group (72.49 ± 8.06) was significantly higher than that of the control group (46.84 ± 11.80) ($p<0.001$). The effect size between pretest and posttest scores was 2.369. An intragroup comparison of the T2DSMS scores showed that the mean posttest score of the intervention group was significantly higher than the pretest score ($p<0.001$) (Table 3). Additionally, at the end of the study, it was observed that the smoking cessation rate among all patients increased. Notably, 56% of the patients in the experimental group who received planned patient education quit smoking, compared to 14% of the control group patients who received routine information from healthcare professionals. Although the smoking cessation rate was higher in the experimental group, the difference between the groups was not statistically significant ($p>0.05$).

Table 2. Demographic and clinical characteristics of patients (n=102)						
	Intervention group (n=51)		Control group (n=51)			
Characteristics	Mean (SD)		Mean (SD)		Test	p^a
Age (years)	58.51 (9.91)		58.84 (9.70)		t= -0.172	0.864
BMI (kg/m²)	28.36 (3.96)		27.50 (4.06)		t= 1.082	0.282
	n	%	n	%	χ²	p^b
Gender						
Female Male	11 40	21.6 78.4	9 42	17.6 82.4	0.249	0.618
Marital status						
Married Single	47 4	92.2 7.8	42 9	82.4 17.6	2.204	0.138

Table 2. Continued

Characteristics	Intervention group (n=51) Mean (SD)		Control group (n=51) Mean (SD)		Test	pᵃ
Education level						
Primary school	24	47.1	35	68.6	4.909	0.179
Secondary school	9	17.6	5	9.8		
High school	12	23.5	7	13.7		
University	6	11.8	4	7.8		
Employment status						
Employed	15	29.4	21	41.2	1.556	0.459
Unemployed/retired	36	70.6	30	58.8		
Income status						
High	7	13.7	3	5.9	2.300	0.317
Moderate	33	64.7	39	76.5		
Low	11	21.6	9	17.6		
History of AMI						
Yes	19	37.3	26	50.9		
No	32	62.7	25	49.1	1.949	0.163
Cigarette smoking status						
No	14	27.5	14	27.5	0.919	0.632
Yes	25	49	21	41.2		
Recently quit smoking	12	23.5	16	31.3		
Duration of DM (years)						
0-10	32	62.7	32	62.7		
≥11	19	37.3	19	37.3	1.000	0.581
Treatment method						
Diet	2	3.9	0	0.0		
Oral antidiabetic drug	36	70.6	37	72.5		
Insulin	6	11.8	8	15.7		
Mix	7	13.7	6	11.8	2.376	0.498
Diabetes education history						
Yes	7	13.7	8	15.7		
No	44	86.3	43	84.3	0.078	0.780

ᵃIndependent samples t-test, ᵇχ² test, p≤0.05

AMI: Acute myocardial infarction, BMI: Body mass index, DM: Diabetes mellitus, SD: Standard deviation, t: Independent-samples t-test, χ²: Chi-square test

Table 3. Comparison of T2DSMS score (n=102)

Scale	Intervention group (n=51) Mean±(SD)	Control group (n=51) Mean±(SD)	Test t	p	95% CI, Lower-Upper
T2DSMS					
Pretest	48.35±11.94	49.86±12.66	-0.620	0.537	-6.34 to 3.32
Posttest	72.49±8.06	46.84±11.80	12.816	<0.001	21.68 to 29.62
tᵃ	-16.405	6.593			
p	<0.001	<0.001			
Effect size (d)	2.369				
95% CI, Lower-Upper	-27.09 to -21.18	2.10 to 3.94			

ᵃPaired samples t-test, p<0.001

CI: Confidence interval, SD: Standard deviation, t: Independent-samples t-test, T2DSMS: Type 2 diabetes self-management scale

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DISCUSSION

This randomized controlled experimental study analyzed the effects of a diabetes education program based on Pender's health promotion model on diabetes self-management among patients with T2D who experienced AMI. The strength of our study lies in the fact that the intervention was based on a patient education model and included follow-up data. A total of 102 patients were recruited for the study. Two sessions of DSMEP were conducted, 3-4 hours apart, and the patients were followed up for 1 month. The present study found that DSMEP was an effective method for increasing the levels of diabetes self-management among patients with T2D who have experienced AMI. These findings confirmed the hypothesis.

Our findings were similar to those of other studies that primarily involved patients with diabetes and collected data through face-to-face interviews. One study examined the effect of diabetes education on self-management in patients with T2D and found that their diabetes self-management improved significantly after 3 months (26). Similarly, a study investigating the relationship between patients' participation in structured diabetes education programs and their self-management behaviors reported that those who participated in such education had higher levels of self-management (28). The study found a significant relationship between self-management behaviors and participation in a DSMEP. In a review of interventions aimed at encouraging healthy lifestyle behaviors in individuals diagnosed with T2D, it was reported that interventions including patient education led to positive improvements in blood pressure and cholesterol levels, as well as in diet and physical activity behaviors (29). The needs of individuals with diabetes are not limited to achieving adequate glycemic control; they also include increasing awareness, acquiring sufficient knowledge, developing self-care skills to prevent diabetes-related complications, and participating in diabetes self-management (30). It is essential for nurses to offer counseling services tailored to the specific learning needs of their patients (31). In a study examining the knowledge of patients with T2D regarding possible cardiovascular complications and their relationship with diabetes self-management, it was reported that patients did not have sufficient knowledge regarding CVD risk (32). In individuals with cardiovascular risk have cardiovascular risk factors, behavioral counseling aimed at motivating healthy eating and exercise may provide moderate benefits in reducing the risk of CVD (33). Improvements in healthy lifestyle behaviors of patients who have experienced MI can be observed within the first 3 months after the heart attack (34). It is especially emphasized that smoking cessation can prevent the risk of developing secondary CVD (35). Cardiovascular complications can be significantly reduced through optimal management of cardiovascular risk factors and smoking cessation in adults with diabetes (36). Patient education may improve healthy lifestyle behaviors to prevent secondary cardiovascular complications (37). Therefore, a holistic evaluation of individuals with T2D who have AMI, along with the implementation of a planned training program under nurse leadership, can make significant contributions to improving patient health.

Unlike other studies, this study was conducted within a limited time frame. Taken together, these studies demonstrate the benefits of DSMEPs in improving the disease self-management behaviors of patients with T2D, thereby preventing chronic complications of diabetes, which supports our findings. We believe that a diabetes education program based on Pender's health promotion model can be an effective intervention for improving disease self-management not only in patients with T2D but also in other patients with diabetes who have vascular complications. We were unable to find any studies on disease self-management in patients with T2D who have experienced AMI. The aim of our study was to examine the effects of a patient education program on diabetes self-management in this patient group. In conclusion, we found that planned patient education is an effective approach for improving disease self-management in patients with T2D who have experienced AMI.

Study Limitations

This study, which was designed within a randomized controlled trial framework, is the first study in our country to comprehensively investigate the effect of an education program on diabetes self-management in individuals with T2D who have experienced AMI. However, this study has several limitations. Because this study was conducted in a single center, it is recommended that the study be repeated in multiple centers. Additionally, in our study, education was provided to the patients, and patient interviews were conducted by the principal investigator. Therefore, the findings may be biased. However, one of the researchers had no prior clinical relationship with the patients included in the study, potentially reducing the risk of bias or coercion. The fact that diabetes self-management outcomes were not evaluated based on hemoglobin A1c levels is a limitation of this study. Another limitation was that the follow-up period after training was only 1 month.

CONCLUSION

In conclusion, this study revealed that the patient education program had a positive effect on diabetes self-management in patients with T2D who experienced AMI. We recommend

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conducting large-scale intervention studies in different hospitals and intensive care settings to evaluate effective teaching methods for self-management education in patients with T2D who have experienced AMI.

This study is the first to focus on increasing diabetes self-management in patients with T2D who have experienced AMI treated in a cardiology specialty hospital in Turkey, and to investigate the effectiveness of an education program. The findings may be useful for planning interventions to improve diabetes self-management behaviors in such patients. Diabetes self-management among patients with T2D who experienced AMI was significantly enhanced through the patient education program. A nurse-led educational program is considered an effective intervention that can be integrated into regular patient care for these patients. Our study results may raise awareness among intensive care nurses about the holistic evaluation of disease self-management in patients with T2D who experienced AMI. Additionally, it may encourage intensive care nurses to seek diabetes education for patients with T2D in ICUs. Further studies by other researchers could help confirm our findings.

Footnote

Ethics Committee Approval: Ethical approval was granted by the Social and Human Sciences Research Ethics Board of İstanbul University-Cerrahpaşa (decision number: 2022/476, date: 06.12.2022).

Informed Consent: We informed the patients about the aim and scope of the study and obtained their informed consent.

Authorship Contributions

Surgical and Medical Practices: Z.K., Concept: Z.K., A.E., Design: Z.K., A.E., Data Collection or Processing: Z.K., Analysis or Interpretation: Z.K., A.E., Literature Search: Z.K., A.E., Writing: Z.K., A.E.

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