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The effect of a health belief model-based education on nutritional behavior and biochemical factors of patients with myocardial infarction: A line follow-up experimental study

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Abstract

Background and Aim: Myocardial infarction is a common cause of hospitalization, and nutritional behaviors are risk factors in such patients. The present study aimed to determine the effect of education based on the health belief model on nutritional behavior and indices in patients with myocardial infarction.

Methods: The present experimental study examined patients with myocardial infarction in 2021. Seventy-two patients with myocardial infarction were randomly divided into intervention and control groups. The intervention group received educational interventions based on the health belief model in four 60-min sessions for 3 months. The constructs of the health belief model, nutritional behavior, and indices were measured using a valid questionnaire before, 1, and 3 months after the intervention. At the end, the study data was analyzed using SPSS version 22 software.

Results: There was a significant difference between the two groups in the mean scores of knowledge, perceived susceptibility, perceived severity, perceived benefits, self-efficacy, nutritional behaviors, and body mass index after the intervention ($p < 0.05$); however, no significant difference was found in the field of perceived barriers ($p > 0.05$). Biochemical factors also had a significant difference after the intervention ($p < 0.05$).

Conclusion: Educational intervention based on the health belief model is effective for myocardial infarction patients and has a significant impact on the constructs of perceived sensitivity, perceived intensity, perceived benefits, and self-efficacy as well as biochemical factors, so it can be used to improve the nutritional status of patients suffered from a myocardial infarction.

KEYWORDS

education, knowledge, myocardial infarction, nutrition

1 | INTRODUCTION

The prevalence of noncommunicable diseases, including coronary artery diseases, has increased owing to changes in human lifestyles.[1] Coronary artery diseases are classified into the category of atherosclerotic diseases and have an inflammatory nature and emerge with angina, myocardial infarction, and sudden cardiac death.[2] Coronary artery diseases have become a global health concern and a major cause of death in developed and developing countries.[2,3] In addition to high mortality, they have social, psychological, and physical consequences.[3] Coronary artery diseases are the leading causes of death in Iran accounting for approximately 40% of deaths.[4] Myocardial infarction (MI) is a common cause of hospitalization.[5] MI is damage to a part of the heart muscle that occurs due to reduced or stopped blood flow to the coronary arteries.[6] The MI mortality rate is on average 166 daily in Iran. According to available reports, 40% of men and 13% of women again experience MI and readmission in the first year after an MI.[7]

A healthy lifestyle, including a proper diet, can reduce mortality from cardiovascular diseases by up to 50%.[8] Studies indicate that approximately 90% of patients with coronary artery disease have at least one of the risk factors, such as hyperlipidemia, hypertension, high blood sugar, obesity, and inactivity.[4] A suitable diet affects risk factors for cardiovascular diseases, such as high cholesterol, body weight, and diabetes.[9] For example, reduction of cholesterol in a person suffering from a heart attack can decrease the risk of reattacks by up to 35% and prevent the disease from becoming worse.[10,11]

Patient education not only has economic justification but also is highly effective in reducing risk-related behaviors as well as increasing healthy behaviors.[12] Patient education has important benefits, such as a considerable reduction in mortality from heart diseases, improvement of quality of life, and reduction of risk-related behaviors.[13] The effectiveness of educational programs also depends on the correct use of suitable educational models.[14] The factors associated with a behavioral or health problem must be first detected to find a suitable educational model.[15]

The lack of awareness among MI patients regarding dietary regimens reflects a deficiency in perceived susceptibility within the Health Belief Model (HBM), highlighting the need for interventions to enhance patients' understanding of the link between diet and their condition.[16,17] Susceptibility to a disease can play an effective role in preventing and controlling high-risk behaviors or disease control, since these people see themselves at higher risk.[18] Having a good understanding of the severity of disease conditions, if not following a proper diet, leads to significant behavioral changes.[19] The more people have a profound knowledge and understanding of the severity of an anomaly, the easier they can overcome the existing barriers.[20] If patients with MI understand that lifestyles and nutrition changes have benefits for improving them, they will be more likely to engage in such behaviors.[1] Barriers, such as costs and the lack of public education, prevent proper nutrition methods and behaviors for MI.[20] Empowering patients with MI to control risk factors and adopt a healthy lifestyle plays a crucial role in making positive changes in their treatment process.[21] Belief in ability to adjust their diet post-MI positively impacts health behaviors and reduces hospitalizations.[11] Considering the significant impact of proper diets on MI patients, as supported by numerous studies, the HBM was chosen as the theoretical framework for this study.

This model is a widely used framework for understanding health behaviors.[22] The HBM acts as a basis for health education interventions.[23] It was developed to explain public nonparticipation in screening and prevention programs in 1950 and is used to examine patients' motivations for adopting a health-related behavior as well as evaluating health behavior interventions[24] (Figure 1).

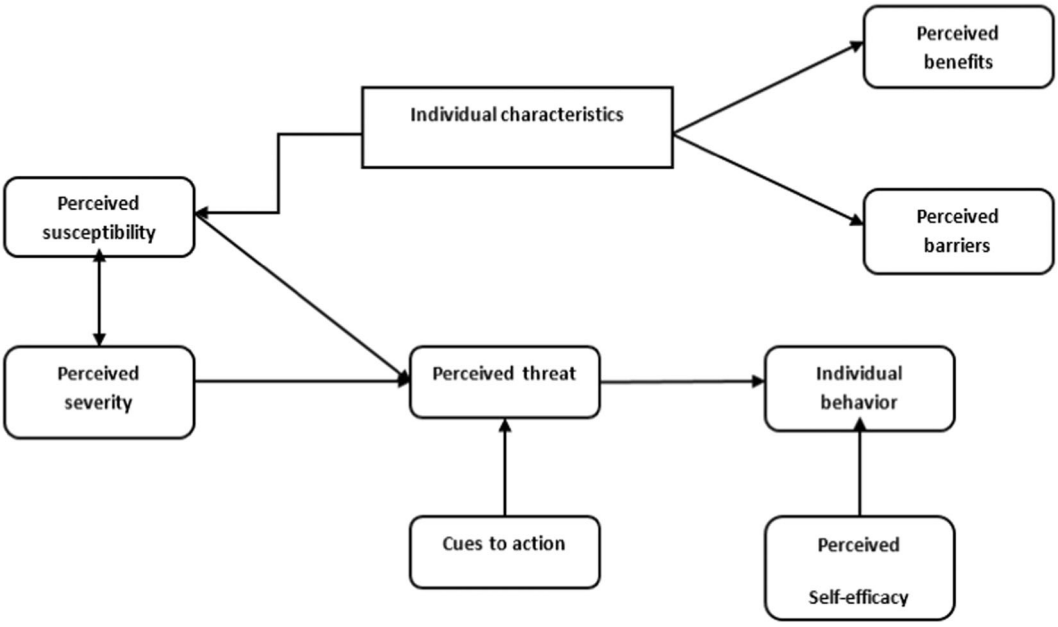

FIGURE 1 Schematic of Health Belief Model.

The utilization of the HBM for educational interventions with patients who have experienced MI is justified for several reasons. First, the HBM provides a comprehensive framework for understanding the cognitive processes and beliefs that influence health-related behaviors. Persons recovering from MI often face complex decisions regarding lifestyle changes, medication adherence, and follow-up care. The HBM allows healthcare providers to assess patients' perceptions of their susceptibility to future MI, the severity of their condition, and the perceived benefits of adopting recommended behaviors. By identifying and addressing these beliefs, healthcare professionals can tailor educational interventions to address specific concerns and motivations, thereby increasing the likelihood of behavior change and adherence to treatment plans. Second, the HBM emphasizes the role of perceived barriers to behavior change, such as financial constraints, lack of social support, or fear of side effects, which are commonly encountered by patient's post-MI. By acknowledging and addressing these barriers within the framework of the HBM, healthcare providers can develop strategies to overcome obstacles and facilitate the adoption of healthier behaviors. By integrating the principles of the HBM into educational interventions, healthcare providers can effectively empower patients to take an active role in managing their cardiac health and reducing the risk of future cardiovascular events.[1,5,16,20]

The findings of the studies under review have shown that the major problem for patients is their inability to maintain an organized diet. On the other hand, unhealthy eating behaviors are very common among patients with cardiovascular diseases. Moreover, interventional studies have demonstrated the positive impact of education on improving dietary behaviors. Furthermore, in interventions related to the components of the HBM, significant improvements in the components of the nutritional HBM among cardiac patients were observed. A significant weakness of many of these studies was their failure to report the impact of interventions on intermediary variables, namely the components of the model. Therefore, if we intend to measure the actual effect of an intervention, it is better to consider outcome variables. Thus, this study aims to address this weakness, so that in addition to examining the effect of education on the components of the model and dietary behavior, some indicators such as total cholesterol, high-density lipoprotein (HDL), low-density lipoprotein (LDL), blood sugar, and body mass index (BMI) are measured and reported for the assessment of the educational impact.

Given the importance and prevalence of coronary artery diseases as well as the prevention of recurrence of MI, its relevant consequences, the therapeutic role of nutrition as a cost-effective treatment with fewer side effects, and the significance of nutritional intervention in the tertiary prevention, the present study aimed to examine the effect of education based on the HBM on nutritional behavior and indices in patients with MI in the Rehabilitation Clinic of the Rehabilitation Research Center, the Isfahan Cardiovascular Research Institute, Isfahan, Iran.

2 | METHODS

2.1 | Study design and sampling

The present line follow-up experimental study was conducted in the Rehabilitation Clinic of the Rehabilitation Research Center of Isfahan Cardiovascular Research Institute, Isfahan, Iran. The statistical population consisted of patients with MI, who visited a rehabilitation clinic with confirmed disease by a specialist. The inclusion criteria of the study were as literacy, ability to communicate, MI, complete visual and hearing health, and the lack of a specific diet. Exclusion criteria were existence of severe disease conditions preventing the patient from participating in education, participation in educational programs similar to the present study, cancel of cooperation, lack of participation in at least one training session, and existence of an underlying disease interfering with the counseling program. The sample size was obtained equal to 32 according to the following equation, and it was estimated to be 36 per group[20] according to the probability of a 10% drop.

$$n = \frac{(Z_1 + Z_2)^2(2S^2)}{d^2},$$

where Z_1 refers to a 95% confidence interval = 1.96; Z_2, 80% test power coefficient = 0.84; S, an estimation of the standard deviation of each variable (scores of knowledge, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and self-efficacy) in the two groups; d, the minimum difference between each variable of the two groups, indicating a significant difference that was considered 0.75.

Among the MI patients, who visited the rehabilitation clinic, 72 were selected by convenience sampling and were then divided into intervention and control groups using a random number table 36 individuals per group (Figure 2). To use the random numbers table, first, the table was determined to read the numbers, and certain numbers were assumed for each group (even numbers were considered for the intervention group and odd numbers for the control group). Then, one hand was put on one number and moved in a predetermined direction, and the numbers were recorded and assigned to the intervention and control groups. Hence, 72 patients meeting the inclusion criteria were selected and divided into the intervention and control groups.

2.2 | Measurement

Data were collected using a three-part questionnaire, and the patients' laboratory indices were measured. The three-part questionnaire included demographic characteristics (age, sex, education level, job, marital status, economic status, family history of cardiac diseases, and BMI), HBM constructs questionnaire, and behavior questions. The Health Belief Model Questionnaire had two parts: first, knowledge questions, and second, questions about constructs of

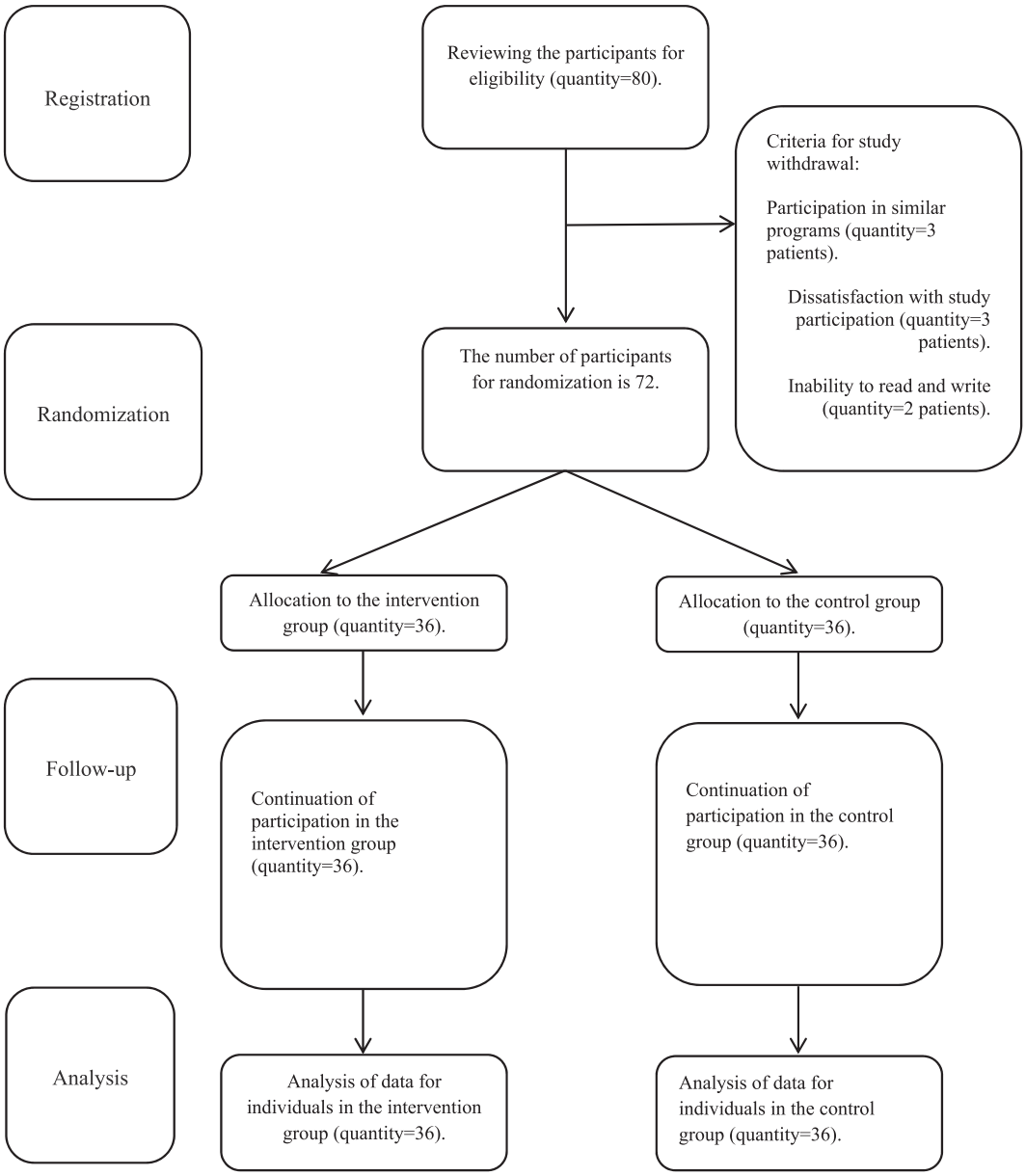

FIGURE 2 The individuals were randomly assigned to the intervention and control groups.

the HBM. The patients' knowledge (e.g., Can high blood fat cause a Myocardial Infarction?) about nutrition was evaluated with 11 questions with the answers of yes (2), no (1), and neutral (0). The second part included the constructs of the HBM, including perceived susceptibility (six questions; e.g., I might have another Myocardial Infarction), perceived severity (seven questions; e.g., Myocardial Infarction attack is very dangerous and may cause disability and shorten my life), perceived benefits (seven questions; e.g., By controlling my disease through diet, I will prevent another Myocardial Infarction), perceived barriers (nine questions; e.g., I don't follow the diet because it costs a lot for the me/family), and perceived self-efficacy (nine questions; e.g., I can implement my diet plan). The questions of the above-mentioned constructs were based on a 5-point Likert scale (strongly agree (5), agree (4), neutral (3), disagree (2), and strongly disagree (1)). The third part of the questionnaire also included nutritional behavior questions (e.g., I don't use the table salt shaker while eating), which were designed with 12 questions as yes (2), no (1), and neutral (0). The questionnaire was completed before, 1, and 3 months after the intervention. A panel of experts was used to determine the validity of the questionnaire. The validity of the questionnaire was confirmed according to the content validity index and ratio, which were 0.79 and 0.85, respectively. To determine the reliability, the questionnaire was given to 10 hospitalized patients with MI in a pilot study. The Cronbach's α coefficient of 0.91 for the questionnaire indicated the suitable reliability of the questionnaire.[20] The individuals' weights were measured with the minimum clothing using a standard Seca weight scale at an error level of 0.5 kg. A nonelastic meter fixed on the wall was used to measure the height,

while the person was barefoot and the shoulders were at a normal position. The maximum error of 0.5 cm was considered. The BMI was calculated by dividing the body weight (kg) by squared height (m^2). Blood fat and sugar were measured at 14 h of fasting by the enzyme method using the Auto Analyzer in the laboratory of the Cardiovascular Research Institute.[25]

2.3 | Intervention

Owing to the public situation during the COVID-19 pandemic, travel restrictions, and the need to maintain social distance, the educational intervention was virtually carried out on the Skyroom. The educational intervention was performed in four 1-h sessions based on the constructs of the HBM, using lecture, question and answer techniques, group discussion, and educational videos. The questionnaires of this research were also prepared online and given to the participants of both groups via Telegram and WhatsApp social networks. The description of the education sessions was as follows.

The first session was held to get acquainted with the research method, increase of knowledge about MI, different food groups, and the importance of diet using educational videos and lectures. During this session, important nutritional points were mentioned, such as modifying the type and amount of oil consumption, proper cooking method, increasing the consumption of vegetables and fruits to at least five units per day, replacing high-fat dairy with low-fat dairy, reducing salt consumption, removing salt shakers from dining tables, and not eating salty foods, replacing plain cereals with whole cereals, eating lean meats, separating the chicken skin before cooking, replacing animal protein with vegetable protein, eating fish one to two times a week, eating raw oily nuts five times a week, and not consuming sweets and fatty foods. The second session of the educational intervention was held to increase perceived severity and susceptibility. This session discussed the risks of the recurrence of MI, lack of proper diet, consequences, and complications of the disease like its impact on work, and social and familial relationships. It was also attempted to cause the MI patients to understand the seriousness of the risk of recurrence and to feel danger and identify the possibility of recurrence, its complications, and aggravation of the current status.

The third session discussed the benefits of a proper diet and the barriers, as well as ways to control them. In this session, patients were asked to write down the benefits and barriers to a proper diet. The patients were also asked to discuss their helpful dietary measures. During this session, they expressed solutions and exchanged ideas to decrease or cope with the barriers. To increase the level of self-efficacy in the fourth session, they were asked to explain their successful diet experiences to other patients. Patients, who followed dietary recommendations correctly, were also encouraged (Table 1).

The instructor was a master's student in health education and promotion, supervised by a nutrition specialist and a health education and promotion specialist, who focused on educating patients.

The control group members did not receive any education during the intervention; however, the educational content was given to them in a booklet after collecting posttest data.

2.4 | Statistical analysis

The χ^2 and Fisher's exact tests (nominal qualitative variables), Mann–Whitney test (ranked qualitative variables), and independent *t*-test (quantitative variables) were employed to compare the demographic characteristics of the two groups. The independent *t*-test was used to compare the mean scores of HBM constructs and the mean scores of nutritional behavior between the two groups. The one-way repeated measures ANOVAs was used for intragroup comparisons of mean scores at three times (before, 1, and 3 months after the intervention). The independent *t*-test was used before the intervention, and the paired *t*-test was used after the intervention to compare the mean scores and univariate analysis of covariance (ANOVA) was used to compare the mean scores of the BMI, cholesterol, HDL, LDL, and fasting blood sugar (FBS) in groups. SPSS version 22 was used to analyze data at a significance level of 0.05.

2.5 | Ethical considerations

The present study was confirmed by the Ethics Committee of Isfahan University of Medical Sciences (Confirmation code: [3400108]), and

TABLE 1 Summary of education sessions based on the constructs of the health belief model.

Education sessions	Theme	Constructs	Educational techniques
Session 1	Familiarity with the research purpose, descriptions of coronary artery diseases, myocardial infarction, and diet	Knowledge	Lectures, educational videos, and questions and answers
Session 2	Increasing perceived susceptibility and severity in myocardial infarction patients about the complications and consequences of the MI recurrence	Perceived susceptibility and severity	Lectures and educational videos
Session 3	Teaching about many benefits of following a healthy diet despite its few barriers	Perceived benefits and barriers	Lectures, group discussion, and questions and answers
Session 4	Improving patients' self-efficacy about following a proper diet	Self-efficacy	Lectures and group discussion

registered in Iran Registry Clinical Trials (IRCT) (code: IRCT20210609051528N1). After explaining objectives of study, participants completed the written consent forms and were ensured for the confidentiality of information. Furthermore, the participants were informed that they had the right to withdraw from the study at any time, and were assured of the confidentiality of the study.

3 | RESULTS

A total of 72 individuals were included in the study. Among them, 36 were in the intervention group with an age range of 31–67, and 36 were in the control group with an age range of 31–60 years. There was no significant difference between the two groups in education level ($p = 0.41$) and monthly income ($p = 0.34$). Gender frequency distribution ($p = 0.40$), family history of cardiac diseases ($p = 0.59$), and job frequency distribution were not significantly different between the two groups ($p = 0.25$). The marital status of the two groups was similar (Table 2).

The mean scores of knowledge were not significantly different between the two groups before the intervention ($p = 0.97$); however, they were significantly higher in the intervention group than in the control group 1 and 3 months after the intervention ($p < 0.001$). The mean scores of knowledge were significantly different between the three times in the intervention group ($p < 0.001$). In the control group, there was no significant difference between the three times ($p = 0.16$) (Table 3).

The mean scores of perceived susceptibility were not significantly different between the two groups before the intervention ($p = 0.88$); however, they were significantly higher in the intervention group than in the control group 1 month ($p < 0.001$) and 3 months ($p = 0.003$) after the intervention. The mean scores of perceived susceptibility in the intervention group were significantly different between the three times ($p < 0.001$). Nevertheless, there was no significant difference between the three times in the control group ($p = 0.06$) (Table 3).

The mean scores of perceived severity were not significantly different between the two groups before the intervention ($p = 0.45$); however, they were significantly higher in the intervention group than in the control group 1 and 3 months after the intervention ($p < 0.001$). The mean scores of perceived severity were significantly different between the three times in the intervention group ($p = 0.001$). Nevertheless, there was no significant difference between the three times in the control group ($p = 0.19$) (Table 3).

The mean scores of perceived benefits were not significantly different between the two groups before the intervention ($p = 0.88$); however, they were significantly higher in the intervention group than in the control group 1 month ($p < 0.001$) and 3 months ($p = 0.002$) after the intervention. The mean scores of perceived benefits were significantly different between the three times in the intervention group ($p < 0.001$). Nevertheless, there was no significant difference between the three times in the control group ($p = 0.18$) (Table 3).

TABLE 2 Comparison of demographic variables between intervention and control groups.

Variable	Intervention group	Control group	*p* Value
	Mean ± SD	Mean ± SD	
Age	50.7 ± 2.5	49.9 ± 7.7	0.88
	Number (%)	Number (%)	
Education level			
Primary school	7 (19.4)	5 (13.9)	0.41
Secondary school	7 (19.4)	9 (25)	
High school diploma	10 (27.8)	5 (13.9)	
Academic	12 (33.4)	17 (47.2)	
Income level			
Under 2 million tomans	5 (13.9)	5 (13.9)	0.34
2–52 million tomans	19 (52.8)	14 (38.9)	
5–102 million tomans	12 (33.3)	17 (47.2)	
Gender			
Female	7 (19.4)	10 (27.8)	0.40
Male	29 (80.6)	26 (72.2)	
Marital status			
Single	1 (2.8)	1 (2.8)	1
Married	35 (97.2)	35 (97.2)	
Job status			
Employee	10 (27.8)	9 (25)	0.25
Self-employed	15 (41.7)	21 (58.3)	
Housewife	6 (16.6)	5 (13.9)	
Retiree	5 (13.9)	1 (2.8)	
History of disease			
Yes	26 (72.2)	28 (77.8)	0.59
No	10 (27.8)	8 (22.2)	

The mean scores of perceived barriers were not significantly different between the two groups at any time ($p > 0.05$). The mean scores of perceived barriers were not significantly different between the three times in the intervention group ($p = 0.12$) and the control group ($p = 0.95$) (Table 3).

The mean scores of self-efficacy were not significantly different between the two groups before the intervention ($p = 0.70$); however, they were significantly higher in the intervention group than in the control group 1 and 3 months after the intervention ($p < 0.001$). The mean scores of self-efficacy were significantly different between the three times in the intervention group ($p < 0.001$). Nevertheless,

TABLE 3 Comparison of the mean scores of the health belief model constructs in the intervention and control groups before, 1, and 3 months after the intervention.

Time	Intervention group Mean ± SD	Control group Mean ± SD	*p* Value[a]
Knowledge			
Before the intervention	18.3 ± 3.38	18.3 ± 3.39	0.97
1 month after the intervention	21.3 ± 3.34	17.1 ± 4.1	<0.001
3 months after the intervention	20.8 ± 3.72	17.4 ± 4.04	<0.001
p Value[b]	<0.001		
Effect size	0.16		
Observed power	0.97		
Perceived susceptibility			
Before the intervention	21.2 ± 2.5	21.2 ± 2.3	0.88
1 month after the intervention	25.4 ± 4.5	20.4 ± 4.4	<0.001
3 months after the intervention	23.4 ± 4.8	20.4 ± 4.3	0.003
p Value[b]	<0.001	0.06	---
p Value[b]	<0.001		
Effect size	0.17		
Observed power	0.99		
Perceived severity			
Before the intervention	28.2 ± 1.9	27.2 ± 6.9	0.45
1 month after the intervention	31.5 ± 4.5	26.5 ± 1.6	<0.001
3 months after the intervention	31.5 ± 7.5	26.5 ± 2.3	<0.001
p Value[b]	0.001	0.19	---
p Value[b]	<0.001		
Effect size	0.17		
Observed power	0.99		
Perceived benefits			
Before the intervention	29.3 ± 2.2	29.3 ± 1.2	0.88
1 month after the intervention	32.5 ± 6.7	27.5 ± 6.6	<0.001
3 months after the intervention	31.5 ± 9.7	27.5 ± 5.9	0.002
p Value[b]	<0.001	0.18	---
p Value[b]	<0.001		
Effect size	0.17		
Observed power	0.98		
Perceived barriers			
Before the intervention	23.8 ± 6.9	23.5 ± 7.7	0.95
1 month after the intervention	23.6 ± 6.7	23.7 ± 9.3	0.87
3 months after the intervention	24.6 ± 6.7	23 ± 9	0.68
p Value[b]	0.12	0.95	---
p Value[b]	0.45		
Effect size	0.01		
Observed power	0.15		
Self-efficacy			
Before the intervention	33.5 ± 2.9	33.5 ± 8.6	0.70
1 month after the intervention	40.7 ± 4.3	31.8 ± 9.9	<0.001
3 months after the intervention	38.7 ± 8.2	31.8 ± 9.1	<0.001
p Value[b]	<0.001	0.18	---
p Value[b]	<0.001		
Effect size	0.25		
Observed power	0.99		
Nutritional behavior			
Before the intervention	20.3 ± 3.2	19.3 ± 7.2	0.46
1 month after the intervention	22.4 ± 9	18.4 ± 4.6	<0.001
3 months after the intervention	22.3 ± 4.9	18.4 ± 5.8	<0.001
p Value[b]	0.001	0.19	---
p Value[b]	<0.001		
Effect size	0.12		
Observed power	0.91		

[a]Independent-samples *t*-test.
[b]Repeated-measures analysis of variance.

there was no significant difference between the three times in the control group ($p = 0.18$) (Table 3).

The mean scores of nutritional behavior were not significantly different between the two groups before the intervention ($p = 0.46$); however, they were significantly higher in the intervention group

than in the control group 1 and 3 months after the intervention ($p < 0.001$). The mean scores of nutritional behavior were significantly different between the three times in the intervention group ($p = 0.001$). Nevertheless, there was no significant difference between the three times in the control group ($p = 0.19$) (Table 3).

In the intervention group, the mean level of HDL ($p = 0.006$) was significantly higher 3 months after the intervention than before the intervention, and the mean levels of LDL ($p = 0.05$), FBS ($p = 0.001$), and the mean level of Chol ($p = 0.001$) were significantly lower 3 months after the intervention than before the intervention. The mean levels of HDL, LDL, FBS, and Chol were not significantly different between the two times in the control group ($p > 0.05$). The mean increase of the HDL level ($p = 0.01$) and decrease of the LDL level ($p = 0.03$), FBS ($p = 0.002$), and Chol ($p = 0.002$) were significantly higher in the intervention group than in the control group. The mean BMI was significantly lower in the intervention group 3 months after the intervention than before the intervention ($p = 0.002$) and was higher in the control group 3 months after the intervention than before the intervention ($p = 0.004$). The mean BMI changes were significantly different between the two groups ($p < 0.001$). The mean BMI decreased in the intervention group over time but increased in the control group (Table 4).

4 | DISCUSSION

The present study aimed to investigate the effect of education based on the HBM on the nutritional behavior and indices of patients with MI on 70 patients with MI. The results indicated that the intervention and control groups were not significantly different before the intervention in the constructs of the HBM, knowledge, nutritional behavior, and indices ($p > 0.05$). The existence of significant differences between intervention and control groups in the constructs of the HBM, knowledge, nutritional behavior, and indices was a reason for the positive effect of educational intervention based on the HBM. This relationship was also indicated in one study by Maghoul et al.[20] Tavassoli et al.[21] found that individuals' knowledge increased significantly after the implementation of the education program. Increase of knowledge about MI and a suitable diet is a prerequisite and an important factor in preventing high-risk behaviors. The results of the present study demonstrated that the mean scores of perceived susceptibility were significantly different in the intervention and control groups after the intervention. In one study by Mohammadi et al.,[1] the mean score of perceived susceptibility increased after the educational intervention. The mean scores of perceived severity were significantly different between the two groups after educational intervention, and such an increase in the mean scores of perceived severity was also observed in other similar studies.[1,20,22] The increase in the mean score of perceived severity in the intervention group was probably due to the observation of complications of the disease in friends, relatives, and even the patients themselves, and probably due to participating in education sessions based on the HBM and warning of severe complications of MI. The results also indicated that the mean score of perceived benefits increased significantly after the intervention, and it was consistent with one study by Ebrahim Pourian et al.[18] The patients' attention to the fact that following a proper diet does not require hospitalization and is quite affordable contrary to high costs of treatment and hospitalization can lead to an increase in the level of perceived benefits. In this study, there was no significant difference in the mean scores of perceived barriers in the

TABLE 4 Comparison of biochemical factors and BMI in the intervention and control groups before and 3 months after the intervention.

Variable	Group	Before the intervention Mean ± SD	3 months after the intervention Mean ± SD	*p* Value[a]	Changes Mean ± SD	*p* Value[b]	*p* Value[c]	Effect size	Observed power
HDL	Intervention	43.74 ± 9.29	45.11 ± 8.58	0.006	1.37 ± 2.77	0.03	0.01	0.08	0.68
	Control	40.65 ± 7.87	40.85 ± 7.70	0.62	0.2 ± 2.33				
LDL	Intervention	78.57 ± 26.57	76.34 ± 28.51	0.051	−2.22 ± 6.5	0.58	0.03	0.06	0.58
	Control	72.42 ± 20.22	73.17 ± 19.15	0.38	0.7 ± 4.91				
FBS	Intervention	120.20 ± 34.44	115.68 ± 35.06	0.001	−4.51 ± 7.16	0.08	0.002	0.13	0.87
	Control	104.28 ± 14.32	104.57 ± 13.39	0.65	0.28 ± 3.66				
Chol	Intervention	144.31 ± 33.32	139.45 ± 35.33	0.001	−4.85 ± 7.67	0.80	0.002	0.12	0.87
	Control	141.22 ± 26.26	141.28 ± 25.25	0.95	0.05 ± 4.95				
BMI	Intervention	27.66 ± 3.97	27.45 ± 3.94	0.002	−0.21 ± 0.37	0.80	0.00	0.23	0.99
	Control	27.38 ± 3.71	27.56 ± 3.75	0.004	0.18 ± 0.34				

Abbreviations: BMI, body mass index; FBS, fasting blood sugar; HDL, high-density lipoprotein; LDL, low-density lipoprotein.

[a]Paired-samples *t*-test.

[b]Independent-samples *t*-test (after the intervention).

[c]Univariate analysis of covariance (ANOVA).

intervention and control groups after the test. The result was inconsistent with studies by Tehrani et al.[19] and Zigheymat et al.[16] and consistent with one study by Abood et al.[26] The most important barriers mentioned by patients included unaffordability in purchasing some food items and impossibility of preparing food separately from family food. Most of these barriers are unavailable to the patients, and their change is possible only by education. Self-efficacy is another HBM construct referring to individuals' belief in their ability to overcome barriers and perform desired behaviors.[27] In the present study, there was a significant difference between the mean scores of self-efficacy in the intervention and control groups after the educational intervention. In one study by Baghianimoghaddam et al.,[24] there was a significant difference in the mean scores of self-efficacy between the intervention and control groups. The significant increase in the patients' mean scores of self-efficacy in the intervention group was probably due to observing the success of others in adhering to a proper diet and benefiting from the instructor's encouragement in exchange for surviving on the right diet. A significant difference between the mean scores of nutritional behaviors in the intervention and control groups after the educational intervention indicated the positive effect of the intervention based on the HBM, being consistent with one study by Maghoul et al.[20] Eqbali Ziyarat et al.[17] also demonstrated the effectiveness of nutrition counseling in improving the nutritional behavior of patients with MI. In this study, BMI significantly decreased in the intervention group. The result was consistent with one study by Lavie et al.,[28] who indicated a decrease in BMI. Laboratory indices, namely LDL, Chol, and FBS decreased significantly, and HDL levels increased in the intervention group after the study. The result was consistent with one study by Sarrafzadegan et al.,[29] who indicated a decrease in LDL and Chol, one study by Kalka et al.,[30] who found a reduction in LDL and Chol, and an increase in HDL. The effectiveness of interventions based on the HBM in influencing levels of HDL, LDL, FBS, and Cholesterol could be attributed to their focus on altering individuals' health beliefsand perceptions. By addressing factors such as perceived susceptibility, severity, benefits of action, and barriers to change, these interventions can motivate individuals to adopt healthier behaviors, leading to improvements in their lipid and glucose profiles.

5 | CONCLUSION

The results of the present study indicated that the educational intervention based on the HBM is effective for MI patients and has a significant impact on the constructs of perceived sensitivity, perceived intensity, perceived benefits, and self-efficacy also. An educational intervention had a significant effect on increasing HDL and decreasing LDL, Chol, and FBS. The mean BMI of patients with MI also decreased significantly. Given the positive effect of education based on the HBM on the nutritional behavior and indices of patients with MI, it appears that holding training sessions at low cost can provide the necessary basis for improving the status of patients with MI and preventing the recurrence of MI and its associated complications. It is recommended that further studies be conducted by increasing the follow-up duration and more participants with different types of coronary artery problems. In addition, adopting virtual classes for patient education emerges as a crucial strategy with numerous benefits. First, virtual classes offer unparalleled accessibility. With the ubiquity of smartphones, tablets, and computers, patients can access educational resources from the comfort of their homes or while on the go. This accessibility is particularly advantageous for individuals residing in remote areas, ensuring equal opportunities to receive vital health information. Moreover, virtual classes promote flexibility in learning. Unlike traditional in-person sessions that require rigid scheduling and logistical arrangements, virtual classes can be recorded and made available for on-demand viewing. This flexibility accommodates patients' diverse schedules and preferences, empowering them to engage with educational materials at their convenience.

6 | LIMITATIONS

Like other studies during the COVID-19 pandemic, the present study also had limitations, including the impossibility of the participants' attendance in face-to-face training, holding virtual classrooms, and collecting some data using a questionnaire and self-report. Individual differences, such as personal beliefs, psychological characteristics, and interest in learning, which affected the learning process, were beyond the researcher's control. Only patients with MI were included in the present study. Future studies should not only examine participants with MI but also investigate patients with all coronary artery diseases.

AUTHOR CONTRIBUTIONS

Fatemeh Fatahian: Conceptualization; writing—original draft; validation; data curation. **Noushin Mohammadifard**: Visualization; writing—review & editing; validation. **Akbar Hassanzadeh**: Methodology; formal analysis; software. **Hossein Shahnazi**: Conceptualization; investigation; funding acquisition; writing—original draft; writing—review & editing; project administration; resources; supervision.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available in Isfahan University of Medical Sciences, Deputy of research at https://iedu.mui.ac.ir/. These data were derived from the following

resources available in the public domain: Isfahan University of Medical Sciences, https://research.mui.ac.ir/fa. The authors confirm that the data supporting the findings of this study are available within the article and its supplementary materials.

TRANSPARENCY STATEMENT

The lead author Hossein Shahnazi affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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