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Effect of Education Based on Health Belief Model on the Dietary Intake of Patients with a Myocardial Infarction

Fatemeh Fatahian[1], Hossein Shahnazi[2], Akbar Hassanzadeh[3], Noushin Mohammadifard[4]

Original Article

Abstract

INTRODUCTION: Dietary modification significantly impacts reducing myocardial infarction (MI) mortality and its recurrence. This study aimed to investigate the effect of education on the dietary intake of patients with MI based on the health belief model.

METHOD: This quasi-experimental study was conducted on patients with MI from October 2021 to January 2022. A total of 72 MI cases were randomly divided into intervention and control groups. The intervention group received an educational intervention based on the health belief model for three months in four sessions. The structures of the health belief model were measured using a questionnaire before the intervention and one and three months following it. Dietary intake was measured with a three-day dietary record before and after three months of the intervention.

RESULTS: After the educational intervention, a significant difference was observed between the two groups in terms of the average scores of awareness, perceived susceptibility, perceived severity, perceived benefits, and self-efficacy (P<0.01). However, no significant difference was observed concerning the perceived obstacles. Although there were no significant differences between dietary intake at the baseline, the intake of energy, cholesterol, and energy percent from carbohydrate, total fat, and saturated fatty acids were lower, and fiber intake was higher in the intervention group versus the control group after the intervention (all P<0.05).

CONCLUSION: Given the positive effect of the health belief model in this study, it is suggested to use this model for designing education for MI patients focusing on nutrition.

Keywords: Health belief model, Dietary intake, Nutrition, Myocardial infarction, Education

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Introduction

Cardiovascular Disease (CVD) is the leading cause of death globally and in Iran [1, 2]. The majority of CVD deaths are due to coronary artery disease (CAD) [3]. Every day, about 166 people with Myocardial Infarction (MI) die in Iran [4]. Additionally, 40% of men and 13% of women have a recurrence of stroke in the first year after an MI [5]. Lifestyle modification, especially diet, is one of the important factors that could significantly reduce the mortality rate of MI and its recurrence [6]. A number of risk factors, such as dyslipidemia, hypertension, diabetes mellitus, and obesity, are attributed to an unhealthy diet, including high saturated fatty acid intake and low consumption of fiber,

1- Student Research Committee, School of Health, Isfahan University of Medical Sciences, Isfahan, Iran
2- Department of health education and promotion, School of health, Isfahan University of Medical Sciences, Isfahan, Iran
3- Instructor, Department of Epidemiology and Biostatistics, Isfahan University of Medical Sciences, Isfahan, Iran
4- Isfahan Cardiovascular Research Center, Cardiovascular Research Institute, Isfahan University of Medical Sciences, Isfahan, Iran

Address for correspondence: Noushin mohammadifard, Isfahan Cardiovascular Research Center, Cardiovascular Research Institute, Isfahan University of Medical Sciences, Isfahan, Iran. Email: nmohammadifard@gmail.com

fruits, and vegetables [7, 8].

Patient education is a beneficial approach to improve lifestyle risk factors, including dietary behaviors [9]. The value and effectiveness of educational programs also depend on the appropriate use of various educational models and theories [10, 11]. Some studies indicated that patients with MI are unaware of the effectiveness of diet in their recovery period [12, 13]. Thus, these patients may modify their behavior after improving their awareness about the risk of MI recurrence (14, 15). Moreover, if patients consider the great benefits of changing their lifestyle, especially diet, despite its few obstacles, and believe in their ability to change their diet, they can control the modifiable risk factors [16-18].

According to the aforementioned factors influencing the healthy diet of patients with MI, the health belief model was considered as a theoretical outline for this study. The health belief model is a basis for health education interventions and is one of the most widely used models for evaluating behavior changes [19, 20]. Therefore, this study aimed to examine the effect of nutrition education on the patients with MI, based on the health belief model, at the clinic of the Cardiac Rehabilitation Research Center, Cardiovascular Research Institute in Isfahan, Iran.

Materials and Methods

Study design and participants

This study was a quasi-experimental study conducted from October 2021 to January 2022 at the clinic of the Cardiac Rehabilitation Research Center Cardiovascular Research Institute, Isfahan, Iran. The sample size was estimated according to the study of Jalili et al. [21]. In total, 72 cases with MI were randomly divided into intervention and control groups (36 subjects in each group) using a random number table. The randomization was done by placing a set of numbers in the table without any particular order. Afterwards, a random row and column were selected in the table, with their intersection point being the starting point of sampling. Subsequently, the authors moved in one of the predetermined directions (up, down, left, and right) and recorded the numbers. The even numbers were considered for the intervention group and the odd ones for the control group. Hence, 36 people were recruited in the intervention group and 36 people in the control group. The inclusion criteria were patients with MI diagnosed by a cardiologist and the patients had symptoms including chest pain, shortness of breath, sweating, vomiting, weakness and pallor, electrocardiogram changes like negative T wave, ST elevation, and abnormal Q wave, as well as a high level of creatine phosphokinase; ability to read and write; healthy vision and hearing; and not being on a special diet. The exclusion criteria included having severe and acute conditions that prevent participation in the training sessions, participating in another educational program, unwillingness to continue the study, not attending at least one educational session. This was approved by the Iranian Biomedical Ethics Committee with the ID of IR.MUI.RESEARCH.REC.1399.755 and registered in the Iranian Registry of Clinical Trials (IRCT20210609051528N1). In addition, all patients signed informed written consent to participate in the study.

Data collection

All patients completed two questionnaires. The first questionnaire focused on demographic and socioeconomic status, including age, sex, education, occupation status, and income. The second questionnaire was based on the health belief model and consisted of two parts. The first part assessed the level of heart patients' knowledge about nutrition through 11 questions with three response options: "don't know," "no," or "yes," corresponding to 0, 1, or 2, respectively. The second part included the constructs of the health belief model, namely perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and perceived self-efficacy. These constructs were presented in the form of 6, 7, 7, and 9 questions, respectively, on the Likert scale (completely agree, agree, have no opinion, disagree, and completely disagree). This questionnaire was

completed before the intervention and 1 and 3 months after that.

The questionnaire used in the aforementioned study was researcher-made, similar to the present work [21]. The expert panel method was utilized to determine the validity and reliability of the questionnaire. According to the content validity index (0.79) and the content validity ratio (0.85), the validity of the questionnaire was confirmed (21). To determine reliability, a questionnaire was administered to 10 patients with an MI who were hospitalized in a pilot study. The Cronbach's alpha coefficient of the questionnaire, with a value of 0.91, indicated its adequate reliability [21].

Dietary assessment

A 3-day food record, including 2 weekdays and 1 weekend day, was used to assess dietary intake. Patients recorded all their consumed foods within the specified 3 days. The method of completing the questionnaire was initially presented in writing. This questionnaire was completed before and 3 months after the educational intervention. After completing the questionnaire, all the nutritional information was entered into the "Iranian Food Consumption Program" (IFCP) software [22]. A translated Iranian food consumption table was used in the software [23]. Trained nutrition experts completed and reviewed the questionnaires and entered the nutritional information into the software. The feed units received were based on the weights of the measuring cup and the baking coefficient provided by Ghafarpour et al. [24]. Primarily, all patients were taught how to complete the questionnaires. In addition, a written guide was provided for completing all questionnaires.

Educational intervention

The educational intervention was conducted during four 1-hour sessions based on the constructs of the health belief model, using techniques such as lectures, questions and answers, group discussions, along with educational clips and slides. The health belief model is a psychological model that predicts individuals' health-related behavior. This model is used for individual and group training, aiming to prevent diseases and their complications (Figure 1) [15]. Due to the COVID-19 pandemic, travel restrictions, and the need to maintain social distances, the educational intervention was conducted online using the Skyroom platform.

The authors had four educational sessions. The first session aimed to teach how to conduct a study, increase awareness about MIs and different food groups, and the importance of following a diet using educational clips and lectures. The educational tips in this session included modification of the type and amount of oil consumed, cooking methods and not using fried food, increasing vegetables and fruit consumption to at least five servings per day, the use of low-fat dairy products instead of high-fat ones, limiting the use of salt, not using salt at the table and salty foods, consumption of whole grains instead of refined grains, consumption of lean meats, removing chicken skin before cooking, replacing animal protein with vegetable protein, consumption of fish once or twice a week, consumption of raw nuts five times a week, and not consuming sweets or fatty foods. The second session of the educational intervention was held to increase perceived severity and susceptibility. The topics discussed in this meeting included the risks of recurrent MIs, unhealthy diet and its consequences, and the complications associated with recurrent MIs, such as its impact on quality of life, work, social relationships, family relationships, and death. The third session aimed to introduce the benefits of a healthy diet and the obstacles ahead of it, as well as ways to overcome these obstacles. The MI patients explained the benefits and obstacles of a healthy diet to the others. They were also asked to talk about the things they have done to follow a healthy diet. The patients provided solutions, and discussed and exchanged opinions for reducing or dealing with the existing obstacles. In the fourth session, to increase the level of self-efficacy of the participants, they were asked to explain their successful experiences following a diet to the others. Those who followed

dietary recommendations correctly were appreciated and encouraged. During the study, the participants were contacted via phone. The control group did not participate in the training sessions. Due to compliance with the ethical standards of the study, the post-test data of the educational information was also given to the members of the control group after the educational intervention.

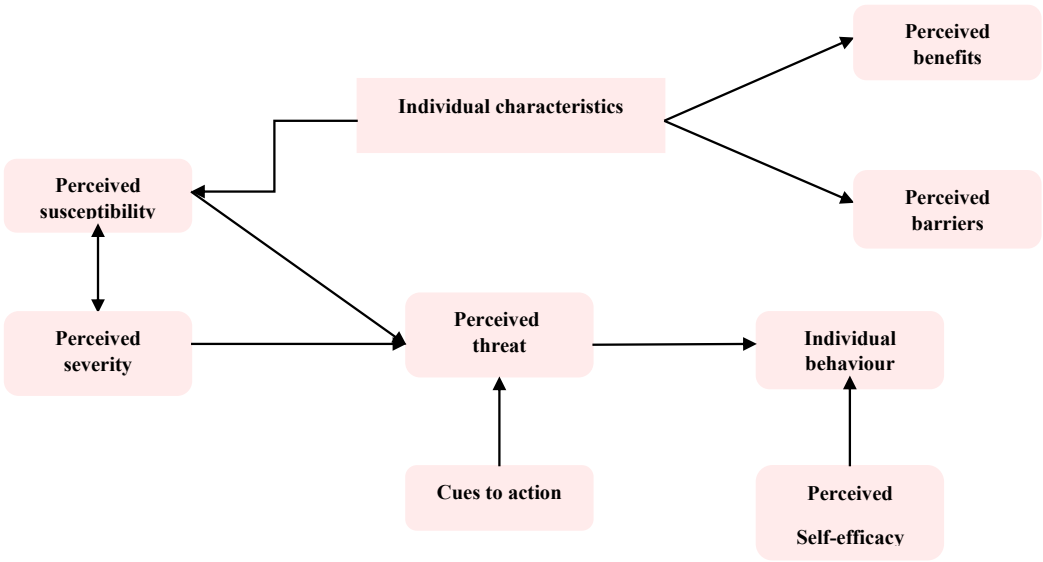

Figure 1. Schematic of Health Belief Model

Statistical analysis

All statistical analyses were carried out using SPSS software (Version 22, IBM Corporation, Armonk, NY, USA). Continuous variables were presented as mean and standard deviation (SD), while categorical variables were presented as number and percentage. To compare the demographic characteristics between the two groups, chi-square or Fisher exact tests (for nominal qualitative variables), Mann-Whitney (for ranked qualitative variables), and independent t-tests (for quantitative variables) were used. To compare the average scores of the health belief model constructs between the two groups before or after the intervention, the independent t-test was used. In addition, a paired t-test was applied to compare the dietary intake in each group before and after the three-month intervention. A p-value of less than or equal to 0.05 was considered statistically significant. The Repeated Measures Analysis of Variance (RM-ANOVA) was used to evaluate the intervention effect over time. Mauchly's sphericity test was used for testing sphericity, and the Greenhouse-Geisser correction was used in the case of lack of sphericity. A p-value of less than 0.05 was considered significant.

Results

A total of 72 patients with MI were included in the study (36 in the intervention group and 36 in the control group). During the study, two people were excluded, one in the intervention group due to unwillingness to cooperate in the study and one in the control group due to death. The age of the patients ranged between 31 and 67 years in the intervention group and 31 and 60 years in the control group.

As shown in Table 1, there was no significant difference between the mean age, the frequency of gender, education, income, occupation, and family history of CAD between the two groups. Prior to the intervention, there was no significant difference between the two groups in the mean score of awareness, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and self-efficacy.

Table 1. Basic characteristics of the intervention and control groups

Characteristics	Intervention group	Control group	P-value
Age (mean±SD)	50.7±2.5	49.9±7.7	0.88[1]
Education level n (%)			
Primary school	7 (19.4)	5 (13.9)	0.41[1]
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			
< 100 US$	5 (13.9)	5 (13.9)	0.34[2]
100-250 US$	19 (52.8)	14 (38.9)	
>250 US$	12 (33.3)	17 (47.2)	
Male gender n (%)	29 (80.6)	26 (72.2)	0.40[1]
Occupation status n (%)			
Employee	10 (27.8)	9 (25)	0.25[3]
Self-employed	15 (41.7)	21 (58.3)	
Housewife	6 (16.6)	5 (13.9)	
Retired	5 (13.9)	1 (2.8)	
Family history of coronary artery disease	26 (72.2)	28 (77.8)	0.59[3]

Data are presented as mean±standard deviation (SD) or number and percentage
1 P-value calculated using independent samples t-test
2 P-value calculated using Mann-Whitney U test
3 P-value calculated using chi-square test

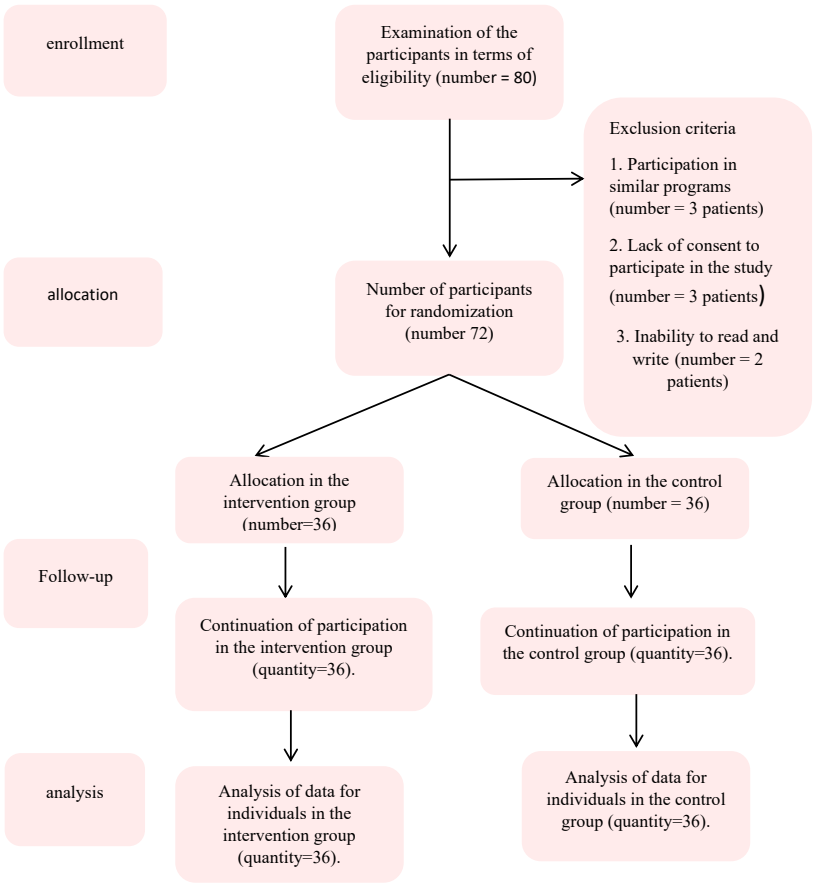

Figure 2. Flow diagram of patient selection

In the intervention group, a significant increasing trend was observed in the mean of awareness (P<0.001), perceived susceptibility (P<0.001), perceived severity (P<0.001), perceived benefits (P=0.002), and self-efficacy (P<0.001). Also, between before and after the intervention in the two groups, a statistically significant difference was observed in the constructs of awareness (P<0.001), perceived sensitivity (P<0.001), perceived severity (P<0.001), perceived self-efficacy (P<0.001), and perceived benefits (P<0.001). However, these factors had no significant differences during three measurements in the control group. There was no significant difference in the average score of perceived barriers before the intervention, and 1 and 3 months following the educational intervention in both groups. Furthermore, there were significant trend effects as the interaction of time and the group were statistically significant for awareness, perceived susceptibility, perceived severity, perceived benefits, and self-efficacy (P<0.001), and there were significant main effects for self-efficacy (P<0.05). According to the Bonferroni multiple comparison test, the mean at baseline for self-efficacy was significantly lower than immediately after the intervention (Table 2).

Table 2. Comparison of the scores of the health awareness and belief model constructs before and after one and three months of intervention based on group

	Time	Intervention group Mean±SD	Control group Mean±SD	P-value
Awareness	**Before**	18.3±5.4	18.3±4.4	0.97[1]
	After 1 month	21.3±4.3	17.1±4	<0.001[1]
	After 3 months	20.3±9.7	17.4±1	<0.001[1]
	P-value	<0.001[2]		0.200[3]
Perceived susceptibility	**Before**	21.2±5.5	21.2±4.3	0.88[1]
	After 1 month	25.4±4.5	20.4±2.4	<0.001[1]
	After 3 months	23.4±4.8	20.4±1.3	0.003[1]
	P-value	<0.001[2]		0.027[3]
Perceived severity	**Before**	28.2±1.9	27.2±6.9	0.45[1]
	After 1 month	31.5±4.5	26.5±1.6	<0.001[1]
	After 3 months	31.5±7.5	26.5±2.3	<0.001[1]
	P-value	<0.001[2]		0.110[3]
Perceived benefits	**Before**	29.3±2.2	29.3±1.2	0.88[1]
	After 1 month	32.5±6.7	27.5±6.6	<0.001[1]
	After 3 months	31.5±9.7	27.5±5.9	0.002[1]
	P-value	<0.001[2]		0.262[3]
Perceived barriers	**Before**	23.8±6.9	23.5±7.7	0.95[1]
	After 1 month	23.6±6.7	23.7±9.3	0.87[1]
	After 3 months	21.6±6.7	23±9	0.68[1]
	P-value	0.452[2]		0.346[3]
Self-efficacy	**Before**	33.5±2.9	33.5±8.6	0.70[1]
	After 1 month	40.7±4.3[4]	31.8±9.9	<0.001[1]
	After 3 months	38.7±8.2	31.8±9.1	<0.001[1]
	P-value	<0.001[2]		<0.05[3]

Data are presented as mean±standard deviation (SD)
1 P-value of between-group comparisons calculated using independent samples t-test
2 P-value for interaction effect (Time & group) obtained from repeated measures analysis of variance
3 P-value for main effect (group) obtained from repeated measures analysis of variance
4 The results of Bonferroni multiple comparison test

Table 3 in the study illustrates the comparison of dietary intakes of the participants before and after three months of the intervention in two groups. The dietary intakes had no significant differences between the two groups before the intervention. The findings indicated that the mean energy (P=0.001), and cholesterol (P=0.001) intake and energy percent from carbohydrate (P=0.037), protein (P=0.045), Saturated Fatty Acids (SFA) (P=0.000), and TFA (P=0.037) were significantly reduced and fiber was increased after three months of intervention in the intervention group. However, there were no significant changes in the energy percent from total fat, Polyunsaturated Fatty Acids (PUFA) and Monounsaturated Fatty Acids (MUFA) in the intervention group. Also, there were no significant changes in the dietary intakes in the control group after three months. The mean intake of energy (P=0.005) and cholesterol (P=0.001) and percent of energy intake from total fat (P=0.029), carbohydrate (P=0.004) and SFA (P=<0.001) were significantly lower and fiber intake was higher in the intervention vs. control group. Meanwhile, there were no significant differences in energy percent from protein, MUFA, PUFA, and TFA between the two groups after the intervention.

Table 3. Comparison of dietary intakes of the participants before and after three months of the intervention based on group

	Time	Intervention group Mean±SD	Control group Mean±SD	P-value[1]
Energy (kcal/day)	Before	2077.13±687.82	2078.72±441.13	0.991
	After 3 months	1833.09±582.62	2224.37±536.02	0.005
	P-value[2]	0.001	0.088	---
Carbohydrate (% of energy intake)	Before	54.56±6.13	53.37±6.17	0.422
	After 3 month	51.56±5.8	56.6±6.8	0.004
	P-value	0.037	0.090	---
Total fat (% of energy intake)	Before	33.91±3.8	33.14±4.7	0.442
	After 3 month	32.45±5.5	35.20±4.8	0.029
	P-value	0.128	0.094	---
Protein (% of energy intake)	Before	18.13±3.45	17.92±2.50	0.772
	After 3 month	16.92±2.32	16.98±2.95	0.934
	P-value	0.045	0.079	---
Fiber (gr/ day)	Before	19.53±7.17	17.25±5.35	0.13
	After 3 months	27.67±8.00	20.17±5.35	0.001
	P-value	0.001	0.32	------
Cholesterol (mg/ day)	Before	302.97±126.20	307.33±128.42	0.88
	After 3 months	207.64±79.83	384.77±153.22	0.001
	P-value	0.001	0.07	------
Saturate fatty acid (% of energy intake)	Before	10.48±2.35	11.23±2.51	0.496
	After 3 month	8.29±1.45	12.69±4.47	< 0.001
	P-value	<0.001	0.061	---
Monounsaturate fatty acid (% of energy intake)	Before	10.29±2.05	10.33±2.00	0.928
	After 3 month	11.10±2.1	11.47±2.87	0.548
	P-value	.077	.091	---
Polyunsaturate fatty acid (% of energy intake)	Before	7.71±2.01	7.09±1.57	0.147
	After 3 month	6.77±2.96	7.20±2.44	0.120
	P-value	0.093	0.147	---
Trans fatty acid (% of energy intake)	Before	0.88	0.95	0.563
	After 3 month	0.69	0.87	0.338
	P-value	0.037	0.100	---

Data are presented as mean±standard deviation

1 P-value for between group analys paired from t-test

2 P-value for within group analysis obtained from paired t-test

Discussion

The study was conducted to investigate the effect of education on the dietary intake of patients with MI based on the health belief model. The results showed a significant improvement in the intervention vs. control group in the constructs of the health belief model, awareness, and dietary intake after the intervention. This indicates the beneficial effect of the health belief model in cardiac rehabilitation patients. These results are in line with those reported by Jalili et al. [21]. Tavassoli et al. reported that the awareness of the participants in the study increased after the educational intervention [17]. Consistent with previous studies, in the current study, there was a significant difference in the average score of perceived susceptibility between the groups after the intervention [21, 25]. The potential reason for the improvement in the susceptibility score in the intervention group might be due to the effectiveness of the educational intervention based on the health belief model on patients' belief that an unhealthy diet could lead to a recurrent MI. In agreement with our findings, several studies reported an increase in the average score of perceived severity after the educational intervention in the intervention vs. control groups [18, 21, 25].

The increase in the score of perceived severity in the intervention group might be due to attending group sessions and discussing other patients' and their relatives' experiences about the complications of recurrent MI. Similar to our findings, perceived benefits were improved in the study of Ebrahimpourian et al. [14]. This might be due to patients' belief in the lower cost of following a healthy diet compared to the cost of hospitalization for MI recurrence. Similarly, the study by Abood et al. found no significant changes in the perceived obstacles after the intervention [18]. However, Dadkhah Tehrani and Dhiqaimet reported an improvement in the perceived obstacles after the educational intervention [12,15]. Financial problems to prepare some healthy foods and the inability to prepare different food for patients in the family were the most important reasons mentioned by the patients regarding the perceived obstacles in our study. Another construct of the health belief model is perceived self-efficacy, meaning a person's belief in his/her ability to overcome obstacles and pursue the desired behavior [26]. In this study, a significant difference was observed in the score of self-efficacy after the educational intervention between the two groups. The study by Baghiani Moghadam et al. also confirmed our results [27]. The significant increase in the average score of self-efficacy in the intervention group could be due to the observation of the successful experiences of other patients following a healthy diet and the encouragement of the trainer for implementing this diet.

The intervention program could improve dietary behaviors between the two groups except for the percent of energy intake from protein, MUFA, PUFA, and TFA intake which was in agreement with several studies [28-30]. Furthermore, Sasanfar et al.'s study had similar results regarding no significant changes in MUFA and TFA after the interventional program [29]. It seems that reducing the intake of total fat caused no improvement after the intervention. Thus, it is suggested that the focus on modifying the oil type is more important than reducing total fat consumption. This study had some limitations. The first limitation was holding online training sessions instead of face-to-face ones, which increases the possibility of bias in the self-report questionnaire. Individual differences, including personal beliefs, psychological characteristics, and interests, which affect learning, were beyond the responsibility of the researcher and were other limitations.

Conclusion

In the present study, the educational intervention based on the health belief model was able to improve dietary behaviors, including the intake of energy, fiber, cholesterol, and the percentage of energy intake from carbohydrates, total fat, and SFA. However, it had no significant effect on the intake of protein, MUFA, PUFA, and TFA. Given the positive effect of education

on the dietary intake of patients with a MI based on the health belief model, it can be concluded that conducting low-cost training sessions can be effective in the recovery of MI patients and prevention of MI recurrence. It is also recommended to conduct further research with a larger number of participants and various types of CVD.

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