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Original Article

The Effect of Phase I Cardiac Rehabilitation Training on Self-Efficacy in Patients After Coronary Artery Bypass Graft Surgery Based on Body Mass Index: A Clinical Trial Study

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Abstract

Background: Body Mass Index (BMI) is an influential factor in conducting cardiac rehabilitation programs for patients following coronary artery bypass graft (CABG) surgery. This study aimed to investigate the effect of Phase I cardiac rehabilitation training on the self-efficacy of CABG patients based on their BMI.

Methods: This clinical trial was conducted on 60 patients who had undergone CABG surgery, selected through convenience sampling. The recruited individuals were randomly allocated into two groups of 30: an intervention group and a control group. Generally, Phase I of the cardiac rehabilitation program, encompassing both theoretical and practical components, was delivered 72 hours after CABG surgery. Data were collected using the Cardiac Self-Efficacy Scale completed by patients in both groups at three time points: pre-intervention, at discharge, and one month after discharge.

Results: The mean age of the participants in the intervention group was 61.6 years, and that of the patients in the control group was 57.9 years. The overall mean self-efficacy score for the patients in the intervention group showed a significant difference compared to pre-intervention only in individuals with normal weight and overweight status at discharge ($P<0.05$) and one month after the intervention ($P<0.05$). Although the overall mean self-efficacy score in obese individuals in the intervention group showed a noticeable difference compared to the control group at discharge and one month after the intervention, this difference was not statistically significant.

Conclusion: The impact of BMI on the effectiveness of cardiac rehabilitation programs varies among patients following CABG surgery. Patients with normal weight and those who are overweight experience a greater increase in the mean scores across various dimensions of cardiac self-efficacy compared to obese individuals. The implementation of cardiac rehabilitation programs appears to be less effective in obese patients.

Keywords: Cardiac rehabilitation, Body mass index, Self-efficacy, Education

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Introduction

Cardiovascular diseases (CVDs), particularly those necessitating surgical interventions like coronary artery bypass graft (CABG) surgery, impose a significant burden on affected individuals and healthcare systems globally (1). Coronary artery disease (CAD) is a major and prevalent cause of mortality across all age groups (2, 3), with CABG surgery being one of its primary treatment modalities (4). CABG surgery demonstrably improves symptoms in over 90% of patients undergoing the procedure and is often preferred over other surgical interventions (5). Recent decades have shown a concerning increase in the burden of CVDs (6), with annual CVD-related deaths projected to exceed 22.2 million by 2030 (7). Statistics indicate a relatively high prevalence of CVDs in Iran (8), alongside substantial associated direct and indirect costs (9).

Body Mass Index (BMI) is one of the most widely used criteria for diagnosing overweight and obesity in adults. Obesity is a known cardiovascular risk factor, and obese patients undergoing CABG surgery face a higher incidence

of complications and reduced survival (10). While obesity is frequently cited as a risk factor for postoperative cardiac surgery complications, this remains a subject of debate (11). Obesity commonly affects patients with coronary artery disease (12). There is increasing evidence that obesity and overweight prevalence are rising worldwide, including in Iran (13), with obesity nearing pandemic status (14). In obese individuals, CVDs are the leading cause of disability and death (15).

In the CABG postoperative phase, the specialized intervention of a rehabilitation nurse during Phase I cardiac rehabilitation is a crucial measure, based on individual assessment and tailored to the patient's health status (16). Phase I cardiac rehabilitation is conducted in the hospital and continues until discharge. Cardiac rehabilitation is a program that integrates various physical, psychological, or educational interventions, aiming to reduce complications and mortality (17). The postoperative period can be challenging, often accompanied by physical and psychological symptoms such as anxiety and depression, immobility issues, respiratory complications, insufficient sleep, and fatigue (18). Phase I cardiac rehabilitation intervention involves the implementation and education of respiratory rehabilitation techniques, including emphasis on exercises of thoracic expansion, active cycle of respiratory techniques, assisted cough, and huffing (19). Studies on Phase I cardiac rehabilitation are limited, and findings regarding the effects of early rehabilitation after cardiac surgery are inconsistent (16).

An increase in self-efficacy in patients plays a fundamental role in improving their condition and reducing complications after cardiac surgery (20). Self-efficacy refers to an individual's belief in their capacity to succeed in specific situations or execute tasks (21). Enhanced self-efficacy empowers patients to take responsibility for their well-being. Furthermore, higher levels of self-efficacy are associated with improved physical and mental function, adherence to treatment, and greater engagement in self-care practices (22).

As stated, studies on the effectiveness of early rehabilitation after cardiac surgery are limited. Moreover, there is scarce information about the effectiveness of cardiac rehabilitation programs in cardiac patients based on their obesity status (23). Accordingly, the present study sought to investigate the effect of Phase I cardiac rehabilitation training on the self-efficacy of patients undergoing coronary artery bypass graft (CABG) surgery, based on their Body Mass Index (BMI).

Methods

This randomized clinical trial study was conducted at Farshchian Heart Hospital in Hamadan, Iran, in 2016. The research population comprised all patients who had undergone Coronary Artery Bypass Graft (CABG) surgery and were admitted to the intensive care unit (ICU) for 72 hours after the surgery. The sample size for each group was determined to be 26 patients, considering a Type I error rate of 0.05 and a statistical power of 90%. However, to prevent bias due to attrition during the study, 30 patients were recruited for each group. In this study, the cardiac rehabilitation program was considered the independent variable, and self-efficacy was the dependent variable.

The inclusion criteria for selecting the participants were: age between 30 and 75 years, full awareness of time and place, ability to comprehend and speak Persian, at least basic literacy (reading and writing), no history of prior heart surgery, absence of motor impairment, an ejection fraction greater than 30%, and adequate cardiac output. The exclusion criteria were uncontrolled arrhythmias, severe and persistent chest pain, and non-cooperation of the patient in data collection. In this study, obesity status was categorized based on Body Mass Index (BMI). BMI below 18.5 kg/m^2 was classified as underweight, between 18.5 and 24 kg/m^2 as normal weight, between 25 and 29 kg/m^2 as overweight, and over 30 kg/m^2 as obese. None of the participants had a BMI below 18.5 kg/m^2. Convenience sampling was used for participant recruitment. The selected patients were then randomly assigned to either the intervention group or the control group. Written informed consent was obtained from all patients, and they were assured of the confidentiality of their information.

The data collection instrument consisted of two sections. The first section recorded the demographic and clinical variables such as age, gender, height, weight, BMI, place of residence, occupation, supplementary insurance, marital status, education level, history of hospitalization, medical history, smoking history, on-pump/off-pump surgery, number of grafts, ejection fraction, and food/drug sensitivities. The second section was the Cardiac Self-Efficacy Scale, comprising 32 items distributed across three dimensions: general self-efficacy (items 1-10), exercise self-efficacy (items 11-20), and feeling of self-efficacy (items 21-32). Items 1 to 20 were scored out of 100 points, and items 21 to 32 were scored out of 60 points. For general and exercise self-efficacy, the participants responded on a 5-point Likert scale ranging from "Always" (5) to "Never" (1). For the feeling of self-efficacy, the participants responded on a 5-point scale from "Strongly Disagree" (1) to "Strongly Agree" (5). The validity of the instrument was established by assessing its content and face validity. Initially, the items in the scale were reviewed by two faculty members from the School of Nursing and Midwifery and three cardiac surgeons who were faculty members of the Medical School. Their corrective feedback was then incorporated into the instrument. This scale was adapted from an instrument developed by Sanaie et al, and its reliability

was confirmed with a Cronbach's alpha coefficient of 0.76 and a correlation coefficient of 0.74 (24).

The items in the scale were completed by the participants at three time points: pre-intervention, at discharge, and one month after discharge. Phase I cardiac rehabilitation programs were conducted for the patients in the intervention group in three 30-minute sessions, tailored to the patients' needs. This program commenced 72 hours after the surgery and continued until discharge.

The sessions involved both theoretical education and physical exercises. The researcher provided theoretical instruction and demonstrated physical movements to the patients, who then performed the Phase I rehabilitation movements and exercises step-by-step. The first session focused on educating patients about modifying reversible risk factors for coronary artery disease (CAD), medication and dietary regimens, chest pain control, pulse-taking methods, counting pulse, and body warm-up/cool-down. The patients then performed physical movements including deep breathing, active limb movements while supine, exercises in a semi-seated position in bed, exercises while seated beside the bed, repetition of previous exercises while seated in a chair, shoulder and arm rotations, walking, and knee flexion. Each stage was performed at least twice daily for 10 to 15 minutes per session. An educational booklet was also provided to the patients during the first session to prepare them for subsequent sessions. The second session was held the day after the first session, where patients were asked to perform exercises in a standing position (e.g., trunk rotation and shoulder and arm rotations), unassisted walking, knee bending and straightening, full body rotation, and repetition of previous movements. The third session took place the day after the second session and before discharge. The second and third sessions were conducted as group sessions in the patients' rooms. After discharge, the patients were followed up twice weekly via telephone to monitor their status. The patients in the control group received routine care and treatment. Following the completion of the study, the members of the control group also received the educational booklet.

Data analysis was performed using SPSS-16 software. Wilcoxon signed-rank test was employed to compare the dimensions of self-efficacy across the three time points in the intervention and control groups. Descriptive statistics, including mean, standard deviation, and frequency distribution, were used to summarize the collected data.

Results

A total of 80 patients who completed informed consent forms to assess their eligibility were screened. Of these, 20 patients were deemed ineligible based on the criteria and were excluded from the study. Consequently, the data from 60 patients in both groups were used in the final analysis (Figure 1).

The mean age of the patients in the intervention group was 61.6 ± 11.7 years, and that of the patients in the control group was 57.9 ± 13.1 years. The distribution of male and female patients was equal in both groups: 53.3% in both groups were male, and 46.7% in both groups were female. The results of Fisher's exact test and the chi-square test showed no significant difference between the two groups ($P > 0.05$) (Table 1).

The data from the Wilcoxon test revealed that the overall mean self-efficacy score significantly increased only in the normal weight and overweight subgroups of the intervention group after the implementation of cardiac rehabilitation training. This significant increase was observed both at discharge ($P < 0.05$) and one month after the intervention ($P < 0.05$). Although the overall mean self-efficacy score in the obese subgroup of the intervention group showed a notable difference compared to the control group at discharge and one month after the intervention, these differences were not statistically significant ($P = 0.056$ and $P = 0.059$). In the control group, no significant difference was observed in the mean self-efficacy scores across any subscales at the evaluated time points. The only exception was in the "feeling of self-efficacy" subscale within the obese subgroup of the intervention group, where cardiac rehabilitation training was effective, demonstrating a significant difference between the mean score obtained one month after the intervention and the pre-intervention score ($P = 0.037$) (Table 2).

Discussion

The findings from the present study indicated that Phase I cardiac rehabilitation, comprising both theoretical and practical sessions, significantly enhanced self-efficacy in daily activities for patients following Coronary Artery Bypass Graft (CABG) surgery. At both discharge and one month after the intervention, self-efficacy scores across all dimensions showed a significant difference between the normal weight and overweight subgroups in the intervention group compared to the control group. This finding suggests that the implementation of educational and cardiac rehabilitation programs was more effective in individuals with normal weight and those who were overweight. Conversely, these programs were less effective in obese individuals, with a significant impact observed only in the "feeling of self-efficacy" dimension.

The data in this study also revealed that the overall mean self-efficacy score was higher in the intervention group compared to the control group, demonstrating a significant difference. Similarly, Varaei et al (25) and Ghlichi Moghaddam et al (22) showed that implementing Phase I cardiac rehabilitation not only increased the mean self-efficacy score but also led to a significant increase in discharge rates within the intervention group compared to the control group. Furthermore, Mohebbi et al (26)

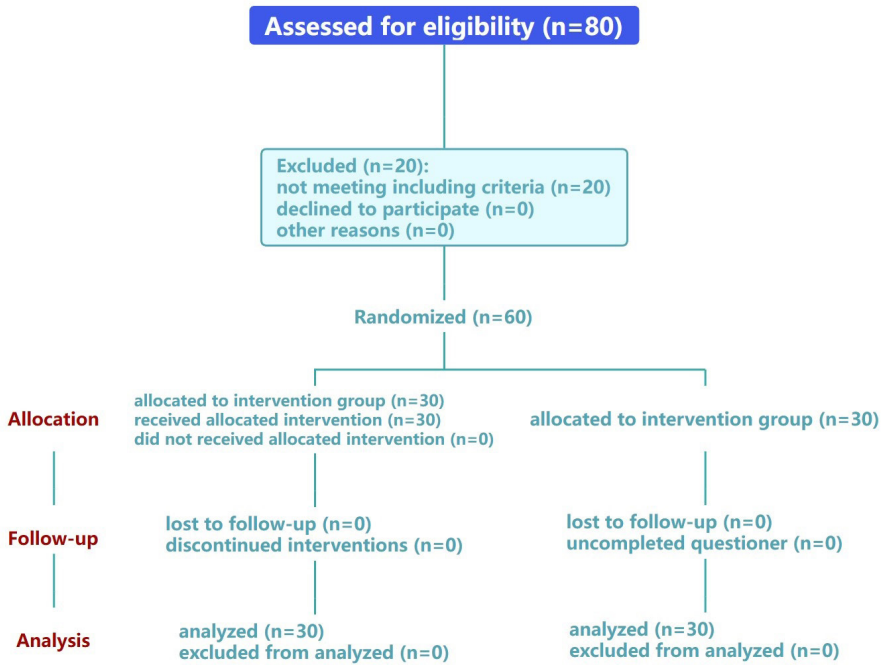

Figure 1. Consort flow diagram

demonstrated that cardiac rehabilitation educational programs, utilizing both multimedia and face-to-face methods, are effective in improving self-efficacy indicators in patients undergoing coronary artery bypass surgery. A high self-efficacy score in CABG patients is a valuable asset that can lead to better treatment outcomes, faster recovery, and improved quality of life (27, 28).

The implementation of Phase I cardiac rehabilitation in this study led to an increase in general self-efficacy in normal-weight and overweight individuals within the intervention group at discharge and one month after the intervention. Likewise, Eghbali et al (29) indicated that educational programs enhance general self-efficacy in post-cardiac surgery patients. General self-efficacy plays a crucial role in the recovery and quality of life for patients after cardiac surgery. Evidence suggests that patients with high general self-efficacy experience better recovery one week after cardiac surgery and report a higher quality of life six months later compared to those with low general self-efficacy (30). Normal-weight and overweight individuals may enter rehabilitation with higher baseline confidence, which could facilitate faster skill acquisition. Conversely, obese patients typically have lower baseline aerobic capacity and likely require more time to acquire the necessary skills compared to normal-weight and overweight individuals. Thus, general self-efficacy is a significant predictor of recovery in cardiac surgery patients, and healthcare providers should pay greater attention to patients' general self-efficacy as part of the rehabilitation process.

In this study, the feeling of self-efficacy and exercise self-efficacy in the intervention group showed a significant difference following Phase I cardiac rehabilitation compared to the control group. This finding is similar to results from other studies (22, 31, 32) that indicated rehabilitation programs lead to a significant increase in the feeling of self-efficacy, exercise capacity, and heart rate in the intervention group. Increased exercise capacity improves the ability to perform daily tasks and reduces fatigue, which can enhance patients' feeling of self-efficacy.

The data in this study indicated that the implementation of educational and cardiac rehabilitation programs was not highly effective in obese individuals. Accordingly, other studies (33, 34) demonstrated that obese women experience less effectiveness from cardiac rehabilitation programs compared to non-obese individuals, and the increase in functional capacity in the obese group is less than in non-obese patients. Contrary to these findings, one study (23) suggested that obesity does not affect the effectiveness of cardiac rehabilitation programs. However, the mentioned study did not use a cardiac self-efficacy questionnaire to assess the impact of these programs and only examined functional capacity in women. These points could explain the differing findings. Lower self-efficacy scores in obese individuals may increase the risks associated with obesity that occur after cardiac surgery. Studies have shown that inflammatory processes and cardiovascular complications are more common in obese individuals, and they may have worse short-term

Table 1. The clinical and demographic characteristics of the patients in the two groups

Variable	Categories	Intervention Group (N = 30)	Control Group (N = 30)	*P* value*
Age (Mean ± SD)		61.6 ± 11.7	57.9 ± 13.1	0.262
Gender	Male	16 (53.3)	16 (53.3)	1.000
	Female	14 (46.7)	14 (46.7)	
Occupation	Employed	17 (56.7)	14 (46.7)	0.606
	Unemployed/homemaker	13 (43.3)	16 (53.3)	
Marital status	Single	2 (6.7)	4 (13.3)	0.671
	Married	28 (93.3)	26 (86.7)	
Education level	Primary	19 (63.3)	16 (53.3)	0.284
	Below diploma	5 (16.7)	8 (26.7)	
	Diploma	2 (6.7)	5 (16.7)	
	University	4 (13.3)	1 (3.3)	
Number of grafts	Two grafts	3 (10.0)	4 (13.3)	0.688
	Three grafts	27 (90.0)	26 (86.7)	
Cardiac surgery type	On-pump	23 (76.7)	20 (66.6)	0.280
	Off-pump	7 (23.3)	10 (33.4)	
Ejection fraction	30–39	4 (13.3)	2 (6.7)	0.855
	40–49	18 (60.0)	19 (63.3)	
	≥ 50	8 (26.7)	9 (30.0)	
Medical history	Hypertension	6 (20.0)	10 (33.3)	0.343
	Hyperlipidemia	4 (13.3)	5 (16.7)	0.500
	Diabetes	5 (16.7)	1 (3.3)	0.195
	Cardiovascular disease	9 (30.0)	11 (36.7)	0.584

*Chi-square test

Table 2. Comparison of self-efficacy subscales in the patients pre-intervention, at discharge, and one month after discharge based on BMI

Variable	Group	Body Mass Index	Pre-Intervention (Mean ± SD)	At Discharge (Mean ± SD)	One Month Post-Intervention (Mean ± SD)	*P* value*	*P* value**
General Self-Efficacy	Intervention	Normal	34.0 ± 1.7	40.5 ± 4.4	41.8 ± 4.5	0.011*	0.003*
		Overweight	39.4 ± 3.7	41.6 ± 3.5	42.9 ± 4.6	0.029*	0.023*
		Obese	35.2 ± 5.2	42.8 ± 4.3	41.5 ± 7.3	0.053	0.063
	Control	Normal	35.2 ± 3.7	35.9 ± 4.1	37.8 ± 3.9	0.677	0.229
		Overweight	37.3 ± 4.5	37.0 ± 6.2	36.2 ± 7.2	0.315	0.969
		Obese	33.3 ± 5.1	34.2 ± 5.3	33.8 ± 6.6	0.465	0.783
Exercise Self-Efficacy	Intervention	Normal	26.4 ± 8.6	38.4 ± 6.2	42.8 ± 7.9	0.008*	0.005*
		Overweight	29.7 ± 4.1	41.8 ± 4.3	46.3 ± 3.8	0.001*	0.001*
		Obese	28.0 ± 10.6	40.2 ± 5.9	43.5 ± 9.7	0.056	0.053
	Control	Normal	33.4 ± 9.6	33.0 ± 9.4	33.7 ± 7.4	0.720	0.909
		Overweight	30.8 ± 11.9	31.1 ± 11.2	31.6 ± 9.6	0.919	0.837
		Obese	29.7 ± 5.1	28.0 ± 4.3	26.3 ± 5.2	0.465	0.249
Feeling of Self-Efficacy	Intervention	Normal	42.8 ± 7.9	48.0 ± 7.2	49.9 ± 7.4	0.008*	0.005*
		Overweight	37.7 ± 5.7	48.8 ± 4.1	51.2 ± 4.6	0.001*	0.001*
		Obese	39.2 ± 6.3	45.5 ± 7.3	50.3 ± 5.4	0.053	0.037*
	Control	Normal	45.0 ± 8.3	41.6 ± 7.5	41.4 ± 8.1	0.137	0.046*
		Overweight	45.5 ± 6.0	44.2 ± 4.3	46.9 ± 7.2	0.408	0.444
		Obese	40.67 ± 6.2	44.2 ± 5.2	42.8 ± 2.7	0.144	0.400
Total Self-Efficacy Score	Intervention	Normal	103.2 ± 20.4	128.9 ± 12.3	134.5 ± 17.9	0.005*	0.003*
		Overweight	106.8 ± 8.4	135.6 ± 6.7	140.5 ± 9.1	0.001*	0.001*
		Obese	102.3 ± 13.9	131.3 ± 11.9	135.0 ± 19.2	0.056	0.059
	Control	Normal	113.6 ± 18.5	110.1 ± 14.5	112.9 ± 13.1	0.202	0.503
		Overweight	113.7 ± 14.7	112.7 ± 13.8	114.7 ± 13.9	0.689	0.813
		Obese	106.8 ± 8.4	105.8 ± 10.9	103.0 ± 10.7	0.340	0.600

*Wilcoxon test for pre-intervention and discharge time points.

outcomes compared to non-obese patients (10, 35). Therefore, when implementing educational programs, their effectiveness in obese individuals must be carefully assessed.

Conclusion

Existing evidence suggests that Phase I cardiac rehabilitation programs can effectively improve self-efficacy in patients following coronary artery bypass graft surgery. However, the impact of BMI on the effectiveness of these programs varies, with normal-weight and overweight patients experiencing a greater increase in mean scores across various dimensions of cardiac self-efficacy compared to obese individuals. Given the significance of cardiac rehabilitation programs and their lower effectiveness in obese patients, a re-evaluation of cardiac rehabilitation programs is necessary to enhance their efficacy for obese individuals, requiring further investigation and attention.

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Authors' Contribution

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Competing Interests

The authors declare that they have no affiliations with or financial interests related to the subject matter or materials discussed in thisresearch.

Ethical Approval

This study used data from a clinical trial registered in the Iranian Clinical Trials Registry (IRCT2016013126294N1) and approved by the Ethics Committee of Hamadan University of Medical Sciences (IR.UMSHA.REC.1394.430).

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