Effectiveness of Healthy Heart Intervention among Bangladeshi with Coronary Artery Bypass Graft: A Randomized Controlled Trial

Jahura Khatun, Usavadee Asdornwised, Orapan Thosinga, Natkamol Chansatitporn, Kriangkrai Tantiwongkosri*

Abstract: Coronary artery bypass grafting is considered to be a more effective surgical procedure for the long-term benefits of people with obstructed coronary artery than other types of treatment. Yet, this measure does not provide an equally successful outcome for all people due to associated psychological and physical impediments. There is a lack of support programs in Bangladesh for people with coronary artery bypass grafting, and for this reason this randomized control trialled investigated the effectiveness of a healthy heart intervention program on the functional status and cardiac risk parameters among these people. A total of 160 participants with coronary artery disease were admitted to a specialized cardiac hospital in Dhaka for bypass grafting and they were randomly assigned to the experimental (n=80) and control group (n=80). The experimental group participated in the healthy heart intervention program in the hospital for 4 weeks in addition to routine care and also received follow-up phone calls at home after hospital discharge, while the control group received only routine hospital care. The data collection tools included demographic data and the health history questionnaire, the Bengali version of SF-36, and the cardiac risk assessment form. The outcomes of the program were measured at baseline, and at 12 and 16 weeks. Data analysis was performed using descriptive statistics, t-test, chi-square, and two-way repeated measures ANOVA.

At baseline, there were no statistically significant differences between the groups in terms of demographic characteristics, health history, functional status, or risk parameters. The mean score for functional status was significantly higher, and the risk parameters for blood pressure and blood glucose were significantly lower in the experimental group than the scores in the control group at twelve and sixteen weeks. The healthy heart intervention program was seen to be useful for improving the functional status and reducing the risk parameters of individuals that have undergone coronary artery bypass grafts. The findings provide evidence for reforming the healthcare of the target population and for further research in order to validate the results before implementation in practice.

Pacific Rim Int J Nurs Res 2021; 25(1) 7-22

Keywords: Coronary artery bypass graft, Functional status, Healthy heart intervention, Randomized controlled trial, Risk parameters

Received 30 December 2019; Revised 24 April 2020; Accepted 24 June 2020

Jahura Khatun, *PhD (Candidate), Faculty of Nursing, Mahidol University, Thailand, and Lecturer, Nursing College, Sher-E-Bangla Nagar, Dhaka, Bangladesh. E-mail: jahura15@gmail.com*

Correspondence to: Usavadee Asdornwised, *RN, PhD, Associate Professor, Surgical Nursing Department, Faculty of Nursing, Mahidol University, Thailand. E-mail: usavadee.asd@mahidol.ac.th*

Orapan Thosinga, *RN, PhD., Associate Professor, Surgical Nursing Department, Faculty of Nursing, Mahidol University, Thailand. E-mail: orapan.tho@mahidol.ac.th*

Natkamol Chansatitporn, *PhD, Assistant Professor, Department of Biostatistics, Faculty of Public Health, Mahidol University, Thailand. E-mail: nutkamol.cha@mahidol.ac.th*

Kriangkrai Tantiwongkosri, *MD, Assistant Professor, Department of Surgery, Faculty Medicine, Siriraj Hospital, Mahidol University, Thailand. E-mail: kae814@yahoo.com*

Introduction

Coronary artery bypass grafting (CABG) is a commonly recommended and established treatment for people with obstructive coronary artery disease (CAD) that have poorly controlled angina pain following

standard medical management.[1,2] The long-term benefits of CABG are superior to medical therapy even in people with advanced CAD in terms of restoring their impaired myocardial blood supply.[3] Still, the procedure of CABG is frequently associated with several acute and chronic complications, such as anxiety, depression, stroke, myocardial infarction, transient neurocognitive impairment, anemia, and infection.[3,4,5] These associated conditions can adversely affect the overall prognosis of patients in their return to normal life. The result of CABG is not always successful in terms of the desired outcomes for all patients, including improving their functional status or the quality of their life.[3,6]

Studies on CABG have reported that the preparation for bypass grafting is a traumatic event for patients that can trigger emotional and physiological responses. Additionally, the development of post-traumatic stress after CABG may lead to increased cardiovascular morbidity and mortality.[5,7] Studies have also reported that people with CABG frequently deal with fatigue, tiredness, pain, reduced functional capacity, and increased risk for further cardiac attack.[5,6,8] These symptoms pose a threat to the successful outcome of CABG and the likelihood of resuming to "normal" life for patients.[6,7] Additionally, considering the patient's need to obtain a full and prompt physical recovery after surgery, allowing a swift return to normal daily life, and adapting to a changing lifestyle, cardiac rehabilitation (CR) is highly recommended for people with early CABG.[4,5] Therefore, health education-based intervention programs are vital for addressing the above-stated conditions.

In Bangladesh, alongside routine hospital care, only some informal education or health suggestions are provided by the physician or nurses for patients, and programs such as exercise-based cardiac rehabilitation or any education-based program for people with cardiac diseases, including CABG, have not been formally adopted.[2,11] In addition, globally, positive outcomes of education and exercise-based programs for various cardiac disease conditions, including CABG, have been well documented.[9,10] The benefits of such intervention are overlooked among healthcare professionals in Bangladesh because of the lack of intervention uses in this field. In response to this gap, the present study adopted an education and practice-based multi-dimensional approach called the Healthy Heart Intervention (HHI) program, consisting of exercise, education, demonstration and re-demonstration, counseling, a booklet guide, and follow-up intervention. The HHI program was implemented both in the hospital and for home-based remedy and its effectiveness in improving the functional status (FS) and reducing the cardiac risk parameters (RPs) of people with CABG in Bangladesh was examined.

The components of the HHI program were developed based on successful exercise-based cardiac rehabilitation,[12] standard guidelines,[13] and an extensive review of related literature.[14] Bandura's theory of self-efficacy was integrated with the implementation of the program as a guiding framework along with strategies to motivate the participants to change their behaviors and self-care practices in the program. The program was found to be suitable for individuals as well as for group sessions through education and counseling on healthy diet, medication management, smoking cessation, stress management, and practice-based demonstrations on physical exercise. Finally, it was expected that this study could improve awareness about and understanding of the outcomes of HHI programs among nurses and others involved in healthcare. Nurses could then integrate these programs along with their routine hospital-based care to maximize patients' functional status and to minimize the cardiac risk parameters in people following CABG surgery.

Literature Review and Theoretical Framework

The literature demonstrates that CABG has now been well recognized as a surgical procedure for treating people with CAD. However, post-CABG

adjustment is commonly associated with various physical, psychological, and social impacts.[4, 5, 6] Studies have found that a significant number of people need to overcome multiple residual problems following CABG, both in the short term (such as cardiac arrest, anxiety, depression, psychological trauma, and fear of dying)[5,6] as well as in the long term (e.g. returning to work, quality of life, stroke, MI, re-hospitalization, and psychological adjustment).[8, 15] Accordingly, CABG is not successful for all patients in improving their quality of life.[3,6]

The literature reviews also revealed that not all CR programs are effective with certain groups of people due to a lack of comprehensiveness and/or the design of the program, for example in a single method program (such as an exercise program only).[16] Considering the result of earlier studies, in the present study, the HHI was developed as a multi-method comprehensive and supervised program, including exercise, education, demonstrations, counseling, a hand booklet, and post-discharge follow-ups. The components of the HHI were integrated based on an extensive review of related literature, successful CR programs and guidelines, and experts' opinions and content validation.

Moreover, regarding the multi-method components of the developed HHI program, this study used self-efficacy theory as a guiding method and as a strategy to motivate the participants to change their behaviors and to engage in the self-care practices of the program. Several earlier studies also indicated that Bandura's self-efficacy theory was a suitable model for several cardiac education or exercise-based rehabilitation programs because it provides a systematic direction that allows one to interpret, modify, change or predict expected behaviors.[17,18]

According to this theory, people with self-efficacy demonstrate confidence and are likely to make efforts to address challenges and to persist longer in those efforts guided by four primary sources of information.[18] First is performance accomplishment, looking for opportunities to identify training successes in order to raise the level of self-efficacy, executed by providing information on CAD and CABG conditions and then overcoming the barriers to performing the behaviors (e.g., demonstrations, exercises, and activities, encouraging healthy behaviors). Second are vicarious experience-sharing successful experiences related to improving functional status and reducing cardiac risk (e.g., sharing of experience by real models [people with CABG], showing pictures illustrating the benefits of healthy behaviors, using the healthy heart booklet in support of consultation and discussion, and periodical review of the log records of daily activities with a focus on healthy behaviors). Third is verbal persuasion by providing verbal explanations to encourage, motivate, and underscore the benefits of healthy behaviors (e.g., exercise, a healthy and modified diet, medication adherence, smoking cessation, and relaxation). Last is the physiological state by demonstrating and practicing deep breathing relaxation, techniques for controlling and managing stress, encouragement to practice warm-ups, and cool-down exercises.

Finally, this study investigated the effectiveness of a developed package of HHI on the functional status and cardiac risk parameters among people with CABG that could offer an evidence-based contribution to nursing and medical care for people with CABG in Bangladesh. In the HHI program, physical activity and exercise, dietary modification, medication adherence, cessation of smoking, and stress management were integrated as comprehensive components, and the self-efficacy theory was used as a guiding method to motivate the participants to continue their behaviors and the self-care practices suggested in the program.

Hypothesis

After finishing the HHI program, the participants in the experimental group will have significantly higher mean scores on functional status and lower mean scores on cardiac risk parameters than those at the beginning of the program, and those of the control group at twelve and sixteen weeks after intervention received.

Methods

Design: A randomized controlled trial with a two-group study design was employed, where the samples were randomly assigned to either the experimental group, who participated in the HHI program and received routine hospital care, or to the control group receiving routine hospital care only.

Setting and Sample: The study setting was a large government cardiac hospital in Dhaka, Bangladesh. The study sample involved people with CAD that had undergone CABG surgery and that met the following inclusion criteria: being male or female; aged 40-70 years; classified with low to moderate risk assessed by the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) stratification algorithm for risk of an event with a left ventricular ejection fraction ratio above 40-50%; no complex dysrhythmias at rest or during walking or exercise;[19] no clinical depression; no hearing impairment; and having the ability to read Bengali. On the other hand, the exclusion criteria were: having any complication that could influence daily activity or exercise performance; uncontrolled hypertension (systolic BP [SBP] above 180 and/or diastolic BP [DBP] above 110 mm Hg); uncontrolled diabetes (fasting blood glucose above 300mg%/ 16.7mmol/L); a chronic disease affecting the lungs, liver or kidneys; and being bedridden.

The estimated sample size was calculated using G*Power analysis, with a power of .80, a significance level of (α) .05, and an estimated effect size of .18 based on a previous study.[20] The required sample size was 82 per group. Considering potential drop-outs, the researchers determined a possible attrition rate of 10%. The sampling and randomization of the participants are shown in Figure 1 below.

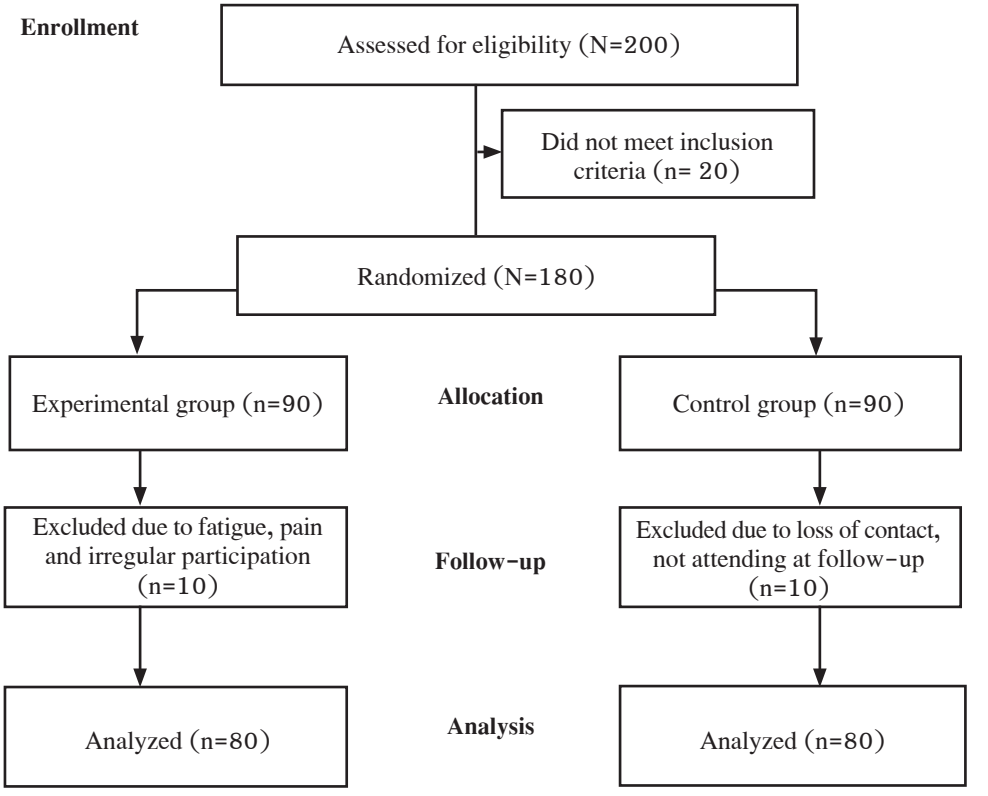

Figure 1: Flow chart of participant recruitment and participation

Ethical Considerations: Approval of this study was obtained from the Institutional Review Board of the Faculty of Nursing, Mahidol University (COA NO. IRB-NS 2016/332.2803), before data collection. All of the participants meeting the inclusion criteria were informed about the study details regarding the research objectives, processes, and preservation of confidentiality and anonymity. Informed consent and agreement were obtained from all of the participants with the permission of hospital authorities and unit heads. Participants' rights were protected throughout the study and they also had the right to withdraw from the study at any time without repercussion.

Research Instruments: The data collection instruments consisted of two parts: part 1-the demographic data form and the health history questionnaire; part 2 - the Short-form Health Survey-36 (SF-36) for assessing functional status, and a cardiac risk parameter assessment form (RPs) for assessing the risk parameters.

Part 1: The demographic data form was developed to obtain information on the participants' age, gender, educational level, marital status, family income, occupation, and past-present smoking history. The *health history questionnaire* was based on a review of the literature in order to collect data on the participants' relevant medical and surgical history, family history of heart disease, and relevant clinical characteristics, such as the ejection fraction category, the number of arteries blocked, the number of blocked arteries that had been grafted, and the medication record. Both the demographic and health history data were collected from the medical records.

Part 2: SF-36 and cardiac risk parameters assessment (RPs): The SF-36 is a standardized self-report measure most commonly used to assess health-related quality of life regarding many disease conditions, including cardiac disease.[21] This 36-item survey tool measures eight dimensions of health-related outcomes: physical function, physical role limitations, emotional role limitations, energy/fatigue, emotional well-being, social functions, pain, and global health.[22] In order to arrive a score, the scales are standardized with a scoring algorithm or by using scoring software to obtain a score ranging from 0 to 100.[22,23] Higher scores indicate better health status and lower scores indicate poorer health status. This scale has been translated into more than 40 languages.[24] In this study, the Bengali version of the SF-36 questionnaire was used to assess the functional status of the participants. An earlier study used the Bengali version, and yielded an overall internal consistency for Cronbach's alpha of 0.9 and Spearman's rho for all domains ($r > 0.82$).[25] The Bengali version of the SF-36 was forward-backward translated according to the IQOLA procedures of Feroz et al.[25] and has been culturally adapted for people with rheumatoid arthritis by experts in order to check for local comprehensibility.[23] The original English version of the SF-36 proved to have a high level of reliability in many earlier studies.[20, 23, 25]

In the present study, Cronbach's alpha for the overall reliability level was found to be 0.92 and was used as the self-reported format for health and well-being status from the perspective of people with CABG during standard (four weeks) and acute (one week) recall periods. The instruments and the contents of the HHI program were reviewed and validated by a panel of five content experts including a cardiac surgeon, a cardiac nurse specialist, a physiotherapist, and a nurse researcher.

The cardiac risk parameter assessment form was used to obtain the biological risk parameter assessment of the participants. These included: body weight, blood pressure (BP), and blood glucose levels (fasting and random). The participants' body weight was assessed using a digital weight scale and they were instructed to wear light clothing, remove their shoes, and to urinate. For measuring the arterial BP, the participants stayed in a sitting position and held onto their right arm using the auscultator method. The same weight measuring scale and blood pressure machine were used at three points of the data collection. For testing the blood

glucose levels the participants were instructed to take nothing orally except medication with a little amount of water for 12 hours before the test. Blood glucose testing was carried out in the blood biochemistry laboratory of the two specialized government hospitals. The blood samples were taken at 9 am for fasting and after taking food, the random blood glucose (RBG) was measured at 11 am.

The HHI Program: This program was developed by the primary investigator (PI) based on an extensive review of cardiac rehabilitation and a secondary prevention program from a range of countries, including the USA, UK, Australia, Canada, Iran, and the Kingdom of Saudi Arabia. Bandura's self-efficacy theory was used as a guiding framework for implementing the program. The content validity of the program was reviewed by 5 experts and was pilot-tested for understanding and for program practicality with ten people with CABG who met the inclusion criteria but did not participate in the main study.

The HHI program aimed to improve the functional status and to reduce the cardiac risk factors of people with CABG. The components of the program consisted of a manual, a booklet, and activity log charts. The program package included providing knowledge-based education on CAD and CABG; counseling on dietary management, medication management, smoking cessation, and stress management; and a demonstration of physical exercises and daily activities. Both individual and group HHI sessions and follow-up activities were integrated as blended activities in order to support the people with CABG before and after surgery. A reference educational booklet was provided to support the experiment group in on-going self-management. Twenty-four HHI program sessions were implemented in two phases as described below:

Phase 1: The *hospital-based HHI* was introduced from day three of admission and continued to day 18 involving both pre- and post-operative periods. The usual length of each session ranged from 30-40 minutes and was conducted either in a group (8-10 participants) or individually using information sharing, verbal persuasion, showing pictures, providing demonstrations, and offering feedback (**Table 1**).

Phase 2: The *home-based* follow-up and counseling HHI program began 1 week after the patients' hospital discharge and continued for 4 weeks (2 days/week) via phone calls for 5-10 minutes. This phase aimed to remind and reinforce the participants about recommended behaviors, to offer psychological support, and to motivate them regarding behavioral change activities. The PI made casual phone calls to the participants or their families about any concerns, questions, or suggestions that they had (**Table 1**).

Table 1: Schedule, contents, and activities of the HHI program

Phases	Time Schedule	Module and Contents	Strategies	Teaching Method
Phase 1: Hospital-based HHI				
	Week-1	**Education and Counseling**	Performance	1) Instruction
	(4 sessions)/week	Introduction on HHI program	accomplishment	2) Group discussion
	30-40 min/day	Basic information on CAD, CABG		3) Practicing
		Warning signs after CABG	Verbal persuasion	4) Demonstrations
		A healthy and modified diet with benefits		5) Picture showing
		Exercise and Physical Activities		
		Relaxation exercise	Physiological state	
		Warm-up & cooling down		
		Diaphragmatic breathing exercise		
		Review of record daily activity log		

Table 1: Schedule, contents, and activities of the HHI program (Cont.)

Phases	Time Schedule	Module and Contents	Strategies	Teaching Method
	Week-2	**Case presentation and Counseling**	Vicarious experience	1) Sharing experiences
	(4 sessions)/ week	Sharing successful experiences		of people with CABG
	30-40 min/day	Medication review and drug checking	Verbal persuasion	2) Group discussion
		Smoking cessation tips and benefits		3) Practicing
		Benefits of healthy behaviors	Physiological state	4) Demonstrations
		Exercise and physical activities		5) Picture showing
		Relaxation exercise		
		Warm-up and cooling down		
		Arm and leg exercises		
		Breathing exercise		
	Week-3	**Education and Counseling**	Performance	1) Discussion
	(4 sessions)/ week	Expectations after CABG	accomplishment	2) Practicing
	30-40 min/day	Barrier management following CABG		3) Re-demonstrations
		Recovering quickly and completely	Verbal persuasion	4) Feedback
		Sexual intercourse		
		Exercise and Physical Activities		
		Tolerance exercise		
		Short walks with staff assistance	Physiological state	
		Sit in a chair as tolerated		
		Self-care practice		
	Week-4	**Education and Counseling**		1) Post-test feedback
	(4 sessions)/ week	Self-monitoring of HHI booklet	Performance	2) Discussions
	30-40 min/day	Healthy eating and heart-healthy diet	accomplishment	3) Self-care practice
		Drug management		4) Review of logbook
		Exercise and Physical Activities	Verbal persuasion	activities
		Maintenance exercise		
		Stairs training with assistance	Physiological state	
		Wash clothing independently		
		Dressed independently		
Phase 2: Home-based HHI				
	Week-5 and 6	**Counseling**		1) Reinforcement
	(2 sessions)/ week	Suggestions for symptom management	Performance	of recommended
	5-10 min	Remind about stress control and exercise	accomplishment	behaviors
		Heart-healthy diet suggestions		2) Psychological support
		Medication management		3) Motivation for
		Exercise and walking performance		behavioral change
		Ask about any symptoms	Verbal persuasion	activities
		Family support to overcome barriers		
		Remained for causal exercise and activities		
		Remind about medical check-up		

Table 1: Schedule, contents, and activities of the HHI program (Cont.)

Phases	Time Schedule	Module and Contents	Strategies	Teaching Method
	Week-7 & 8 (2 sessions)/ week 5-10 min	**Counseling** Review of recovery progress CABG recommended activity log Follow daily routine Medical check-up if needed Monitor the progress of activities Ask about any symptoms during the home period Daily activities, exercise Feedback to achieve short-term goals Use of record diary Remind about medical check-ups	Performance accomplishment Verbal persuasion	1) Reinforcement of recommended behaviors 2) Psychological support 3) Motivation for behavioral change activities

Routine Hospital Care: This refers to the care provided to people with CABG during hospitalization by doctors, nurses, and other support staff. It includes completing the necessary routine investigation, obtaining consent for operations and routine post-operative daily follow-ups by doctors, and verbal suggestions to patients during discharge by nurses. Finally, participants are discharged with advice on diet, drugs, restricted activities/behaviors, medication, and further routine medical check-ups.

Data Collection: This began after receiving permission from the director of the hospital, the unit's head, and the charge nurses of the units. The HHI intervention program was implemented by the PI and data were collected by two trained research assistants. One research assistant assessed functional status using the SF-36 questionnaire, while another was responsible for collecting data on the selected risk parameters by examining body weight, measuring BP, and documenting the blood glucose (fasting and random) results from laboratory findings. However, at this point, the data collectors were unfamiliar or "blind" about which participants belonged to which group.

The demographic and health history data were collected on admission for both the experimental and control group as baseline data (Time 1, T1). Health history included the ejection fraction (EF) category, the number of coronary arteries blocked, the number of arterial grafts, and risk parameters, including blood pressure and glucose level. The health history was comprised of the medical record data and the interview data. The effect of the HHI program was evaluated by collecting data on functional status (FS) and cardiac risk parameters (RPs). Data collection took place three times; T1 (as baseline data) was conducted during week 1 after recruitment and the group assignment; T2 was conducted at week 12 and T3 was conducted at week 16.

Data Analysis: Data analysis was performed using the statistical software SPSS statistics (IBM SPSS Statistics V20.0.0) for testing the assumptions, study variables, and HHI outcomes. Descriptive statistics were used to analyze demographic data, health history, and clinical characteristics by using frequency, mean, and standard deviation. The independent t-test and chi-square statistics were used to examine the differences between the two groups at T1, T2, and T3. Repeated measures ANOVA was used to analyze the effect of HHI across time points and on different groups.

Results

Demographic characteristics of the study participants

At baseline, the demographic characteristics of the study participants did not show any significant

differences between the experimental and the control groups (p >.05) (**Table 2**). With regard to the participants' health history, the individuals in the experimental group had a history of hypertension at 41.2% and diabetes at 28.7%, while in the control group these figures were at 43.8% and 26.3%, respectively. At baseline, there was no significant difference in the history of hypertension, diabetes, or the percentage of the ejection fraction and the number of bypass grafts by the doctor planned between the two groups (p >.05) **(Table 2).**

Table 2. Demographic characteristics and health history of the study participants.

Characteristics		Experimental Group (n=80)	Control Group (n=80)	p-value
Age (year), (Mean± SD)		54.37±7.7	54.93±7.0	.84[a]
Gender, n (%)	Male	73(91.3)	75(93.8)	.76[b]
	Female	7(8.7)	5(6.2)	
Marital status, n (%)	Married	74(92.5)	75(93.8)	.99[b]
	Single	6(7.5)	5(6.2)	
Education, n (%)	Primary	32(40.0)	41(51.2)	.56[b]
	Secondary	26(32.5)	21(26.3)	
	Higher secondary and above	22(27.5)	18(22.5)	
Occupation, n (%)	Service	19(23.7)	13(16.3)	.84[b]
	Businessmen	32(40.0)	33(41.3)	
	Others	29(36.3)	35(42.4)	
Smoking history, n (%)	Smoker	62(77.5)	57(71.2)	.46[b]
	Non-smoker	18(22.5)	23(28.8)	
Health history, n (%)	Hospitalization for cardiac diseases	14(17.5)	17(21.3)	.54[b]
	Ejection fraction %			.75[b]
	40-49%	37(46.3)	35(43.8)	
	50-70 %	43(53.7)	45(56.2)	
	Planned bypass grafting			.51[b]
	2 grafts	53(66)	49(61)	
	3 grafts	27(34)	31(39)	
	Hypertension	33(41.2)	35(43.8)	.56[b]
	Diabetes	23(28.8)	21(26.3)	.72[b]

Note: a = Independent t-test; b = Chi-Square test

Effects of HHI program

The results from the independent t-test showed that the average score on functional status (FS) and the scores for all cardiac risk parameters were not significantly different between the groups at baseline (p >.05). At Weeks 12 and 16, however, the mean FS scores were significantly higher and the RPs scores were significantly lower for the experimental group than those for the control group (p <.05) **(Table 3).**

Table 3. Comparison of outcome variables between the groups.

Data	Mean (SD)		t-test	p-value
	Experimental Group	Control Group		
Functional status (FS)				
Baseline	31.74(5.16)	31.50(4.71)	-.31	.755
Week 12	55.95(7.08)	44.76(7.65)	-9.55	<.001
Week 16	69.42(4.62)	56.39(5.49)	-16.23	<.001

Table 3. Comparison of outcome variables between the groups. (Cont.)

Data	Mean (SD)		t-test	p-value
	Experimental Group	Control Group		
Risk parameters (RPs)				
SBP				
Baseline	124.94(12.96)	126.12(12.80)	.583	.561
Week 12	121.94(11.18)	125.63(12.20)	1.99	.048
Week 16	119.19(9.82)	124.50(11.73)	3.10	.002
DBP				
Baseline	83.38(9.02)	84.25(9.55)	.596	.552
Week 12	81.63(8.33)	84.63(9.67)	2.10	.037
Week 16	79.75(7.37)	84.25(9.28)	3.39	.001
FBG				
Baseline	121.93(11.89)	122.00(13.67)	.031	.977
Week 12	117.12(12.31)	121.50(12.78)	2.20	.029
Week 16	114.12(13.35)	120.15(13.84)	2.80	.006
RBG				
Baseline	174.50(60.64)	174.93(65.27)	.044	.956
Week 12	148.03(42.54)	166.30(59.28)	2.23	.028
Week 16	137.68(45.35)	160.78(57.93)	2.80	.007

Note: SBP= Systolic blood pressure, DBP= Diastolic blood pressure, FBG= Fasting blood glucose, RBG= Random blood glucose

The analysis of the repeated measures ANOVA results revealed that the overall FS score between subjects by group was significantly different (p <.001) and also for all risk parameters (p <.05) except SBP, which exhibited a marginally significant difference between the groups (p.05) **(Table 4)**.

Table 4. The effects of the HHI program on functional status and selected cardiac risk parameters.

Source			SS	df	MS	F	p-value
Functional status (FS)							
	B/S	Group	7982.9	1	7982.9	244.4	<.001
		Within group (error)	5158.9	158	32.6		
	W/S	Time	79315.5	1.89	41871.6	1101.7	<.001
		Group x Time	3824.1	1.89	2018.7	53.1	<.001
		Time x Within Group (error)	11374.9	299.29	38.00		
Risk parameters (RPs)							
SBP	B/S	Group	1383.80	1	1383.80	3.90	.050
		Within group (error)	55953.22	158	354.13		
	W/S	Time	1088.75	1.63	665.52	16.51	<.001
		Group x Time	345.41	1.63	211.14	5.24	.010
		Time x Within group (error)	10415.83	258.47	40.29		

Table 4. The effects of the HHI program on functional status and selected cardiac risk parameters. (Cont.)

Source			SS	df	MS	F	p-value
Functional status (FS)							
DBP		Group	935.20	1	935.20	4.19	.042
		Within group (error)	35221.25	158	222.91		
	W/S	Time	267.91	1.68	158.99	17.63	<.001
		Group x Time	265.41	1.68	157.50	17.47	<.001
		Time x Within group (error)	2400.00	266.24	9.014		
FBG		Group	1459.51	1	1459.51	5.58	.019
		Within group (error)	41276.79	158	261.24		
		Time	1873.45	1.80	1038.01	7.62	<.001
		Group x Time	758.28	1.80	420.14	3.08	.042
		Time x Within group (error)	38807.59	258	136.08		
RBG	B/S	Group	23296.53	1	23296.53	4.03	.046
		Within group (error)	913376.63	158	5780.86		
	W/S	Time	54410.73	1.25	43263.81	15.29	<.001
		Group x Time	11396.27	1.25	9061.56	3.20	.048
		Time x Within group (error)	562128.31	198.70	2828.90		

The post-hoc analysis revealed that the HHI elicited a significant improvement in FS from T1 to T2 (p <.001) and from T2 to T3 (p <.001). In the control group, there was a significant improvement in FS from T1 to T2 (p <.001) and from T2 to T3 (p <.001); but the magnitude of the mean differences in FS across time points was greater for the experimental group than for the control group. Mostly similar results were found for all of the risk parameters (p <.05) (Table 5).

Table 5. Pairwise comparisons of the outcome variables for the experimental and control groups by time measures

Sources	Mean Differ.	SE	p-value	Mean Differ.	SE	p-value
	Experimental Group			Control Group		
Functional status (FS)						
T2-T1	24.21	1.04	<.001	13.26	1.46	<.001
T3-T1	37.68	.83	<.001	24.88	.85	<.001
T3-T2	13.47	.93	<.001	11.62	.97	<.001
Risk parameters (RPs)						
Systolic blood pressure (SBP)						
T1-T2	3.00	.755	<.001	.50	.755	.509
T1-T3	5.75	1.09	<.001	1.62	1.09	.141
T2-T3	2.75	.834	.001	1.12	.834	.179

Table 5. Pairwise comparisons of the outcome variables for the experimental and control groups by time measures (Cont.)

Sources	Mean Differ.	SE	p-value	Mean Differ.	SE	p-value
	Experimental Group			Control Group		
Diastolic blood pressure (DBP)						
T1-T2	1.750	.412	<.001	.375	.412	.360
T1-T3	3.625	.519	<.001	.500	1.744	.770
T2-T3	1.875	.362	.049	.375	.362	.300
Fasting blood glucose (FBG)						
T1-T2	4.81	1.74	.006	.50	1.74	.775
T1-T3	7.81	1.99	.000	1.85	1.99	.354
T2-T3	3.00	1.48	.045	1.35	1.48	.365
Random blood glucose (RBG)						
T1-T2	26.46	7.87	.001	8.63	7.87	.274
T1-T3	36.81	7.81	<.001	14.15	7.81	.072
T2-T3	10.35	3.21	.002	5.51	3.21	.088

Note:T1=Baseline, T2= Week12, T3= Week16

Discussion

This study examined the effectiveness of the HHI program on the functional status and risk parameters among Bangladeshi people that had gone through CABG surgery. The findings demonstrated that the HHI program was successful in improving functional capacity and also in reducing the selected risk parameters following CABG. However, these favorable differences were not seen among the people that did not participate in the program and that were treated as a control group with routine hospital care. This comparison of the two groups was confirmed by the results of the study.

In this study, the HHI was designed scientific and knowledge-based information for people with CABG, including behavioral changes and nutrition education, counseling, and planned physical activities or exercises. The entire HHI program was implemented using close monitoring and supervision at the hospital and with home-based follow-ups through phone calls. Additionally, regarding the routine hospital care, the participants in the experimental group practiced using the provided information as guidelines that helped them to combat the conditions that could slow down their normal return to daily life, and this contributed to improving their functional capacity and also to decreasing possible further cardiac risk parameters.

The results of our study have been supported by evidence from other studies[9,26,27] where after CABG, a multidisciplinary HHI program helped the patients to quickly recover and optimized their physical functionality and mental status[7]. Likewise, in a former study, the experimental group participated in the 1st and 2nd phases of the rehabilitation program and it was found that exercise self-efficacy improved with a statistical difference at discharge (p <.001) and a month after discharge (p <.001) compared to the control group among the people that had CABG. The researchers placed more emphasis on the first phase of the cardiac rehabilitation program both increased

self-efficacy with respect to independent daily activities and reduced the need for the second phase.[26] A similar result was also found in another study; a 3-week hospital and 6-month outpatient exercise-based cardiac rehabilitation program was successful in improving the exercise and functional capacity of people with CABG.[27] Based on the findings, it can be concluded that the HHI program was equally beneficial and effective for improving functional outcomes and adjustment to the normal post-CABG life of people in Bangladesh.

Corresponding with functional capacity, the control of cardiac risk factors is equally imperative, which can directly and indirectly influence the expected outcomes of CABG, including better survival, stroke, ischemic coronary events, and so on.[28,29,30] The present study also aimed to assess the effectiveness of the HHI in terms of controlling the selective cardiac risk parameters, including BP, blood glucose, and body weight. The results reflected that the participants participated in the HHI program significantly lowered their mean scores for BP and blood glucose (fasting and random) compared to the control group, as well as from baseline to weeks 12 and 16 (p<.05).

Our findings regarding cardiac risk factors were parallel with some other earlier studies.[10, 31] For example, Mohammed and Shabana found that the effect of multiple exercise and counseling-based CR programs was highly significant in reducing blood pressure and HbA1c (p <.01).[31] Similarly, an 8-week hospital-based exercise- rehabilitation program was found to have a significant effect on the reduction of blood pressure in both SBP (p.04) and DBP (p.03) in the experimental group.[10] Both studies claimed that the changes in blood glucose and blood pressure were due to the combined effect of dietary or nutritional education and counseling, as well as because the participants performed routine exercise. These studies were strongly supported by the integrated HHI program of the present study. Moreover, the participants in the HHI group perhaps might have had self-motivation and commitment to changing their unhealthy behaviors to healthy behaviors as expected regarding the self-efficacy theory used in the present study as a theoretical framework.[32] Finally, it can be claimed that at week 16 the HHI program was effective in improving functional status, including physical activities and exercise capacity, as well as in controlling certain cardiac risk parameters such as blood pressure and blood glucose. Therefore, we recommend that it could be further implemented and tested in order to validate the results.

Limitations and Recommendations

It should be acknowledge that there are some limitations to the present study. First, the study was conducted in a single setting, and generalization to other settings is therefore limited. Second, the FS scores were based on the participants› self-assessments of their functional capabilities, not a direct measurement of FS. Third, the study did not control for some covariances, including the use and duration of antihypertensive and diabetic control drugs. Future studies should consider what other factors, such as treatment, care, and lifestyle, may affect outcomes. Therefore, more research is needed involving at least two different study settings in order to examine the stability of the results and to address the weak points in the present study, such as the control of possible covariance. Fourth, in oder to determine the true effect, a long-term study of the effect of HHI on risk parameters is recommended. Finally, family involvement and their support are important in any rehabilitation process in facilitating the patients' recovery in self-care, especially while the patients are staying at home.

Conclusions and Implications for Nursing Practice

The findings indicate that the HHI was an effective program in terms of strengthening the functional capacity and in reducing the various cardiac risk parameters, especially in terms of controlling blood pressure, blood glucose, managing stress, and adjustment

to normal life for people with CABG in Bangladesh. This study's findings also provide useful information for nurses regarding the careful assessment of CABG people's caring needs from the beginning of their hospitalization to discharge and while staying at home. In conclusion, the benefits of the nursing support HHI program can improve health outcomes and reduce the risk of new cardiac events of individuals that have had coronary artery bypass grafting through education, support, supervision, and reinforcement.

Acknowledgments

The authors would like to thank the Government of the People's Republic of Bangladesh and the Directorate General of Nursing and Midwifery for their funding and the participants in this study.

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ประสิทธิผลของโปรแกรมสุขภาพหัวใจดี ในชาวบังคลาเทศที่ได้รับการผ่าตัดทำทางเบี่ยงหลอดเลือดหัวใจ: การทดลองแบบสุ่มและมีกลุ่มควบคุม

Jahura Khatun อุษาวดี อัศดรวิเศษ อรพรรณ โตสิงห์ ณัฐกมล ชาญสาธิตพร เกรียงไกร ตันติวงศ์โกสีย์*

บทคัดย่อ: การผ่าตัดทำทางเบี่ยงหลอดเลือดหัวใจเป็นวิธีการผ่าตัดที่มีประสิทธิภาพ เพื่อประโยชน์ในระยะยาวสำหรับบุคคลที่มีการอุดตันของหลอดเลือดหัวใจกว่าวิธีการรักษาแบบอื่นๆ ผลลัพธ์ของการรักษาด้วยวิธีนี้ ไม่ได้ส่งผลสำเร็จอย่างเท่าเทียมกันสำหรับทุกคนเนื่องจากอุปสรรคจากด้านร่างกาย และจิตใจ การขาดแคลนโปรแกรมในการสนับสนุนการดูแลบุคคลที่ได้รับการผ่าตัดทำทางเบี่ยงหลอดเลือดหัวใจในบังคลาเทศ ดังนั้นการศึกษานี้จึงเป็นการทดลองแบบสุ่มและมีกลุ่มควบคุม เพื่อประเมินประสิทธิผลของโปรแกรมสุขภาพหัวใจดี ต่อความสามารถในการทำหน้าที่ และพารามิเตอร์ความเสี่ยงทางหัวใจ ในผู้ที่ได้รับการผ่าตัดทำทางเบี่ยงหลอดเลือดหัวใจ จำนวนผู้ป่วยโรคหลอดเลือดหัวใจที่รับเข้ารักษาด้วยการผ่าตัดทำทางเบี่ยงหลอดเลือดหัวใจทั้งหมด 160 คน ได้รับการสุ่มเข้ากลุ่มทดลอง (n = 80) หรือ กลุ่มควบคุม (n = 80) กลุ่มทดลองได้รับโปรแกรมสุขภาพหัวใจดี ในโรงพยาบาลเป็นเวลา 4 อาทิตย์ ร่วมกับการดูแลตามปกติในโรงพยาบาลและการติดตามเยี่ยมบ้านผ่านสื่อโทรศัพท์หลังจำหน่ายออกจากโรงพยาบาล ขณะที่กลุ่มควบคุมได้รับการดูแลตามปกติในโรงพยาบาลเท่านั้น การเก็บรวบรวมข้อมูล ประกอบด้วย แบบสอบถามข้อมูลส่วนบุคคล และประวัติสุขภาพ เครื่องมือวัดความสามารถในการทำหน้าที่ ในภาษาเบงกอล และเครื่องมือประเมินพารามิเตอร์ความเสี่ยงทางหัวใจ ผลลัพธ์ของโปรแกรมจะได้รับการประเมิน ณ เวลาตั้งต้นเป็นข้อมูลพื้นฐาน สัปดาห์ที่ 12 และสัปดาห์ที่ 16 การวิเคราะห์ทางสถิติ ใช้สถิติเชิงพรรณนา การทดสอบที (t-test) การทดสอบไคสแควร์ (chi-square) และ การวิเคราะห์ความแปรปรวนแบบสองทางเมื่อมีการวัดซ้ำ (two-way repeated-measures of ANOVAs)

ผลการศึกษาพบว่า ข้อมูลส่วนบุคคล และประวัติสุขภาพ ที่เป็นข้อมูลพื้นฐาน ความสามารถในการทำหน้าที่ และพารามิเตอร์ความเสี่ยงทางหัวใจ ไม่มีความแตกต่างอย่างมีนัยสำคัญทางสถิติระหว่างกลุ่มทดลองและกลุ่มควบคุม ค่าเฉลี่ยของคะแนนความสามารถในการทำหน้าที่ ในกลุ่มทดลองสูงกว่าและค่าเฉลี่ยคะแนนความเสี่ยงทางหัวใจ (ความดันโลหิตและระดับน้ำตาลในเลือด) ต่ำกว่าค่าเฉลี่ยในกลุ่มควบคุม ทั้งในสัปดาห์ที่ 12 และสัปดาห์ที่ 16 โปรแกรมสุขภาพหัวใจดี สามารถใช้ประโยชน์เพื่อพัฒนาความสามารถในการทำหน้าที่ และพารามิเตอร์ความเสี่ยงทางหัวใจลดลง ในบุคคลที่ได้รับการผ่าตัดทำทางเบี่ยงหลอดเลือดหัวใจ การศึกษาครั้งนี้ ได้เสนอการปฏิบัติบนหลักฐานเชิงประจักษ์ เพื่อที่จะได้ทำการศึกษาวิจัยต่อไป เพื่อให้ได้ผลก่อนนำไปใช้ทางคลินิกต่อไป

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คำสำคัญ: โปรแกรมสุขภาพหัวใจดี ความสามารถในการทำหน้าที่ พารามิเตอร์ความเสี่ยง การผ่าตัดทำทางเบี่ยงหลอดเลือดหัวใจ การทดลองแบบสุ่มและมีกลุ่มควบคุม

Jahura Khatun *นักศึกษาหลักสูตรปรัชญาดุษฎีบัณฑิต สาขาการพยาบาล (หลักสูตรนานาชาติและหลักสูตรร่วมกับมหาวิทยาลัยในต่างประเทศ) โครงการร่วม คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี และคณะพยาบาลศาสตร์ มหาวิทยาลัยมหิดล*
E-mail: jahura15@gmail.com
ติดต่อที่: อุษาวดี อัศดรวิเศษ* *รองศาสตราจารย์ คณะพยาบาลศาสตร์ มหาวิทยาลัยมหิดล*
E-mail: usavadee.asd@mahidol.ac.th
อรพรรณ โตสิงห์ *รองศาสตราจารย์ คณะพยาบาลศาสตร์ มหาวิทยาลัยมหิดล*
E-mail: orapan.tho@mahidol.ac.th
ณัฐกมล ชาญสาธิตพร *ผู้ช่วยศาสตราจารย์ คณะสาธารณสุขศาสตร์ มหาวิทยาลัยมหิดล*
E-mail: nutkamol.cha@mahidol.ac.th
เกรียงไกร ตันติวงศ์โกสีย์ *ผู้ช่วยศาสตราจารย์ คณะแพทยศาสตร์ศิริราชพยาบาล มหาวิทยาลัยมหิดล. E-mail: kae814@yahoo.com*