Indonesian Journal of Global Health Research
Volume 7 Number 5, October 2025
e-ISSN 2715-1972; p-ISSN 2714-9749
http://jurnal.globalhealthsciencegroup.com/index.php/IJGHR

THE EFFECTIVENESS OF THE PHASE II CARDIAC REHABILITATION PROGRAM ON THE FUNCTIONAL CAPACITY OF THE HEART AND QUALITY OF LIFE OF POST-CABG PATIENTS

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ABSTRACT
The Coronary Artery Bypass Graft (CABG) procedure is a form of surgical intervention carried out to treat coronary heart disease (CHD). Cardiac rehabilitation programs are training and education programs that aim to improve patients' heart health, especially after surgery. One of the goals of cardiac rehabilitation is to return patients to achieve optimal conditions, increase the functional capacity of the heart, and improve the quality of life. The purpose of the study was to test the effectiveness of the phase II cardiac rehabilitation program on increasing cardiac functional capacity and quality of life of post-CABG patients at H. Adam Malik Hospital Medan. The research design is a quasi-experimental one group pre-test and post-test design. The sampling technique is purposive sampling. The number of samples was 33 respondents. Data analysis was conducted using dependent t tests for heart rate (HR), systolic blood pressure, and diastole blood pressure. Data on respiratory rate (RR), METs, oxygen saturation (SpO2), and quality of life variables were used to test the wilcoxon. The results of the data analysis showed that there was no effect of the phase II cardiac rehabilitation program on HR and RR ($p>0.05$ value) because the majority of respondents took beta-blocker drugs. However, the results of statistical tests showed that there was an effect of the phase II cardiac rehabilitation program on systole and diastole blood pressure, METs, SpO2, and the quality of life of the respondents (p value <0.05). This study proves that the phase II cardiac rehabilitation program is effective in improving the functional capacity of the heart and the quality of life of post-CABG patients.

Keywords: cardiac rehabilitation program phase II; cardiac functional capacity; quality of life

How to cite (in APA style)
Maraksa, D. W., Sitohang, N. A., & Tarigan, M. (2025). The Effectiveness of the Phase II Cardiac Rehabilitation Program on the Functional Capacity of the Heart and Quality of Life of Post-CABG Patients. Indonesian Journal of Global Health Research, 7(5), 151-158. https://doi.org/10.37287/ijghr.v7i5.6600.

INTRODUCTION

Coronary heart disease (CHD) is one of the leading causes of morbidity and mortality worldwide. CHD is caused by plaque that accumulates in the coronary arteries that supply oxygen to the heart muscle (Ministry of Health, 2020). CHD is characterized by chest pain or discomfort in the chest or chest feeling severely depressed when doing strenuous activities or walking in a hurry when walking on a flat road or walking long distances (Dirgantoro, et al, 2018). CHD causes the deaths of more than 17 million people each year. (WHO., 2024). CHD caused 45 deaths (WHO, 2023). The WHO estimates that this number will increase to 23.3 million by 2030. The death rate of CHD in Indonesia is quite high, namely 1.25 million people even though Indonesia has a population of 281.6 million people as of June 2024. The North Sumatra Health Office (2023) recorded 9,228 people with heart disorders with the most cases coming from Medan City, which reached 3,855 cases. Data at the H. Adam Malik Central General Hospital in the last six months shows that there are an average of 84 to 120 patients for heart surgery (Integrated Heart Center., 2024).

Coronary Artery Bypass Grafting (CABG) is a heart surgery that is a method of treating coronary artery disease. Coronary Artery Bypass Graft (CABG) procedure is a form of surgical intervention that is commonly performed to treat CHD, with the aim of improving

blood flow to the heart muscle and reducing symptoms such as chest pain and shortness of breath (Yuniadi., 2015). CABG significantly improves the patient's long-term prognosis, postoperative recovery is often a challenge.Patients experience physical weakness, decreased functional capacity, and adverse psychological impacts, such as anxiety and depression. Cardiac rehabilitation programs are very important in supporting patient recovery. Cardiac rehabilitation programs are training and education programs that aim to improve patients' heart health, especially after undergoing surgery or heart attack (AHA., 2020).

The rehabilitation phase of CABG patients is divided into 3 phases, which include phase I is carried out when the patient is hospitalized before and after CABG, phase II to phase III/IV is carried out by post-CABG patients who have been discharged from the hospital and to prevent recurrence. In Rehabilitation Phase I (inpatient phase) it is divided into pre- and post-CABG. The goal of pre-CABG rehabilitation is to prevent post-CABG complications, especially pulmonary complications (AHA., 2020).Research conducted by Endarti and Handito (2019) shows that cardiac rehabilitation can increase patients' physical capacity, reduce anxiety and depression levels, and improve overall quality of life. Post-CABG patients need to undergo phase II cardiac rehabilitation, to improve physical abilities that can be trained gradually and regularly until the client's confidence appears to return to daily activities as before the illness so that by doing good activities, the client's quality of life is expected to increase (Tessler & Bordoni., 2023). Research by Rahman et al (2024) states that after CABG surgery, quality of life improves and feels better.

Aziza (2013) research on the quality of life of post-CABG patients stated the psychological response of participants by seeking support, shock and fear. The physical response is to complain of pain in the scars of the surgery. The conclusion of this study was that most of the participants stated that they were satisfied with their quality of life. Research by Schmidt-Riovalle, (2020) states that the quality of life of post-CABG patients after 6 weeks changes dramatically, physical complaints increase. Research by Peric, et al (2015) stated that elderly patients improved their quality of life after six months after CABG. Given the importance of this rehabilitation program and its relationship with the patient's quality of life, the researcher is interested in finding out more about how effective cardiac rehabilitation is in increasing the functional capacity of the heart and the quality of life of patients after CABG. Therefore, the purpose of this study is to test the effectiveness of the phase II cardiac rehabilitation program on increasing cardiac functional capacity and quality of life of post-CABG patients at H. Adam Malik Hospital in 2025.

METHOD

This type of research is quantitative research. The research design used was quasi-experimental one group pre-test and post-test. The sampling technique is purposive sampling. The number of samples in this study was 33 respondents. The instruments used were a heart's functional capacity observation sheet consisting of 6MWT (blood pressure, pulse rate, respiratory frequency, metabolic equivalent of task/METs, and oxygen saturation) and NYHA functional class, as well as KCCQ (Kansas City Cardiomypathy Questionnaire) to measure the patient's quality of life. The KCCQ questionnaire has been tested for construct validity ($r=0.70$) and reliability test with a Cronbach's alpha of 0.97. The location of the research is in the Cardiac Prevention and Rehabilitation room of H. Adam Malik Hospital Medan. The implementation began with a pre-test by measuring the functional capacity of the heart and the quality of life of the respondents before the intervention. Then phase II cardiac rehabilitation was carried out with walking exercises on the jogging track, prevention room, and cardiac rehabilitation. The distance traveled and time are adjusted to the patient's ability based on the measurement of the heart's functional capacity during the pre-test, 5-10 minute

rest, 10 minute stationary bike, 45-55 minute RPM, 10 minute rest, walking on a treadmill at a low speed of 2.8km/h – 4km/h. The intervention was carried out 5 times for 3 weeks. The post test is carried out in the last week. Data analysis was conducted using dependent t test and wilcoxon test. This research was conducted after obtaining an ethics permit from the Health Ethics Committee of the University of North Sumatra with Number 360/KEPK/USU/2025.

RESULT

Table 1.
Frequency Distribution and Presentation Based on Respondent Characteristics

Variable	*f* (n=33)	%
Age		
- 36 – 45 Years	5	15.2
- 46 – 55 Years	13	39.4
- 56 – 65 Years	13	39.4
- 66 – 75 Years	2	6.1
Gender		
- Male – Male	28	84.8
- Woman	5	15..2
Education		
- SMA	14	42.4
- D3	9	27.3
- S1	10	30.3
Marital Status		
- Marry	33	100
- Unmarried	-	-
- Widow/Doubter	-	100
Work		
- Work	9	27.3
- Not Working	24	72.7
Diabetes Mellitus		
- Yes	15	45.5
- Not	18	54.5
Hypertension		
- Yes	20	60.6
- Not	13	39.4

Table 2.
Frequency Distribution of Cardiac Functional Capacity Observation (n=33)

Variable	Mean	SD	Min - Max Value	95% CI	
				Lower	Upper
HR					
Before	81,21	7,921	68 – 100	78,40	84,02
After	79,73	7,273	68-97	77,15	82,31
RR					
Before	18,06	2,106	12 – 22	17,31	18,81
After	17,79	2,176	12-22	17,02	18,56
Sistole					
Before	106,52	15,573	81 – 150	100,99	112,04
After	111,70	12,583	91-143	107,24	116,16
Diastole					
Before	65,36	10,627	43 – 82	61,60	69,13
After	69,55	8,836	56-94	72.68	72,68
METS					
Before	3,118	0,810	1,22-5,00	2,83	3,4
After	6,969	1,589	2,52-9,8	7,533	7,533
SaO2					
Before After	97,67	0,692	96 – 99	97,42	97,91

	98,12	0,415	97-99	97,97	98,27

Table 3.
Cardiac Functional Capacity Frequency Distribution: NYHA (n=33)

Variable	*f* (n=33)	%
NYHA I		
Before	-	-
After	18	54,5
NYHA II		
Before	1	3
After	12	36,4
NYHA III		
Before	31	93,9
After	3	9,1
NYHA IV		
Before	1	3
After	-	-

Table 4.
Frequency Distribution of Respondents' Quality of Life (n=33)

Variable	Mean	SD	Min - Max Value	95% CI	
				Lower	Upper
Pre Test Score	31,73	11,883	18-58	27,51	35,94
Post Test Score	59,97	5,817	43-64	57,91	62,03

Table 5.
Effect of Phase II Rehabilitation Program on Heart Functional Capacity: Heart Rate (HR), Systolic Blood Pressure, and Diastole Blood Pressure

Variable	Mean	SD	Mean Difference	ONE	Value p
Heart Rate (HR)					
Before	81,21	7,921	1,485	1,804	0,417
After	79,73	7,273			
TD Systole					
Before	106,52	15,573	5,182	1,819	0,008
After	111,7	12,583			
TD Diastole					
Before	65,36	10,627	4,182	1,974	0,042
After	69,55	8,836			

Table 6.
Effect of Phase II Rehabilitation Program on Heart Functional Capacity: Respiratory Rate (RR), METs, and Oxygen Saturation (SpO2)

Variable	N		MeanRank	Zscore	Value p
Respiratory Rate (RR)					
Before	Negative rank	10 to	8,9	-600b	0,549
After	Positive rank	7 b	9,14		
	Ties	16 c			
Mets					
Before	Negative rank	0 to	16	-4.86 b	0,000
After	Positive rank	31 b			
	Ties	2 c			
SpO2					
Before	Negative rank	1 a	6,5	-3,116 b	0,002
After	Positive rank	13 b	7,58		
	Ties	19 c			

Table 7.
The Effect of Phase II Rehabilitation Programs on Quality of Life

Variable	n		MeanRank	Zscore	Value p
Quality of Life					
Before	Negative rank	0 to	16,5	-4,939 b	0,000
After	Positive rank	32 b			
	Ties	1 c			

DISCUSSION

The age of patients after CABG is mostly in the age range of adults (46-55 years) and the elderly (56-65 years). Age is a major risk factor in the development of coronary heart disease (CHD). As we age, a person's risk of developing CHD increases significantly. Research by Park, et al (2015) involving 6,311 individuals in Asia, found that the prevalence of CHD increased in older individuals. The gender of the most post-CABG patients was male (84.8%). The majority of post-CABG patients' education levels are high school (42.4%). Education plays an important role in the recovery of coronary heart disease after CABG, where education can improve quality of life, knowledge, adherence to treatment, and reduce postoperative complications. All post-CABG patients studied were married. Marital status is a psychosocial factor that has a significant effect on recovery in patients after CABG. The majority of post-CABG patients did not work (72.7%). Raynaldo's research, (2021) analyzed data from 68 post-CABG patients at H. Adam Malik Hospital, Medan, showing that 58.8% of patients returned to work within 6 months after surgery.

The results of this study showed that the majority of respondents did not suffer from Diabetes Mellitus, which is an important factor in assessing the risk of complications and prognosis after CABG in patients with Coronary Heart Disease (CHD). The majority of post-CABG patients suffer from hypertension (60.6%). Hypertension is one of the main risk factors in CHD patients undergoing CABG surgery. Research by Deng, et al. (2025) showed that poor blood pressure control in hypertensive patients post-CABG was associated with decreased graft patency. Optimal blood pressure control is necessary to maintain long-term graft patency. The results of the statistical test of Heart Rate (HR) patients after CABG were obtained with a mean difference of 1,485. Although there was a decrease in the average HR after the intervention, statistical tests showed that there was no effect of the phase II rehabilitation program on the respondents' HR (p value > 0.05). This can be caused by the majority of post-CABG patients at H Adam Malik Hospital, Medan taking beta-blocker drugs, such as bisoprolol. The use of beta-blockers in post-CABG patients has a significant effect on decreasing heart rate. Beta-blockers work by inhibiting β-adrenergic receptors, which reduce

the stimulating effects of adrenaline on the heart, thereby lowering heart rate and blood pressure (Park, et al., 2020).

The results of this study obtained a p value of p > 0.05, which showed that there was no effect of the phase II rehabilitation program on the RR of the respondents. This can also be seen from 33 respondents, 10 people experienced a decrease in RR after the intervention, 7 people experienced an increase in RR after the intervention, and 16 people did not experience a change in RR. The research of Adam, et al, (2009) suggests that patients who start the rehabilitation phase in a stable condition or with a respiratory condition that is already within normal limits, then there is not much room for improvement. Cardiac rehabilitation tends to focus more on increasing heart capacity, exercise tolerance, and autonomic balance, rather than modifying the rate of breathing. In addition, most patients also take medications such as beta-blockers or ACE inhibitors, which can obscure the expected physiological changes, including the effect on respiration.

A p value of < 0.05 was obtained, so that there was an effect of the phase II rehabilitation program on systolic blood pressure in post-CABG patients. An increase in systolic TD after a phase II rehabilitation program can be interpreted as the body's adaptive response to physical exercise, which reflects an increase in the working capacity of the heart and vascular system (Osailan & Abdelbasset, 2019). The results of the phase II cardiac rehabilitation program on diastole blood pressure obtained a p value of < 0.05, so that there was an effect of the phase II rehabilitation program on diastole blood pressure in post-CABG patients. This study is in line with Osailan and Abdelbasset (2020) showing that after 8 weeks of an exercise-based cardiac rehabilitation program, there was a significant decrease in resting diastolic blood pressure in post-CABG patients.The results of this study showed that of the 33 respondents, 31 showed an improvement in METS scores after the intervention, 2 people experienced no change in their METS scores after the intervention, and none experienced a decrease in their METS scores after the intervention. A p = 0.000 value was obtained, which showed that there was an influence of the phase II rehabilitation program on the respondents' METS. Study by Son, et al. (2021) found that an increase in METs after phase II cardiac rehabilitation correlates with a decrease in major cardiovascular incidence (MACE) within 3 months after CABG in patients with left ventricular systolic dysfunction.

The results of this study showed that out of 33 respondents, 1 respondent showed a decrease in SpO2 after the intervention, 13 showed an increase in SpO2 after the intervention, and 19 showed the same SpO2 results before and after the intervention. A p value of 0.05 was obtained <, which showed that there was an effect of the phase II rehabilitation program on the oxygen saturation of the respondents.The results of this study showed that the majority of post-CABG patients before the intervention were NYHA III (93.9%), while after the intervention was NYHA I (54.5%). This shows that the phase II cardiac rehabilitation program is effective in increasing the functional capacity of the patient's heart. These results are in line with a study published in the European Journal of Preventive Cardiology (2025), which reported that after participating in a phase II cardiac rehabilitation program, most patients experienced an improvement to NYHA class I, accompanied by improvements in other clinical parameters such as decreased NT-pro BNP levels and increased functional capacity based on a 6-minute walk test.

The results of this study showed a value of p = 0.000, so that there was an effect of the phase II rehabilitation program on the quality of life in post-CABG patients. This study is in line with the research conducted by Andra, et al, (2022) obtained a p< value of 0.001, which shows a statistically significant difference between the change in functional capacity after the program and the quality of life of patients after CABG surgery, with a correlation coefficient r

= 0.592 indicating a moderate correlation. This study shows that quality of life risks will be compromised 3 months after CABG surgery in the METS group. Where changes in the heart's low functional capacity have a 5.3 times greater risk of a decrease in the patient's quality of life.

CONCLUSION

This study proves that the phase II cardiac rehabilitation program can improve cardiac functional capacity and quality of life in post-CABG patients. Therefore, this program can be used by health workers as a follow-up therapy for post-CABG patients in assisting the post-CABG recovery process

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