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EFFECTS OF CARDIAC REHABILITATION ON FUNCTIONAL EXERCISE CAPACITY IN PATIENTS WITH POST CORONARY ARTERY BYPASS GRAFT

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HIGHLIGHTS

- Cardiac rehabilitation has positively impacted the functional exercise capacity of post-coronary artery bypass graft (CABG) patients.
- The program typically includes supervised exercise, education on healthy lifestyle habits, and counseling to address psychological needs
- Studies have found that patients who participate in cardiac rehabilitation programs have improved exercise tolerance, reduced symptoms of angina, and decreased risk of cardiovascular events.

ABSTRACT

Cardiovascular diseases pose a major global public health issue and are the leading cause of illness and death. To address this, the American Heart Association has advocated for cardiac rehabilitation programs as a vital part of treatment to enhance patients' functional capacity. This study aimed to evaluate the effects of cardiac rehabilitation on the functional status of individuals who underwent coronary artery bypass graft (CABG) surgery. **Objective:** to determine the effects of cardiac rehabilitation on functional exercise capacity in patients with post-coronary artery bypass graft. **Material and Methods:** Researchers conducted a cross-sectional investigation involving both genders with coronary artery bypass grafting (CABG) surgery. The selection of participants was carried out through convenient non-probability sampling from those admitted to cardiac rehabilitation units. During their hospitalization, the patients underwent a 6-minute walk test (6MWT) aimed at evaluating their functional capacity. The principal focus of the study was the distance traversed during the 6-minute walk test. **Results:** Among a total of 105 patients, 55 (52.4%) were male and 50 (47.6%) were female. The average age was 54.17 years with a range of 40 to 65 years. The mean height was 64.23 cm ranging from 59 to 72 cm, and the mean weight was 57.66 kg with a range of 37 to 97 kg. The 6-minute walk test distance before cardiac rehabilitation was 433.06 m on average (ranging from 400 to 460 m), while after rehabilitation, it increased to 494.92 m on average (ranging from 470 to 520 m). There were significant differences observed in the 6-minute walk test results before and after rehabilitation, as well as in relation to the New York Heart Association (NYHA) functional classification ($p<0.05$). **Conclusion:** A significant difference was observed between the 6-minute walk test results before and after cardiac rehabilitation. This implies that participating in a cardiac rehabilitation program can have a meaningful impact on the functional capacity of patients.

Keywords: Cardiac Rehabilitation, Coronary Artery Bypass Grafting, CABG, Exercise Capacity, Functional Capacity.
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INTRODUCTION

Cardiovascular disease (CVD) is a major cause of morbidity and mortality worldwide, with an estimated 17.3 million deaths per year and a projected increase to around 23.6 million by the year 2020. About 80% of deaths are due to heart attacks and strokes.[1] According to Islamabad, non-communicable diseases account for 30 to 40% of deaths in Pakistan, with cardiovascular disease having the greatest mortality rate with over 2 lac fatalities each year and 410 deaths per 100,000 people.[2,3] There are various cardiovascular disease risk factors that are both malleable and variable.[4] Smoking, high blood sugar, inactivity, eating poorly, cholesterol, and being overweight or obese are all modifiable risk factors.[5] The main aims of the global health care system at this time are prevention, management, and patient rehabilitation from the impacts of this condition. This is because the majority of risk factors for cardiovascular disease are modifiable.[6]

Cardiovascular rehabilitation has undergone significant advancements, transforming from basic monitoring to a holistic approach.[7] This comprehensive strategy includes personalized meal plans, closely supervised exercise programs, individual counseling, and patient and family education. These interventions have the potential to improve the management of conditions.[8] Sedentary behavior ranks as the fourth major risk factor for cardiovascular diseases, contributing to 32.1 million DALYs and 3.2 million annual deaths.[4] Insufficient physical activity is defined as a weekly vigorous activity lasting less than 20 minutes or a weekly moderate activity lasting less than 30 minutes.[9] Cardio-respiratory fitness is closely linked to physical fitness, emphasizing the importance of physical activity in cardiac rehabilitation. [10] Research indicates that prolonged bed rest can lead to a significant decline of 27% in an individual's cardio-respiratory fitness after just 20 days.[11] This decline can result in a substantial reduction in daily step count, from 10,051 to 1,344 steps, equating to a 7% estimated loss in VO. [12]

To expedite recovery and prevent disease progression, cardiovascular rehabilitation (CR) incorporates these techniques. [13] The goal of Phase-ll, also known as a supervised ambulatory outpatient programmed, is to raise the patient's overall level of physical fitness over the course of six to eight months. The final phase, sometimes referred to as Phase-ll or the lifetime maintenance phase, aims to adjust the risk variables using the exercises learned in Phase-ll.[14-16] The risk is decreased by 28% by smoking, among other potentially modifiable factors. Phase-ll cardiac rehabilitation is essential for both preventing and treating the problem since it lowers mortality risk from cardiovascular disease by 12% by increasing IMET (Metabolic Equivalent to Task) in functional capabilities.[17,18] Research indicates that dietary recommendations, emphasizing the significance of nutritional counseling and weight management, should be a part of phase I of cardiovascular rehabilitation. The plan calls for just a 7% decrease in total calorie intake of saturated fats, an increase in cholesterol of 200 mg/dl, and 10% and 20% increases in total calorie intake of polyunsaturated and monounsaturated fats, respectively. Additionally, there is an increase in fiber consumption (approximately 20-30 g/d), and there is an adequate distribution of calorie sources.[19] Other than this, psychological distress also causes cardiac pathologies such as myocardial infarction (20%). [20] The purpose of this observational study is to examine whether cardiac rehabilitation has a positive effect on the evaluation of functional capacity in post-coronary artery bypass graft (CABG) patients, as measured by the 6-minute walk test (6MWT). It is hypothesized that participation in cardiac rehabilitation programs will lead to improvements in functional capacity, enabling CABG patients to recover more quickly and exhibit enhanced strength and physical well-being.

MATERIAL AND METHODS

Prior to commencing this research, the necessary ethical clearance was obtained from the

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University of Lahore's ethical committee. To gather data, permission was sought from the University of Lahore teaching hospital and Punjab Institute of Cardiology, and patients' consent was obtained. The questionnaire used in the study was validated based on existing literature, and a modified Healthy Heart Questionnaire was provided to participants in the form of a pamphlet. Data collection was carried out meticulously to prevent any biases, and the information was securely stored. This cross-sectional study focused on both male and female patients, aged 40-65 years who had undergone coronary artery bypass grafting (CABG), and their functional capacity was assessed through the 6-minute walk test (6MWT) upon admission.

RESULTS

In this study, a total of 105 participants were included, with 55 (52.4%) being males and 50 (47.6%) being females. The average age was 54.17 years with a range of 40 to 65 years.

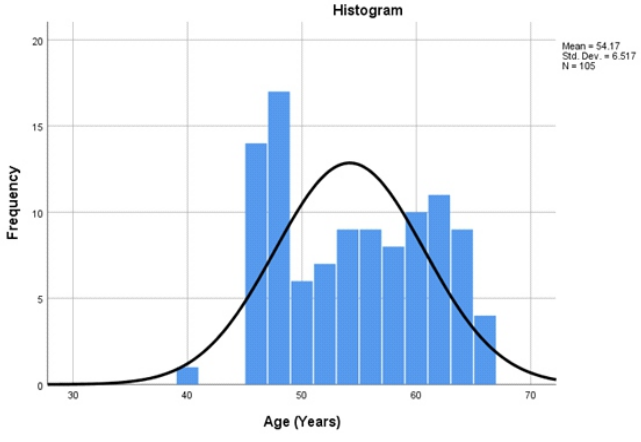

Figure 1: Descriptive statistics of age

The mean height was 64.23 cm ranging from 59 to 72 cm, and the mean weight was 57.66 kg with a range of 37 to 97 kg. Additionally, 77.1% of the participants had high blood pressure, while 22.9% did not. Hyperlipidemia was present in 89.5% of the participants, with 10.5% not having the condition. Moreover, 66.7% of the participants were diabetic, while 33.5% were not.

Table 1: Statistics for baseline attributes of CABG patients

Variables	Construct	Frequency	Percentage
Diabetic	Yes	70	66.7%
	No	35	33.5%
Hypertension	Yes	81	77.1%
	No	24	22.9%
Hyperlipidemia	Yes	94	89.5%
	No	11	10.5%

Among the total of 105 participants, 19.0% had pulmonary conditions, while 81.0% did not. In terms of smoking habits, 76.2% were smokers and 23.8% were nonsmokers. Around 47.6% of the participants had a daily walking routine, while 52.4% did not. Additionally, 76.2% of the patients with chest pain related to cardiac symptoms reported other associated symptoms, while 23.8% did not have any additional symptoms. Regarding weight gain due to thyroid dysfunction, 47.6% experienced it, whereas 52.4% did not report weight gain related to thyroid issues. Before cardiac rehabilitation, the average distance covered during the 6-minute walk test was 433.06 m (ranging from 400 to 460 m), while after rehabilitation, it increased to 494.92 m (ranging from 470 to 520 m).

Table 2: Statistics for 6-minute-walk test before & after cardiac rehabilitation

Variables	Mean	Std. Deviation	Minimum	Maximum
6-minute walk test before CR	433.06	17.906	400	460
6-minute walk test after CR	494.92	14.636	470	520

The mean differences were statistically significant ($p<0.05$) when tested with one sample t test. Significant differences were observed when considering the New York Heart Association

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(NYHA) functional classification in relation to the 6-minute walk test results. The study concludes that cardiac rehabilitation leads to improved functional capacity, as evidenced by the increased distances covered during the 6-minute walk test.

Table 3: One Sample T-Test

	t	P- Value
6-minute walk test before Cardiac rehabilitation (m)	247.8	0.000
6-minute walk test after Cardiac rehabilitation (m)	346.5	

DISCUSSION

Among the total of 105 participants, 1.9% were classified as Very Severely Underweight, 4.8% as Severely Underweight, 21.9% as Underweight, 48.6% as Normal weight, and 3.8% as Obese. Additionally, 77.1% of the participants had high blood pressure, while 22.9% did not. Hyperlipidemia was present in 89.5% of the participants, with 10.5% not having the condition. Moreover, 66.7% of the participants were diabetic, while 33.5% were not.

Ghashghaei FE, Sadeghi M., et al. (2021), similar to the current study, found significant improvements in walking distance ($p<0.01$) and various hemodynamic parameters. The study highlights the positive impact of cardiovascular rehabilitation on functional capabilities and hemodynamic responses. Rehabilitation centers are encouraged for post-surgery recovery. [21]

Nazari N, Hashemi-Javaheri AA, et al. (2018) conducted a study to evaluate the impact of cardiovascular rehabilitation on strength and balance after coronary artery bypass graft surgery. Results revealed significant improvements in lower limb strength ($p=0.001$), static balance ($p=0.023$), and dynamic balance ($p=0.037$) after one month of cardiac rehabilitation. The findings emphasize the beneficial effects of cardiac rehabilitation on balance and lower limb strength in patients who have undergone coronary artery bypass surgery. Enhanced muscle strength also contributes to an improved quality of life by facilitating daily tasks.[22] These findings suggest that with the cardiac rehabilitation, functional abilities improve, in consistent with the present study's results that states enhancement of functional capabilities.

In this study, out of a total of 105 participants, the New York Heart Association (NYHA) functional classification revealed that 52.4% were in Class I, 30.5% in Class II, 11.4% in Class III, and 5.7% in Class IV. Shabani, R., Nikbakht, H., et al. (2017) examined the impact of cardiovascular rehabilitation on heart rate, blood pressure, physical stamina, and myocardial oxygen consumption after CABG. Following rehabilitation, the case group showed significant improvements in exercise timings, maximum heart rates, systolic blood pressures, and rate pressure products ($p<0.001$). Systolic blood pressure and resting heart rate were notably lower ($p<0.001$). The control group did not experience significant changes. Cardiac rehabilitation can rapidly enhance exercise tolerance, RPP, HRR, and decrease resting blood pressure in CABG patients. [23]

CONCLUSION

The study findings suggest a remarkable difference between the 6-minute walk test results before and after cardiac rehabilitation, highlighting the potential benefits of such programs. While this study solely relied on observations and did not involve a controlled experimental design, it still provides valuable insights. The observed increase in the distance covered during the 6-minute walk test after cardiac rehabilitation indicates the potential positive impact of these programs on patients' functional capacity. Further research utilizing experimental designs would be valuable to confirm and expand upon these findings.

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DECLARATIONS

Availability of data and materials: Data will be available on request. The corresponding author will submit all dataset Files.
Competing interests: None
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