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The Relationship Between Aerobic Physical Exercise to Functional Capacity in Heart Failure Patients at Haji Adam Malik General Hospital Medan

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ABSTRACT

Introduction: The prevalence of heart failure is known to increase day by day, as well as the incidence of rehospitalization and death. One way that can be done is to optimize health status and perform cardiac rehabilitation. Aerobic exercise is recommended for patients with heart failure. Aerobic exercise has been shown to increase functional capacity in patient with heart failure. The aim of this study is to assess the relationship between aerobic exercise with functional capacity improvement in patient with heart failure in Haji Adam Malik General Hospital, Medan.

Method: This study was conducted using prospective cohort method on 35 patients with heart failure in a cardiac rehabilitation program at Haji Adam Malik General Hospital, Medan. Functional capacity and 6-Minute Walk Test (6MWT) data were collected before and after aerobic exercise. Univariate and bivariate data analysis were performed using SPSS.

Results: 35 samples were included in this study, with an average age of 54,57±1,28 years and dominated by male. The result showed an increase in distance after aerobic exercise program compared to the initial examination (373,6±133,64 vs 192,57±64,68) with p-value <0,001. There was an increase in functional capacity from 3,55±1,12 MET to 6,6±2,44 MET after aerobic exercise (P<0,001).

Conclusion: There is a significant relationship between aerobic exercise and functional capacity improvement in patients with heart failure at Haji Adam Malik General Hospital, Medan.

Keywords

Functional capacity, Aerobic exercise, Heart failure, 6MWT

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INTRODUCTION

Heart failure is a clinical syndrome that can be caused by cardiac functional, structural, or other precipitating factors that eventually lead to impaired ventricular filling or the ejection of blood into the systemic circulation. Heart failure is also a common cardiovascular disease worldwide, with high morbidity and mortality rates. An estimated 26 million people worldwide suffer from heart failure, resulting in increased health care costs. The incidence of heart failure also increases with age, around 1% for those aged <55 years, to >10% for those aged 70 years and over. Based on RISKESDAS data, Indonesia's prevalence of heart failure is 1.5% or around 1,017,290 residents.[1]

One of the efforts needed to reduce the prevalence and rate of rehospitalization in heart failure patients is by optimizing health status, changing lifestyles, and carrying out cardiac rehabilitation. Structured physical

exercise, such as aerobic physical exercise, can reduce rehospitalization rates and treatment costs and help improve the patient's overall quality of life to achieve optimal fitness.[2]

Aerobic physical exercise with moderate intensity is known to increase exercise tolerance in patients with heart failure and shows a positive and significant correlation to the functional capacity of patients with heart failure. Functional capacity itself is a measure of fitness that can be assessed through cardiac training tests and can be used as a predictor of mortality in heart failure patients. One of the heart training tests is the 6-Minute Walk Test.[3] The aim of this study was to determine whether there is a relationship between aerobic physical exercise on functional capacity in heart failure patients at Haji Adam Malik General Hospital, Medan.

METHOD

This study is an analytic study with a prospective cohort study design carried out on Heart Failure patients and were treated at Haji Adam Malik General Hospital Medan starting from June 2022. The minimum sample size was 33 people. The inclusion criteria were Heart Failure patients with an Ejection Fraction <50% (EF<50%), without signs of decompensation, severe valvular heart disease, congenital heart disease and eligible to be included in phase II of the cardiac rehabilitation program. The exclusion criteria were patients with symptoms of respiratory diseases, neurological diseases, and musculoskeletal disease that hindered the patients' movement. Each individual who was included in the research sample was made an written consent signed by the participants and the researcher. The researcher examined the patients' medical record to evaluate the medical history, physical examinations, electrocardiography (ECG), laboratory results, diagnosis, and then performed complete data recording.

Patients are advised to do a 6-Minute Walk Test before carrying out phase 2 cardiac rehabilitation. The 6-Minute Walk Test is carried out by a cardiology resident who is in charge of the cardiac rehabilitation and prevention division after seeking approval from the patient and the doctor in charge of the patient.

The 6-Minute Walk Test is carried out according to the guidelines of the American Thoracic Society in 2002 and is carried out in a room with a flat and hard surface, with a corridor distance of 30 meters. Before carrying out the 6-Minute Walk Test, the patient is asked to rest for 10 minutes, and then the patient is asked to walk for 30 minutes. The total distance traveled for 6 minutes was then measured to determine the patient's functional capacity.

After the 6-Minute Walk test, the patient took part in the phase II cardiac rehabilitation program, namely aerobic physical exercise in the rehabilitation and prevention room at Haji Adam Malik General Hospital Medan for 1 month for 12 sessions. The initial exercise is in the form of a 5-minute warm-up followed by moderate-intensity aerobic exercise such as outdoor walking (walking or jogging) or indoors (walking on a treadmill without inclination) with a duration of 20-30 minutes. After the core exercise, the patient is asked to do a cool down exercise for 10 minutes. The frequency of aerobic physical exercise is three times a week for one month. Patients may do other types of aerobic physical exercise, and patients can increase the intensity of their exercise according to their abilities. After 1 month of participating in the phase II cardiac rehabilitation program, the patient is scheduled to do the 6-Minute Walk Test again.

Statistical data processing and analysis using the SPSS application. Categorical variables are presented with frequency (n) and percentage (%). Numerical variables are presented with the mean (mean) and standard deviation (SD) for normally distributed data. Meanwhile, for data that are not normally distributed, numerical variables are presented with the median and interquartile ranges. The normality test for numerical variables on all research subjects used the Kolmogorov-Smirnov test with $n > 50$ or the Saphiro Wilk test if $n < 50$. Bivariate analysis will be done using paired T-test. The variable is considered significant if the p value < 0.05.

RESULT

In this study, 35 samples were obtained from patients who underwent phase II cardiac rehabilitation in the form of aerobic physical exercise. The average age was 54.57+1.28 years, and male sex were 30 people (85.7%). The most common risk factors for heart failure were 26 people smoking (74.3%), 22 people with

dyslipidemia (62.9%), 20 obese people (57.1%), hypertension (48.6%), and 14 people with diabetes mellitus (40%). The ECG results showed that 32 people had sinus rhythm (91.4%) and 3 people had atrial fibrillation (8.6%). Echocardiography results showed that the median ejection fraction was 42 (14-49) with 21 samples (60%) having an EF between 40-49% and an EF <40% found in 14 samples (40%).

Table 1. Baseline Characteristics of the Patients

Variables	n (%)
Age	54,57±1,28
Gender	
Men	30 (85,7)
Women	5 (14,3)
Weights in Kg	70±1,99
Heights in cm	163,31±0,95
Body Mass Index	26,39±0,61
Obesity	20 (57,1)
Smoker	26 (74,3)
Dyslipidemia	22 (62,9)
Diabetes	14 (40)
Hypertension	17 (48,6)
ECG	
Sinus Rhythm	32 (91,4)
Atrial Fibrillation	3 (8,6)
Ejection Fraction	42 (14-49)
HFmrEF	21 (60)
HFrEF	14 (40)
LVDD	51,97±7,89
E/A	1,01 (0,58-2,71)
E/e'	11,78 (6,3-37,43)
LAVI	33,18±11,8
TAPSE	18,57±4,5
Medications	
Antiplatelet	32 (91,4)
Statin	31 (88,6)
ACE/i	20 (57,1)
ARB	12 (34,3)
Diuretics	26 (74,3)
β-Blocker	26 (74,3)
MRA	21 (60)

Table 2 presents characteristic data before and after 1 month of cardiac rehabilitation. Prior to aerobic exercise, the average functional capacity was 3.55 + 1.12 MET. These results increased after cardiac rehabilitation to 6.6+2.44 MET. The results of the 6-minute walking test showed an average increase in distance from 192.57+64.68 meters to 373.6+133.64 meters after aerobic physical exercise.

Table 2. Patients' characteristic data before and after 1 month of cardiac rehabilitation

Variables	Pre-rehabilitation	After 1 Month of Rehabilitation	p Value
6 Minute walk test	192,57±64,68	373,6±133,64	<0,001
Functional Capacity	3,55±1,12	6,6±2,44	<0,001

Table 3 presents data on the functional capacity of the heart before and after the aerobic physical exercise program based on the ejection fraction value. There was a greater increase in functional capacity and 6MWT distance in the HFmrEF group compared to the HFrEF group after aerobic exercise. However, no significant

relationship was found between decreased ejection fraction, functional capacity improvement, and increased 6MWT distance.

Table 3. Patient's functional capacity of the heart before and after 1 month of cardiac rehabilitation

Variables	HFmrEF	HFrEF	Nilai p
Functional Capacity			
Before	3,54±0,199	3,56±0,37	0,198
After	7,03±0,602	5,98±0,48	
6-Minute Walk Distances			
Before	187, 61±11,37	200±21,81	0,414
After	389,80±33,51	349,28±25,84	

DISCUSSION

The results of this study showed an increase in the average functional capacity of the heart after an aerobic exercise program from 3.55±1.12 MET to 6.6±2.44 MET (P<0.001). These results are in line with other research, regarding the impact of aerobic physical exercise (walking for 30 minutes with a frequency of 3 times per week), on the functional capacity of heart failure patients, showing a positive and significant correlation.

Research by Chen et al in heart failure patients with decreased ejection fraction showed an increase in functional capacity in the group that was given an intervention in the form of aerobic exercise at home three times per week (5.5±1.8 vs 6.0±1.9, p <0.01).[4-5]

There was an increase in the average 6-MWT distance from 192.57±64.68 meters to 373.6±133.64 meters after the aerobic exercise program (P<0.001). These results are in line with previous research, in the group that participated in aerobic exercise, there was a significant increase in the 6MWT distance from 435.4 ± 49.4 to 498.3 ± 52.1 (p=0.001, ES=0.78). The results of the study by Rouf et al also showed similar results, there was an increase in the 6-MWT distance between the aerobic exercise group (107.9 ± 22.153 meters) compared to the control group (21.3 ± 16.166 meters) which was significantly better in physical exercise group.[6-8]

There was an increase in mean cardiac functional capacity and 6MWT distance in the HFmrEF and HFrEF groups however, no statistically significant association was found between patients with HFmrEF and HFrEF to improvement in functional capacity after the aerobic exercise program. These findings differ from previous studies by Mahdi et al, where there was a significant difference in functional capacity improvement between patients who had an EF <35 and those who had an EF >35. However, in other studies, it was stated that EF did not have a significant relationship with functional capacity improvement.[9-10]

CONCLUSION

The average functional capacity in heart failure patients is 3.55±1.12 MET with a 6-Minute walk distance of 192.57±64.68 meters. After the patients went through the aerobic physical exercise, there is an increase in functional capacity to 6.6±2.44 MET and an increase in 6-Minute Walk distance to 373.6+133.64 meters. Based on the results, we concluded that there is a significant relationship between aerobic physical exercise and increased functional capacity in heart failure patients at Haji Adam Malik General Hospital (p < 0.001).

DECLARATIONS

Ethics approval and consent to participate. Permission for this study was obtained from the Ethics Committee of Universitas Sumatera Utara and Haji Adam Malik General Hospital.

CONSENT FOR PUBLICATION

The Authors agree to publication in Journal of Society Medicine.

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AUTHORS' CONTRIBUTIONS
All authors significantly contribute to the work reported, whether in the conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas. Contribute to drafting, revising, or critically reviewing the article. Approved the final version to be published, agreed on the journal to be submitted, and agreed to be accountable for all aspects of the work.

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REFERENCE
1. Savarese G, Lund LH. Global Public Health Burden of Heart Failure. Card Fail Rev. 2017;03(01):7.
2. Heidenreich PA, Bozkurt B, Aguilar D, Allen LA, Byun JJ, Colvin MM, et al. 2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. Circulation. 2022;145(18).
3. McDonagh TA, Metra M, Adamo M, Gardner RS, Baumbach A, Böhm M, et al. 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. Eur Heart J. 2021; 42(36):3599–726.
4. Aroyah N. Program Latihan Fisik Rehabilitatif Pada Penderita Penyakit Jantung. Medikora. 2010; 4(1): 11–22.
5. Radi B, Tiksnadi BB, Dwiputra B, Sarasvati D, Ambari AM. Panduan Rehabilitasi Kardiovaskular. Jakarta: PERKI; 2019. p 3-46.
6. Giannitsi S, Bougiakli M, Bechlioulis A, Kotsia A, Michalis LK, Naka KK. 6-minute walking test: A useful tool in the management of heart failure patients. Ther Adv Cardiovasc Dis. 2019;13:1–10.
7. Chen YW, Wang CY, Lai YH, Liao YC, Wen YK, Chang ST, et al. Home-based cardiac rehabilitation improves quality of life, aerobic capacity, and readmission rates in patients with chronic heart failure. Medicine. 2018 Jan;97(4):e9629.
8. Rouf MK, Arso IA, Pramantara IDP. The Effects of Aerobic Exercise on Functional Capacity of Geriatric Chronic Heart Failure Patients. J Intern Med. 2018; 6 (2): 93–101.
9. Mahdi HM, Masoumeh S, Ali KM, Roohafza H, Mohammad RF. Relationship between Changes in Functional Capacity and Anthropometric, Clinical and Psychological Indicators in Cardiac Patients Participating in Cardiac Rehabilitation Program. Health N Hav. 2021; 13 (11): 1303–13.
10. Scrutinio D, Guida P, La Rovere MT, Bussotti M, Corrà U, Forni G, et al. Functional outcome after cardiac rehabilitation and its association with survival in heart failure across the spectrum of ejection fraction. Eur J Intern Med. 2023; 110: 86–92.