The Impact of a Physical Exercise Program on Functional Capacity in Patients with Hypertension

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ABSTRACT

Cardiac rehabilitation (CR)-based exercise is a therapeutic intervention that could reduce the mortality and morbidity rates of patients with hypertension by 40–55%. The purpose of this exercise program service is to improve the physiological and psychosocial status of patients with a history of hypertension. From several outpatient cardiac rehabilitation exercise programs in hospitals that refer to aerobic physical exercise, no research has implemented specific treadmill and stationary bike exercise programs. The two exercise programs are considered to be very effective and optimal for evaluating and measuring the impact of functional capacities such as blood pressure and pulse in patients with hypertension. The study measured blood pressure and pulse in 40 subjects using a sphygmomanometer. The data analysis technique used is ANOVA to determine the differences between groups and to compare which group has a significant impact. All treatment groups have the same optimal impact on the capacity of heart function in patients with hypertension. This study has proven that physical exercise programs in the form of treadmill and stationary bike exercises can increase the functional capacity of patients with hypertension. This 12-week research concludes that using treadmills and stationary bikes can optimize functional capacities. This research is the development of a physical exercise model to increase functional capacity safely and effectively. However, the combination of both exercises has the most optimal effect on blood pressure and pulse rate in patients with hypertension.

Keywords: functional capacity, hypertension, stationary bikes, treadmill

INTRODUCTION

Hypertension is a risk factor that has a high prevalence in the development of cardiovascular disease (Carlén et al., 2024). It is predicted that the prevalence of hypertension will increase by more than 30% during the next 20 years and result in an enormous disease burden for society (Crowley et al. 2022). In line with this ongoing development, the availability of suitable medicines and accurate measurements in the clinic and at home is crucial for patients with hypertension. An important factor in hypertension treatment is increasing the fitness of cardiac functional capacities, namely blood pressure (BP) and pulse or heart rate (HR) (Bruggisser et al., 2025). Previous studies have shown that imbalanced blood pressure and heart rate are the causes of hypertension (Spicuzza et al., 2025). Blood pressure and heart rate obtained in ambulatory monitoring reflect the daily activities of patients with hypertension. The UK guidelines explain the benefits of ambulatory monitoring that contradict the recommendations for ambulatory blood pressure and HR published by the 2016 European Society of Hypertension and European Society of Cardiology Guidelines (Correia et al., 2023).

Practitioners have made various efforts for patients with hypertension. However, overcoming hypertension problems still becomes an obstacle (Higashi, 2024). Historically, the debate about exercise management for hypertensive patients has been an obstacle, especially in finding the right solution. Interestingly, beneficial physical exercises have been suggested to deal with hypertension by optimizing the vascular wall (Lang et al., 2024). Besides conventional pharmacological treatment, physical exercise may therefore potentially prevent or treat hypertension (Alemayehu & Teferi, 2023). A review of various

research journal articles on exercises for cardiovascular disease has found strong evidence that a structured exercise program is a safe recommendation and has tremendous beneficial effects to prevent cardiovascular disease and manage diseases, especially hypertension (Romero et al., 2024). However, the results of this review do not explain in detail what types of exercises are given, either aerobic exercise (functional capacity), stretching exercises (passive or active), or balance exercises (Safitri et al., 2025).

To date, no research has implemented a treadmill and stationary bike exercise program for the management of patients with hypertension (Leeyio et al., 2025). These programs are considered effective and optimal for evaluating and measuring the impacts of functional capacities, such as blood pressure and pulse, in patients with hypertension (Sucipto et al., 2022). This study aims to evaluate the overall clinical impacts of the exercises and compare the exercise programs to discover which has the most significant impact on patients with hypertension. Thus, this study focuses on measuring the impacts of the treadmill exercise program, the stationary bike, and the combination of both.

METHODS

Participants in this study were 40 patients diagnosed with hypertension in an independent private clinical practice laboratory in Denpasar, Bali. The patients participated in the training twice a week for 12 weeks. Moreover, the patients were divided into four groups (10 patients per group). Group 1 received a treadmill exercise treatment (Low-bruce protocol). Group 2 received a stationary bike exercise (YCMA). Group 3 received a combination exercise between a treadmill and a stationary bike. Finally, group 4 was assigned as a control group. The patients were aged 50 to 65 years old according to the data of the Indonesian Hypertension Association Consensus (PERKI) and had no history of chronic comorbidities, such as post-stroke, diabetes mellitus, and chronic lung disease. All patients were educated about the risks and benefits of the training. During the follow-up period, they received the 6-minute walking test (6MWT) (D'Almeida et al., 2025). Informed consent had been obtained from the patients before they took part in the study. This research was tested through a proposal review involving human subjects and approved by the Research Ethics Committee of the Faculty of Medicine of Udayana University with number B/39401/UN38.8.1/PP.11.01/2025.

The measurement used the 6MWT, which was evaluated thoroughly and integrated all systems involved during the exercises, including the pulmonary and cardiovascular systems, systemic circulation, peripheral circulation, blood, neuromuscular units, and muscle metabolism. The patients in each group received training for 24 meetings. Then, they were retested to evaluate the capacity of heart functions (blood pressure and pulse). In the next stage, the researcher collected data and coordinated with the persons in charge of PJT and cardiac rehabilitation. Afterward, they recommended physiotherapy actions in private clinical practice, especially in exercise laboratories. Furthermore, this study explained the research objectives, general characteristics of patients, research instruments, data collection procedures, and the usefulness of this research to the patients. If they had agreed, they would have become the research patients and signed the informed consent.

In the implementation phase, the researchers recruited field workers, such as competent physiotherapists in the cardiovascular field, to assist the researchers in collecting data. Furthermore, the researchers recruited instructor trainers to explain the research implementation process so that this implementation was uniform with the researchers' expectations. To obtain pre-test data, the patients would undergo the BP and pulse measurements. The next step was conducting physical exercise programs on a tread-mills and stationary bikes, referring to the standard operating procedures. The final stage was collecting post-test data after conducting a series of training processes. Afterward, the research subjects were sorted into groups and trained to do treadmill and stationary bike exercises according to a predetermined schedule and exercise program.

The data were analyzed using the statistical package for the social sciences (SPSS) for Windows. The normality test was conducted to assess continuous variables to fit a normal distribution and normally distributed continuous variables. Moreover, one-way ANOVA was performed to find out the difference between groups, followed by Duncan's post hoc test.

RESULTS AND DISCUSSION

The normality test of the data used the Shapiro Wilk-Test while the homogeneity test used the Lavene's Test. The results of the normality test (Shapiro Wilk-Test) have shown that the total value data (p-value) before and after the treatments is less than 0.05 ($p < 0.05$). However, the pulse rate before treatment is more than 0.05 ($p = 0.193$). Thus, the average values of the functional capacity in the heart before and after the treatments are not normally distributed. Meanwhile, the homogeneity test (Lavene's Test) has obtained an average result of $p < 0.05$, which indicates the data are not homogeneous except for the value of the pulse before the treatments ($p = 0.614$), as presented in Table 1.

Table 1. Homogeneity and Normality Test Results pre and post Treatment of All Groups

Functional Capacity	P. Normality Test (Shapiro Wilk-Test)	P. Homogeneity (Levine's Test)
Blood pressure before treatment	0.001	0.320
Pulse before treatment	0.193	0.614
Blood pressure after treatment	0.006	0.002
Pulse after treatment	0.002	0.019

Table 2 demonstrates that the treadmill group has a blood pressure value of 136.7 and a pulse value of 81.8. The stationary bike group has a blood pressure value of 136.1 and a pulse with a value of 80.6. The combination of the treadmill and stationary bike group has the lowest blood pressure value of 125.9 and the lowest pulse rate value of 75.5. The control group has the highest blood pressure value of 153.3 and the highest pulse rate value of 91.4.

Duncan's test has proven that the treadmill and stationary bike groups have received an optimal impact on the functional capacity of blood pressure and pulse. Meanwhile, the group combining treadmills with stationary bike exercises has received the most effective and optimal impacts on the capacity of heart functions with a p-value = 0.000 ($p < 0.05$). This proves that the combination exercise program group has received the most significant impact on the capacity of heart functions in the form of blood pressure and pulse rate.

Table 2. Effect of 12-week treatment on blood pressure and pulse rate of patients with hypertension

Group	Variable	
	Blood pressure (mmHg)	Pulse rate (bpm)
Treadmill	136.7^{b}	81.8^{b}
Stationary bike	136.1^{b}	80.6^{b}
Treadmill and stationary bike	125.9^{a}	75.5^{a}
Control	153.3^{b}	91.4^{c}
Anova (p)	0.000	0.000

*Annotation:
1. p value < 0.05 is called significantly different or significant
2. Numbers followed by the same notation are in the same group
3. The notation “a” indicates the lowest average
4. The notation “c” indicates the highest average
5.Numbers followed by the same alphabet are the same group. If the alphabets are different, they are classified into different groups.

The preliminary evidence supporting this study shows that a structured and measurable physical exercise program can be used to improve heart function against risk factors (Hisamoto et al., 2025). Several studies have proved that a 45% ejection fraction could optimize and lower the blood pressure of 133 patients aged 45 to 65 years old who have high blood pressure after receiving a physical exercise program (Lin, 2023). However, other studies have found that the clinical evidence of a physical exercise program in the form of aerobic exercise is still inconclusive because testing the effects of physical exercise on older adults for three months still shows an unclear health status and much lower pulse and blood pressure than conventional treatment (Galván et al., 2025). Patients with hypertension tend to

experience complex cardiac function instability (Tamayo et al., 2022). The current study has proven that the impacts of aerobic exercise in the form of a treadmill are significantly beneficial to the aerobic fitness capacities, such as VO2max and pulse rate, and can reduce mortality of outpatients with hypertension. Generally, treadmills and stationary bike exercises provide similar benefits to heart function. Theoretically, treadmills and stationary bikes are included in the categories of aerobic exercises used to optimize the overall cardiac function capacities of patients with hypertension. Scientific literature evidence explains that treadmill and stationary bike exercises offer the most significant effects on blood pressure and VO2Max (Estévez-Caro et al., 2025).

Another study has proven that static cycling exercise can decrease systolic and diastolic blood pressure in patients with hypertension (Zhang et al., 2025). Thus, static bicycles are a safe modality to conduct physical exercise programs for hypertensive patients (Sli, 2022). Recent advances in physical exercises for cardiac function capacities and comprehensive treatment of exercise programs for hypertensive patients include aerobic exercises, such as treadmills and stationary bikes (Delgado-Floody et al., 2020). These exercises can increase the effectiveness of heart functions so that patients are able to improve their quality of life. This study shows that treadmill and stationary bike exercises impact heart functions. Treadmill and stationary bike exercise programs effectively improve the cardiovascular fitness of elderly patients and are easily used (Wang et al., 2025). The patient's exercise intensity was measured during exercise on weeks 3, 9, and 12. The literature explains that treadmills and stationary bikes can optimize blood pressure, pulse, and VO2max of patients with hypertension. One mechanism that explains changes in heart functions is that treadmill and stationary bike exercises provide benefits to brain health and reduce anxiety or depression (Ren et al., 2022). Another study has discovered different impacts of a six-minute walk test on a controlled clinical trial sample evaluating 300 outpatients and proved that the test could improve functional capacities and quality of life of patients receiving treadmill and stationary bike exercises because they have stable blood pressure and a normal pulse (Li et al., 2022; Dalton-Alves et al., 2024). The study also explains that most patients will die three years after the cardiac rehabilitation. These preliminary findings suggest that future studies should assess the efficacy of a community receiving the combined intervention of treadmill and stationary bike exercise programs that are believed to increase hypertensive patients' physical activities and proportion (150 minutes of moderate-intensity aerobic physical activities per week) (Helgerud et al., 2022). Other findings prove that treadmill and stationary bike exercises for 20 weeks have a significant 45% effect on pulse rates and VO2Max because treadmill and static bicycle exercises can maintain a balance of body performance by prioritizing concentration (Sahgal, 2024). Consequently, the VO2Max more optimally increases (Kim et al., 2025). The literature or previous research shows that treadmills and stationary bikes are potentially used as safe and effective exercise options to optimize blood pressure, pulse rate, and VO2Max (Lopes, 2024).

To date, no study has compared treadmill and stationary bike exercises (Pesova et al., 2023). Therefore, the results of this study can only be compared with those of similar studies. Furthermore, various previous studies still show different findings, and no similar studies have been published in Asia, especially in Indonesia. Thus, this study provides an introduction to the benefits of a combined exercise program and functions as a potential exercise for patients with hypertension who cannot or do not willingly take a conventional cardiac rehabilitation program, such as solely performing aerobic exercises.

CONCLUSION

A research study conducted over 12 weeks concludes that the physical exercise programs using treadmills and stationary bikes can optimize functional capacities. However, the combination of both exercises brings the most optimal effect on the functional capacities of blood pressure and pulse rate of patients with hypertension.

ACKNOWLEDGEMENTS

The authors would like to deliver sincere gratitude to the University of Dhyana Pura for supporting this research.

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