



THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY AND BLOOD PRESSURE STATUS IN HYPERTENSIVE PATIENTS

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ABSTRACT

Hypertension is a major global health problem with an increasing prevalence and a high risk of serious complications. Insufficient physical activity is recognized as a significant modifiable risk factor for elevated blood pressure. This study aims to identify the relationship between physical activity and blood pressure status in hypertensive patients in the working area of the Nguter Community Health Center, Sukoharjo Regency. This quantitative study employed a descriptive correlational design with a retrospective longitudinal approach. Sampling was conducted using purposive sampling based on specific criteria, resulting in 207 hypertensive respondents. Physical activity levels were assessed using the Global Physical Activity Questionnaire (GPAQ), which has been tested for validity and reliability. Blood pressure was measured using a sphygmomanometer that had been calibrated by the Agency for the Security of Medical Devices and Facilities (BPAFK) in Surakarta. Data analysis involved univariate examination, bivariate testing with Spearman rank test, and odds ratio calculation. The majority of respondents had light physical activity (61.4%) and stage 2 hypertension (69.9%). The analysis showed a significant negative correlation between physical activity and blood pressure status in hypertensive patients ($p < 0.001$; $r = -0.337$). Respondents with light physical activity were 4.5 times more likely to have stage 2 hypertension than those with moderate and heavy physical activity (OR = 0.221; 95% CI: 0.118-0.415). In conclusion, respondents with light physical activity had a higher risk of developing stage 2 hypertension. Regular physical activity plays a crucial role in the prevention and control of hypertension. Education from health professionals and community motivation are necessary to enhance awareness of the benefits of regular physical activity.

Keywords: blood pressure; hypertension; physical activity

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INTRODUCTION

Hypertension is a serious global health issue with a continuously increasing number of cases. It is often asymptomatic but can lead to serious complications, earning it the nickname "silent killer." Hypertension is a chronic condition characterized by increased blood pressure against the walls of the arteries, causing the heart to work harder (Putri Amelia & Nur Rosyid, 2025). Hypertensive patients are often unaware of their condition because it doesn't show clear symptoms and tends to resemble common complaints. Symptoms that appear include difficulty sleeping, headaches, palpitations, shortness of breath, and others. The symptoms of hypertension are influenced by high blood pressure and the duration of untreated hypertension (Horne et al., 2023).

Complications such as kidney failure, stroke, the onset of heart disease, damage to visual organs like retinopathy, and disorders of the peripheral arteries are caused by continuously elevated and uncontrolled blood pressure (Ayuningjati & Nur Rosyid, 2024). High blood pressure is closely associated with a potential increase in left ventricular hypertrophy, which increases the risk of coronary heart disease, atrial fibrillation, and heart failure (Baffour et al., 2024).

In Indonesia, data on hypertension recorded in the Indonesian Health Survey (SKI) in 2023 revealed that 30.8% of the population aged 18 and over had hypertension based on blood pressure

measurements (Kemenkes RI, 2023). According to the 2023 report from Sukoharjo Regency, data showed 266,043 residents aged ≥ 15 years with hypertension. The number of hypertension cases in 2023 increased compared to the number of hypertension sufferers in 2022, which reached 263,830 people aged ≥ 15 years (DKK Kab.Sukoharjo, 2023).

Several factors influence blood pressure, including non-modifiable factors such as gender, race, and genetic factors. Modifiable factors include lifestyle, low physical activity, obesity, occupation, education, stress, and excessive salt intake (>5 g/day). At the age of over 70, it will cause enlargement of the arteries and a decrease in blood vessel elasticity. The aging process is natural and inevitable. Engaging in physical activity can prevent the onset of degenerative diseases like hypertension, which can affect the quality of life in the elderly (Setyowati Putri & Supratman, 2021).

Management for preventing worsening hypertension includes both medication and non-medication approaches. Non-pharmacological techniques involve lifestyle modifications such as increasing physical activity, controlling diet, limiting sodium intake, managing stress, and avoiding alcohol and smoking (Dinita & Maliya, 2024). Physical inactivity can be one of the predisposing factors for increased blood pressure. Regular physical activity, as a non-pharmacological treatment, is effective in regulating blood pressure. However, many hypertensive patients still engage in only light physical activity, making blood pressure control challenging.

In Behavioral Risk Factor theory, it is explained that physical activity is a behavioral factor that can influence a person's health status. As an effort to maintain optimal heart health, adults aged 18 to 64 are recommended to engage in moderate-intensity physical activity for at least 150 to 300 minutes per week, or 75 to 150 minutes of high-intensity physical activity. Meanwhile, seniors are advised to engage in moderate-intensity physical activity daily for 30 minutes per week (Charchar et al., 2024). This aligns with the study conducted by Janah & Hudiawati (2024), which demonstrates that physical activity therapy has an effect on lowering blood pressure in hypertensive patients.

Although much research has been conducted on physical activity in hypertensive patients, most studies still use a cross-sectional design, which describes the association at a single point in time without considering changes in blood pressure over a specific period. There are still few studies that specifically examine the relationship between physical activity and blood pressure status in the Nguter Community Health Center service area, Sukoharjo Regency. Based on the explanation above, the researcher is interested in knowing the relationship between physical activity and blood pressure status in hypertensive patients within the Nguter Community Health Center service area, Sukoharjo Regency. The novelty of this study lies in its research design, which uses a retrospective longitudinal approach and odds ratio analysis to determine the magnitude of hypertension risk based on physical activity levels. This research aims to provide useful insights, information, and knowledge, as well as increase public understanding of the importance of physical activity in preventing and controlling blood pressure.

METHOD

This study employed a descriptive correlational quantitative design with a retrospective longitudinal method. The population size in this study is 3,166 hypertensive patients within the working area of the Nguter Community Health Center, Sukoharjo Regency. To determine the sample size, G-Power was used with the following parameters: one-tailed test, correlation p H1 or effect size 0.2, power 0.95, and probability error 0.1 or 10%. This resulted in a sample size of 207 respondents, who were selected using purposive sampling techniques based on specific criteria such as being able to communicate well, having hypertension with a minimum age of 20 years (regardless of whether they were currently undergoing treatment), and being willing to participate as respondents by signing informed consent.

Furthermore, the research instruments used in this study include the GPAQ questionnaire from the World Health Organization (WHO), which contains 16 questions with 3 core components: workplace activity, travel activity, and recreational activity, as well as an additional component regarding sitting duration (sedentary behavior). The GPAQ reliability test has strong reliability values with Kappa results of 0.67–0.73, whereas the validity test results have a moderate validity level correlated with accelerometer data ($r=0.48$) (Saputra et al., 2023). Physical activity levels were calculated using the Metabolic Equivalent of Task (MET) scoring system and categorized as low (<600 MET-minutes/week), moderate (600-2.999 MET-minutes/week), and high (≥ 3000 MET-minutes/week). The tool used to measure the respondents' blood pressure was a digital sphygmomanometer that had been calibrated by the Agency for the Security of Medical Devices and Facilities (BPAFK) in Surakarta. The calibration test results showed an accuracy level of 95% confidence with a blood pressure uncertainty value of ± 0.8 – ± 1.2 and a heart rate uncertainty of ± 0.8 . Based on the calibration results, the device functioned well and was declared fit for use with certificate number 7-8-1/BPAFKS/LPK/2025/00210. Blood pressure data were classified according to the International Society of Hypertension (ISH, 2020) with the category of high blood pressure if systolic 130-139 mmHg and diastolic 85-89 mmHg, stage 1 hypertension when systolic 140-159 mmHg and diastolic 90-99 mmHg, and stage 2 hypertension when systolic pressure is 160 mmHg and diastolic pressure is 100 mmHg.

Data analysis included univariate analysis to determine the distribution of respondent's characteristics, and bivariate analysis using the Spearman Rank correlation test because both variables were ordinal and not normally distributed. This analysis was performed to examine the relationship between physical activity and blood pressure status among hypertensive patients. Odds ratio (OR) testing was conducted to determine the likelihood of developing stage 2 hypertension based on respondents' physical activity. This research has undergone ethical review and received approval from the Health Research Ethics Committee of the Faculty of Medicine, Muhammadiyah University of Surakarta, with the number 5692/B.1/KEPK-FKUMS/V/2025. It also received permission to be conducted from the Faculty of Health Sciences, Muhammadiyah University of Surakarta, with the number 1554.1/C.8-III/FIK/2025. To ensure the legality of the research, the researcher also included official permits from the Sukoharjo Health Office with the number 070/2256/DKK/IV/2025 and obtained operational permits from the Nguter Community Health Center as the research location.

RESULT

Table 1.
Respondent characteristics (n= 207)

Respondent characteristics	f	%
Age		
30-45	12	5.8
46-55	35	16.9
56-65	76	36.7
>65	84	40.6
Gender		
Male	54	26.1
Female	153	73.9
Job		
Unemployed	107	51.7
Housewife	15	7.2
Civil Servant	4	1.9
Farmer	47	22.7
Seller	14	6.8
Laborer	6	2.9
Tailor	1	0.5
Entrepreneur	11	5.3
Craftsman	2	1.0

The results of the study are shown in Table 1, present the demographic characteristics of the respondents including age, gender, and occupation. Most respondents were aged over 65 years totaling 84 respondents (40.6%). The majority were female, numbering 153 respondents (73.9%) and more than half of the respondents 107 (51.7%) were unemployed.

Table 2.
Distribution of physical activity categories and blood pressure categories of respondents (n=207)

Variable	F	%
Physical Activity Categories		
Light	127	61.4
Moderate	69	33.3
Heavy	11	5.3
Blood Pressure Categories		
Stage 1 Hypertension	63	30.4
Stage 2 Hypertension	144	69.6

Based on the results obtained from MET assessment category through the GPAQ questionnaire and blood pressure measurements of respondents. As shown in Table 2, 127 (61.4%) respondents showed a category of light physical activity and 144 (69.6%) respondents were in stage 2 hypertension.

Table 3.
Relationship between Physical Activity and Blood Pressure Status (n=207)

Physical Activity	Blood Pressure				f	
	Stage 1		Stage 2		f	%
	f	%	f	%		
Light	23	11.1	104	88.3	127	61.4
Moderate	34	16.4	35	16.9	69	33.3
Heavy	6	2.9	5	2.4	11	5.3
P Value	0.000 (p < 0.001)					
Correlation Coefficient	-0.337					
OR(95% CI)	0.221 (0.118-0.415)					

Table 2 shows that 104 respondents (88.3%) had light physical activity and stage 2 hypertension. The results of the Spearman rank test showed a p-value of 0.000 with a correlation coefficient between the two variables of -0.337, indicating a significant relationship between physical activity and blood pressure status in hypertensive patients, so that the heavier the physical activity, the lower the blood pressure status and vice versa. The results of the Odds Ratio (OR) risk analysis were 0.221 (95% CI; 0.118-0.415). An OR value < 1 indicates that moderate to heavy physical activity has a protective effect against stage 2 hypertension. Consequently, respondents with light physical activity increased their chances of stage 2 hypertension by about 4.5 times compared to respondents with moderate to heavy physical activity.

DISCUSSION

The findings of this study show that most respondents were aged over 65 years old (40.6%), followed by respondents aged 56-65 years (36.7%). Increasing age is well recognized as a major risk factor for hypertension. In the elderly group, the risk of hypertension rises due to combination of aging-related physiological changes, lifestyle factors, and genetic predisposition (Artistin et al., 2025). Degenerative changes associated with aging include collagen accumulation within the ventricular walls, which causes narrowing of the blood vessels, contributing to an increase in blood pressure (Vatner et al., 2021).

Based on the results of the study, female respondents dominated the research sample with 153 respondents (73.9%). This condition may be explained by postmenopausal hormonal changes, such as a decrease in estrogen levels, which play a role in maintaining blood vessel elasticity (Ryczkowska et al., 2023). After menopause, women also tend to experience weight gain and fat

accumulation in the abdominal area. Obesity also causes many other chronic diseases, one of which is hypertension (Orhan et al., 2025).

From a work perspective, unemployed respondents were the majority group with 107 respondents (51.7%), while based on physical activity levels, 127 respondents (61.4%) were in the light physical activity category and were classified as having stage 2 hypertension (69.6%). The results of this study indicate that occupational factors influence blood pressure status. Occupational factors that involving heavy physical workloads, such as those experienced by construction workers, laborers, and those engaged in digging activities, can lead to increased respiratory rate and a higher heart rate, thereby increasing the risk of cardiovascular disorders like hypertension. The findings of Andini and Siregar (2024) reported a significant positive correlation between working hours and hypertension, indicating that longer working hours are associated with a higher risk of developing elevated blood pressure.

Physical activity plays a crucial role in the regulation of blood pressure. The research findings indicate that 127 respondents (61.4%) have a light level of physical activity. Increasing physical activity is one of the non-pharmacological strategies for preventing and controlling hypertension. Physical activity is considered effective because it can improve the cardiovascular system and stimulate the production of Nitric Oxide (NO) from within the body, resulting in a positive impact by relaxing muscles, optimizing blood pressure, and aiding oxygen delivery throughout the body (Faizizah & Muhlisin, 2024). Physical activity increases the amount of antioxidants in the body, which helps reduce oxidative stress by increasing factors such as Nrf2, which protects cells from free radicals (El Assar et al., 2022). The long-term impact of regular physical exercise can reduce the number of pro-inflammatory cytokines, thereby minimizing the occurrence of systemic inflammation. Cytokines are mediators of the immune system.

During physical activity, the immune system is triggered by an increase in pro-inflammatory cytokines, such as IL-6 and TNF- α , but this must be balanced by an increase in IL-10 as an anti-inflammatory cytokine to prevent negative impacts on health (Pertiwi et al., 2022). In addition, regular physical activity has shown to improve quality of life because it contributes to regulating mood by increasing neurotransmitters such as dopamine and serotonin. Jogging at moderate to high intensity at least twice a week has been proven to alleviate depression and maintain overall physical health (Denny Pratama & Nadiyah Nisrinaa, 2025).

This study indicates a significant relationship with an inverse direction between physical activity and blood pressure status in hypertensive patients. Moderate to heavy physical activity is protective against the occurrence of stage 2 hypertension, while light physical activity increases the risk of stage 2 hypertension. Zhang et al. (2023) study also reported a negative correlation between physical activity and blood pressure status, as indicated by an OR value of 0.86 (95% CI; 0.74-0.99). Additionally, a study by Masanovic et al. (2022) demonstrated that a reduced risk of hypertension was associated with moderate to vigorous levels of physical activity, as indicated by an OR value of 0.82 (95% CI; 0.73-0.93). Light physical activity may lead to reduced muscle contractions frequency, which decreases anti-inflammatory hormone production and increases vascular inflammation. This inflammation triggers changes in blood vessel structure and arterial elasticity, leading to an increased risk of high blood pressure and complications from hypertension (Rios et al., 2024).

CONCLUSION

This study demonstrates that physical activity plays a crucial role in blood pressure control among patients with hypertension. This indicates that the better a person's level of physical activity, the lower the likelihood of developing more severe hypertension. The research findings support that

regular physical activity contributes to the maintenance of cardiovascular function and reduces the risk of hypertension related complications.

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