Journal of Health Promotion and Behavior (2026), 11(03): 355-366
Master's Program in Public Health, Universitas Sebelas Maret

Original article
Open Access

Effect of Yoga and Walking on Systolic Blood Pressure and Physical Fitness in Older People with Hypertension

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Received: May 26, 2026; Accepted: July 10, 2026; Available online: July 16, 2026

ABSTRACT

Background: Hypertension in the elderly is one of the most common health problems and is at risk of causing cardiovascular complications. Physical activities such as yoga and walking are seen as effective non-pharmacological interventions in helping control blood pressure, improving physical fitness, and providing a positive impact on the quality of elderly health services. This study aims to analyze the effect of yoga and walking on systolic blood pressure and physical fitness in older people with hypertension.

Subjects and Method: This was an experimental study. The independent variable was yoga and walking program. The dependent variables were systolic blood pressure and physical fitness. The effect of yoga and walking interventions on systolic blood pressure and physical fitness was analyzed using Freadman test.

Results: The results showed that yoga and walking had a significant effect on reducing systolic blood pressure in the elderly with (Sig. 0.001 <0.05). Spearman's rho analysis results indicate that behavioral activity is significantly associated with all variables, as the p-value is < 0.001. The strongest association was found with pre-test systolic blood pressure (r = 0.78). Meanwhile, post-test physical fitness showed an r-value of 0.67, pre-test physical fitness r = 0.54, and systolic blood pressure r = 0.47.

Conclusion: There is a significant difference in the effect of behavioral activity on systolic blood pressure and physical fitness in elderly people with hypertension, based on the Friedman test. Behavioral activity has been shown to contribute to lowering systolic blood pressure and improving physical fitness; there is a strong relationship between behavioral activity on systolic blood pressure and physical fitness based on the Spearman's rho correlation test.

Keywords: Yoga, walking, systolic blood pressure, physical fitness, hypertensive elderly.

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Cite this as:
Susiani ET, Dewi YLR, Khoiriyah S, Ghozali DA, Prayitno A (2026). Effect of Yoga and Walking on Systolic Blood Pressure and Physical Fitness in Older People with Hypertension. *J Health Promot Behav.* 11(03): 355-366. https://doi.org/10.26911/thejhpb.2026.11.03.05.

BACKGROUND

Hypertension remains a major public health problem among older adults in Indonesia, including Ponorogo Regency, where its prevalence continues to increase with population ageing. According to the Ponorogo Regency Health Office, approximately 226,337 individuals (38.28%) were diagnosed with hypertension in 2025. Documentation from the Elderly Community Health Post (Posyandu) in Ngampel Village further indicated that 53.5% of older adults had hypertension. Although community-based educational initiatives, such as the SERASI Program in Kadipaten Village, have successfully improved knowledge regarding hypertension prevention and management, evidence regarding the effectiveness of physical activity interventions for blood pressure control in community settings remains limited. These findings highlight the need for safe, practical, and sustainable non-pharmacological strategies that can be implemented at the primary healthcare level.

Physical inactivity is one of the most important modifiable risk factors for hypertension (Pumpo, 2024). Sedentary behavior contributes to elevated blood pressure through increased peripheral vascular resistance, endothelial dysfunction, excess body weight, and reduced cardiovascular fitness. Conversely, regular physical activity improves cardiovascular function and contributes to blood pressure reduction (da Silva Rodrigues et al., 2025). Among the various forms of exercise, yoga and walking are particularly suitable for older adults because they are safe, inexpensive, easy to perform, and adaptable to different functional abilities (Kumar & Rathi, 2025). Previous studies have consistently shown that structured physical activity can significantly reduce systolic blood pressure; however, its implementation within community-based elderly health programs remains suboptimal (Penrod & Moore, 2022).

Previous studies have demonstrated that yoga is effective in reducing blood pressure among individuals with prehypertension and hypertension (Thiyagarajan et al., 2018; Kumar, 2023; Rahmatani & Sutrisno, 2025). However, most investigations have evaluated yoga as a single intervention and primarily involved the general adult population or individuals with prehypertension rather than older adults with established hypertension. In addition, few studies have integrated yoga with walking as a combined physical activity program that may simultaneously enhance cardiovascular fitness and blood pressure control. Existing research has also focused mainly on blood pressure outcomes, with limited attention to broader indicators of physical fitness, including cardiorespiratory endurance, muscle strength, muscular endurance, flexibility, and body composition. Furthermore, satisfaction with healthcare services among older adults has rarely been evaluated as part of exercise intervention studies (Mathersul, 2025; Wang, 2024). Evidence from Indonesia, particularly Ponorogo Regency, is also scarce, limiting the availability of local evidence to support community-based hypertension prevention and management programs.

The Indonesian Ministry of Health emphasizes that individuals aged 15 years and older with hypertension are entitled to standardized healthcare services that include non-pharmacological education, lifestyle counselling, routine blood pressure monitoring, and appropriate therapy (Ministry of Health of the Republic of Indonesia, 2024). Strengthening evidence-based, community-based interventions is therefore essential to support the implementation of these national recommenda-

tions in primary healthcare settings (Li et al., 2022).

Therefore, this study aimed to evaluate the effects of a combined yoga and walking intervention on systolic blood pressure, physical fitness, and satisfaction with healthcare services among older adults with hypertension in Ponorogo Regency. Unlike previous studies, this research integrates two complementary forms of physical activity within a community-based intervention and simultaneously evaluates multidimensional outcomes, including blood pressure, cardiorespiratory endurance, muscle strength and endurance, flexibility, body composition, and healthcare service satisfaction. The findings are expected to provide locally relevant evidence to support the development of effective promotive and preventive programs for hypertension control among older adults and inform regional health policy for elderly healthcare services.

SUBJECTS AND METHOD

1. Study Design

This was an experimental study conducted in a community integrated health post for older people in Ponorogo, East Java, Indonesia.

2. Population and Sample

The study participants were 39 older people who had hypertension and were selected using the Federer formula (Gentili et al., 2024).

3. Study Variables

The dependent variables were systolic blood pressure and physical fitness. The independent variable was yoga and walking program.

4. Operational Definition of Variables

Yoga Physical activity in the form of a combination of postures (asana), breathing (pranayama), and relaxation is carried out in a structured manner for 40 minutes per session, 2x a week.

Walking physical activity in the form of moving with steps for a duration of 40 minutes per session, 2x a week as a form of exercise.

Physical fitness the body's ability to perform physical activity without excessive fatigue, including cardiorespiratory aspects, muscle strength, endurance

Blood pressure the pressure exerted by blood on the artery walls is measured as systolic pressure. After the respondent rests for 5 minutes, the measurement is carried out twice.

5. Study Instruments

Demographic characteristics (age, gender, residence, education, occupation, body weight, and body height) were colelcted using a set of questionnaire.

Systolic blood pressure was measured using a calibrated digital sphygmomanometer to obtain accurate results. Measurements were taken before and after the yoga and walking intervention program.

Physical fitness was measured using simple physical fitness tests tailored to the conditions of the elderly respondents, such as a six-minute walk test and a light endurance test.

6. Data analysis

Descriptive statistics were used to summarize participant characteristics and study variables. Prior to inferential analyses, the assumptions of normality and homogeneity of variance were assessed. Bivariate analyses were conducted to examine differences in systolic blood pressure, physical fitness, and healthcare service satisfaction between the intervention and control groups. Multivariate analysis was subsequently performed to evaluate the overall effect of the intervention on multiple dependent variables simultaneously while accounting for the correlation among the

outcome measures. Statistical significance was set at $p < 0.05$.

7. Research Ethics

Ethical considerations, including informed consent, anonymity, and data confidentiality, were strictly implemented throughout the research process. Ethical approval for this study was obtained from the Research Ethics Committee of Dr. Moewardi Hospital, Surakarta, Indonesia, on January 15, 2026, with approval number 055/I/HREC/2026.

RESULTS

1. Sample Characteristics

Based on Table 1, the majority of the 39 respondents fell within the 60–65 age group (74.4%). Physically, most weighed between 51 and 60 kg (65.4%) and had a height of 160–170 cm (48.7%). Regarding education, more than half of the respondents had completed primary school (53. 8%), followed by those with a high school education (25.6%) and junior high school education (17.9%), while only 2.6% held a bachelor's degree. In terms of health status, all respondents suffered from hypertension; the majority fell into the Grade 1 Hypertension category (69.2%), with the remainder in the Grade 2 Hypertension category (30.8%). Their physical fitness levels were predominantly classified as "Poor" (59.0%) and "Fair" (41.0%), with no respondents falling into the "Very Poor," "Good," or "Very Good" categories. Meanwhile, regarding physical activity, the respondents were evenly distributed (33.3% each) across three types of activities: yoga, walking, and a combination of both.

Table 1. Frequency Distribution of Research Variables

Variable	Frequency (n)	Percentage (%)
Age group		
60-65 years old	29	74.4
66-70 years old	10	25.6
Body Weight (kg)		
40-50	12	30.8
51-60	22	65.4
61-70	5	12.8
Height (cm)		
140-150	11	28.2
160-170	19	48.7
161-170	9	23.1
Education		
Elementary School	21	53.8
Junior High School	7	17.9
Senior High School	10	25.6
Higher Education	1	2.6
Systolic Blood Pressure (mmHg)		
Grade 1 Hypertension	27	69.2
Grade 2 Hypertension	12	30.8
Physical Fitness		
Poor (11-20)	23	59.0
Fair (21-30)	16	41.0
Activity		
Yoga	13	33.3
Walking	13	33.3
Combination (yoga dan walking)	13	33.3

Based on Table 2, which presents descriptive statistics for the 39 older people, positive changes were observed in the variables of systolic blood pressure and physical fitness between the pre-intervention (pre-test) and post-intervention (post-test) stages. Regarding systolic blood pressure, there was a significant decrease in the mean value from 156.41 mmHg at the pre-test (range: 147–163 mmHg) to 144.90 mmHg at the post-test (range: 139–150 mmHg). The standard deviation also decreased from 4.666 to 2.836, indicating that the data distribution became more concentrated around the mean. Conversely, for the physical fitness variable, the mean value increased from 33.56 at the pre-test (range: 22–44) to 38.72 at the post-test (range: 30–45). The standard deviation also decreased from 5.098 to 4.594. Overall, these results indicate that the implemented activity intervention program was effective in lowering systolic blood pressure while simultaneously improving the respondents' physical fitness.

Table 2 Descriptive Statistics for Behavioral Activity, Systolic Blood Pressure, and Physical Fitness

Variables	Mean	SD	Min.	Max.
Systolic Blood Pressure				
Pre-test	156.41	4.666	147	163
Post-test	144.90	2.836	139	150
Physical Fitness Pre-test	33.56	5.098	22	44
Physical Fitness Post-test	38.72	4.594	30	45

2. Bivariate Analysis

A Friedman test was then performed. Table 3 shows that behavioral activities significantly influence systolic blood pressure, physical fitness, and satisfaction with health services for the elderly.

Table 3 Results of the analysis of the differential effects of behavioral activities on systolic blood pressure and physical fitness.

Variables		Sum of Squares	df	Mean Square	F	p
Systolic Blood Pressure	Between Groups	184.97	2	92.48	3.913	<0.001
	Within Groups	850.92	36	23.63		
	Total	1035.89	38			
Physical Fitness	Between Groups	130.82	2	65.41	3.773	<0.001
	Within Groups	624.15	36	17.33		
	Total	754.97	38			

3. Multivariate analysis

There was a moderate positive relationship between behavioral activity and systolic blood pressure before the intervention (r= 0.47; p<0.001). After the intervention, positive relationship between behavioral activity and systolic blood pressure (r= 0.79; p<0.001).

There was a relationship between behavioral activity and physical fitness at the initial stage (pre-test) (r= 0.67; p <0.001). After the intervention, There was a

relationship between behavioral activity and physical fitness (r= 0.55; p <0.001).

Table 4. Effect of Behavioral Activity on Systolic Blood Pressure and Physical Fitness

Variables	r	p
Systolic Blood Pressure		
Pre-Test	0.47	< 0.001
Post-Test	0.78	< 0.001
Physical Fitness		
Pre Test	0.54	< 0.001
Post- Test	0.67	< 0.001

DISCUSSION

Differences in the Effect of Behavioral Activities on Systolic Blood Pressure.

The results of the study showed that various behavioral activities had different effects on systolic blood pressure. This finding indicates that each form of health behavior engaged in by an individual contributes differently to the body's physiological condition, particularly systolic blood pressure. Behavioral activities, including physical activity, stress management, rest patterns, medication adherence, and healthy eating habits, can have varying effects on the cardiovascular system.

The Health Promotion Model (HPM) developed Rojas-torres (2025) explains that health promotion behavior is influenced by individual characteristics, previous experiences, perceived benefits, perceived barriers, self-efficacy, interpersonal influences, and situational factors, which ultimately determine a person's commitment to healthy behaviors. In the context of this study, the differences in the influence of various behavioral activities on systolic blood pressure indicate that individuals with better health behaviors tend to be able to maintain blood pressure within normal limits compared to individuals with less optimal health behaviors Matrona (2022).

From an epistemological perspective, Pender's theory explains that knowledge about health is acquired through understanding individual experiences and the factors influencing health behaviors Rojas-torres (2025). The results of this study provide empirical evidence that specific behavioral activities can differentially affect systolic blood pressure. This knowledge supports the HPM assumption that health behaviors are important predictors of achieving better health status.

In an axiological perspective, Health Promotion Modelemphasizes the value and benefits of implementing health-promoting behaviors to improve an individual's quality of life. The results of this study have high practical value because they can be used as a basis for developing nursing intervention programs and health promotion programs to control hypertension. Nurses can utilize these findings to identify the most effective behavioral activities for lowering systolic blood pressure and encourage patients to more actively adopt healthy behaviors.

The results of the study indicate that there are differences in the influence of various behavioral activities on physical fitness. This finding indicates that each form of behavior related to physical activity contributes differently to improving a person's fitness level. Individuals who engage in physical activity regularly, in a planned manner, and according to their

physical capacity tend to have better physical fitness levels than those who engage in low or irregular physical activity (Garcia et al., 2025).

Differences in Behavioral Activities on Physical Fitness.

These findings were analyzed using the health behavior theory of Junior et al. (2020), specifically the PRECEDE-PROCEED model. According to Sousa, health behavior is influenced by three main factors: predisposing factors, enabling factors, and reinforcing factors. Physical activity as a form of health behavior does not emerge spontaneously but is influenced by various factors that shape and support the behavior. From a predisposing factor perspective, knowledge is the primary basis for someone to engage in physical activity. Knowledge about the benefits of exercise, the risks of sedentary behavior, and the importance of maintaining physical fitness can encourage individuals to engage in healthy behaviors Garcia et al. (2025). This knowledge is obtained through various sources, such as formal education, health counseling, mass media, social media, personal experience, and interactions with health professionals. The better a person's knowledge about the benefits of physical activity, the more likely they are to have a positive attitude toward exercise and fitness.

In everyday life, good knowledge doesn't always translate into good behavior. Many individuals understand the benefits of physical activity but still lead sedentary lifestyles due to time constraints, busy work schedules, lack of motivation, or an unsupportive environment. Practicing physical activity wisely means adjusting the type, intensity, frequency, and duration of activity to an individual's health, age, and abilities. Excessive physical activity can actually increase the risk of injury, while excessive activity may not have an optimal impact on physical fitness. Therefore, a balance is needed between the body's needs and the individual's abilities in carrying out physical activity. Based on the findings (Junior et al., 2020) and the results of this study, it can be concluded that the differences in the effects of various behavioral activities on physical fitness are influenced by the individual's level of knowledge, the availability of supporting facilities, and social support. Knowledge gained from various sources needs to be implemented in concrete actions through regular and judicious physical activity to produce optimal improvements in physical fitness.

The Influence of Behavioral Activity on Systolic Blood Pressure.

The relationship between behavioral activity and systolic blood pressure is an important area of study in the health field, particularly regarding the prevention and control of hypertension. Behavioral activity encompasses various individual actions such as physical activity, a healthy lifestyle, stress management, sleep patterns, and relaxation practices like yoga. Several studies have shown that positive behavioral changes can significantly reduce systolic blood pressure. This finding is supported by research Cohen et al. (2016) examining the effects of yoga on blood pressure, as well as research Shetty et al. (2022) on the role of an integrated yoga therapy approach in improving cardiovascular health.

This study examines the nature of the relationship between human behavior and systolic blood pressure as an observable variable. Systolic blood pressure is a physiological indicator that describes blood pressure when the heart contracts to pump blood throughout the body. Meanwhile, behavioral activity is a manifestation of individual actions influenced by biological,

psychological, social, and environmental factors.

From an ontological perspective, behavior is not simply a physical act, but rather part of a living system that directly or indirectly influences bodily functions. When someone engages in calming activities such as yoga, meditation, or regular exercise, physiological changes occur in the form of decreased sympathetic nervous system activity and increased parasympathetic activity.

Research Cohen et al. (2016) shows that regular yoga practice can lower blood pressure in individuals with hypertension and prehypertension. This confirms that therapeutic behavior has a real impact on the body's physiological mechanisms. Similarly, research Shetty et al. (2022) found that an integrated yoga approach can improve the balance of bodily functions through a combination of physical exercise, breathing, meditation, and stress management.

The relationship between behavioral activity and systolic blood pressure is delivered through a systematic scientific process. Knowledge about the influence of behavior on blood pressure is built through observation, measurement, experimentation, and verifiable data analysis (Cohen et al., 2016). Meanwhile, research by Shetty et al. (2022) used an integrated yoga therapy approach encompassing physical, mental, and spiritual aspects. The results showed improvements in health parameters, including systolic blood pressure. These findings support the theory that structured behavioral changes can produce measurable physiological changes.

The study of the relationship between behavioral activity and systolic blood pressure has significant value and benefits for both individuals and society. This knowledge can be used as a basis for promotive and preventive efforts to reduce the risk of hypertension and cardiovascular disease complications. Research by Cohen et al., (2016) suggests that yoga can be a safe, affordable, and easily implemented non-pharmacological therapy alternative in everyday life.

The research also provides significant axiological contributions. An integrated yoga approach demonstrates that health is influenced not only by physical aspects, but also by mental and emotional balance Shetty et al (2022). Therefore, public health programs can incorporate behavioral interventions such as yoga as part of their hypertension management strategies. The axiological value of this research lies in its ability to encourage healthier lifestyle changes (Shruthi et al., 2025).

The Relationship between Behavioral Activities and Physical Fitness.

Behavioral activity or physical activity has a close relationship with a person's level of physical fitness. In daily life, physical fitness is influenced not only by biological factors but also by an individual's habits, knowledge, and behavioral patterns in carrying out physical activity. This relationship can be analyzed through the perspective of reality, knowledge, and behavior (Rodrigues et al., 2025).

From a reality perspective, the phenomenon occurring in society shows that sedentary or less active lifestyles are increasing due to technological developments and changes in work patterns. Many people spend hours sitting in front of computers, using motorized vehicles, and engaging in minimal physical activity. This condition has an impact on decreased physical fitness, an increased risk of obesity, cardiovascular disease, and a decreased quality of life. Research by Rodrigues et al. (2025) found that a 14-week multicomponent exercise program was able to

improve health, physical fitness, and anthropometric parameters in adults and elderly who previously had a sedentary lifestyle.

From a knowledge perspective, individuals who understand the benefits of physical activity generally have a higher awareness of maintaining their fitness. Knowledge about the benefits of exercise, a healthy lifestyle, and the negative impacts of a sedentary lifestyle can shape the belief that physical activity is an essential need. A study by Ahles et al. (2022) showed that older adults who received health support interventions and underwent fitness measurements experienced increased handgrip strength and improved psychological function, including the ability to think, learn, remember, and concentrate.

From a behavioral perspective, physical activity is a concrete manifestation of a person's knowledge. Active behavior is demonstrated through regular exercise, walking, cycling, strength training, or other physical activities. In health behavior theory, repeated actions form habits that ultimately influence an individual's health status. Rodrigues' research shows that sustained physical exercise can improve various fitness and health indicators in previously inactive adults and older adults.
The relationship between behavioral activity and physical fitness can be explained through the interconnectedness of reality, knowledge, and behavior. Reality shows that a sedentary lifestyle is a modern health challenge. Knowledge provides an understanding of the importance of physical activity for health and fitness. Meanwhile, behavior is the determining factor that transforms knowledge into concrete actions. Based on these two studies, it can be concluded that regular and sustained physical activity has a positive impact on physical fitness, mental health, bodily function, and quality of life for individuals, both adults and the elderly. Therefore, efforts to improve physical fitness need to be carried out through adequate education and the development of active behaviors so that people can live healthier and more productive lives.

AUTHOR CONTRIBUTION

ETS contributed to the study conception and design, data acquisition, analysis and interpretation, and drafted the manuscript. YLRD contributed to the study design, supervision, methodology, and critical revision of the manuscript. SK contributed to the study design, data analysis and interpretation, and manuscript revision. DAG contributed to data validation, interpretation of findings, and critical revision of the manuscript. AP contributed to the critical review of the manuscript and intellectual input. All authors approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

FINANCIAL SUPPORT AND SPONSORSHIP

This research received no external funding from any government agency, commercial organization, or non-profit institution. All research activities, including data collection, analysis, manuscript preparation, and publication-related expenses, were fully supported through the personal funds of the authors. Therefore, the study was conducted independently without any financial sponsorship or institutional grant.

ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to the Faculty of Medicine, Public Health Study Program, Universitas Sebelas Maret, Surakarta, Indonesia, for the academic support and

facilities provided throughout this research. Appreciation is also extended to all respondents, field assistants, and colleagues who contributed to the data collection and research process. Their valuable cooperation, insights, and support greatly contributed to the completion of this study and the preparation of this article for publication.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest related to the publication of this article. The research was conducted independently without any financial, commercial, or personal relationships that could influence the study design, data collection, analysis, interpretation of results, or the decision to publish the findings presented in this manuscript.

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