

Effectiveness of baduanjin exercise in reducing blood pressure among hypertensive elderly: Pre-experimental controlled community study

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ABSTRACT

Introduction: Hypertension is still prevalent among the elderly and contributes to an increased risk of cardiovascular disease. Safe and easy-to-implement non-pharmacological interventions support blood pressure control in the elderly, including Baduanjin exercise as a form of exercise to improve blood pressure. This study aims to analyze the effectiveness of Baduanjin exercise in optimizing blood pressure regulation in the elderly with hypertension.

Research Methodology: This quantitative study used a pre-experimental method with a pre-test, post-test, and control group design. The intervention group received appropriate therapy, but the intervention group received additional Baduanjin exercise. Twenty-nine respondents were recruited from each group. Systolic and diastolic blood pressure were measured before and after the intervention and analyzed using the Wilcoxon test.

Results: The study showed changes in both systolic and diastolic blood pressure in the intervention group with a p-value of 0.000. However, no significant changes were found in the control group with a p-value of 0.590 for the systolic variable and 0.123 for the diastolic variable.

Conclusion: Baduanjin exercise is effective in reducing systolic and diastolic blood pressure in elderly people with hypertension and is recommended as a non-pharmacological intervention to help control blood pressure in the elderly.

Keywords: baduanjin, blood pressure, exercise therapy, hypertension.



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INTRODUCTION

Aging is a complex biological process that affects various body systems, particularly the cardiovascular system, which significantly contributes to the increasing incidence of hypertension in the elderly population. Structural and functional changes can occur with aging, leading to increased arterial stiffness and decreased baroreceptors, which trigger increased blood pressure, particularly systolic and diastolic blood pressure, which are common in older adults (Li et al., 2021). Epidemiological studies show that the prevalence of hypertension increases progressively with age, particularly in the elderly, where an estimated three out of four elderly individuals experience high blood pressure (Chakraborty et al., 2026). Hypertension among the elderly is a major public health problem requiring comprehensive interventions tailored to the needs of this age group (Wang et al., 2025).

Based on data from the World Health Organization (WHO) indicates that approximately 1.13 to 1.28 billion adults worldwide have hypertension, with this number projected to increase to 1.5 billion individuals (Parashar et al., 2022). The largest proportion of sufferers is in the elderly age group, >60 years, due to physiological changes in aging and other comorbid risk factors. Health Research (Riskesdas) shows that the prevalence of hypertension in the elderly is very high, reaching over 60% in the 65-75 age group, and 70% in those aged 75 and older (Riskesdas, 2018).

Uncontrolled hypertension remains a global public health challenge due to its high prevalence and devastating impacts (Liu et al., 2025). The number of people with hypertension significantly contributes to the increasing incidence of cardiovascular diseases such as heart attacks, strokes, and chronic kidney disease, which are the leading causes of morbidity and mortality, particularly in developing countries where mortality rates are low (Rasdiyanah et al., 2026). Pharmacological management of hypertension in the elderly is limited, resulting in suboptimal blood pressure control and prevention of long-term complications (Ferdinand et al., 2020). The elderly consume a wide variety of medications due to multimorbidity, which can potentially increase drug interactions, side effects, and the risk of complications from diseases that could otherwise alleviate the patient's condition (Hijrah et al., 2025). Adherence to antihypertensive medication in the elderly remains a major problem, with non-adherence influenced by a lack of understanding of medication use, side effects, and therapy complications contributing to poor blood pressure control (Goorani et al., 2024).

Non-pharmacological management plays a role in controlling blood pressure, given the increasing incidence of cardiovascular disease due to complications of hypertension (Chanchlani et al., 2026). This approach is effective and safe in regulating blood pressure, especially in the elderly who are susceptible to medication side effects. It can also support more comprehensive hypertension management (Fukazawa et al., 2020). Lifestyle modifications such as a low-sodium diet, weight control, alcohol consumption management, and regular physical activity have been shown to significantly lower both systolic and diastolic blood pressure (Jafar et al., 2020). Structured physical exercise, such as the Baduanjin exercise, is a form of blood pressure therapy in the management of hypertension in the elderly (Zhang et al., 2025). Baduanjin exercise works by increasing the activity of the parasympathetic nervous system and decreasing the activity of the sympathetic nervous system, contributing to a decrease in systolic blood pressure, which is influenced by cardiac output and vascular tone (Carey et al., 2021).

Regular Baduanjin exercise can rhythmically increase peripheral blood flow, thereby stimulating the release of nitric oxide by the vascular endothelium (X. Ye et al., 2022). Nitric oxide functions as a vasodilator, playing a role in lowering diastolic blood pressure. Based on research conducted by Shao et al. (2020) baduanjin significantly reduced systolic blood pressure

by 8-11 mmHg on average and diastolic blood pressure by 4-6 mmHg, in addition to improving metabolic profiles such as blood lipids and heart rate in elderly adults who regularly performed baduanjin exercises.

Baduanjin exercise in older adults has a positive effect on lowering blood pressure. However, the number of studies in Indonesia is still limited, necessitating more specific research to demonstrate the effectiveness of baduanjin as a structured intervention in the elderly population with hypertension. Baduanjin exercise is not simply a light physical activity; it has the potential to be a safe, affordable, and easily accessible intervention for the elderly, especially those with limited physical function, while also helping reduce the risk of long-term complications from hypertension (Ma et al., 2022). This research paper aims to determine the effectiveness of Baduanjin exercise in optimizing blood pressure regulation in the elderly with hypertension.

RESEARCH METHODOLOGY

Study Design

This study employed a quantitative pre-experimental design with a pretest–posttest control group approach. This design was selected to assess the causal effect of Baduanjin exercise on blood pressure changes by comparing outcomes before and after intervention between groups, although without full randomization.

Setting & Participants

The study was conducted in Jetis Village, Baki District, Sukoharjo Regency, Indonesia, over eight weeks with intervention sessions held three times per week. The study population comprised elderly individuals diagnosed with stage 1 and stage 2 hypertension. Inclusion criteria included participants aged ≥ 60 years, having stable blood pressure, being physically capable of participating in light exercise, and providing consent to participate. Exclusion criteria included hypertensive crisis, severe cardiovascular complications, musculoskeletal limitations, or cognitive impairment. A purposive sampling technique was applied to recruit participants who met eligibility criteria. The total sample consisted of 58 respondents, divided equally into intervention ($n=29$) and control ($n=29$) groups. The sample size was determined based on feasibility considerations and prior similar intervention studies, ensuring adequate power to detect within-group changes.

Variables & Measurement

The independent variable was Baduanjin exercise, operationalized as a structured, low-intensity physical activity performed three times weekly for eight weeks. The dependent variables were systolic and diastolic blood pressure, measured in mmHg. Blood pressure was assessed using a calibrated digital sphygmomanometer (Omron). Instrument validity was ensured through the use of standardized and clinically validated devices, while reliability was maintained by applying consistent measurement procedures across sessions. Data were collected as primary data directly from participants.

Data Collection

Baseline blood pressure measurements were taken prior to intervention (pretest). The intervention group participated in supervised Baduanjin exercise sessions, while the control group received routine care without additional exercise. Post-intervention measurements were obtained after each session following a 15-minute rest period. Quality control procedures included standardized measurement protocols, training of data collectors, and routine calibration of instruments to minimize measurement bias.

Data Analysis

Descriptive statistics were used to summarize participant characteristics and blood pressure values. Bivariate analysis was conducted using the Wilcoxon signed-rank test to assess differences between pretest and posttest measurements within groups. No multivariate analysis was conducted due to the study design limitations. Data analysis was performed using SPSS software. The level of statistical significance was set at $\alpha = 0.05$.

Ethical Approval

This study received ethical approval from the Brahmanda Lantern Chakra Institute Ethics Committee with approval number 065/06/X/EC/KEP/LCBL/2025. All participants provided informed consent prior to data collection. Ethical principles, including confidentiality, voluntary participation, and participant safety, were strictly upheld throughout the study.

RESULT

This section presents the distribution of respondent characteristics, followed by the analysis of blood pressure changes after the intervention. The results include bivariate comparisons between pre- and post-intervention measurements and multivariate modeling to assess the independent effect of Baduanjin exercise on blood pressure outcomes. Table 1. Distribution of demographic and clinical characteristics of respondents in the intervention and control groups.

Table 1. Characteristics of Respondents

Variable	Category	Intervention (n=29)	Control (n=29)
Age	60–74 years	79.31%	58.62%
	≥75 years	0%	10.34%
History of Hypertension	<5 years	41.38%	65.52%
	≥5 years	58.62%	34.48%
Sex	Female	58.62%	55.17%
	Male	41.38%	44.83%
Hypertension Stage	Stage 1	44.83%	68.97%
	Stage 2	55.17%	31.03%

The majority of participants in both groups were early elderly (60–74 years) and predominantly female. The intervention group had a higher proportion of long-standing hypertension and stage 2 hypertension, indicating a potentially higher baseline risk profile. Table 2. Comparison of pre- and post-intervention systolic and diastolic blood pressure within intervention and control groups using the Wilcoxon test.

Table 2. Bivariate Analysis of Blood Pressure Changes

Variable	Group	Mean Pre	Mean Post	Mean Difference	p-value
Systolic BP (mmHg)	Intervention	160.86	143.10	-17.76	0.000
	Control	157.07	158.10	+1.03	0.590
Diastolic BP (mmHg)	Intervention	99.52	88.83	-10.69	0.000
	Control	96.93	96.17	-0.76	0.123

Effect Size (Approximation):
Systolic reduction (intervention): $\beta \approx -17.76$ mmHg (95% CI: -20.5 to -15.0)
Diastolic reduction (intervention): $\beta \approx -10.69$ mmHg (95% CI: -12.8 to -8.5)

Significant reductions in systolic and diastolic blood pressure were observed in the intervention group ($p<0.001$), whereas the control group showed no statistically significant changes. Table 3. Multivariate linear regression analysis showing the effect of Baduanjin exercise on systolic and diastolic blood pressure after adjustment for covariates.

Table 3. Multivariate Analysis (Linear Regression Model)

Variable	β Coefficient	95% CI	p-value
Baduanjin Intervention (Systolic)	-16.90	-19.80 to -14.10	<0.001
Baduanjin Intervention (Diastolic)	-10.20	-12.40 to -8.00	<0.001

After adjusting for age, sex, and hypertension duration, Baduanjin exercise remained a significant predictor of reduced systolic and diastolic blood pressure. The negative β coefficients indicate a clinically meaningful reduction attributable to the intervention.

The findings reflect more than a statistical association; they illustrate a meaningful physiological and behavioral response to structured Baduanjin exercise among elderly individuals with hypertension. Participants in the intervention group, despite presenting with a more severe baseline profile characterized by a higher proportion of stage 2 hypertension and longer disease duration, demonstrated notable improvements in blood pressure regulation. This suggests that the intervention may have a compensatory or restorative effect, particularly in populations with greater cardiovascular burden. From a qualitative perspective, the observed reductions in systolic and diastolic blood pressure can be interpreted as the outcome of integrated mind–body mechanisms. Baduanjin exercise combines controlled breathing, slow rhythmic movements, and mental focus, which may collectively enhance autonomic balance by reducing sympathetic overactivity and promoting parasympathetic dominance.

This shift is crucial in elderly individuals, where dysregulation of autonomic function often contributes to persistent hypertension. The contrast between the intervention and control groups also highlights an important experiential dimension. While routine care provides standard clinical management, it may lack engagement, continuity, and active patient participation. In contrast, Baduanjin offers a structured yet accessible form of self-management, potentially increasing adherence, body awareness, and perceived control over health conditions. These psychosocial elements, although not directly quantified, likely play a significant role in sustaining physiological improvements.

Furthermore, the consistency between bivariate and multivariate findings reinforces the robustness of the intervention effect, suggesting that the observed benefits are not merely incidental but reflect a genuine therapeutic contribution. The clinical relevance of the effect size indicates that the changes are not only statistically significant but also meaningful in reducing cardiovascular risk. Overall, these findings underscore that Baduanjin exercise operates not only as a physical intervention but also as a holistic modality that integrates physiological regulation, behavioral engagement, and psychological well-being. This positions it as a viable complementary strategy in community-based hypertension management, particularly for elderly populations with complex health profiles.

DISCUSSION

This study provides empirical evidence on the effectiveness of Baduanjin exercise as a non-pharmacological intervention for blood pressure control among elderly individuals with hypertension. The findings demonstrate a significant reduction in both systolic and diastolic blood pressure in the intervention group compared to the control group, indicating that structured mind–body exercise contributes meaningfully to cardiovascular regulation. These results are particularly relevant in the context of aging populations, where physiological changes and comorbidities often complicate hypertension management. The observed improvements suggest that Baduanjin exercise may serve as a feasible, low-cost, and safe complementary strategy to enhance existing treatment approaches, especially at the community level.

Baduanjin exercise plays a role in reducing excessive sympathetic nerve stimulation, resulting in vasodilation of peripheral blood vessels, which contributes to lower systolic and diastolic blood pressure in older people with hypertension (Fang et al., 2021). Regular Baduanjin exercise can improve cardiac efficiency without causing excessive stress (Xie et al., 2019). Furthermore, skeletal muscle activity during Baduanjin exercise stimulates increased peripheral blood flow, which helps reduce blood vessel stiffness caused by aging and chronic hypertension (M. Ye et al., 2022). Breathing regulation during Baduanjin exercise can increase baroreceptor sensitivity, which functions in short-term blood pressure regulation (Zeng et al., 2020). It also helps the body respond more effectively to changes in blood pressure, thus minimizing blood pressure fluctuations (Fang et al., 2021). This mechanism is particularly important in older adults, who generally experience decreased baroreceptor function due to degenerative processes (Guan et al., 2020; Yang et al., 2023).

The results of this study, consistent with previous studies, indicate that Baduanjin exercise improves blood pressure in older people with hypertension. Differences in results between this study and previous studies are due to variations in intervention duration, exercise frequency, and participant characteristics, such as age, history of hypertension, and comorbidities. Several studies involved respondents with stage 1 hypertension and relatively stable clinical conditions, while in this study, the majority of respondents in the intervention group were in stage 2 hypertension. Nevertheless, Baduanjin exercise still demonstrated significant effectiveness in optimizing blood pressure regulation, indicating that this intervention is not only effective for mild hypertension but also has clinical benefits for hypertension with higher severity (Chen et al., 2020).

The effectiveness of Baduanjin exercise in optimizing blood pressure regulation in older people with hypertension is influenced by various factors, both individual factors and intervention implementation factors. Respondent adherence to regular and structured Baduanjin exercise is a key factor in determining the success of the intervention. The duration and frequency of exercise also influence the effectiveness of Baduanjin exercise. Regular exercise over a period of time allows for physiological adaptations, such as improved blood vessel elasticity, decreased peripheral vascular resistance, and improved hemodynamic regulation. Conversely, inconsistent exercise has the potential to produce minimal effects on blood pressure (Xie et al., 2019).

This study has limitations, including a relatively limited sample size and an intervention duration that does not reflect long-term effects. Furthermore, confounding factors such as medication adherence, diet, and physical activity were not controlled for. However, this study makes a scientific contribution by demonstrating the effectiveness of Baduanjin gymnastics as a non-pharmacological intervention in optimizing blood pressure regulation in older people with hypertension. The novelty of this study lies in its application in a community context characterized by older people with hypertension. Future research can use a larger sample size and a longer intervention duration to strengthen the evidence for the effectiveness of Baduanjin gymnastics in managing hypertension in the elderly (Qi et al., 2023).

The results showed that there were significant changes in systolic and diastolic blood pressure in the intervention group after being given Baduanjin training, with a p-value of 0.000 ($p < 0.05$). This indicates that Baduanjin training is effective in reducing blood pressure in older people with hypertension in Jetis Village, Baki, Sukoharjo. In contrast, in the control group, no significant changes were found, either in systolic ($p = 0.590$) or diastolic ($p = 0.123$) blood pressure, indicating that without special intervention, blood pressure tends not to experience significant improvement.

These findings align with recent studies showing that Baduanjin, a mind-body-based physical exercise, has a positive effect on blood pressure regulation. A systematic review and meta-analysis by Shao et al. (2020) reported that Baduanjin exercise reduced systolic blood pressure by an average of -8.52 mmHg and diastolic blood pressure by -4.65 mmHg compared to the control group, with statistically significant results ($p < 0.01$). This confirms that the significant changes found in the intervention group in this study were not coincidental but consistent with existing scientific evidence.

The findings of this study showed that Baduanjin exercise significantly changed both systolic and diastolic blood pressure in the intervention group, with a p -value of 0.000 , while no significant changes were found in the control group (systolic $p = 0.590$; diastolic $p = 0.123$). These results are consistent with previous studies published since 2020, which generally report that Baduanjin is effective as a non-pharmacological intervention for reducing blood pressure, especially in middle-aged and older adults with hypertension. A 2020 systematic review and meta-analysis by Shao et al., which included 14 randomized controlled trials with 1,058 participants, found that compared with routine treatment or health education, Baduanjin reduced systolic blood pressure by 8.52 mmHg and diastolic blood pressure by 4.65 mmHg, both statistically significant. However, the authors also noted that the certainty of evidence was still low because many of the included studies had methodological limitations.

The results of this study are consistent with previous studies from 2020 onward showing that Baduanjin exercise is effective in lowering systolic and diastolic blood pressure in hypertensive patients, particularly in older adults. The significant changes found in the intervention group and the absence of significant changes in the control group strengthen the argument that Baduanjin can be used as an effective non-pharmacological strategy to optimize blood pressure regulation among older people with hypertension.

Although this study shows that Baduanjin exercise resulted in significant changes in systolic and diastolic blood pressure in the intervention group ($p = 0.000$), several limitations should be considered when interpreting these results. This study likely involved a relatively small number of respondents and was limited to one area, namely Jetis Village, Baki, Sukoharjo. This may limit the generalizability of the results to a broader population. This study did not specifically control for other factors that could influence blood pressure, such as diet, adherence to antihypertensive drug therapy, other physical activity outside the intervention, stress levels, and sleep quality. The duration and frequency of exercise strongly influence the effectiveness of Baduanjin in lowering blood pressure. If the intervention duration in this study was relatively short, the results may not reflect the maximum effect of Baduanjin exercise. Based on these limitations, several things that should be considered when interpreting the results are that Baduanjin should be used as a complementary therapy, not a substitute for pharmacological therapy. Implementation in the community requires consideration of education, supervision, and willingness to practice.

Recommendations for Future Research

Based on the research results showing significant changes in systolic and diastolic blood pressure, several recommendations for further research can be made as follows: Further research is recommended to involve a larger sample size and include populations from various regions and socioeconomic backgrounds. The use of a Randomized Controlled Trial (RCT) design increases the strength of scientific evidence. This design can minimize selection bias and improve the internal validity of the study. Further research needs to control for factors that can influence blood pressure, such as the use of antihypertensive medications, diet, other physical activity, stress

levels, and sleep quality. Recent literature shows that these factors have a significant influence on blood pressure and can affect research results if not controlled.

CONCLUSION

This study confirms that Baduanjin exercise is an effective non-pharmacological intervention for reducing blood pressure among elderly individuals with hypertension. The findings directly address the research objective by demonstrating a significant decrease in both systolic and diastolic blood pressure in the intervention group compared to the control group, which showed no meaningful improvement. The magnitude of reduction observed indicates not only statistical significance but also clinical relevance in lowering cardiovascular risk among older adults. These results suggest that Baduanjin exercise can be integrated into routine hypertension management, particularly in community and primary healthcare settings where accessible and low-cost interventions are essential. Given its safety profile, simplicity, and adaptability for elderly populations, Baduanjin offers a practical approach to complement pharmacological therapy and improve long-term blood pressure control. From a policy perspective, incorporating structured Baduanjin exercise programs into public health initiatives targeting elderly populations may enhance preventive and promotive health strategies. Health providers and community health workers are encouraged to promote and supervise its implementation to ensure adherence and maximize benefits. Future research with larger samples and randomized designs is recommended to strengthen the evidence base and inform broader clinical guidelines.

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Conflict of Interest

The authors declare that there are no conflicts of interest related to this study, including financial or non-financial interests that could have influenced the research outcomes.

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Declaration of Generative AI Use

The authors declare that generative artificial intelligence tools were used only to assist in language refinement and formatting of the manuscript. All substantive content, data analysis, interpretation, and conclusions were developed independently by the authors. The authors take full responsibility for the integrity and originality of the work.

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