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The Effect of Exercise for the Elderly on Blood Pressure Reduction in Menopausal Women in Bongo III Village, Wonosari District, Boalemo Regency

Ni Komang Yuliani[1], Tut Rayani Aksohini Wijayanti[2*]
[1-2] Program Sarjana Kebidanan, Fakultas Ilmu Kesehatan, Institut Sains dan Teknologi Kesehatan RS Dr. Soepraoen, Malang, Indonesia

** Corresponding author: tutrayani@itsk-soepraoen.ac.id*

Abstract: *Hypertension constitutes a significant health issue in menopausal women, attributed to physiological and hormonal alterations that elevate the risk of cardiovascular disease. Regular physical activity, including exercise for the elderly, is advised as a non-pharmacological strategy to manage blood pressure, particularly within community settings. This study is to examine the impact of exercise on blood pressure reduction among older menopausal women in Bongo III Village, Wonosari District, Boalemo Regency. This research employed a quasi-experimental design with a one-group pretest-posttest methodology. The sample comprised 50 menopausal women recruited by purposive sampling. The elderly gymnastics intervention was conducted consistently over a three-month period. Systolic and diastolic blood pressure were assessed prior to and subsequent to the intervention utilizing established protocols. Data analysis was conducted both descriptively and inferentially utilizing a paired t-test at a significance level of 0.05. The findings indicated that physical activity among the elderly substantially reduced blood pressure. A notable reduction in systolic and diastolic blood pressure occurred following the intervention. The distribution of blood pressure categories indicated a transition from grade I and II hypertension to prehypertension and normal categories among the majority of respondents. These data demonstrate a clinical enhancement in blood pressure levels. In conclusion, exercise for the elderly serves as an effective non-pharmacological strategy for reducing blood pressure in menopausal women. This program has the capacity to be included into community-based public health initiatives as a promotional and preventive strategy for hypertension management.*

Keywords: *Blood Pressure; Exercise for the Elderly; Hypertension; Menopause; Physical Activity.*

1. INTRODUCTION

Hypertension is a primary risk factor for cardiovascular disease, dramatically impacting global morbidity and mortality rates. The World Health Organization indicates that about 1.28 billion persons aged 30 to 79 are affected with hypertension, with approximately two-thirds residing in low- and middle-income nations (World Health Organization [WHO], 2021). The prevalence of hypertension is expected to rise due to increasing life expectancy and shifts towards inactive lifestyles. The 2018 Riskesdas results indicate a hypertension prevalence of 34.1% among individuals aged ≥18 years in Indonesia, highlighting a significant public health issue that necessitates comprehensive management methods (Indonesian Ministry of Health, 2018). Women of middle age and older are becoming an increasingly susceptible demographic, particularly with the onset of menopause.

Menopause is a normal biological process marked by the loss of ovarian function and a reduction in estrogen production, significantly affecting the cardiovascular system. Estrogen serves a protective effect in blood arteries by enhancing endothelial function, controlling vascular tone, and altering the renin–angiotensin–aldosterone system (RAAS) (Reckelhoff,

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2018). Reduced estrogen levels in menopausal women correlate with heightened arterial stiffness, endothelial dysfunction, augmented sympathetic nervous system activity, and alterations in lipid and glucose metabolism, all of which contribute to elevated blood pressure (Mishra et al., 2020). Extensive cohort studies indicate that postmenopausal women have a greater prevalence of hypertension compared to premenopausal women, even when age is controlled for (Song et al., 2018).

In an epidemiological context, early menopause or a rapid menopausal transition correlates with a heightened risk of hypertension and cardiovascular disease in later life (Muka et al., 2016). In underdeveloped nations, such as Indonesia, this situation is intensified by restricted access to preventative healthcare services and inadequate adoption of an active lifestyle. Research in Indonesia indicates that menopausal women exhibit an elevated risk of hypertension, particularly when associated with central obesity and reduced physical activity (Rahajeng & Tuminah, 2019). These findings underscore the significance of non-pharmacological interventions that can be broadly executed in communities, particularly in rural regions.

Physical activity is essential for the prevention and management of hypertension. The International Society of Hypertension and the American Heart Association advocate for regular moderate-intensity aerobic exercise as the primary treatment for hypertension, either as a standalone intervention or in conjunction with pharmacotherapy (Unger et al., 2020; Whelton et al., 2018). The WHO advises a minimum of 150–300 minutes of aerobic physical activity weekly to mitigate the risk of hypertension and cardiovascular disease (WHO, 2020). Nonetheless, the degree of physical activity in Indonesia remains comparatively low, particularly among the elderly and women, consequently heightening the risk of uncontrolled hypertension (Guthold et al., 2018).

Aerobic exercise physiologically reduces blood pressure by mechanisms such as diminished peripheral vascular resistance, enhanced insulin sensitivity, improved endothelial function, and regulation of autonomic nerve balance (Diaz & Shimbo, 2019). Meta-analyses indicate that aerobic exercise consistently reduces both systolic and diastolic blood pressure, exhibiting more pronounced effects in hypertensive patients compared to those with normal blood pressure (Cornelissen & Smart, 2013; Pescatello et al., 2019). In the senior demographic, organized physical exercise has been demonstrated to be both safe and effective in reducing blood pressure and enhancing quality of life (Liu et al., 2021).

In Indonesia, the predominant method of physical activity is elderly gymnastics, characterized as a sort of light to moderate intensity rhythmic aerobic exercise conducted in

groups. Senior gymnastics has the benefits of affordability, ease of implementation, and alignment with the promotive-preventive culture at the village and health post levels. Numerous local research indicate that senior gymnastics and hypertension gymnastics can markedly reduce blood pressure in elderly individuals with hypertension (Sulastri et al., 2020; Wahyuni et al., 2022). A quasi-experimental study in primary care settings indicated a reduction in systolic and diastolic blood pressure following several weeks of exercise intervention for the elderly (Putri et al., 2021).

Nevertheless, the majority of prior research predominantly concentrated on the elderly as a whole, failing to differentiate menopausal state, employed pre-experimental designs with restricted control groups, and were executed in urban locales or healthcare institutions. Research explicitly investigating the impact of exercise on menopausal women in rural regions, particularly among the elderly, remains significantly scarce. Menopausal women possess distinct physiological and hormonal traits that can influence their reactions to physical exercise interventions (Mishra et al., 2020). These constraints highlight a significant research need that must be addressed, particularly with the development of contextual and sustainable community-based interventions.

Bongo III Village, located in the Wonosari Subdistrict of Boalemo Regency, exemplifies the prevalent issues of hypertension management in Indonesia, including scarce health services and insufficient structured physical exercise. Exercise treatments for the elderly may serve as an effective technique for reducing blood pressure in menopausal women in this region, while simultaneously bolstering village-based public health initiatives. This study is to examine the impact of exercise on lowering systolic and diastolic blood pressure among older menopausal women in Bongo III Village, Wonosari Subdistrict, Boalemo Regency. This study's outcomes are anticipated to yield locally pertinent scientific evidence and establish a foundation for enhancing non-pharmacological approaches in managing hypertension among menopausal women in Indonesia.

2. RESEARCH METHOD

This study employed a quasi-experimental design with a one-group pretest-posttest methodology to evaluate alterations in blood pressure in menopausal women before and after an exercise intervention. This approach was selected as it enables researchers to assess the efficacy of an intervention in real-world settings, particularly in rural communities, where the implementation of randomization and control groups frequently encounters ethical and

operational constraints. This design allows each subject to serve as their own control, enabling direct observation of changes following the intervention.

The research was carried out in Bongo III Village, Wonosari Subdistrict, Boalemo Regency, characterized as a rural locality with a largely senior demographic and restricted organized physical activities for menopausal women. The site was selected according to the health requirements of the local populace and the support provided by village officials and health personnel. The study was executed between May and June 2026, encompassing the preparatory phase, beginning assessment (pretest), execution of the geriatric exercise intervention, and concluding assessment (posttest).

The study population comprised all menopausal women living in Bongo III Village. In this study, menopause was defined as the condition in which women have undergone natural amenorrhea for a minimum of 12 consecutive months. The research sample was chosen using purposive sampling, considering the inclusion and exclusion criteria. The inclusion criteria comprised menopausal women aged ≥45 years, with systolic blood pressure ≥130 mmHg and/or diastolic blood pressure ≥80 mmHg, capable of engaging in light to moderate physical activity, and willing to participate by signing a consent form. The exclusion criteria encompassed: women with a history of serious cardiovascular disease, musculoskeletal diseases that restricted physical activity, or those experiencing acute conditions that hindered their participation in exercise. The quantity of samples that satisfied the requirements and consented to participate was [number of samples] respondents.

This study comprised independent and dependent factors. The independent variable is exercise for the elderly, namely organized aerobic physical activity conducted in groups at light to moderate intensity. The dependent variable is blood pressure, encompassing both systolic and diastolic measurements. Additionally, respondent characteristics like age, duration of menopause, and body mass index were documented as supplementary data to offer an overview of the research subjects.

This study utilized a calibrated digital/mercury sphygmomanometer for blood pressure measurement, together with observation sheets and questionnaires regarding respondent characteristics. Blood pressure measurements were conducted following standard protocols, specifically with participants seated, resting for a minimum of 5 minutes, arms positioned parallel to the heart, and abstaining from physical exertion, smoking, or caffeine consumption for at least 30 minutes before measurement. Each measurement was conducted twice with an interval of 1 to 2 minutes, and the average value was calculated to enhance data accuracy.

The research process commenced with a preparatory phase, encompassing the acquisition of permits, collaboration with the village administration and health personnel, and outreach to prospective participants. Upon meeting the requirements and providing consent, first blood pressure measures (pre-test) were recorded. Subsequently, participants engaged in organized exercise interventions for the elderly, namely three times weekly for a duration of four weeks, with each session lasting roughly 30 to 45 minutes. The senior fitness sessions were led by proficient instructors and included a warm-up segment, light to moderate aerobic core activities, and a cool-down segment. Throughout the intervention period, participants were instructed to sustain their existing activity patterns and antihypertensive medication usage to mitigate confounding variables. Upon the completion of all intervention sessions, a final blood pressure measurement (post-test) was obtained utilizing the identical protocol as the original measurement.

The gathered data were analyzed with statistical tools. The data analysis commenced with descriptive analysis to delineate the characteristics of the respondents and the distribution of blood pressure prior to and following the intervention. The Shapiro–Wilk test was employed to assess data normality. The difference in blood pressure before and after the intervention was analyzed using a paired t-test, assuming normal distribution of the data. If the data were not normally distributed, the Wilcoxon signed-rank test was employed. All statistical analyses were conducted at a significance threshold of $\alpha = 0.05$. The analysis findings were provided as mean values, standard deviations, and p-values to assess the impact of exercise on blood pressure reduction in menopausal women.

3. RESULTS AND DISCUSSION

Results

Respondent Characteristics

This study involved 50 menopausal women who regularly participated in an exercise programme for the elderly. The distribution of respondent characteristics based on age group is presented in Table 4.1.

Table 1 Distribution of Respondents Based on Age Group.

Age Group (years)	n	Persentase (%)
45–59	0	0,0
60–69	26	52,0
≥70	23	46,0
Total	**50**	**100,0**

The majority of responders were aged 60–69 (52%), followed by those aged 70 and above (46%). This suggests that the responders were primarily older, who are biologically at an increased risk of hypertension due to diminished blood vessel flexibility and post-menopausal hormonal alterations.

Blood Pressure Distribution Before Elderly Exercise Intervention

Systolic blood pressure distribution before elderly exercise was classified based on hypertension categories.

Table 2 Blood Pressure Distribution Before Elderly Exercise.

Blood Pressure Categories	n	Persentase (%)
Prehypertension	1	2,0
Grade I hypertension	43	86,0
Grade II hypertension	5	10,0
Total	**50**	**100,0**

The majority of respondents (86%) were in the stage I hypertension category prior to intervention. This condition indicates that most menopausal women in this study had experienced an increase in blood pressure that required non-pharmacological intervention.

Blood Pressure Distribution After Exercise Intervention for the Elderly

Blood pressure distribution after the intervention showed significant changes in blood pressure categories.

Table 3 Blood Pressure Distribution After Exercise for the Elderly.

Blood Pressure Categories	n	Persentase (%)
Normal	1	2,0
Prehypertension	36	72,0
Grade I hypertension	10	20,0
Grade II hypertension	2	4,0
Total	**50**	**100,0**

After participating in exercise for the elderly, most respondents (72%) were in the pre-hypertension category, indicating a shift in blood pressure categories towards a better condition.

Cross-tabulation of Blood Pressure Before and After Intervention

Table 4 Cross-tabulation of Blood Pressure Categories Before and After Exercise for the Elderly.

Blood Pressure Before	Normal	Pra-HT	HT I	HT II	Total
Prehypertension	1	0	0	0	1
Grade I hypertension	0	36	7	0	43
Grade II hypertension	0	0	3	2	5
Total	**1**	**36**	**10**	**2**	**50**

Thirty-six respondents previously classified as stage I hypertension transitioned to the pre-hypertension category following the intervention. This illustrates the efficacy of exercise in enhancing blood pressure classifications among menopausal women in the elderly population.

Analysis of Blood Pressure Differences Before and After Intervention

Table 5 Differences in Average Blood Pressure Before and After Exercise for the Elderly.

Variable	Mean ± SD (Before)	Mean ± SD (After)	Δ Mean	p-value
Sistolik (mmHg)	151,4 ± 10,3	133,4 ± 7,45	−18,0	<0,001
Diastolik (mmHg)	80,8 ± 3,40	79,6 ± 1,98	−1,2	0,032

The paired t-test results indicated a statistically significant difference in blood pressure before and after exercise among the elderly, with systolic blood pressure ($p < 0.001$) and diastolic blood pressure ($p = 0.032$).

Discussion

This study demonstrates that exercise for the elderly significantly reduces blood pressure in menopausal women. The primary findings of the study indicate a substantial reduction in both systolic and diastolic blood pressure following the exercise intervention, with a more pronounced decrease in systolic blood pressure. The data validate that organized aerobic exercise can serve as an effective non-pharmacological strategy for managing hypertension in menopausal women, particularly in rural areas.

The study's average drop in systolic blood pressure of 18 mmHg is clinically significant. Epidemiological studies indicate that a decrease in systolic blood pressure of even 10 mmHg can diminish the risk of coronary heart disease by around 20% and the risk of stroke by as much as 40% (Ettehad et al., 2016). The extent of the decrease in systolic blood pressure in this study holds significant significance for the prevention of cardiovascular problems in menopausal women. Simultaneously, the decrease in diastolic blood pressure, albeit modest, remained statistically significant and signified an enhancement in hemodynamic stability.

The results of this study align with prior research indicating that regular aerobic exercise effectively reduces blood pressure in older persons. Huang et al. (2019) conducted a study demonstrating that an 8–12 week regimen of light to moderate aerobic exercise effectively lowered systolic and diastolic blood pressure in elderly individuals with hypertension. Moraes et al. (2020) similarly demonstrated that community-based group exercise significantly enhanced blood pressure regulation and compliance with physical activity in the older population. The consistency of these findings reinforces the notion that exercise is a suitable and beneficial form of aerobic activity for the aged population.

The decrease in blood pressure resulting from exercise in the elderly can be elucidated through many physiological mechanisms from a clinical theory standpoint. Aerobic exercise enhances endothelial function by elevating nitric oxide production, which facilitates vasodilation and reduces peripheral vascular resistance (Green et al., 2017). Furthermore, exercise diminishes sympathetic nervous system activity and enhances baroreceptor sensitivity, therefore aiding in the regulation of long-term blood pressure (Carter et al., 2018). In menopausal women, physical exercise is crucial in mitigating the effects of reduced estrogen, which leads to arterial stiffness and endothelial impairment (Stute et al., 2020).

The alterations in blood pressure category distribution prior to and following the intervention in this trial demonstrated notable clinical enhancement. The majority of respondents formerly classified as stage I hypertension transitioned to the prehypertension group following the intervention. The results align with a community study conducted by Kim et al. (2021), which indicated that community-based group exercise can reduce hypertension classifications to a milder level in older persons. This category shift is significant since persons with pre-hypertension possess a diminished risk of problems compared to those with severe hypertension.

Nonetheless, this investigation revealed that the decrease in diastolic blood pressure was comparatively less significant than that in systolic blood pressure. This phenomenon can be attributed to the relative stability of diastolic blood pressure in the elderly, which is affected by structural artery stiffness that is challenging to alter rapidly (Franklin et al., 2017). Moreover, certain respondents remained classified as hypertensive post-intervention, indicating that exercise for the elderly may require integration with additional strategies such as dietary management, stress reduction, and compliance with pharmacological treatment to attain optimal blood pressure regulation (Williams et al., 2018).

The clinical ramifications of this work are notably substantial. Exercise for the elderly may be advocated as a component of a non-pharmacological approach to managing hypertension in

menopausal women, particularly in regions with restricted access to healthcare facilities. This intervention is secure, cost-effective, and readily executable by public health personnel and senior health center staff.

A group-based approach can enhance motivation, adherence, and social contact among the elderly, hence positively influencing mental health and quality of life (Bangsbo et al., 2019). Despite the significant findings of this investigation, some limitations warrant consideration. The absence of a control group in the quasi-experimental design restricts the capacity to entirely eliminate confounding variables. Furthermore, additional variables including diet, adherence to antihypertensive medication, and stress levels were not thoroughly examined. Consequently, more research employing an experimental design with a control group and incorporating various lifestyle variables is advisable to achieve a more thorough comprehension.

This study's findings substantiate the notion that exercise serves as an effective non-pharmacological intervention for reducing blood pressure in menopausal women and holds significant potential for incorporation into community-based health promotion programs.

4. CONCLUSION

This study is to examine the impact of exercise on blood pressure reduction among older menopausal women in Bongo III Village, Wonosari District, Boalemo Regency, as part of a community-based hypertension management initiative. The study's results demonstrate that exercise for the elderly significantly enhances blood pressure regulation, especially systolic blood pressure, subsequently leading to improvements in diastolic blood pressure. The data validate that organized aerobic exercise serves as an effective non-pharmacological intervention for menopausal women with heightened cardiovascular risk stemming from physiological and hormonal alterations.

This study provides scientific evidence that frequent light to moderate exercise enhances vascular control and cardiovascular function in older persons. This study offers contextual contributions by offering actual evidence from rural areas, which has been scarce in the literature. From a clinical and public health standpoint, exercise for the aged serves as a significant, cost-effective, and easily executable promotive and preventative measure to manage hypertension in menopausal women. Therefore, incorporating exercise for the elderly into village-level public health programs may enhance their quality of life and diminish the risk of long-term cardiovascular issues.

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This research aims to enhance scientific knowledge and public health practices, specifically with the management of hypertension in menopausal women.

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