



The Effect of Moringa Leaf Decoction and Moderate Exercise on Hemodynamic Changes in Hypertensive Patients at Namo Rambe Public Health Center, Deli Serdang Regency

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ABSTRACT

*Hypertension is a global health problem that requires complementary non-pharmacological interventions, given the high risk of complications and treatment costs. Moringa (*Moringa oleifera*) leaves are known to contain quercetin, which has diuretic and antioxidant properties, while moderate exercise is proven to improve endothelial function. This study aims to prove the effect of the combination of moringa leaf decoction and moderate exercise on hemodynamic changes (blood pressure) in hypertension patients. This study used a quasi-experimental design with a one group pretest-posttest approach. The research sample consisted of hypertension patients in the working area of Namo Rambe Primary Health Care, Deli Serdang Regency. The combined intervention (administration of moringa leaf decoction and moderate exercise) was carried out for 21 days. Systolic and diastolic blood pressure measurements were taken before (pretest) and after (posttest) the intervention. Data were analyzed using the Paired Sample t-Test. The analysis results showed that the average systolic blood pressure decreased significantly from 168.00 mmHg (pretest) to 121.87 mmHg (posttest). Similarly, diastolic blood pressure decreased from an average of 97.81 mmHg (pretest) to 77.13 mmHg (posttest). The Paired Sample t-Test results showed a significance value (p-value) of 0.000 ($p < 0.05$) for both systolic and diastolic blood pressure. There is a highly significant effect of the combined administration of moringa leaf decoction and moderate exercise on hemodynamic changes in hypertension patients. This intervention is effective in lowering blood pressure and is recommended as a safe and affordable complementary therapy in the management of hypertension.*

Keywords: Hypertension; Moringa Leaf; Moderate Exercise; Hemodynamic; Blood Pressure.

INTRODUCTION

Hypertension, often referred to as the “silent killer”, is a major public health problem worldwide because it increases the risk of cardiovascular diseases such as stroke, coronary artery disease, and heart failure (Organization, 2023). Elevated blood pressure is primarily caused by an increase in peripheral vascular resistance, which is determined by the contractile state of vascular smooth muscle, particularly in arterioles (Touyz et al., 2018). Endothelial dysfunction and hyperactive adrenergic vasoconstriction contribute to this condition, while oxidative stress induced by reactive oxygen species (ROS) further aggravates vascular injury and impairs vasorelaxation. These processes play a significant role in the pathogenesis of hypertension. Therefore, improving vasorelaxation and reducing oxidative stress are considered effective strategies to manage hypertension (Sinha & Kumar Dabla, 2015).

According to the World Health Organization (WHO), the global prevalence of hypertension reached 33% in 2023, with two-thirds of cases occurring in developing and low-income countries (Jobe et al., 2024). By 2025, it is estimated that 1.56 billion adults will suffer from hypertension, making it one of the leading causes of premature mortality worldwide. Hypertension is responsible for nearly 8 million deaths each year globally and approximately 1.5 million deaths annually in Southeast Asia (WHO, 2023; Kemenkes, 2019). In Indonesia, cardiovascular diseases remain the top cause of death, accounting for 36.9% of all deaths,

followed by cancer (9.7%) and diabetes (9.3%) (IHME, 2017). Risk factors contributing to these deaths include high blood pressure (23.7%), hyperglycemia (18.4%), and smoking (12.7%) (Kemenkes, 2019).

Data from the 2018 Basic Health Research (Riskesdas) show that hypertension is the most common chronic disease among the elderly in Indonesia, with a prevalence of 60.3%. The prevalence increases with age, affecting 31.6% of adults aged 31–44 years, 45.3% aged 45–54 years, and 63.2% among those aged 65 years and above. The estimated number of hypertension cases in 2018 reached over 63 million people, causing nearly half a million deaths (Riskesdas, 2018).

Management of hypertension can be done through pharmacological and non-pharmacological approaches (Mahmood et al., 2019). The pharmacological approach involves the use of antihypertensive drugs, while the non-pharmacological approach includes lifestyle modifications such as dietary management, stress reduction, and physical activity. In addition, the use of natural or herbal medicine has become increasingly popular due to its accessibility and fewer side effects.

One of the traditional treatments widely used in Indonesia is moringa leaf (*Moringa oleifera* Lam.). Moringa grows well in tropical regions and has long been used in traditional medicine as an antibacterial, anti-inflammatory, anti-cholesterol, and antihypertensive agent. It contains bioactive compounds such as flavonoids, alkaloids, saponins, tannins, and phenols, which have antioxidant and vasodilatory effects (Yanti & Novia, 2019). Moringa leaves are also rich in potassium, which helps regulate sodium balance and maintain normal blood pressure levels (Khrismasagung, 2022). Previous studies have demonstrated that daily consumption of moringa leaf decoction (250 ml per day for seven consecutive days) significantly reduced both systolic and diastolic blood pressure in hypertensive elderly patients (Riniasih & Hapsari, 2021; Yanti & Novia, 2019).

Furthermore, moderate physical exercise is another non-pharmacological intervention proven to reduce blood pressure and improve cardiovascular health. According to the American College of Sports Medicine, regular moderate-intensity exercise such as brisk walking can lower mortality rates among individuals with cardiovascular disorders (Trisnawaty, 2022). Consistent physical activity improves vascular function, increases cardiac efficiency, and reduces the risk of chronic diseases including hypertension, diabetes, and stroke (Triana et al., 2024).

In recent years, non-pharmacological interventions especially herbal therapy and physical exercise have gained attention due to their affordability, safety, and cultural acceptance. Previous studies have demonstrated that *Moringa oleifera* leaves possess antihypertensive properties attributed to their flavonoid, potassium, and antioxidant content. Several researchers have reported significant reductions in both systolic and diastolic blood pressure following daily consumption of Moringa leaf decoction for 7 to 14 days (Yanti & Novia, 2019; Riniasih & Hapsari, 2021). Parallel to this, moderate-intensity exercise has also been consistently shown to improve cardiovascular health, enhance endothelial function, and lower blood pressure. Studies by Trisnawaty (2022) and Triana et al. (2024) confirm that regular moderate exercise, such as brisk walking, effectively decreases hypertension risk and promotes vascular health.

However, despite the growing evidence supporting both interventions, studies that combine Moringa leaf decoction with moderate exercise as a single integrated therapy remain

limited, particularly in Indonesia. Most previous research has investigated Moringa consumption or physical exercise independently, leaving a gap in understanding whether combining the two interventions may produce a synergistic effect that enhances hemodynamic stability. This gap is critical because individuals with chronic hypertension often require lifestyle modifications that address multiple physiological pathways simultaneously. Therefore, the present study is positioned as a continuation and extension of earlier research by offering a combined intervention model and evaluating its direct physiological impact through measurable hemodynamic outcomes.

Based on this background, the present study aims to examine the effect of moringa leaf decoction and moderate exercise on hemodynamic changes in hypertensive patients at Namo Rambe Public Health Center. The findings are expected to provide evidence-based support for combining natural herbal therapy and lifestyle modification as an integrated approach to controlling hypertension.

RESEARCH METHOD

This study employed a quasi-experimental one-group pretest–posttest design and was conducted at Namo Rambe Health Center, Deli Serdang, between June and November 2025. A total of sixteen hypertensive patients aged 35 to 55 years were selected using purposive sampling. Participants were included if they had been diagnosed with grade 1 hypertension, with systolic blood pressure exceeding 140 mmHg and diastolic pressure above 90 mmHg. Only individuals who expressed willingness to participate and were able to comply with the full intervention protocol were enrolled. Additionally, participants were required not to be consuming any other herbal supplements that could potentially influence blood pressure. Patients with cardiovascular or renal complications, pregnant women, and individuals who failed to complete the intervention sessions were excluded from the study.

The intervention consisted of administering Moringa leaf decoction in combination with moderate exercise. Each participant consumed 250 ml of Moringa leaf decoction daily, which was prepared from 2.5 grams of dried Moringa leaves steeped in 90°C water for five minutes. Alongside this herbal intake, participants performed moderate-intensity exercise in the form of brisk walking for 30 minutes each day. The exercise intensity was maintained at 50 to 70 percent of the participant's maximum heart rate. Both components of the intervention were carried out consistently for 21 consecutive days. Compliance with the intervention was monitored regularly to ensure standardization and minimize variations in implementation.

Blood pressure measurements were collected before and after the intervention using a calibrated mercury sphygmomanometer and a standard stethoscope. Measurements followed established clinical procedures to ensure accuracy and reliability. Systolic and diastolic blood pressure values were recorded during both pretest and posttest assessments. All collected data were processed and analyzed using IBM SPSS Statistics version 25. Descriptive statistics were used to present the characteristics of the participants, while the paired t-test was applied to determine differences between pre-intervention and post-intervention blood pressure measurements. A significance level of $p < 0.05$ with a 95 percent confidence interval was used to determine statistical significance. This study obtained ethical approval from the Health

Research Ethics Committee of Universitas Prima Indonesia, with registration number: 056/KEPK/UNPRI/VIII/2025.

RESULTS AND DISCUSSION

This study involved 16 hypertensive patients who met the inclusion criteria and completed the entire 7-day intervention consisting of Moringa leaf decoction and moderate exercise. All participants underwent pretest and posttest blood pressure measurements using standardized procedures. No participants dropped out during the intervention period, ensuring complete paired data for all statistical analyses.

Table 1. Characteristics of Respondents (N = 16)

Variable	Category	n (%) / Mean $\pm$ SD
Age (years)	Range 42–56	49.37 $\pm$ 4.03
Gender	Male	8 (50%)
	Female	8 (50%)
Occupation	Farmer	4 (25.0%)
	Housewife	3 (18.8%)
	Teacher	2 (12.5%)
	Employee	2 (12.5%)
	Civil servant	2 (12.5%)
	Entrepreneur	2 (12.5%)
	Trader	1 (6.3%)
Hypertension history	Yes	16 (100%)
Routine medication	Yes	16 (100%)

Source: Primary research data (2025)

The demographic and clinical characteristics of the respondents are presented in Table 1. The age of respondents ranged from 42 to 56 years, with a mean of 49.37 years (SD = 4.03). This places the majority of participants within the middle-adult group, which is known to experience heightened vascular stiffness and reduced arterial compliance, predisposing them to hypertension.

Gender distribution was equal, with 8 males (50%) and 8 females (50%). This balanced distribution indicates that hypertension affects both genders similarly within this population. Occupation varied among respondents, dominated by farmers (25.0%), followed by housewives (18.8%). The rest consisted of teachers, employees, civil servants, and entrepreneurs, each comprising 12.5% of the sample, while 6.3% were traders.

All respondents (100%) had a documented history of hypertension and were on routine antihypertensive medication. This indicates that the population had chronic hypertension and was under consistent medical management, making it suitable for assessing the additional effects of non-pharmacological interventions such as Moringa decoction and moderate exercise.

Table 2. Descriptive and Paired t-Test Results for Hemodynamic Changes (N = 16)

Variable	Minimum	Maximum	Mean $\pm$ SD	p-value
Systolic (pretest)	137	200	168.00 $\pm$ 19.02	
Systolic (posttest)	118	128	121.87 $\pm$ 2.98	0.000*
Diastolic (pretest)	80	110	97.81 $\pm$ 7.88	
Diastolic (posttest)	71	85	77.13 $\pm$ 3.57	0.000*

*Paired t-test, $\alpha = 0.05$

Source: Primary research data, processed using SPSS version 25 (2025)

Pretest and posttest measurements of systolic and diastolic blood pressure revealed substantial changes following the 21-day intervention. Before the treatment, participants exhibited elevated systolic blood pressure (range 137–200 mmHg) with a mean of 168.00 mmHg (SD = 19.02), indicating stage 1 to stage 2 hypertension according to JNC 8 criteria. Diastolic blood pressure ranged from 80 to 110 mmHg, with a mean of 97.81 mmHg (SD = 7.88). After completing the intervention, there was a marked reduction in both systolic and diastolic pressure. The mean posttest systolic pressure declined to 121.87 mmHg (SD = 2.98), placing most participants close to the normal blood pressure range. Diastolic pressure also decreased significantly to a mean of 77.13 mmHg (SD = 3.57). The reduction in mean systolic pressure by 46.13 mmHg and diastolic pressure by 20.69 mmHg reflects a clinically meaningful improvement in hemodynamic stability. Additionally, variation in systolic and diastolic pressure (as indicated by standard deviation) decreased in the posttest results, suggesting better blood pressure regulation and stability among participants after the intervention.

Normality testing was performed using the Shapiro–Wilk test to determine whether the data followed a normal distribution. All variables—systolic and diastolic measurements at both pretest and posttest—had p-values > 0.05 , indicating normal distribution.

This confirms that the assumptions for conducting a paired t-test were satisfied. The normal distribution of the data also reflects consistency in respondent hemodynamic patterns before and after the intervention.

The confirmation of normality strengthens the validity of using parametric analysis to determine the statistical significance of the intervention's impact.

The paired t-test revealed statistically significant differences between pretest and posttest blood pressure measurements for both systolic and diastolic values. The p-value for systolic blood pressure was 0.000 ($p < 0.001$), and the p-value for diastolic blood pressure was also 0.000 ($p < 0.001$). These results indicate that the intervention resulted in significant reductions in blood pressure.

The mean difference of 46.13 mmHg in systolic pressure demonstrates a strong physiological response to the combined effects of Moringa leaf decoction and moderate exercise. Similarly, the 20.69 mmHg reduction in diastolic pressure suggests improved vascular relaxation and peripheral resistance control.

The significant t-test results corroborate the descriptive findings and suggest that the intervention positively altered cardiovascular functioning within a relatively short period (7 days). This type of change is clinically relevant, indicating that non-pharmacological interventions can provide rapid hemodynamic improvements even in populations already undergoing pharmacological treatment.

Additionally, the reduction in standard deviation values in posttest readings suggests improved consistency and tighter regulation of blood pressure among participants, further supporting the effectiveness of the intervention.

The characteristics of respondents in this study indicate that hypertension patients in the working area of Namo Rambe Community Health Center were predominantly aged 42–56 years, with a mean age of 49.37 years. This age group falls into the middle-aged category, during which the risk of developing hypertension increases due to physiological changes, such as decreased vascular elasticity and increased arterial stiffness. These changes contribute to elevated blood pressure with aging. This finding aligns with the Ministry of Health of the Republic of Indonesia (Kemenkes RI, 2023), which reported that hypertension prevalence rises in individuals over 40 years due to vascular structural changes and hormonal regulation disturbances that affect blood pressure.

The gender distribution in this study was equal, with 50% male and 50% female participants, indicating that hypertension can occur in both sexes with a relatively similar risk. Physiologically, women experience increased risk after menopause due to decreased estrogen levels, which play a protective role in vascular health (Mayo Clinic, 2022). In men, hypertension risk is often associated with smoking, alcohol consumption, and high occupational stress (Rahmawati et al., 2021).

Regarding occupation, most respondents were farmers (25%) and housewives (18.8%), with others including employees, teachers, civil servants, and entrepreneurs. This occupational distribution reflects varying levels of physical activity. However, most respondents exhibited irregular physical activity patterns and high dietary salt intake, factors that can increase hypertension risk. The World Health Organization (WHO, 2021) states that excessive sodium intake and physical inactivity are major contributors to hypertension in developing countries, including Indonesia.

All respondents had a history of hypertension and were routinely taking antihypertensive medications, indicating a population with chronic hypertension under medical supervision. This demonstrates adequate awareness of hypertension management, though ongoing education is needed to support blood pressure control through non-pharmacological interventions, such as diet modification, regular exercise, and consumption of natural products that help reduce blood pressure (Fitriani, 2020).

The blood pressure measurements before intervention showed an average systolic pressure of 168.00 mmHg and diastolic pressure of 97.81 mmHg, which falls into the category of stage 1 to stage 2 hypertension according to JNC 8 classification. Elevated blood pressure in respondents may result from high-salt diets, lack of physical activity, stress, and genetic predisposition (Kemenkes RI, 2023). Physiologically, early-stage hypertension is associated with sympathetic-parasympathetic imbalance and overactivation of the renin-angiotensin-aldosterone system (RAAS), leading to vasoconstriction and fluid retention (Guyton & Hall, 2020).

After a seven-day intervention combining Moringa oleifera leaf decoction and moderate exercise, significant reductions in blood pressure were observed. The mean systolic pressure decreased to 121.87 mmHg and diastolic to 77.13 mmHg, indicating that this combination effectively improved hemodynamics in hypertensive patients. The bioactive compounds in

Moringa leaves, including flavonoids, tannins, saponins, and potassium, likely contributed to vasodilation, antioxidant effects, and natriuresis, thereby reducing peripheral resistance and blood volume (Mahmood et al., 2020).

Moderate-intensity exercise also contributed to blood pressure reduction by enhancing cardiac function, improving vascular elasticity, and reducing sympathetic activity, consistent with previous findings showing that 30 minutes of daily moderate exercise can significantly lower blood pressure (Fitriani, 2020). The synergistic effect of Moringa leaf decoction and moderate exercise aligns with the theory of Guyton & Hall (2020), suggesting that vasodilation and reduction in circulatory volume can improve long-term blood pressure regulation.

Paired sample t-test results confirmed a significant effect of the intervention on both systolic and diastolic blood pressure ($p = 0.000 < 0.05$), demonstrating that the combination of Moringa leaf decoction and moderate exercise effectively improves hemodynamic parameters. This finding is consistent with Rahmawati et al. (2021), which reported that consuming Moringa leaf decoction for one week significantly lowers blood pressure due to its diuretic and antioxidant properties.

In conclusion, the combination of Moringa oleifera leaf decoction and moderate exercise significantly reduces blood pressure and improves cardiovascular function in hypertensive patients. This non-pharmacological approach is safe, cost-effective, and feasible for rural communities, offering a potential alternative strategy for blood pressure management and cardiovascular risk reduction.

CONCLUSION

This study shows that administering Moringa leaf decoction combined with moderate-intensity exercise for 21 days significantly reduced systolic and diastolic blood pressure in hypertensive patients. All study participants experienced a statistically significant reduction in blood pressure, reflecting improvements in hemodynamics and cardiovascular function. The effectiveness of this intervention is supported by the bioactive compounds in Moringa leaves, which have antioxidant, diuretic, and vasodilatory properties, as well as the benefits of moderate exercise, which increase blood vessel elasticity and reduce peripheral resistance. These results confirm that non-pharmacological therapy, such as consuming Moringa leaf decoction and regular exercise, is a safe, affordable, and potentially effective approach to help manage hypertension, especially in communities with limited access to healthcare. In addition to demonstrating the effectiveness of combining Moringa leaf decoction and moderate exercise in reducing blood pressure, this study recommends encouraging wider use of this complementary approach in primary healthcare settings. Health workers should provide consistent education on safe herbal intake, the importance of regular physical activity, and routine blood pressure monitoring. Future studies are advised to examine longer intervention durations, varied Moringa dosages, or comparisons with other exercise types to strengthen evidence for long-term application.

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