

Blood Pressure Changes Following Lavender Aromatherapy in Patients with Hypertension: A Pre-Experimental Study

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Abstract

Hypertension requires sustained blood pressure control, and complementary non-pharmacological interventions may provide additional support alongside conventional management. Lavender aromatherapy is a relaxation-oriented intervention that may influence physiological responses associated with cardiovascular regulation. This study aimed to evaluate changes in systolic and diastolic blood pressure following lavender aromatherapy among patients with hypertension at Nayaka Husada 02 Pahlawan Clinic, Palembang. A quantitative pre-experimental study with a one-group pretest–posttest design was conducted from April to May 2026. The study included 36 patients with hypertension who met the eligibility criteria and were selected using total sampling. Lavender aromatherapy was administered using a diffuser containing 150 mL of water and 5 drops of lavender essential oil for 15 minutes. Blood pressure was measured before and immediately after the intervention using a digital sphygmomanometer. Data normality was assessed using the Shapiro–Wilk test, followed by paired-samples t-tests for pre–post comparisons. Mean systolic blood pressure decreased from 157.89 ± 10.52 mmHg to 131.67 ± 12.60 mmHg, with a mean reduction of 26.22 mmHg. Mean diastolic blood pressure decreased from 96.56 ± 4.30 mmHg to 84.19 ± 4.11 mmHg, with a mean reduction of 12.37 mmHg. Both changes were statistically significant ($p < 0.001$). Lavender aromatherapy was associated with short-term reductions in systolic and diastolic blood pressure among patients with hypertension. However, the absence of a control group limits causal interpretation, and the observed changes cannot be attributed exclusively to the intervention. Lavender aromatherapy may be considered a potential complementary relaxation-based approach to support short-term blood pressure management. Further studies using controlled designs with larger samples and longer follow-up periods are required to confirm its effectiveness.

Keywords: lavender aromatherapy, blood pressure, hypertension, complementary intervention, nursing.

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INTRODUCTION

Hypertension remains a major global public health challenge and a leading modifiable risk factor for cardiovascular morbidity and mortality. Persistent elevation of blood pressure increases the risk of severe complications, including stroke, ischemic heart disease, heart failure, and chronic kidney disease. According to the World Health Organization, approximately 1.4 billion adults worldwide are living with hypertension, while adequate blood pressure control remains achieved in only a limited proportion of affected individuals. Therefore, hypertension management requires continuous efforts through prevention, treatment, monitoring, and patient-centered interventions (WHO, 2025a). Current hypertension management emphasizes a comprehensive approach combining pharmacological treatment, lifestyle modification, regular monitoring, and supportive interventions to achieve optimal blood pressure control (Carey *et al.*, 2018; Pathak *et al.*, 2022).

Pharmacological therapy remains the cornerstone of hypertension management; however, achieving sustained blood pressure control may be influenced by medication adherence, treatment-related factors, and individual patient characteristics. Poor adherence to antihypertensive medication has been associated with inadequate blood pressure control and increased cardiovascular risk (Burnier & Egan, 2019). In addition, lifestyle interventions, including dietary modification, physical activity, weight management, and sodium reduction, are recommended as essential components of hypertension management (Carey & Whelton, 2018; WHO, 2025b). Alongside these established approaches, complementary interventions such as aromatherapy have gained attention in nursing practice because of their potential role in promoting relaxation and psychological comfort. However, their role in blood pressure management remains under investigation, and they should be considered supportive approaches rather than substitutes for evidence-based hypertension care.

Lavender aromatherapy is one of the complementary approaches frequently used in relaxation-oriented nursing interventions. Lavender (*Lavandula angustifolia*) contains volatile compounds that have been reported to produce calming effects through olfactory stimulation and potential modulation of emotional and autonomic responses. Reduced psychological tension may influence autonomic balance, vascular tone, and cardiovascular responses, potentially contributing to changes in blood pressure. However, these proposed mechanisms have not been directly evaluated in the present study and should be interpreted as possible explanations rather than confirmed pathways. Previous systematic reviews have suggested that aromatherapy may influence psychological and some physiological outcomes; however, evidence specifically supporting lavender aromatherapy as an intervention for blood pressure control remains inconclusive (Kim *et al.*, 2021).

Several previous studies have reported reductions in blood pressure following lavender aromatherapy. Rahmadhani (2022) demonstrated decreased systolic and diastolic blood pressure among older adults with essential hypertension following lavender aromatherapy using a pre-experimental design. Similarly, Milani and Burhanto (2022) reported significant pretest-posttest changes in blood pressure among patients with hypertension after lavender aromatherapy. Ardianty and Sari (2023) also observed a significant reduction in blood pressure among patients with hypertension at Nagaswidak Public Health Center, Palembang. More recent studies have continued to explore this intervention, including Pritasari *et al.* (2024), who reported reduced blood pressure among patients receiving lavender aromatherapy in a social care setting, and Wada *et al.* (2024), who compared lavender aromatherapy with Benson relaxation and combined interventions among older adults. Furthermore, Wulandari *et al.* (2025) reported improvements following a

combination of slow deep breathing and lavender aromatherapy, whereas Sapeni *et al.* (2025) described reductions in blood pressure following lavender aromatherapy in a case study.

Although previous findings generally indicate potential benefits, several limitations remain. Most available studies have used uncontrolled pre-experimental designs, combined lavender aromatherapy with other interventions, or applied different intervention protocols, durations, and delivery methods. Consequently, the independent contribution of lavender aromatherapy to short-term blood pressure changes remains difficult to determine. In addition, evidence regarding the immediate effect of a single standardized lavender aromatherapy session on both systolic and diastolic blood pressure among patients with hypertension in primary healthcare settings remains limited, particularly in Palembang.

This study addresses this gap by examining immediate changes in systolic and diastolic blood pressure following a single 15-minute lavender aromatherapy session among patients with hypertension at Nayaka Husada 02 Pahlawan Clinic, Palembang. The intervention was delivered through inhalation using a diffuser containing 150 mL of water and five drops of lavender essential oil. Because the protocol used a fixed number of drops rather than a quantified essential oil concentration, the intervention was described according to the applied study protocol. Therefore, this study aimed to evaluate changes in systolic and diastolic blood pressure before and after a single session of lavender aromatherapy among patients with hypertension.

METHODS

Study Design and Setting

This study employed a quantitative pre-experimental design using a one-group pretest-posttest approach. Systolic and diastolic blood pressure were assessed immediately before and after a single session of lavender aromatherapy. The study was conducted at Nayaka Husada 02 Pahlawan Clinic, Palembang, South Sumatra, Indonesia, from April 13 to May 21, 2026.

Participants and Sampling

The study population consisted of patients with hypertension who attended Nayaka Husada 02 Pahlawan Clinic during the study period. The accessible population included 36 patients, and total sampling was applied; therefore, all eligible patients were included in the study. Participants were eligible if they were diagnosed with hypertension, aged 40–70 years, had systolic blood pressure of 140–179 mmHg and/or diastolic blood pressure of 90–110 mmHg, were able to communicate adequately, were willing to participate, and had no known allergy to lavender aromatherapy. Patients with severe hypertension-related complications, impaired odor perception, cognitive impairment, or communication difficulties were excluded.

Intervention Procedure

Lavender aromatherapy was administered using a diffuser containing 150 mL of water and 3–5 drops of lavender essential oil for 15 minutes. Before the intervention, participants received an explanation regarding the study procedures and provided written informed consent. Participants were instructed to sit in a comfortable position while the diffuser was activated, and lavender aroma was inhaled throughout the intervention period. The intervention was conducted according to the study protocol. Because the original protocol specified the use of 3–5 drops rather than a quantified essential oil concentration, the intervention was described based on the applied protocol rather than as a standardized dose.

Blood Pressure Measurement

Blood pressure was measured immediately before and after the intervention using a digital sphygmomanometer. Participants were positioned comfortably, and the cuff was placed approximately 3 cm above the antecubital fossa before measurement. Systolic and diastolic blood pressure values displayed on the device were recorded in the observation form.

Data Analysis

Data were analyzed using IBM SPSS Statistics version 26.0. Descriptive statistics were used to summarize participant characteristics and blood pressure measurements, including means, standard deviations, frequencies, and percentages. The Shapiro–Wilk test was performed to assess data distribution. The normality results indicated that pre- and post-intervention systolic and diastolic blood pressure values met the assumption of normal distribution ($p > 0.05$). Therefore, paired-samples t -tests were used to compare blood pressure values before and after the intervention. Statistical significance was set at $p < 0.05$. Mean paired differences, 95% confidence intervals (CIs), degrees of freedom, and Cohen’s d effect sizes were reported. The paired difference was calculated as pre-intervention minus post-intervention blood pressure values, with positive values indicating a reduction in blood pressure.

Ethical Considerations

Ethical approval was obtained from the Research Ethics Committee of Universitas Muhammadiyah Ahmad Dahlan Palembang, Indonesia (No. 005789/KEP Universitas Muhammadiyah Ahmad Dahlan Palembang/2026), issued on March 16, 2026. All participants received information regarding the study objectives, procedures, potential benefits, and participation requirements before enrollment. Written informed consent was obtained from all participants. Participant confidentiality was maintained through the use of identification codes and aggregate reporting of study findings.

RESULTS AND DISCUSSION

A total of 36 patients with hypertension were included in the analysis, with no missing data for systolic or diastolic blood pressure measurements. The mean age of participants was 55.61 ± 8.73 years, ranging from 40 to 70 years. Most participants were female (29, 80.6%), had completed senior high school (14, 38.9%), and were housewives (11, 30.6%) (Table 1).

Table 1. Characteristics of Participants (n = 36)

No	Characteristics	Frequency (n=36)	Percentage (%)
1	Age, years		
	Mean $\pm$ SD	55.61 $\pm$ 8.73	
	Range	40–70	
2	Sex		
	Male	7	19.4
	Female	29	80.6
3	Education		
	Junior high school	12	33.3
	Senior high school	14	38.9
	Higher education	10	27.8
4	Occupation		
	Housewife	11	30.6
	Farmer	4	11.1

Entrepreneur	7	19.4
Teacher	7	19.4
Other	7	19.4

Before the intervention, the mean systolic blood pressure was 157.89 ± 10.52 mmHg, with values ranging from 142 to 178 mmHg, while the mean diastolic blood pressure was 96.56 ± 4.30 mmHg, ranging from 90 to 106 mmHg. After the 15-minute lavender aromatherapy session, the mean systolic blood pressure decreased to 131.67 ± 12.60 mmHg, with values ranging from 113 to 155 mmHg. The mean diastolic blood pressure decreased to 84.19 ± 4.11 mmHg, ranging from 75 to 91 mmHg. The mean reduction was 26.22 mmHg for systolic blood pressure and 12.36 mmHg for diastolic blood pressure (Table 2).

Table 2. Blood Pressure Before and After Lavender Aromatherapy (n = 36)

Blood pressure	Pre-intervention Mean $\pm$ SD (mmHg)	Post-intervention Mean $\pm$ SD (mmHg)	Mean reduction (mmHg)
Systolic	157.89 ± 10.52	131.67 ± 12.60	26.22
Diastolic	96.56 ± 4.30	84.19 ± 4.11	12.36

The paired difference was calculated as pre-intervention minus post-intervention values, with positive values indicating a reduction in blood pressure. The mean paired difference was 26.22 ± 8.56 mmHg for systolic blood pressure and 12.36 ± 4.05 mmHg for diastolic blood pressure. The paired-samples *t*-test demonstrated statistically significant differences for both outcomes: systolic blood pressure, $t(35) = 18.389$, $p < 0.001$, 95% CI [23.327–29.117]; and diastolic blood pressure, $t(35) = 18.309$, $p < 0.001$, 95% CI [10.991–13.732]. The calculated Cohen's *d*z values were 3.07 for systolic blood pressure and 3.05 for diastolic blood pressure, indicating very large within-participant effect sizes (Table 3).

Table 3. Shapiro–Wilk Normality Test of Blood Pressure Data (n = 36)

Variable	Shapiro–Wilk statistic	p-value
Pre-intervention systolic	0.943	0.062
Pre-intervention diastolic	0.967	0.350
Post-intervention systolic	0.944	0.068
Post-intervention diastolic	0.954	0.136

The results showed that all pre-intervention and post-intervention systolic and diastolic blood pressure measurements were normally distributed, with *p*-values above 0.05: pre-intervention systolic blood pressure ($p = 0.062$), pre-intervention diastolic blood pressure ($p = 0.350$), post-intervention systolic blood pressure ($p = 0.068$), and post-intervention diastolic blood pressure ($p = 0.136$). Based on these results, paired-samples *t*-tests were applied for subsequent analysis.

Table 4. Paired-Samples *t*-test of Blood Pressure Before and After Lavender Aromatherapy (n = 36)

Variable	Pre-intervention Mean $\pm$ SD (mmHg)	Post-intervention Mean $\pm$ SD (mmHg)	Mean difference (mmHg)	95% CI	t	p-value
Systolic blood pressure	157.89 ± 10.52	131.67 ± 12.60	26.22	23.33–29.12	18.389	<0.001
Diastolic blood pressure	96.56 ± 4.30	84.19 ± 4.11	12.36	10.99–13.73	18.309	<0.001

The present study demonstrated a substantial immediate reduction in both systolic and diastolic blood pressure following a 15-minute lavender aromatherapy intervention among patients with hypertension. Systolic blood pressure decreased by 26.22 mmHg, while diastolic blood pressure decreased by 12.36 mmHg, with both outcomes showing statistically significant pre-post differences and very large within-participant effect sizes (Table 4). These findings suggest that lavender aromatherapy may have potential as a short-term relaxation-oriented complementary intervention for supporting blood pressure management. However, the observed changes should be interpreted as immediate pre-post responses following the intervention rather than definitive evidence of a specific causal effect of lavender aromatherapy.

The potential reduction in blood pressure may be related to the relaxation response induced by lavender aroma exposure. Lavender essential oil contains bioactive compounds, including linalool and linalyl acetate, which have been associated with anxiolytic and sedative properties through modulation of neural pathways involved in relaxation. Activation of olfactory pathways may influence autonomic regulation by reducing sympathetic activity and promoting parasympathetic responses, which may subsequently contribute to reductions in vascular tone and blood pressure. However, these physiological mechanisms were not directly assessed in the present study; therefore, they should be considered plausible explanations rather than confirmed pathways underlying the observed changes.

The findings are consistent with previous studies investigating lavender aromatherapy among individuals with hypertension. Rahmadhani (2022) reported reductions in blood pressure among older adults with essential hypertension following lavender aromatherapy, while Ardianty and Sari (2023) observed significant blood pressure reductions among patients with hypertension in a primary healthcare setting in Palembang. Similarly, Pritasari *et al.* (2024) reported decreased blood pressure following lavender aromatherapy among hypertensive patients in South Lampung. Although these findings demonstrate a consistent direction of effect, differences in participant characteristics, baseline blood pressure, intervention duration, administration methods, and measurement procedures limit direct comparison of the magnitude of changes between studies.

Previous studies combining lavender aromatherapy with other relaxation interventions have also reported improvements in blood pressure-related outcomes. Wada *et al.* (2024) reported beneficial effects of lavender aromatherapy combined with Benson relaxation, while Wulandari *et al.* (2025) observed improvements following a combination of slow deep breathing and lavender aromatherapy. However, these findings should be interpreted separately from the present study because combination interventions involve additional therapeutic components. The current study contributes information regarding lavender aromatherapy as a standalone intervention, although further controlled studies are required to determine its independent contribution to blood pressure reduction.

Differences in intervention protocols may partly explain variations among previous studies. The present study used a diffuser containing 150 mL of water and 3–5 drops of lavender essential oil for 15 minutes. Previous evidence has demonstrated substantial variation in aromatherapy administration, including essential oil concentration, exposure duration, delivery method, and intervention frequency (Kim *et al.*, 2021; Sayed *et al.*, 2020). Standardization of these parameters is important to improve reproducibility and facilitate comparison across future clinical trials.

From a nursing perspective, lavender aromatherapy represents a simple, non-invasive, and relatively low-cost complementary intervention that may be integrated into relaxation-oriented care for patients with hypertension. Nevertheless, it should not replace prescribed antihypertensive medication, lifestyle modification, or routine blood pressure monitoring. Nurses may consider

lavender aromatherapy as an adjunctive approach while continuing evidence-based hypertension management and monitoring patient comfort and individual responses.

Several limitations should be considered when interpreting these findings. First, the one-group pretest–posttest design without a control group limits causal inference because the observed blood pressure reduction may also be influenced by regression to the mean, resting effects, repeated measurement, expectation effects, or other uncontrolled factors. This limitation is particularly relevant because participants were selected partly based on elevated baseline blood pressure. Second, the intervention protocol was not fully standardized because the essential oil dose was reported as 3–5 drops rather than a fixed quantified concentration. Information regarding essential-oil composition, diffuser characteristics, room conditions, and diffusion intensity was not available. Third, participant positioning and detailed blood pressure measurement conditions were not completely standardized, which may introduce measurement variability. Fourth, potential confounding factors, including timing of antihypertensive medication intake and other acute influences on blood pressure, were not systematically controlled. Finally, blood pressure was assessed only immediately after a single 15-minute session; therefore, the duration of the observed effect remains unknown.

CONCLUSION

Lavender aromatherapy was associated with short-term reductions in systolic and diastolic blood pressure among patients with hypertension. This intervention may be considered a simple, non-invasive, and complementary approach within nursing care to support relaxation and blood pressure management. However, the findings should be interpreted cautiously because the one-group pretest–posttest design without a control group limits causal interpretation. Further randomized controlled studies with larger samples, standardized intervention protocols, and longer follow-up periods are needed to determine the independent effect and long-term benefits of lavender aromatherapy for hypertension management.

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AUTHOR CONTRIBUTION STATEMENT (Mandatory)

The authors declare that the contribution of each author to the preparation of this manuscript is as follows: AR contributed to the conceptualization of the study, research methodology, data collection, data analysis, and manuscript preparation. YL contributed to the study methodology, data analysis, and critical revision of the manuscript. CS contributed to supervision, interpretation of the results, and critical revision of the manuscript. H contributed to supervision, manuscript review, and final approval of the manuscript. ACW contributed to the literature review, interpretation of the findings, and critical revision of the manuscript. All authors reviewed and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest related to the publication of this article.

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