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THE EFFECT OF MORINGA LEAF TEA CONSUMPTION ON BLOOD PRESSURE IN HYPERTENSION SUFFERERS AMONG PROLANIS PARTICIPANTS AT THE SIDABOWA PRIMARY CLINIC, PATIKRAJA DISTRICT, BANYUMAS REGENCY

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ABSTRACT

Hypertension is a condition where blood pressure is higher than normal, and one of its causes is increased inflammation and oxidative stress. Moringa leaves contain high levels of antioxidants, such as flavonoids, which can help control blood pressure as an effort to prevent complications from hypertension. The study aimed to determine the effect of moringa leaf tea consumption on blood pressure in hypertension sufferers among Prolanis participants at the Sidabowa Primary Clinic, Patikraja District, Banyumas Regency. An analytical observational study with a case-control design, which was selected through total sampling. Data analysis was performed using the Independent T Test. The respondents of this study numbered 41 individuals. The results of this study showed the significance values of the blood pressure changes between the two groups: systolic blood pressure 0.146 ($p>0.05$) and diastolic blood pressure 0.258 ($p>0.05$), which means there was no effect of moringa leaf tea consumption on blood pressure in hypertension sufferers among Prolanis participants. Consumption of moringa tea did not change the blood pressure of hypertensive patients in prolanis participants of Sidabowa Primary Outpatient Clinic, Patikraja District, Banyumas Regency after consuming moringa tea for 14 days. However, the decrease in systolic blood pressure was greater in the case group.

Keywords: Blood pressure, moringa leaf tea, oxidative stress

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INTRODUCTION

Hypertension is a major public health problem in Indonesia. In 2015, the World Health Organization (WHO) reported that approximately 1.13 billion people worldwide suffered from hypertension, meaning that one in three individuals globally is affected by this condition. Southeast Asia ranks third in prevalence, with 25% of the population affected. In Indonesia, the 2018 Basic Health Research (Riskesdas) indicated that 34.1% of the population has elevated blood pressure (Ministry of Health of the Republic of Indonesia, 2019). Hypertension remains the most prevalent non-communicable disease reported in Central Java Province, accounting for 76.5% of cases (Central Java Provincial Health Office, 2011). In Banyumas Regency, hypertension is the most common non-communicable disease, with 173,434 recorded cases. Patikraja Subdistrict contributes 10.42% of these cases (Sulaeman & Algifari, 2021).

Hypertension is a condition characterized by blood pressure exceeding normal levels. Diagnosis is made by measuring blood pressure in clinical or healthcare settings. An individual is classified as hypertensive when the systolic blood pressure (SBP) is ≥140 mmHg and/or the diastolic blood pressure (DBP) is ≥90 mmHg (Indonesian Heart Association, 2021). As a chronic condition with no definitive cure, hypertension requires long-term therapy and continuous management to prevent complications (Tumundo et al., 2021). Potential complications include cardiovascular diseases such as coronary heart disease, cerebrovascular diseases such as stroke, and nephro-urological disorders such as kidney failure (Anshari, 2020). In addition to pharmacological therapy, emphasis should also be placed on lifestyle modifications. Non-pharmacological interventions include dietary changes, weight reduction, increased physical activity, and reduced alcohol consumption (Verma et al., 2021).

One contributing factor to elevated blood pressure is increased inflammation and oxidative stress. Therefore, adequate intake of antioxidants through nutrition is essential to reduce oxidative stress (Verma et al., 2021). Currently, there are no pharmacological therapies specifically aimed at reducing oxidative stress in hypertensive patients. *Moringa oleifera* (MO), commonly known as the moringa plant, is widely found in Asia and Africa. Its leaves are rich in proteins, minerals, and antioxidant compounds, and are typically consumed fresh or processed into powder. These leaves are commonly used as vegetables, snacks, herbal teas, or spices (Alia et al., 2022).

Studies have shown that 50% ethanol extract of moringa leaves contains high levels of antioxidants, with a total flavonoid content of 5.12% and phenolic acid content of 2.37%. The antioxidant activity of moringa ethanol extract is particularly high in the kidneys, which play a key role in blood pressure regulation. Therefore, reducing oxidative stress in the kidneys may contribute to better hypertension management. Administration of ethanol extract of Moringa leaves for 14 days at a dose equivalent to 5.32 grams of dried Moringa leaves can reduce oxidative stress in the kidneys (Laksana et al., 2022). Moringa has also demonstrated long-term blood pressure-lowering effects through the activation of endothelial nitric oxide synthase (eNOS) via NOS-sGC-dependent signaling pathways, leading to increased nitric oxide availability and resulting in vasorelaxation of the endothelium (Alia et al., 2022). In addition to its antioxidant properties, MO has been shown to inhibit Angiotensin-Converting Enzyme (ACE) activity, primarily due to the presence of quercetin-3-O-glucoside and kaempferol-3-O-glucoside. The ACE-inhibitory activity of

these compounds has even been found to be more potent than captopril, a standard positive control (Alia et al., 2022).

Over the past four years, the number of patients with hypertension and diabetes mellitus enrolled in the Chronic Disease Management Program (PROLANIS) at the Sidabowa Outpatient Primary Clinic has nearly doubled, increasing from 65 to 131 cases. Among these participants, 30% have experienced complications, a figure considered significantly high, highlighting the urgent need for complication prevention efforts. However, current preventive measures for hypertension and diabetes mellitus complications at the Sidabowa Primary Clinic have not been optimal due to limited resources.

Based on the aforementioned background, it can be concluded that one of the main mechanisms underlying hypertension is oxidative stress. Previous research has shown that moringa leaves possess a high antioxidant content, thereby necessitating further investigation into the effect of moringa leaf consumption on blood pressure in hypertensive patients at the Sidabowa Outpatient Primary Clinic in Banyumas Regency. This study aims to examine the effect of moringa leaf tea on the blood pressure of hypertensive patients participating in the PROLANIS program at the Sidabowa Outpatient Primary Clinic, Patikraja Subdistrict, Banyumas Regency.

METHODS

The tools and materials used in this study included research forms for recording study data. The data were obtained from the patients' medical records. This study employed a case-control design. The study population consisted of 121 participants enrolled in the PROLANIS program at the Sidabowa Outpatient Primary Clinic, of whom 68 were diagnosed with hypertension. The sample included hypertensive PROLANIS participants at the Sidabowa Outpatient Primary Clinic who met the inclusion criteria: being diagnosed with hypertension, willing to undergo a series of interventions, and willing to sign an informed consent form. Exclusion criteria included being pregnant or breastfeeding and/or currently taking other herbal medicines. This study utilized secondary data, which were obtained from patient medical records compiled during a community service program led by Dr. dr. Agung Saprasetya Dwi Laksana and his team. The collected data were analyzed using univariate analysis to assess frequency distributions and bivariate analysis to test the research hypotheses. Data analysis was performed using IBM SPSS version 30.0.0. Data normality was tested using the Shapiro–Wilk test. Pre- and post-intervention data in the case group were analyzed using the paired t-test, as the data were normally distributed. In contrast, data in the control group were analyzed using the Wilcoxon signed-rank test, due to non-normal distribution. Hypothesis testing was conducted using bivariate analysis with the independent t-test, as the data were normally distributed. Additionally, odds ratio calculations were conducted to assess whether the observed outcomes were associated with the exposure.

RESULTS AND DISCUSSION

This study received ethical approval from the Research Ethics Committee of the Faculty of Medicine, Jenderal Soedirman University, as stated in the ethical clearance letter No. 094/KEPK/PE/X/2024. The study examined the effect of *Moringa oleifera* leaf tea consumption on blood pressure among participants of the PROLANIS program at the

Sidabowa Outpatient Primary Clinic, Patikraja Subdistrict, Banyumas Regency. The research was conducted from September to October 2024 at the Sidabowa Outpatient Primary Clinic, with a total of 41 hypertensive PROLANIS participants as research subjects. The characteristics of the subjects included gender, age, dietary patterns, physical activity, smoking habits, obesity status, and family history of hypertension.

Table 1. Respondent Characteristics

Variable		Frequencies				Total	
		Cases		Comparator group			
		n	%	n	%	n	%
Age	<65	13	31,71	4	9,52	17	41,46
	≥65	11	26,83	13	30,95	24	58,54
Sex	M	19	46,34	12	28,57	31	75,61
	F	5	12,20	5	11,90	10	24,39
Smoking	Yes	0	0,00	0	0,00	0	0,00
	No	24	58,54	17	40,48	41	100,00
Obesity	Yes	5	12,20	6	14,29	11	26,83
	No	19	46,34	11	26,19	30	73,17
Physical activity	Yes	3	7,32	3	7,14	6	12,20
	No	21	51,22	14	35,71	35	87,80
High-Sodium and High-Fat Diet	Yes	19	46,34	9	21,43	28	68,29
	No	5	12,20	8	19,05	13	31,71
Family History	Yes	11	26,83	8	19,05	19	46,34
	No	13	31,71	9	21,43	22	53,66

Table 4.1 presents the characteristics of the respondents, displayed as frequency distributions for each variable, including age, gender, smoking status, obesity, physical activity, high-sodium and high-fat diet, and family history. In terms of age, the majority of respondents in the case group were under 65 years old, whereas most individuals in the comparator group were aged 65 years or older. Regarding gender, both the case and comparator groups consisted predominantly of female participants. With respect to smoking history, all participants in both groups were non-smokers. Based on Body Mass Index (BMI), the majority of respondents in both groups were not classified as obese. In terms of physical activity, most participants in both groups reported not engaging in regular physical activity. Regarding dietary patterns, the majority of participants in both groups followed a high-sodium and high-fat diet. Lastly, in terms of family history, most respondents in both groups did not have a family history of hypertension.

Table 2. Distribution of Systolic and Diastolic Blood Pressure

	Cases				Comparator	
	SISTOLYC BLOOD PRESSURE (SBP)		DISTOLIC BLOOD PRESSURE (DBP)		FINAL SBP	INITIAL DBP
	Initial	Final	Initial	Final		
Mean	151.58	131.25	83.58	77.83	135.53	87.82
Standard Deviation	17.779	16.480	8.642	10.453	19.246	7.707

Table 2 presents the systolic and diastolic blood pressure values for both groups. In the case group, the initial systolic blood pressure had a mean of 151.58 mmHg with a standard deviation of 17.779, while the final systolic blood pressure had a mean of 131.25 mmHg with a standard deviation of 16.480. The initial diastolic blood pressure had a mean of 83.58 mmHg with a standard deviation of 8.642, and the final diastolic blood pressure had a mean of 77.83 mmHg with a standard deviation of 10.453. In the comparator group, the final systolic blood pressure had a mean of 135.53 mmHg with a standard deviation of 19.246. The initial diastolic blood pressure in this group had a mean of 83.82 mmHg with a standard deviation of 7.707.

Table 3. Distribution of Blood Pressure in the Comparator Group

	Initial SBP	Final DBP
Median	145	80
Minimum	127	70
Maximum	205	105

Table 3 presents the initial systolic and final diastolic blood pressure measurements of the comparator group. The systolic blood pressure prior to consuming *Moringa oleifera* leaf tea ranged from a maximum of 205 mmHg to a minimum of 127 mmHg. On day 15, the diastolic blood pressure ranged from a maximum of 100 mmHg to a minimum of 60 mmHg. A bivariate analysis was conducted to compare systolic and diastolic blood pressure before and after consuming *Moringa oleifera* leaf tea in the case group using the paired t-test. Table 4.4 presents the significance values for both systolic and diastolic blood pressure before and after the intervention in the case group. The systolic blood pressure showed a significance value of $p = 0.001$ (<0.05), while the diastolic blood pressure showed a significance value of $p = 0.006$ (<0.05). These results indicate a statistically significant difference in both systolic and diastolic blood pressure before and after consuming *Moringa oleifera* leaf tea in the case group.

Table 4. Comparison of Blood Pressure Before and After Consuming *Moringa oleifera* Leaf Tea in the Case Group

Blood Pressure	95% CI	*P value*
Systolic	10,475-30,192	0,001
Diastolic	1,352-10,148	0,006

Table 5. Comparison of Blood Pressure Before and After Consuming *Moringa oleifera* Leaf Tea in the Comparator Group

Blood Pressure	*P value*
Sistolik	0,026
Diastolik	0,005

Table 5 presents the significance values for systolic and diastolic blood pressure before and after consuming *Moringa oleifera* leaf tea in the comparator group. The systolic blood pressure showed a significance value of p = 0.026 (<0.05), and the diastolic blood pressure showed a significance value of p = 0.005 (<0.05). These findings indicate a statistically significant difference in both systolic and diastolic blood pressure before and after consuming *Moringa oleifera* leaf tea in the comparator group.

Table 6. Changes in Blood Pressure on Day 15 Between the Case and Comparator Groups

Blood Pressure	Groups	
	Case	Comparator
Systolic	20,33	12,76
Diastolic	5,75	7,82

Table 6 shows the reduction in systolic and diastolic blood pressure on day 15 between the case and comparator groups. In the case group, systolic blood pressure decreased by 20.33 mmHg and diastolic blood pressure decreased by 5.75 mmHg. In the comparator group, systolic blood pressure decreased by 12.76 mmHg and diastolic blood pressure decreased by 7.82 mmHg.

Table 7. Comparison of Blood Pressure Changes on Day 15 Between the Case and Comparator Groups

Blood Pressure	95% CI	*P value*
Systolic	-21.92-6,785	0,146
Diastolic	-4,319-8,467	0,258

Table 7 shows the significance values of systolic and diastolic blood pressure on day 15 between the intervention group and the control group. The systolic blood pressure had a p-value >0.05, specifically 0.146. Based on this data, it can be concluded that there was no significant difference in systolic blood pressure after consuming moringa leaf tea between the intervention and control groups. The diastolic blood pressure also had a p-value >0.05, namely 0.258. From this result, it can be concluded that there was no significant difference in diastolic blood pressure after consuming moringa leaf tea between the intervention and control groups.

The comparison of blood pressure reduction between the intervention group and the control group was not statistically significant; however, the decrease in systolic blood pressure was greater in the intervention group. This finding aligns with a study by Agustin

(2024). Moringa leaf tea is believed to lower blood pressure due to its flavonoid content. Flavonoids reduce oxidative stress, which subsequently induces relaxation of resistant arteries. These compounds exert vasodilatory effects by relaxing smooth muscles and enhancing vascular function, thereby lowering blood pressure (Alifariki, 2023; Alia et al., 2022; Laksana et al., 2021). In addition to flavonoids, moringa leaves also contain calcium, potassium, and magnesium, which are essential for smooth muscle relaxation. Calcium may also suppress RAAS activity, leading to vasodilation and a decrease in peripheral resistance, thus contributing to blood pressure reduction (Srianjani & Susanti, 2023).

In contrast to systolic pressure, the reduction in diastolic pressure was greater in the control group. In this study, the average age of participants was 65 years. After the age of 50, diastolic blood pressure tends to increase due to higher arteriolar resistance. With aging, arteries become stiffer as the collagen-to-elastin ratio increases. Ventricular wall muscles also lose elasticity, which raises diastolic filling pressure due to reduced cardiac compliance (Mawardy et al., 2021; Yunus et al., 2021).

Many factors can influence blood pressure, including sex, age, genetics, diet, physical activity, and others (Rahmadhani, 2020). In this study, the intervention group had a higher intake of sodium- and fat-rich diets and lower physical activity levels than the control group. Specifically, 46.34% of respondents in the intervention group consumed a high-sodium and high-fat diet, and 51.22% did not engage in physical activity. Low physical activity can lead to increased peripheral vascular resistance, forcing the heart to contract more strongly, thus causing hypertension. Regular physical activity reduces stress and anxiety, promoting vasodilation by suppressing sympathetic nerve activity, which contributes to blood pressure reduction (Putu et al., 2021). High salt intake increases peripheral resistance and blood pressure by elevating plasma volume, cardiac output, and arterial pressure. The heart compensates for the increased blood volume by pumping more forcefully, further raising blood pressure (Mardianto et al., 2021). Excessive saturated fat intake can elevate LDL cholesterol levels, which may adhere to vessel walls and form plaques, narrowing blood vessels and increasing vascular resistance. High-fat diets may also enhance oxidative stress, contributing to endothelial dysfunction. This dysfunction impairs nitric oxide (NO) production, thereby increasing blood pressure (Salsabila et al., 2023).

In this study, participants consumed 5.32 grams of moringa tea, equivalent to 250 mg/kg body weight in rats when converted. Laksana (2022) found in a rat study that a 250 mg dose of moringa resulted in decreased hepcidin levels, while a 500 mg dose reduced both hepcidin and malondialdehyde (MDA). Moreover, the same study reported that moringa also increased glutathione (GSH) and delta-aminolevulinic acid dehydratase (δ-ALAD) levels. Lower hepcidin levels reduce inflammation, decreased MDA enhances NO production and reduces vascular damage, and increased GSH mitigates oxidative stress, lowering diastolic blood pressure. Decreased δ-ALAD also helps prevent oxidative stress and vascular damage (Ramadhani et al., 2021; Sulaiman & Sangging, 2024). Thus, reducing oxidative stress and vascular injury may prevent blood pressure elevation.

This study observed the effects of consuming moringa leaf tea over a 14-day period. By day 15, more participants experienced a reduction in both systolic and diastolic blood pressure than those who did not. A longer duration of tea consumption may lead to more significant reductions in blood pressure. This finding is supported by Aulia (2020), which used a quasi-experimental control group design. In that study, participants consumed moringa tea for 21 days, and significant differences were observed between the intervention and control groups.

In this study, adherence to antihypertensive medication was assumed to be consistent across all participants, as the sample consisted of Prolanis participants who regularly attended the program. According to a previous study conducted in Latvia, the prevalence of non-adherence to medication was 46.20%, with the most common reason being the patients' perception of being healthy (Mardianto et al., 2022). Nurdin (2023) reported that higher adherence to antihypertensive medication among hypertensive patients was associated with better blood pressure outcomes. However, this study did not confirm differences in blood pressure reduction between participants who adhered to medication and those who did not.

CONCLUSION

The consumption of Moringa leaf tea did not significantly affect changes in blood pressure among hypertensive patients participating in the Prolanis program at the Sidabowa Primary Outpatient Clinic, Patikraja District, Banyumas Regency after 14 days of consumption. However, a greater reduction in systolic blood pressure was observed in the intervention group.

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