

## The effectiveness of celery leaf decoction and progressive muscle relaxation in lowering blood pressure

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### Abstract

**Background:** Hypertension is one of the leading non-communicable diseases causing global mortality, with an increasing prevalence, including in Indonesia. Both pharmacological and non-pharmacological approaches are employed in managing hypertension. One non-pharmacological therapy is the administration of celery leaf decoction (*Apium graveolens* L.), which contains active compounds such as flavonoids and phthalides with potential blood pressure-lowering effects. Additionally, Progressive Muscle Relaxation (PMR) techniques are effective in reducing blood pressure through physical and mental relaxation.

**Method:** The study employed a quasi-experimental design with a pretest-posttest without control group approach. The subjects were hypertensive patients at Adhyaksa Clinic, selected through purposive sampling. Data were analyzed using the Wilcoxon signed-rank test.

**Results:** The abstract contains background (a brief description of the problem and research objectives) methods used, the results of the research, and conclusions (indicate the main conclusions).

**Conclusion:** The majority of respondents were male (71.4%), aged 41–45 years (42.9%), held a bachelor's degree (85.7%), and worked as prosecutors (66.7%). The average systolic and diastolic blood pressures before the intervention were 149.52 mmHg and 89.52 mmHg, respectively, which decreased to 126.19 mmHg and 74.29 mmHg after the intervention. The analysis showed that celery leaf decoction and PMR movements were effective in reducing blood pressure, with a p-value of 0.000 (< 0.05).

**Keywords:** hypertension, celery leaf, progressive muscle relaxation, blood pressure

### INTRODUCTION

Hypertension is one of the non-communicable diseases that is a leading cause of morbidity and mortality worldwide. This condition is characterized by a systolic blood pressure  $\geq 140$  mmHg and/or diastolic blood pressure  $\geq 90$  mmHg, which can lead to serious complications such as stroke, heart failure, and kidney failure if not managed properly.

According to the World Health Organization (WHO), approximately 1.13 billion people worldwide suffer from hypertension, resulting in 7.5 million deaths annually due to this disease (1). In Indonesia, the prevalence of hypertension has continued to rise, from 25.8% in 2013 to

34.1% in 2023 (2). In Riau Province, the incidence of hypertension has reached 36.5%, which is higher than the national average. Data from the Adhyaksa Clinic of the High Prosecutor's Office in Riau shows an increase in the number of hypertension patient visits, from 149 cases in 2022 to 269 cases in 2023, and by August 2024, there were 192 visits for hypertension patients (3).

Hypertension management includes both pharmacological and non-pharmacological therapies. Although antihypertensive medications are effective, their use is often accompanied by side effects and high costs, prompting many patients to seek non-pharmacological alternatives, such as herbal therapies and

relaxation techniques. Celery (*Apium graveolens* L.) is known to contain active compounds like essential oils, flavonoids, apigenin, and phthalides, which help reduce blood pressure through vasodilation and antioxidant mechanisms. Studies have shown that consuming celery decoction can significantly lower blood pressure.

In addition, Progressive Muscle Relaxation (PMR) techniques have been proven effective in reducing blood pressure by reducing muscle tension and stimulating the parasympathetic nervous system's relaxation. Previous research has shown that PMR can lower blood pressure in hypertensive patients and improve their quality of life.

Agusdarman et al. (2021) demonstrated that the administration of 300 cc celery leaf decoction for one week in elderly hypertensive patients significantly reduced blood pressure ( $p$ -value 0.000) (4). Kartika (2020) also reported that the administration of 200 cc celery leaf decoction for five days reduced blood pressure from 148/91 mmHg to 147/88 mmHg (5). Besides herbal therapy, Progressive Muscle Relaxation (PMR) can also help lower blood pressure through the relaxation mechanism of the nervous system and stress reduction (6). A study by Azizah et al. (2021) showed that PMR performed over three days in hypertensive patients significantly reduced both systolic and diastolic blood pressure.

In the Adhyaksa Clinic of the High Prosecutor's Office in Riau, the incidence of hypertension continues to rise, with the number of hypertension patient visits increasing from 149 cases in 2022 to 269 cases in 2023, and 192 cases by August 2024. A preliminary study revealed that many patients face difficulties in controlling their blood pressure and exhibit non-compliance with therapy.

Based on this background, this study aims to evaluate the effectiveness of celery leaf decoction and Progressive Muscle Relaxation (PMR) in lowering blood pressure in hypertensive patients at the Adhyaksa Clinic of the High Prosecutor's Office in Riau.

It is hoped that the results of this study will provide an effective non-pharmacological therapy alternative in hypertension management.

## METHOD

The research used a quasi-experimental design with a pretest-posttest without control group design. The study was conducted at the Adhyaksa Clinic of the High Prosecutor's Office in Riau in August 2024. The research subjects were hypertensive patients at the Adhyaksa Clinic, selected using purposive sampling, resulting in a sample size of 21 individuals. The study began with the measurement of initial blood pressure (pretest) using a sphygmomanometer to obtain baseline data on systolic and diastolic blood pressure. The intervention was carried out in two forms: celery leaf decoction and Progressive Muscle Relaxation therapy. The celery leaf decoction was made by boiling 100 grams of celery leaves in 400 cc of water for 10 minutes until 200 cc remained, then it was administered to the respondents at the prescribed dosage every day at the same time for 7 days. Meanwhile, the Progressive Muscle Relaxation therapy was performed for 20-30 minutes every day, accompanied by relaxation music to create a calm atmosphere. After the intervention, blood pressure was measured again (posttest) every day before and after the intervention, and changes in systolic and diastolic blood pressure were recorded in an observation sheet. The measurement results over 7 days were then analyzed by calculating the average blood pressure reduction to evaluate the effectiveness of the intervention. Data were analyzed using the Wilcoxon signed-rank test. Conducted ethical test Number. 42/EC/KEPITEKES-CU/XII/2024 dated 24 December 2024.

## RESULT

This study involves hypertensive patients at the Adhyaksa High Prosecutor's Office Clinic, with a sample size of 21 individuals.

## 1. Respondent Characteristics

**Table 1.** Frequency Distribution of Respondent Characteristics at the Adhyaksa Clinic, High Prosecutor's Office of Riau

No	Respondent Characteristics	Frequency	%
1	Gender		
	Male	15	71.4
	Female	6	28.6
	Total	21	100
2	Age		
	31-40 years	4	19.0
	41-50 years	12	57.1
	51-60 years	3	14.3
	61-70 years	2	9.5
	Total	21	100
3	Education		
	Master's Degree (S2)	3	14.3
	Bachelor's Degree (S1)	18	85.7
	Total	21	100
4	Position		
	Prosecutor	14	66.7
	Administrative Staff (TU)	7	33.3
	Total	21	100

Based on gender, the majority (71.4%) of the respondents were male, with 15 individuals. In terms of age, 4 individuals (19.0%) were aged 31-40 years, 12 (57.1%) were aged 41-50 years, 3 (14.3%) were aged 51-60 years, and 2 (9.5%) were aged 61-70 years. Regarding education, most (85.7%) had a bachelor's degree, and 3 individuals (14.3%) had a master's degree. In terms of position, 14 individuals (66.7%) were prosecutors, while 7 individuals (33.3%) held administrative positions at the Adhyaksa Clinic, High Prosecutor's Office of Riau.

**Table 2.** Average Blood Pressure of Respondents Before the Intervention

Blood Pressure (Pre-Test)	n	Mean	SD	Min	Max
Systolic	21	149.52	10.713	140	170
Diastolic		89.52	5.896	80	100

## 2. Average Blood Pressure Before the Intervention (Pre-test)

Based on table 2, the average systolic blood pressure for hypertensive patients before the intervention was 149.52 mmHg, with a standard deviation of 10.713. The minimum blood pressure was 140 mmHg, and the maximum was 170 mmHg. For diastolic blood pressure, the average was 89.52 mmHg with a standard deviation of 5.896, with a minimum of 80 mmHg and a maximum of 100 mmHg at the Adhyaksa Clinic, High Prosecutor's Office of Riau.

## 3. The average blood pressure after the treatment (post-test).

**Table 3.** The average blood pressure after the treatment (post-test)

Blood Pressure (Post-Test)	n	Mean	SD	Min	Max
Systolic	21	126.19	14.310	110	180
Diastolic		74.29	5.071	70	80

Based on table 3, the average systolic blood pressure after the intervention was 126.19 mmHg, with a standard deviation of 14.310. The minimum blood pressure was 110 mmHg, and the maximum was 180 mmHg. For diastolic blood pressure, the average was 74.29 mmHg with a standard deviation of 5.071, with a minimum of 70 mmHg and a maximum of 80 mmHg at the Adhyaksa Clinic, High Prosecutor's Office of Riau.

## 4. The average blood pressure before and after the treatment (pre and post-test)

Based on Table 4, it can be seen that the blood pressure of hypertension patients after administering celery leaf boiled water and progressive muscle relaxation exercises (pre- and post-test) shows a decrease in blood pressure. For systolic blood pressure, the average decrease was 11.45 mmHg with a standard deviation of 3.999. Meanwhile, for diastolic blood pressure, the average decrease was 10.50 mmHg with a standard deviation of 4.0008.

**Tabel 4** The average blood pressure before and after the treatment (pre and post-test)

Blood Pressure (Post-Test)	n	Mean	SD
Systolic	21	11.45	3.999
Diastolic		10.50	4.008

### 5. Effectiveness of Celery Leaf Decoction and Progressive Muscle Relaxation Movements on Blood Pressure Reduction in Hypertensive Patients

Based on table 5, the effectiveness of celery leaf decoction and progressive muscle relaxation movements in reducing blood pressure is evident from the changes before and after the intervention. Systolic blood pressure decreased from 149.52 mmHg to 126.19 mmHg, with 20 respondents

experiencing an average decrease of 11.45 mmHg, while 1 respondent experienced an increase of 2.00 mmHg. The statistical test showed a Z value of -3.994 with a p-value of 0.000 ( $p < 0.05$ ), indicating that the intervention was effective in reducing systolic blood pressure.

For diastolic blood pressure, a decrease from 89.52 mmHg to 74.29 mmHg occurred, with 20 respondents experiencing an average decrease of 10.50 mmHg, and 1 respondent showing no change. The statistical test showed a Z value of -4.008 with a p-value of 0.000 ( $p < 0.05$ ), indicating that the intervention was also effective in reducing diastolic blood pressure in hypertensive patients at the Adhyaksa Clinic, High Prosecutor's Office of Riau.

**Table 5** Wilcoxon Signed Rank Test

Blood Pressure		N	Mean	Negative Rank	Positive Rank	Ties	z	p -Value
Systolic	Pre	21	149.52	20	1	0	-3.994	0.000
	Post		126.19					
Diastolic	Pre	21	89.52	20	0	1	-4.008	0.000
	Post		74.29					

## DISCUSSION

### 1. Respondent Characteristics

The majority of respondents in this study were male (71.4%). The prevalence of hypertension is higher in males before menopause because estrogen plays a role in maintaining blood vessel elasticity, as explained by Guyton and Hall (2020). However, after menopause, the risk of hypertension increases in females due to a decrease in estrogen levels (7).

Most of the respondents were aged 41–50 years (42.9% were 41–45 years old and 33.3% were 46–50 years old). This age group is considered middle-aged, which has an increased risk of hypertension due to a decline in blood vessel elasticity and an increase in peripheral resistance (8). Kearney et al. (2020) also showed that the incidence of hypertension increases

significantly in individuals over the age of 40 (9).

All respondents had higher education levels (undergraduate and graduate degrees), which could increase health awareness, in line with the Health Belief Model by Green and Kreuter (2020). However, health awareness is not only influenced by education but also by motivation and the environment (10).

The majority of respondents worked as prosecutors (66.7%). A profession associated with high levels of stress that contributes to hypertension. Chronic stress can increase cortisol levels and activate the sympathetic nervous system, contributing to elevated blood pressure (11). This job-related factor is also supported by findings from Whelton et al. (2020), which stated that age, gender, education, and occupation are

important determinants in the prevalence of hypertension (12).

## 2. Average Blood Pressure Before Treatment (Pre-Test)

Before the intervention, the average systolic blood pressure of the respondents was 149.52 mmHg (SD 10.713), with a range of 140–170 mmHg. Meanwhile, the average diastolic blood pressure was 89.52 mmHg (SD 5.896), with a range of 80–100 mmHg.

This result is in line with the study by Mather (2021), which showed that before the intervention with celery leaf decoction, the average systolic and diastolic blood pressure in elderly hypertensive patients was 154.88 mmHg and 96.63 mmHg, respectively (13). The research by Yohana Adibah (2021) also supports this finding, with an average blood pressure before the progressive muscle relaxation intervention of 147.22 mmHg and 96.11 mmHg (14).

Hypertension is categorized as systolic blood pressure  $\geq 140$  mmHg and/or diastolic blood pressure  $\geq 90$  mmHg (15)(16). Based on the pre-test results, most respondents experienced mild to moderate hypertension. The celery leaf decoction is believed to lower blood pressure due to its potassium content and active compounds that act as vasodilators. Progressive muscle relaxation is also hypothesized to reduce stress and lower sympathetic nervous system activity, thus effectively lowering blood pressure.

## 3. Average Blood Pressure After Treatment (Post-Test)

After the intervention, a significant reduction in blood pressure was observed. The average systolic blood pressure dropped to 126.19 mmHg (SD 14.310), with a range of 110–180 mmHg. Meanwhile, the diastolic blood pressure decreased to 74.29 mmHg (SD 5.071), with a range of 70–80 mmHg.

This reduction is consistent with the study by Mather (2021), which showed that after the intervention with celery leaf decoction, the average systolic and diastolic blood pressure decreased to 139.40 mmHg and 87.83 mmHg, respectively (13).

Similarly, the research by Yohana Adibah (2021) showed a reduction in blood pressure after the progressive muscle relaxation intervention, with values of 138.41 mmHg and 87.37 mmHg (14).

Celery (*Apium graveolens* L.) contains apigenin, mannitol, and apiin, which function as vasodilators and diuretics, helping to reduce blood pressure by reducing the volume of fluid in the blood (17). Apigenin in celery acts as a natural beta-blocker, slowing the heart rate and reducing heart contractions, thus lowering blood pressure.

Progressive muscle relaxation has also been proven effective in reducing blood pressure through mechanisms that reduce muscle tension and stress. This technique contributes to regulating the sympathetic nervous system, which can physiologically lower blood pressure (18).

According to the WHO (2020), the combination of herbal therapy and relaxation techniques can be an effective non-pharmacological approach to lowering blood pressure in hypertensive patients. The results of this study show that the combination of celery leaf decoction and progressive muscle relaxation plays a role in managing hypertension by significantly lowering blood pressure, in line with the mechanisms of both interventions (15).

## 4. Average Difference in Blood Pressure of Respondents Before and After Treatment

Based on the research results, it was found that the blood pressure of hypertensive patients decreased after being given celery leaf boiled water and progressive muscle relaxation exercises (pre-posttest). For systolic blood pressure, the average reduction was 11.45 mmHg with a standard deviation of 3.999, while for diastolic blood pressure, the average reduction was 10.50 mmHg with a standard deviation of 4.008.

This research is in line with a study conducted by Selvy Afrozi in 2023, which stated that after the intervention, blood pressure decreased by 1.34 mmHg from



3.28 to 1.94 after the progressive muscle relaxation technique was applied, with a P-value of 0.001, indicating a significant effect on reducing blood pressure. Another study conducted by Dina Rohmah in 2022 showed similar results, where giving 200 cc and 300 cc of celery leaf boiled water had an effect on lowering blood pressure, with the 200cc dose being more effective in reducing blood pressure.

According to the homeostasis theory proposed by Freud in 2010, the body tries to maintain stable internal balance despite external changes, such as medical interventions. Interventions can include medications, physical therapy, or other actions designed to improve a patient's condition. If done correctly, the blood pressure is expected to return to a normal range. Another theory put forward by Luzziz in 2020 states that celery is rich in potassium, which is an essential mineral for maintaining electrolyte balance and helping to lower blood pressure. Potassium helps reduce the effects of sodium in the body, which can result in lower blood pressure. When a person consumes foods high in potassium, such as celery, the kidneys become more efficient at excreting sodium, ultimately lowering blood pressure.

Therefore, the researcher assumes that the difference in blood pressure before and after the intervention is closely related to the effectiveness of celery leaf boiled water and progressive muscle relaxation.

### **5. Effectiveness of Celery Leaf Decoction and Progressive Muscle Relaxation Movements in Reducing Blood Pressure in Hypertensive Patients**

This study shows that the administration of celery leaf decoction and progressive muscle relaxation movements is effective in reducing blood pressure in hypertensive patients. The analysis results showed that systolic blood pressure decreased from an average of 149.52 mmHg to 126.19 mmHg, with 20 respondents showing a significant decrease and one

respondent experiencing an increase of 2.00 mmHg. Diastolic blood pressure also decreased from an average of 89.52 mmHg to 74.29 mmHg. The Wilcoxon Signed Rank Test produced a Z value of -3.994 for systolic blood pressure and -4.008 for diastolic blood pressure, with a p-value of 0.000 ( $p < 0.005$ ), indicating the significant effectiveness of these two interventions in reducing blood pressure.

The findings of this study are supported by previous studies. Riska Mauliza (2024) found that celery leaf decoction significantly reduced blood pressure in elderly hypertensive patients with a p-value  $< 0.05$  (19). Meanwhile, the study by Nabilla Yuliana (2023) showed that progressive muscle relaxation techniques had an effect on the blood pressure of elderly hypertensive patients with similar results (20).

Physiologically, hypertension occurs due to an increase in blood pressure within the arteries, which, if uncontrolled, can lead to serious complications such as stroke, myocardial infarction, and kidney failure (21). Therefore, managing hypertension through non-pharmacological approaches is crucial.

The mechanism of celery (*Apium graveolens* L) as an antihypertensive therapy comes from its flavonoid content, which produces apigenin as a natural beta-blocker that slows heart contractions and reduces blood pressure. In addition, celery contains phthalides and magnesium, which help relax blood vessel muscles, reduce arterial constriction, and normalize blood pressure (22). Mannitol in celery also acts as a diuretic, helping the kidneys expel excess fluid from the blood, thereby reducing blood volume and blood pressure.

On the other hand, progressive muscle relaxation is a technique that reduces skeletal muscle tension through a systematic cycle of contraction and relaxation. This technique is effective in reducing stress, lowering sympathetic nervous system activity, and improving blood pressure regulation (23). A study by Ekarini et al. (2019) also showed that progressive muscle

relaxation therapy significantly reduced blood pressure through these mechanisms (24).

Thus, the combination of celery leaf decoction and progressive muscle relaxation movements can be an effective and safe non-pharmacological intervention for lowering blood pressure in hypertensive patients. The results of this study indicate that these two methods complement each other in helping to control blood pressure and can be applied in the management of hypertension at the Adhyaksa High Prosecutor's Office Clinic in Riau.

The limitation of this study is the absence of a control group. With a control group, it is hoped that the research results obtained will be more measurable.

## CONCLUSIONS

Based on the results of the study on the effectiveness of celery leaf decoction and progressive muscle relaxation movements in hypertensive patients at the Adhyaksa High Prosecutor's Office Clinic in Riau, the researcher can draw the following conclusions:

1. The majority (71.4%) of respondents were male, nearly half (42.9%) were in the age range of 41–45 years, most (85.7%) had completed a Bachelor's degree, and most (66.7%) held the position of prosecutor at the Adhyaksa High Prosecutor's Office Clinic in Riau.
2. The average systolic and diastolic blood pressure before the administration of celery leaf decoction and progressive muscle relaxation movements was 149.52 and 89.52 mmHg, respectively, at the Adhyaksa High Prosecutor's Office Clinic in Riau.
3. The average systolic and diastolic blood pressure after the administration of celery leaf decoction and progressive muscle relaxation movements was 126.19 and 74.29 mmHg, respectively, at the Adhyaksa High Prosecutor's Office Clinic in Riau.
4. There is an effectiveness of celery leaf decoction and progressive muscle relaxation movements in hypertensive patients, with a p-value of 0.000 ( $< 0.05$ ) at the Adhyaksa High Prosecutor's Office Clinic in Riau, with an average reduction of 10.50 mmHg.

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