



## The Effect of *Passiflora foetida* L. Leaves Decoction on Blood Pressure Profile and Its Correlation with the Demographics of Hypertensive Patients

Krishna Purnawan Candra<sup>1,2\*</sup>, Sulika<sup>1</sup>, Maulida Rachmawati<sup>1</sup>, Anton Rahmadi<sup>1</sup>, Miftakhur Rohmah<sup>1</sup>, Iwan Muhamad Ramdan<sup>3</sup>, Yuliani<sup>1</sup>

<sup>1</sup>Department of Agricultural Product Technology, Faculty of Agriculture, Mulawarman University, Jl. Tanah Grogot, Kampus Gunung Kelua, Samarinda, Indonesia

<sup>2</sup>Postgraduate Study Program of Environmental Science of Mulawarman University, Jl. Sambaliung, Kampus Gunung Kelua, Samarinda, Indonesia

<sup>3</sup>Faculty of Public Health, Mulawarman University, Jl. Sambaliung, Kampus Gunung Kelua, Samarinda, Indonesia

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### Abstract

*Passiflora foetida* L. is an endemic herb species located in Kalimantan and is typically administered among the local population to maintain cardiovascular health. Previous studies examining its effectiveness remain limited. This study aimed to examine the effects of the *P. foetida* L. leaves decoction on adult blood pressure and its correlation with the demographics of hypertensive patients. A quasi-experiment was conducted by assigning the passion leaves decoction to 26 people randomly divided into two groups (13 individuals each) in two stages. The decoction was prepared by boiling 10 fresh cut leaves (6-7 grams) in 400 mL water and letting half of the water volume evaporate. The decoction was freshly prepared daily for each respondent. The first group was administered the decoction at the initial stages of the study, while the second group was administered placebo. The treatment dose of 100 mL was administered twice (at 9AM and 5PM) for a period of seven days. The second stage was carried out three weeks following completion of the initial stage and placebo and decoction were administered to the first and second groups, respectively. Blood pressure data were analyzed using paired t-tests. The correlation between blood pressure and the demographics of hypertensive patients was analyzed using Kendall's Tau-b and Spearman's test. We demonstrated that the passion leaves decoction significantly reduced blood pressure in hypertensive patients ( $p < 0.01$ ). The decoction was shown to improve the blood pressure profile of hypertensive patients, reducing the number of hypertensive patients with second-degree hypertension prevalence from 57.69% to 7.69% and 30.77% to 7.69% for systolic and diastolic blood pressure, respectively. Our findings also demonstrated that the decoction eliminated the correlation between age, occupation, body weight status, and blood pressure. The *P. foetida* leaves decoction can potentially be developed as a tea herb to maintain blood pressure among hypertensive patients across the globe.

**Keywords:** Passion; Hypertension; Decoction; *Passiflora foetida*

### Introduction

The function of all body organs typically declines with age, which may lead to decreased endurance and immunity among humans, along with increased risks of contracting diseases. Hypertension is a high-risk disease that affects individual over the age of 20 years,

with the risk increasing exponentially in the elderly, especially among women who remain at the highest risk [1,2]. Hypertension prevalence is defined as a blood pressure that reaches 140/90 mmHg or above [3]. The Joint National Committee on Prevention Detection Evaluation and Treatment of High Blood Pres-

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\*Corresponding Author: Krishna Purnawan Candra

Department of Agricultural Product Technology, Faculty of Agriculture, Mulawarman University, Jl. Tanah Grogot Kampus Gunung Kelua, Samarinda, Indonesia

Email: candra@faperta.unmul.ac.id

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sure [4] classify hypertension into six groups: optimal (Systolic <120, Diastolic <80), normal (Systolic <130, Diastolic <85), high-normal (Systolic 130-139, Diastolic 85-89), hypertension stage 1 (Systolic 140-159, Diastolic 90-99), hypertension stage 2 (Systolic 160-179, Diastolic 100-109), and hypertension stage 3 (Systolic  $\geq$ 180, Diastolic  $\geq$ 110).

Hypertension has become a serious health threat in Indonesia since the hypertensive prevalence has increased significantly. For example, from 2013 to 2018, the prevalence has increased from 25.80% to 34.11%. East Kalimantan has the second highest prevalence of hypertension, with a prevalence of 39.30% in 2018 [2,5].

Herbal-based medicine is currently becoming a popular alternative in the community. It offers the advantage of minimizing adverse side effects on the health of organs relative to synthetic drugs administered for a long duration of time [6]. *Passiflora foetida* L. known as “Kelubut, Kemot, or Permot” in Kalimantan [7], and as “Rambusa” in Java [8], Indonesia, belongs to endemic wild herbs. It is used by local Kalimantan tribe (Dayak Meratus) as a medicinal herb for wound healing, diabetic, and hypertensive [7] and by the Wawoni tribe in Southeast Sulawesi as an antidote for food poisoning [9].

Decoction of all parts of *P. foetida* helps maintain cardiovascular health and treats neurological disorders, kidney disease, cough, inflammation of the cervical lymph nodes (cervical lymphadenitis), insomnia, and hyperlipidemia [7,10]. A recent study demonstrated that the effect of passion juice at a dose of 2 g leaves per day in 2 mL of water (administered for four weeks) was able to reduce the systolic and diastolic blood pressure of hypertensive patients [11]. The fruit pulp [12] and methanol extract of the rind [13] of *Passiflora edulis* also showed reduced blood pressure in spontaneous hypertensive rats. The potential of *P. foetida* L. leaves as a tea herb for anti-hypertensive treatment has not yet been reported. The present study aimed to determine the effect of *P. foetida* leaves decoction (PLD) on the blood pressure profile of adult hypertensive patients and assess its correlation with their demographic characteristics.

## Methods

### Study Design

*P. foetida* leaves (Figure 1) were obtained from the house yard in Wonotirto Village, Samboja District, Kutai Kartanegara Regency, East Kalimantan Province, Indonesia. The description of herbs used in this experiment as *P. foetida* L. was proofed by the plant specimens description collected from Ta’u Island, American Samoa Manu’a Islands by the National Tropical Botanical Garden (USA Hawaii, Kalaheo,

1990, Voucher ID: PTBG 11703) [14]. This research consisted of two experiments: a study of the blood pressure profile of hypertensive patients following the treatment of PLD and a survey of its association with the blood pressure profile and demographics of these hypertension patients.



Figure 1. Botany of *Passiflora foetida* L.

A quasi-experiment was conducted using a pre-test–post-test model and employed 26 respondents with hypertension (11 men and 15 women) living in Wonotirto Village, Samboja District, Kutai Kartanegara Regency, East Kalimantan Province. The respondents comprised 13.06% of all people suffering from hypertension in Wonotirto Village in the work area of the Community Health Center in Samboja District (199 people, consisting of 71 men and 128 women). The respondents agreed to participate in this experiment by completing the participation form.

Demographic characteristics of hypertensive patients were determined by in-depth interviews using a questionnaire during the survey, which included information about sex, age, education, job, and body mass index.

In the two-stage experiment, respondents were divided into two groups (A and B, each with 13 respondents). The second stage of the investigation was conducted three weeks following completion of the first stage. In the first stage, groups A and B were treated with PLD and placebo, respectively, whereas the second stage was conducted in a vice-versa manner (Figure 2). The first-stage experiment was conducted for seven days with a dose of 100 mL of PLD and boiled water for treatment and placebo, respectively. The dose was administered twice per day (9 AM and 5 PM). Blood pressure was measured before (pre-test) and after treatment (post-test) using a digital Taff Omicron B869 digital tensimeter.

### Data Collection

This study was conducted from December 2021 to January 2022 in Wonotirto Village, Samboja District, Kutai Kartanegara Regency, East Kalimantan Province, Indonesia. The researchers collected all the data. Demographic data were collected by interviews

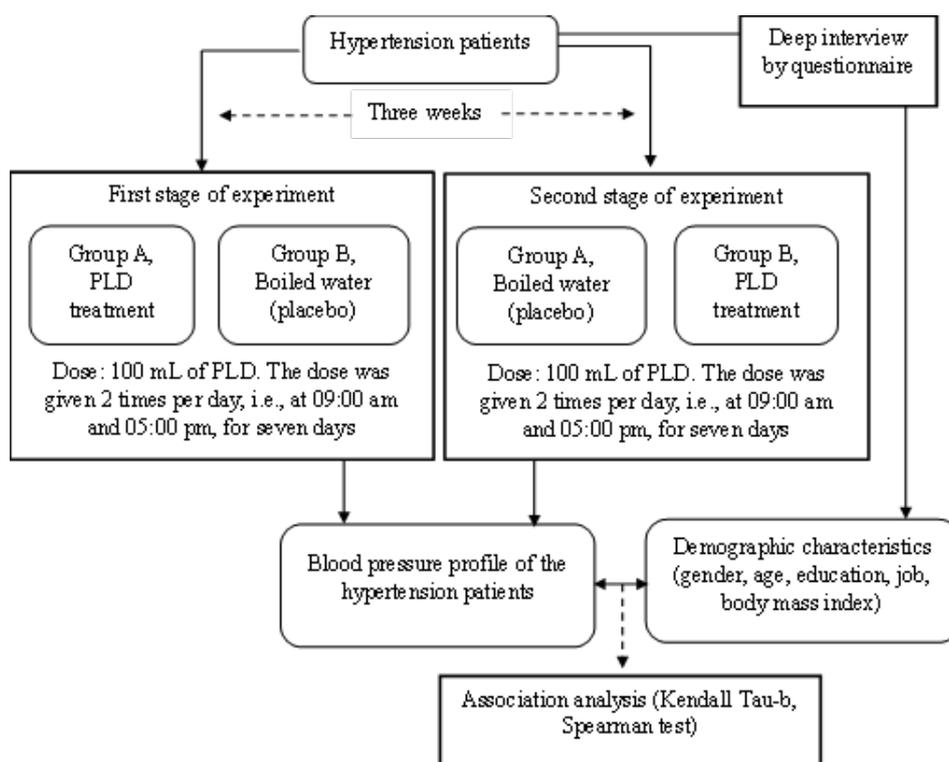


Figure 2. Study design of *P. foetida* L. Leaves Decoction (PLD) treatment on hypertension patients.

relying on a questionnaire, while blood pressure data were collected from consenting respondents. The respondents' sampling activity, treatment of PLD, and measurement of blood pressure were supervised by a doctor from the Community Health Center of Samboja District.

### Data Analysis

The blood pressure profiles of hypertensive patients before and after PLD treatment were analyzed using a paired t-test. In addition, the correlation between demographic characteristics of hypertensive patients and their blood pressure profile was tested using Kendall's tau-b test for sex and Spearman's test for age, education, occupation, and body weight status.

### Ethical Clearance

The investigation was conducted from December 2021 to January 2022 after providing the ethical clearance issued on 21st December 2021 by the Ethical Commission for Medical Experiment of Mulawarman University No.127/KEPKFK/XXI/2021.

## Results

### Demographic characteristics

During this study, 3,098 people with hypertension were registered in the Health Community Center area of the Samboja subdistrict. Wonotirto village, one of

the 23 villages in the Samboja Sub-district, has 199 hypertensive patients, and 26 people (13%) self-willingly joined as respondents for purposes of this study. The gender of the respondents in this study was balanced between male and female (42.31% and 57.69%, respectively). The percentages of respondents aged 30, 31-50, 51-70 and >70 years were 30.77%, 7.692%, 50.00%, and 11.54%, respectively. The education level of the respondents was classified as "not entered school," "graduated from elementary school" "graduated from junior high school" "graduated from high school" and "graduated from college" and had proportions of 26.92%, 19.23%, 11.54%, 26.92%, and 15.38%, respectively. The diversity of jobs among the respondents were categorized as "not working/housewife," "entrepreneur," "labor," "farmers," and "civil servants," with proportions of 34.62%, 19.23%, 11.54%, 30.77%, and 3.85%, respectively. The weight status of the respondents was classified as "underweight," "normal," "overweight", and "obesity" had proportions of 0.00%, 61.54%, 26.92%, and 11.54%, respectively. The respondents' demographic characteristics are presented in table 1.

### Effect of *Passiflora foetida* L. Leaves Decoction (PLD) on the Profile of Blood Pressure of Hypertensive Patients

The blood pressure profile of the respondents was

either classified as “high-normal” or “hypertension stage-1,” as shown by the systolic and diastolic blood pressure of the respondents treated by placebo (Table 2). The systolic blood pressure was 157 and 158 mmHg pre- and post-treatment within the placebo group, while the diastolic blood pressure was 91 and 88 mmHg pre- and post-treatment, respectively. Therefore, the blood pressure profile of the respondents could be classified as uniform, as evidenced by the average blood pressure change in the placebo group following pre- and post-treatment were -1 (decrease of 1 unit) and -3 (decrease of 3 units) for systolic and diastolic blood pressure, respectively.

PLD treatment significantly decreased the blood pressure ( $p < 0.01$ ) of the respondents with a range of 28 and 12 mmHg for systolic and diastolic blood pressure, respectively (Table 3 and Figure 3). As a result, the blood pressure profile of hypertensive patients was shown to improve as a result of the decoction. Based on the systolic blood pressure data, the number of hypertensive patients with hypertension stages 1, 2, and 3 decreased from 42.31% to 34.62%, 19.23% to 7.69%, and 38.46% to 0.00%, respectively. The hypertensive patients shifted to high-normal and normal ranges, increasing from 0.00% to 42.31% and 0.00% to 15.38%, respectively (Table 2). Diastolic blood pressure data

**Table 1.** Association of blood pressure profile with demography characteristics of hypertensive patients (n=26)

Respondents' characteristics	n	%	Pretest				Post-test			
			Systolic		Diastolic		Systolic		Diastolic	
			r	p	r	p	r	p	r	p
<i>Gender</i>			-0.309	0.081	-0.142	0.460	0.065	0.723	-0.169	0.355
Men	11	42.31								
Women	15	57.69								
<i>Ages</i>			0.525**	0.006	0.057	0.781	0.302	0.133	0.416*	0.035
≤ 30	8	30.77								
31-50	2	7.692								
51-70	13	50.00								
> 70	3	11.54								
<i>Education (graduated from)</i>			-0.041	0.844	0.110	0.957	0.075	0.715	-0.305	0.130
Not going to school	7	26.92								
Elementary School	5	19.23								
Junior High School	3	11.54								
Senior High School	7	26.92								
University	4	15.38								
<i>Occupation</i>			0.437*	0.026	0.393*	0.047	0.178	0.385	0.249	0.219
Jobless	9	34.62								
Entrepreneur	5	19.23								
Labor	3	11.54								
Farmer	8	30.77								
Civil servant	1	3.85								
<i>Body Mass Index (Weight Status)</i>			0.419*	0.033	0.157	0.444	0.151	0.461	0.004	0.984
< 18.5 (Under-weight)	0	0.00								
18.5-24.9 (Normal)	16	61.54								
25.0-29.9 (Over-weight)	7	26.92								
≥ 30.0 (Obese 2)	3	11.54								

Note: Demography characteristics were analyzed by Kendall's Tau-b test for gender, and Spearman's test for age, education, job, and body mass index (weight status).

**Table 2.** Effect of *Passiflora foetida* L. Leaves Decoction (PLD) treatment on blood pressure of hypertension respondents (n=26)

No Re- spon- dents	Systolic						Diastolic					
	Placebo			Treatment			Placebo			Treatment		
	Pre	Post	Post-Pre	Pre	Post	Post-Pre	Pre	Post	Post-Pre	Pre	Post	Post-Pre
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1	200	200	0	190	150	-40	90	100	10	100	90	-10
2	140	140	0	140	130	-10	90	90	0	90	70	-20
3	150	150	0	150	120	-30	100	80	-20	100	70	-30
4	140	150	10	160	130	-30	90	100	10	90	100	10
5	160	160	0	160	150	-10	100	90	-10	90	80	-10
6	130	120	-10	140	120	-20	90	70	-20	90	90	0
7	170	170	0	180	140	-40	80	90	10	90	90	0
8	130	120	-10	150	130	-20	80	80	0	90	70	-20
9	190	170	-20	160	130	-30	100	90	-10	90	90	0
10	160	170	10	200	140	-60	90	70	-20	120	100	-20
11	190	200	10	190	130	-60	90	90	0	90	90	0
12	150	140	-10	160	130	-30	100	90	-10	90	80	-10
13	140	150	10	140	130	-10	70	90	20	90	80	-10
14	150	160	10	180	140	-40	100	90	-10	100	80	-20
15	150	140	-10	150	150	0	80	80	0	90	80	-10
16	140	140	0	150	130	-20	90	90	0	100	90	-10
17	160	160	0	190	140	-50	80	90	10	80	70	-10
18	160	150	-10	180	130	-50	90	100	10	90	60	-30
19	150	150	0	150	120	-30	100	100	0	100	80	-20
20	160	170	10	160	140	-20	100	80	-20	90	80	-10
21	140	150	10	180	170	-10	90	90	0	90	90	0
22	140	140	0	140	120	-20	90	90	0	90	60	-30
23	150	140	-10	140	130	-10	90	90	0	90	80	-10
24	210	210	0	200	160	-40	90	90	0	110	90	-20
25	190	180	-10	180	140	-40	100	80	-20	100	80	-20
26	160	160	0	150	130	-20	90	90	0	90	80	-10
Mean	158	157	-1	164	136	-28	91	88	-3	94	82	-12

Note: Placebo = boiled water. Treatment = *P. foetida* L. leaves decoction. . Column (4) = (3)-(2), column (7) = (6)-(5), column (10) = (9)-(8), column (12) = (11)-(10)

showed similar trends. Normal and optimal blood pressure increased from 3.85% to 38.46% and from 0.00% to 23.08%, respectively (Table 3).

*Correlation of Blood Pressure Profile with Demographics of Hypertensive Patients*

Except for sex and education, all other parameters (age, occupation, and weight status) were significantly correlated with systolic blood pressure. Meanwhile, diastolic blood pressure was only related to occupation type (Table 1).

A previous study by Wicaksono [15] showed that age is correlated with the prevalence of hypertension.

Most hypertensive patients were aged 56-65 years (43.8%) [16]. The potential of PLD treatment as herbal therapy for patients with hypertension was investigated in this study. PLD treatment in patients with hypertension was shown to offer significant benefits by reducing the correlation between blood pressure and some demographic characteristics, such as age, occupation, and weight status (Table 1).

The prevalence of hypertension increases among groups with low physical activity [16]. Strenuous activity generally stimulates the body to sweat and burn fat; therefore, the chances of obesity and blood vessel constriction are lower. The systolic and diastolic

values of pre-test and post-test hypertensive patients (Table 3) showed that PLD treatment decreased or eliminated the correlation between blood pressure and occupation.

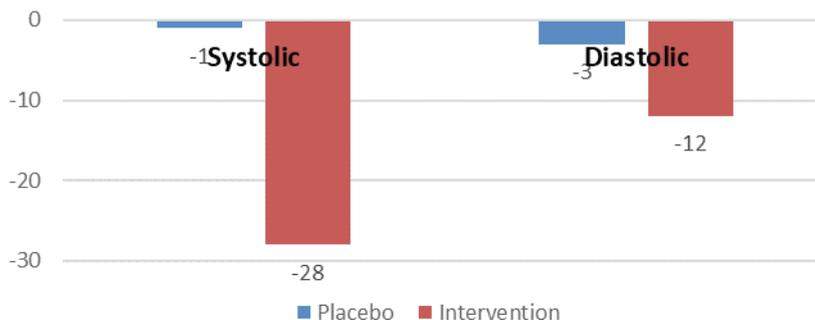
### Discussion

The results of this study clearly show that PLD has the potential to lower the blood pressure in patients with hypertension. Falah [1] reported that elderly women

**Table 3.** The improvement of the blood pressure profile of the adult hypertensive patients (n=26) following the treatment of PLD

Blood pressure classification	Pre-test		Post-test	
	n	%	n	%
<b>Systolic (mmHg)</b>				
<i>Optimal</i> (<120)	0	0.00	0	0.00
<i>Normal</i> (<130)	0	0.00	4	15.38
<i>High-Normal</i> (130-139)	0	0.00	11	42.31
<i>Hypertension Stage 1</i> (140-159)	11	42.31	9	34.62
<i>Hypertension Stage 2</i> (160-179)	5	19.23	2	7.69
<i>Hypertension Stage 3</i> (≥180)	10	38.46	0	0.00
<b>Diastolic (mmHg)</b>				
<i>Optimal</i> (<80)	0	0.00	6	23.08
<i>Normal</i> (<85)	1	3.85	10	38.46
<i>High-Normal</i> (85-89)	0	0.00	0	0.00
<i>Hypertension Stage 1</i> (90-99)	17	65.38	8	30.77
<i>Hypertension Stage 2</i> (100-109)	6	23.08	2	7.69
<i>Hypertension Stage 3</i> (≥110)	2	7.69	0	0.00

Note: Blood pressure classification is based on classification advised on Sixth Report by Joint National Committee on Prevention Detection Evaluation and Treatment of High Blood Pressure (1997).



**Figure 3.** Decreasing blood pressure (systolic and diastolic) of hypertensive patients following getting treatment of *P. foetida* leaves decoction (PLD). The dose and another note are the same as the note in Table 1. \*\*) Systolic and diastolic blood pressure (post-test – pretest) between placebo and treatment were significantly different (t-paired test, p<0.01)

tend to have a higher risk of hypertension than men due to reduced estrogen expression. However, in this study, it was shown that gender was not significantly related to systolic or diastolic blood pressure. The same evidence has been reported by Nuraeni [17] and Yunus [18] which demonstrated that gender was not significantly correlated with blood pressure. Chatterjee [15] reported a decrease in blood pressure in hypertensive Wistar rats following treatment with

an ethyl acetate extract of “Rambusa” leaves; these are known to stimulate activation of nitric oxide-dependent vasodilation and phenolics which affects antihypertensive individuals. The ethanol extract of passion leaves contains flavonoids, alkaloids, and saponins [19], whereas the hexane extract contains aliphatic compounds, such as fatty acids and esters, long-chain alcohols, steroids, and some minerals (phosphorus, magnesium, sulfur, and potassium) [10]. Fadillah et

al. [20] and Camilo et al. [11] added that “Rambusa” leaves contain essential compounds, such as angiotensin-converting enzyme inhibitors (ACEI), to lower blood pressure. De Melo Filho et al. [10] stated that these leaves also provide potassium, which is vital for maintaining muscle work and heart rate. Tension in the blood vessel walls can be relieved by potassium to decrease blood pressure. Gamma aminobutyric acid ( $\gamma$ -aminobutyric acid) is also responsible in the anti-hypertensive mechanism of *Passiflora edulis* [13,21]. Weight or nutritional status is a risk factor for hypertension and other degenerative diseases due to increased insulin and aldosterone levels in the plasma of obese patients [22,23]. In addition, overweight individuals may spend long durations of time remaining sedentary; in order to be physically active, the heart requires pumping blood and produce blood pressure. Therefore, weight status is significantly correlated with systolic blood pressure [22]. In this study, PLD treatment eliminated the correlation that was previously significantly related to an insignificant correlation between the blood pressure of hypertensive patients and weight status.

A limitation of this study is that the respondents’ diets were not set. However, the fact that PLD may improve the cardiovascular health and blood pressure profile of hypertensive individuals poses a crucial advantage for commercializing herbal tea treatment for hypertensive patients.

### Conclusion

PLD treatment has the potential to maintain the blood pressure profile of hypertensive patients at normal and/or optimal levels. Based on systolic blood pressure, the number of patients with stage 3, stage 2, and stage 1 hypertension decreased by 100.00%, 60.01%, and 18.18%, respectively, shifting to highly normal and normal conditions. Moreover, diastolic blood pressure clearly decreased the blood pressure of patients with stage 2 and stage 1 by 66.68% and 52.60%, respectively, which shifted to normal and optimal by 38.46% and 23.08%, respectively. PLD treatment can reduce or even negate the association of age, job, and weight status with the blood pressure profile among hypertensive patients.

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### Conflict of Interests

There is no conflict of interest between the authors

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