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EFFECTIVENESS BUTTERFLY PEA FLOWER (CLITORIA TERNATEA) NANOPARTICLES SYRUP ON BLOOD PRESSURE GRADE I IN HYPERTENSION PATIENTS

Efektivitas Sirup Nanopartikel Bunga Telang (Clitoria ternatea) terhadap Tekanan Darah pada Pasien Hipertensi Grade I

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ABSTRAK

Hipertensi merupakan silent killer dimana gejala dapat bervariasi pada masing-masing individu. Pencegahan hipertensi dengan terapi farmakologis dan nonfarmakologis yaitu dengan menggunakan kearifan lokal salah satunya menggunakan bunga telang untuk mengupayakan stabilitas tekanan darah sistolik dan diastolik. Penelitian ini bertujuan untuk mengetahui efektivitas sirup nanopartikel bunga telang terhadap tekanan darah sistolik dan diastolik pada pasien hipertensi grade I. Desain penelitian ini quasy experiment dengan menggunakan rancangan pre-post test design with control group. Penelitian ini dilaksanakan di wilayah kerja Puskesmas Pidie pada bulan September sampai dengan Oktober 2024. Besar sampel dalam penelitian ini adalah 60 responden dengan Teknik purposive sampling. Kelompok intervensi diberikan sirup nanopartikel bunga telang dosis 0,9 gr dengan kandungan antosianin 0,115 mg perhari selama 14 hari dan obat anti hipertensi dan kelompok kontrol diberikan obat anti hipertensi. Analisis data menggunakan Paired Sampel T test dan Independent Sampel T test. Hasil tekanan darah sistolik pada kelompok intervensi mengalami penurunan rata-rata 28,300 mmHg (p=0,000) dan tekanan darah diastolik pada kelompok intervensi mengalami penurunan rata-rata 11,667 mmHg (p=0,000), sedangkan pada kelompok kontrol terdapat penurunan rata-rata tekanan darah sistolik 0,867 mmHg (p=0,219) dan rata-rata penurunan tekanan darah diastolik 0,367 mmHg (p=0,469). Pemberian sirup nanopartikel bunga telang efektif untuk menurunkan tekanan darah sistolik (81%) dan tekanan darah diastolik (87%) (p=0,000). Pemberian sirup nanopartikel bunga telang selama 14 hari efektif untuk menurunkan tekanan darah sistolik dan diastolik pada pasien hipertensi grade I.

Kata kunci: *hipertensi, sirup nanopartikel, bunga telang (Clitoria ternatea)*

ABSTRACT

Hypertension is often called a “silent killer” because its symptoms vary between individuals. Prevention can be achieved through pharmacological and non-pharmacological therapies, including the use of local wisdom such as butterfly pea (Clitoria ternatea) flower to help stabilize blood pressure. This quasi-experimental study, conducted in the Pidie Health Center service area from September to October 2024, The study aimed to determine the effectiveness of butterfly pea flower nanoparticle syrup on blood pressure in patients with grade I hypertension. A total of 60 respondents were recruited using purposive sampling, with the intervention group receiving 0.9 g of butterfly pea flower nanoparticle syrup containing 0.115 mg of anthocyanins per day for 14 days along with antihypertensive medication, while the control group received only antihypertensive medication. Data were analyzed using Paired Sample t-tests and Independent Sample t-tests. Results showed that in the intervention group, mean systolic blood pressure decreased by 28.300 mmHg (p=0.000) and diastolic blood pressure decreased by 11.667 mmHg (p=0.000), whereas in the control group, systolic blood pressure decreased by 0.867 mmHg

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(p=0.219) and diastolic blood pressure by 0.367 mmHg (p=0.469). Administration of butterfly pea flower nanoparticle syrup was effective in reducing systolic blood pressure by 81% and diastolic blood pressure by 87% (p=0.000), indicating that 14 days of supplementation is effective in reducing both systolic and diastolic blood pressure in patients with grade I hypertension.

Keywords: hypertension, butterfly pea flower, nanoparticle syrup (*Clitoria ternatea)*

INTRODUCTION

Hypertension is a silent killer, and symptoms vary from person to person [1]. If systolic blood pressure is more than 140 mmHg or diastolic blood pressure is more than 90 mmHg on repeated examinations, it is considered hypertension [2]. Grade I hypertension is a condition where systolic blood pressure ranges between 140–159 mmHg or diastolic blood pressure is in the range of 90–99 mmHg [1].

In 2019 the World Health Organization (WHO) reported that hypertension is one of the most common health problems worldwide. Worldwide, approximately 1.13 billion people suffer from hypertension, or one in three people are diagnosed. The number of people with hypertension is expected to increase to 1.5 billion by 2025. Complications of hypertension, such as heart disease and stroke, are among the most common causes of death worldwide, causing nearly 9.4 million deaths annually. Hypertension is the most common disease, affecting 25% of people in Southeast Asia [3]. According to a 2023 report by the World Health Organization (WHO), an estimated 1.28 billion adults aged 30 to 79 worldwide suffer from hypertension. Approximately forty-six percent of them are unaware that they have it [4].

According to the 2018 Basic Health Research, the prevalence of hypertension in Indonesia increased from 25.8% to 34.1%, with a death rate of 427,218 people[5]. The 2023 Indonesian Health Survey found that the prevalence of hypertension as measured by a sphygmomanometer reached 10.7% in the 18–24 age group and 17.4% in the 25–34 age group[6]. The incidence of hypertension in Aceh province in 2022 was 38.29% [7]. In Pidie Regency in 2022, the incidence of hypertension was 16.3% [8]. Total visits of hypertension patients at Pidie Community Health Center in 2023There were 1,935 visits, with 905 grade I visits. Hypertension is the leading non-communicable disease at the Pidie Community Health Center.

Hypertension that does not receive optimal treatment or treatment can cause other more serious complications, such as stroke (51%), coronary heart disease (45%), and chronic kidney failure (32%), which is the highest cause of death. In addition to medication, the Ministry of Health is implementing a hypertension prevention and management program, including limiting salt intake to no more than one teaspoon per day, engaging in regular physical activity, quitting smoking, and avoiding exposure to secondhand smoke. Furthermore, it is recommended to adopt a balanced diet, maintain an ideal body weight, and avoid alcohol consumption [9].

Treatment and prevention of hypertension by taking medication regularly and checking your health regularly [10]. Hypertension sufferers are treated with antihypertensive drugs such as captopril at a dose of 12.5 mg – 100 mg daily which is included in the angiotensin-converting enzyme inhibitor (ACEI) drug class and amlodipine at a dose of 2.5 – 10 mg daily [2].

Long-term use of pharmacological therapy carries the risk of unwanted side effects. Therefore, supportive therapy is necessary to optimally enhance the effectiveness of hypertension treatment [11]. Non-pharmacological therapy is currently a popular choice for treating hypertension, in addition to medical (pharmacological) treatment [11]. Providing non-pharmacological therapy minimizes side effects and has the potential to improve overall quality of life, and can help reduce the amount of medication needed and increase the effectiveness of pharmacological therapy [12],[13]. A decoction of bay

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leaves and celery is a non-pharmacological method that can lower systolic and diastolic blood pressure. Research shows that this complementary therapy is effective in lowering blood pressure in hypertensive patients, but it still has limitations. The results showed that a decoction of bay leaves lowered systolic blood pressure by 3.00 mmHg and diastolic blood pressure by 2.13 mmHg in patients with primary hypertension. On the other hand, research showed that a decoction of celery leaves can lower systolic blood pressure by up to 9.3 mmHg [14].

Research conducted in 2021 by Lampanichakul M, Chaihongsa N, and colleagues, butterfly pea flower extract (Clitoria ternatea) orally at a dose of 300 mg/kg/day in rats with hypertension induced by L-NAME had a significant effect in preventing the development of hypertension [15]. Research conducted by Nisita Chaihongsa and colleagues in 2019 found that a dose of 500 mg/kg of Clitoria ternatea (CT) extract in hypertensive rats reduced systolic blood pressure by 141.52 ± 9.63 mmHg and diastolic blood pressure by 83.55 ± 8.42 mmHg [16]. Research conducted by Eva Nurlina Aprilia in 2022 on the consumption of brewed butterfly pea flower tea in elderly people with hypertension for 14 days without any dosage information provided, in this study did not show a significant decrease in systolic and diastolic blood pressure [17].

Nanoparticles can increase bioavailability, absorption leading to dose reduction. The advantage of nanoparticles is that they are small in size and the surface of the nanoparticles can be modified according to needs. With this nanoparticle method, the benefit is obtained for controlling and maintaining the release of active compounds during the distribution process in the body so that it can reduce side effects [18]. Butterfly pea flowers contain various bioactive anthocyanin components which exhibit antihypertensive properties [19]. Anthocyanins function as inhibitors of the Angiotensin Converting Enzyme (ACE), which plays a role in converting angiotensin I to angiotensin II. The presence of anthocyanins can prevent the formation of angiotensin II [20].

This study administered 0.9 gram of butterfly pea flower nanoparticle syrup containing 0.115 mg of anthocyanin per day to grade I hypertension patients. This condition is the initial stage of hypertension.where systolic blood pressure is 140–159 mmHg and diastolic is 90–99 mmHg, is still within relatively controllable limits. At this stage, lifestyle changes and non-pharmacological interventions are still possible to help control blood pressure [1]. It is hoped that administering butterfly pea flower nanoparticle syrup can reduce the risk of complications of grade II hypertension and prevent heart disease, stroke, and kidney failure.

In this research, butterfly pea flowers (clitoria ternatea) were made into nanoparticle syrup preparations in sachet packaging, 10 ml. There is 0.9 gram of butterfly pea flower extract with an anthocyanin content of 0.115 mg drink directly without adding water. This study aimed to determine the effectiveness of butterfly pea flower nanoparticle syrup (clitoria ternatea) on systolic and diastolic blood pressure in hypertensive patients grade I.

METHODS

This research found *Ethical Clearance* from the Health Research Ethics Committee of the Poltekkes Kemenkes Semarang, with number 1000/EA/KEPK/2024 which is valid from July 10, 2024 to July 10, 2025. This research was conducted in the working area of the Pidie Health Center from September to October 2024. This research method used a quasi-experimental with a pre-post test design with a control group. The research subjects were grade I hypertension patients (blood pressure systolic 140 – 159, diastolic blood pressure 90-99 mmHg) who actively participated in Prolanis. Researchers provide an explanation regarding the intent, purpose, and benefits to respondents and sign an informed consent form to become respondents during the research. Samples were taken as many as 30 people with the *Lemeshow* formula, sample determination by looking at the data of grade I hypertension patients who

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actively follow Prolanis and carry out initial pre-research measurements for blood pressure then the sample was divided into 2 groups based on the sequence number made by the researcher into 15 intervention groups (odd sequence numbers) and 15 control groups (even sequence numbers) continued using targeted sampling techniques (purposive sampling), namely sampling techniques based on inclusion, exclusion, and dropout criteria. Inclusion criteria in this study Grade I hypertension respondents: systolic 140 – 159, diastolic 90-99 mmHg in the Pidie Health Center working area who actively participate in Prolanis, respondents with an age range of 19-59 years, and regularly taking the antihypertensive drug amlodipine 1 x 1, while the exclusion criteria are hypertensive clients who have chronic diseases such as diabetes mellitus, heart failure, stroke and kidney failure, hypertensive clients who are pregnant and hypertensive clients who get other complementary therapies.

Based on laboratory results, 100 grams of butterfly pea flower extract contains 12.8 mg of anthocyanin. Nine grams of butterfly pea flower extract was used in this study, made into a 100 ml syrup formula into 10 doses, each 10 ml dose containing 0.9 grams of butterfly pea flower extract. 1 gram of butterfly pea flower extract contains 0.128 mg of anthocyanin. Butterfly pea flower nanoparticle syrup was given 1 x 1 sachet of 10 ml containing 0.9 grams of butterfly pea flower extract with an anthocyanin content of 0.115 mg per day.

Butterfly pea flower nanoparticle syrup on blood pressure in grade I hypertension patients, measurements in the intervention group and control group with pre-test and post-test in the form of systolic and diastolic blood pressure measurements. The intervention group was given a dose of 0.9 grams of butterfly pea flower nanoparticle syrup with an anthocyanin content of 0.115 mg per day for 14 days and antihypertensive medication. The butterfly pea flower nanoparticle syrup was given to respondents in the form of a standing pouch containing 14 pouches 10 ml butterfly pea flower nanoparticle syrup sachets, which were drunk directly without adding water. The butterfly pea flower nanoparticle syrup was drunk 1 x 1 sachet per day, drunk at night, after 2 hours of taking antihypertensive medication for 14 days. Meanwhile, the control group took their respective antihypertensive medications for the 14-day study period. The instrument used in this study was an Omron HEM-7121J digital sphygmomanometer, rather than a manual sphygmomanometer. Other variables, such as gender, diet, and physical activity, were confounding factors that the researchers controlled for through food recalls.

This study was complemented by data analysis using univariate tests to explore the distribution and characteristics of the data. Bivariate tests used paired t-tests and independent t-tests. The paired t-test was used to compare pre-test and post-test differences within the same group, while the independent t-test was used to compare mean differences between the intervention and control groups at pre-post-test time.

RESULT

Table 1. Comparative Analysis of Systolic and Diastolic Blood Pressure Before and After Intervention in Treatment and Control Groups

Blood pressure	*Pretest* (n=30)		*Posttest* (n=30)		Delta Mean	*t*	*p**
	Mean	Elementary School	Mean	Elementary School			
Intervention							
Systolic BP	150.07	3,973	121.77	6,146	28,300	28,459	0,000
Diastolic BP	94.60	2,920	82.93	3,903	11,667	17,278	0,000
Control							
Systolic BP	149.87	4,855	149.00	6,390	0.867	1,257	0.219
Diastolic BP	94.00	2,678	93.63	3,837	0.367	0.734	0.469

**Paired T Test p <0.05*

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Based on Table 1, the results of the paired t-test for the intervention group showed a p-value <0.05, indicating significant changes in systolic and diastolic blood pressure. Conversely, for the control group, the p-value >0.05 indicated no significant changes in blood pressure.

Table 2. Analysis of Differences in Changes in Systolic and Diastolic Blood Pressure Between the Intervention and Control Groups Before and After Treatment

Blood pressure	Intervention (n=30)		Control (n=30)		Delta Mean	*t*	*p**
	Mean	Elementary School	Mean	Elementary School			
Pre-test							
Systolic BP	150.07	3,973	149.87	4,855	0.200	0.175	0.862
Diastolic BP	94.60	2,920	94.00	2,678	0.600	0.829	0.410
Post-test							
Systolic BP	121.77	6,146	149.00	6,390	-27,233	-16,825	0,000
Diastolic BP	82.93	3,903	93.63	3,837	-10,700	-10,707	0,000

**Independent Sample T Test p <0.05*

Table 2 shows the results of the independent sample t-test. Before (pre-test) administration of butterfly pea flower nanoparticle syrup, systolic blood pressure in the intervention group had a mean of 150.07 mmHg (SD 3.973), and in the control group, 149.87 mmHg (SD 4.855). The mean difference was 0.200, t-value 0.175, and p>0.05, indicating no significant difference between the two groups. For diastolic blood pressure, the mean in the intervention group was 94.60 mmHg (SD 2.920) and the control group 94.00 mmHg (SD 2.678); the mean difference was 0.600, t-value 0.829, p>0.05, also indicating no significant difference. After (post-test) administration of syrup, systolic blood pressure in the intervention group decreased to 121.27 mmHg (SD 6.146), while the control group remained high at 149.00 mmHg (SD 6.390). The mean difference was -27.233, t-value -16.825, p <0.05, indicating a significant difference. Diastolic blood pressure in the intervention group was 82.93 mmHg (SD 3.903), control 93.63 mmHg (SD 3.837), the mean difference was -10.700, t-value -10.707, p <0.05, also indicating a significant difference.

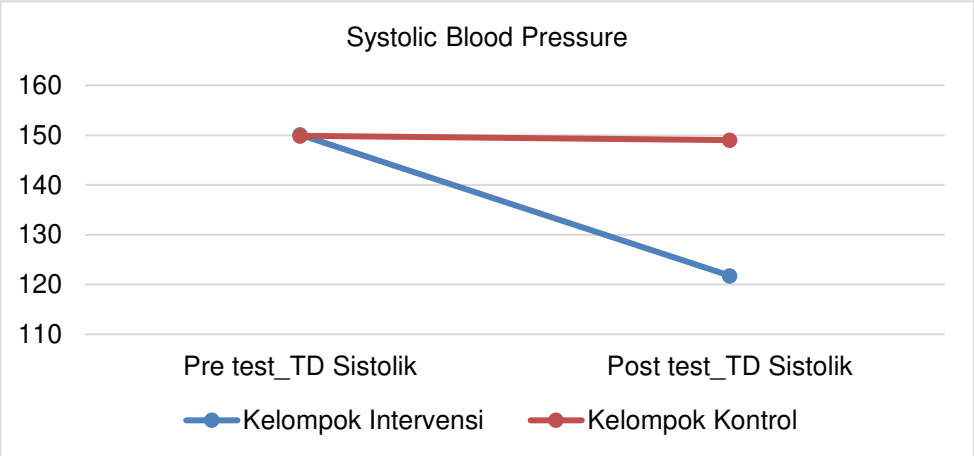

Figure 1. Comparison of Mean Systolic Blood Pressure Before and After Treatment in the Intervention and Control Groups.

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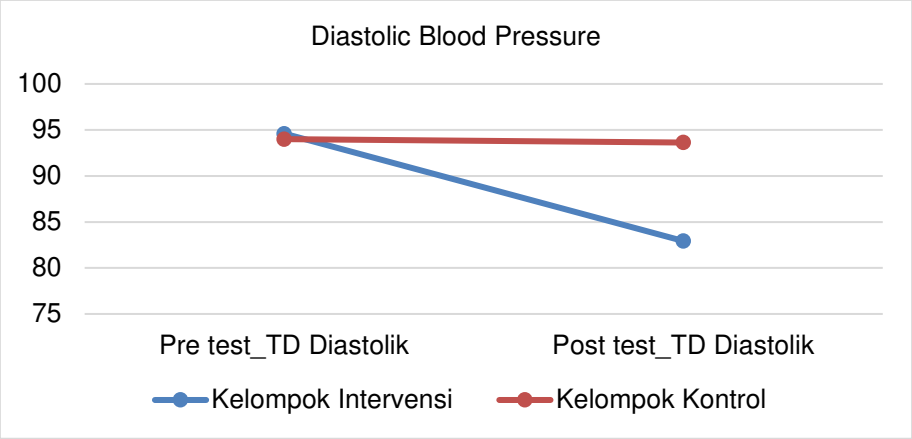

Figure 2. Comparison of Mean Diastolic Blood Pressure Before and After Treatment in the Intervention and Control Groups.

Figures 1 and 2 show a decrease in systolic and diastolic blood pressure in the intervention and control groups, but the decrease in the intervention group was greater than the control group. The intervention group experienced a decrease in systolic blood pressure of 28.300 mmHg and a decrease in diastolic blood pressure of 11.667 mmHg, while the control group only experienced a decrease in systolic blood pressure of 0.867 mmHg and a decrease in diastolic blood pressure of 0.367 mmHg.

Table 3. Analysis of the Effects of Butterfly Pea Flower Nanoparticle Syrup on Systolic and Diastolic Blood Pressure

Blood pressure	N	Mean	Elementary School	*Cohen's Effect*
Systolic:				
Intervention	30	121.77	6,146	4.34
Control	30	149.00	6,390	
Diastolic:				
Intervention	30	82.93	3,903	2.76
Control	30	93.63	3,837	

**Cohen's Effect Test*

Table 3 shows that the effect size is different between the intervention group and the control group with an effect size value of 4.34 in the very strong category on systolic blood pressure and 2.76 in the very strong category on diastolic blood pressure. This study explains that the administration of butterfly pea flower nanoparticle syrup in terms of effect size has the potential to reduce systolic and diastolic blood pressure in grade I hypertension patients.

DISCUSSION

Administration of butterfly pea flower nanoparticle syrup for 14 days has been proven effective in reducing systolic and diastolic blood pressure. The effect level of this study was 4.34 (very strong) on systolic blood pressure and 2.76 (very strong) on diastolic blood pressure, which indicates that the significance level in this study is very strong with a *Cohen's d Effect value of more than 1 explaining that the reduction in systolic and diastolic blood pressure in patients with grade I hypertension is clinically different.Butterfly pea flower nanoparticle syrup works to lower systolic and diastolic blood pressure through its ability to penetrate the intercellular spaces that only colloidal particles can. This nanoparticle technology in syrup form can optimally enhance the body's absorption of active ingredients. As a drug delivery system, this formulation provides greater effectiveness in hypertension sufferers because it can be precisely modified to release the active ingredients in a targeted manner to the primary target

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blood vessel tissue [21]. The blood pressure-lowering effect is related to the active ingredient in butterfly pea flowers, anthocyanins, which have the ability to inhibit the Angiotensin Converting Enzyme (ACE). By inhibiting ACE, the conversion of angiotensin I to angiotensin II does not occur, thus preventing blood pressure from increasing [20]. Anthocyanins have antioxidant activity that helps maintain nitric oxide levels and regulate endothelial function, thereby preventing oxidative stress, meeting oxygen needs in blood vessels, inhibiting vasoconstriction, and lowering systolic and diastolic blood pressure [22].

Research conducted on hypertensive women of childbearing age who were given celery leaf nanoparticles (Apium Graveolens L.) with 0.9 mg anthocyanin for 14 days, found that the average posttest systolic blood pressure was 140.38 mmHg and diastolic blood pressure was 88.75 mmHg, with a p-value = 0.000 [23]. These results are in line with research on the administration of rosella flower tea containing 0.33 mg of anthocyanin, which showed a decrease in systolic blood pressure to 135.83 mmHg and diastolic to 85.11 mmHg in hypertensive patients, also with a p-value = 0.000 [24]. This study shows that administering butterfly pea flower nanoparticle syrup (Clitoria ternatea) with an anthocyanin content of 0.115 mg per day is more effective in reducing systolic and diastolic blood pressure compared to studies administering celery leaf nanoparticles and studies administering rosella flower tea.

The advantage of this research is that the butterfly pea flower nanoparticle syrup is made in sachet form, making it easier and more practical to consume according to the dosage. The butterfly pea flower nanoparticle syrup has better stability and longer shelf life than the butterfly pea flower infusion. Limitations of this research: the determination of the dose in this study was based on the results of expert consultations and journal research, without comparing dose variants.This study has program and policy implications regarding the need to implement butterfly pea flower nanoparticle syrup as a complementary treatment to reduce systolic and diastolic blood pressure in grade I hypertension patients. Community nurses can improve public health services by increasing knowledge about butterfly pea flower nanoparticle syrup, which can be used as a form of complementary therapy for the community.

CONCLUSION

There was a difference in systolic and diastolic blood pressure in the intervention group, administration of butterfly pea flower nanoparticle syrup at a dose of 0.9 gr with an anthocyanin content of 0.115 mg for 14 days in grade I hypertension patients was proven to be effective in reducing systolic blood pressure from 150.07 mmHg to 121.77 mmHg with an average decrease of 28,300 mmHg, and diastolic from 94.60 mmHg to 82.93 mmHg with an average decrease of 11,667 mmHg, with a very strong effect size of 4.34 and 2.76, respectively. It is hoped that further researchers will be able to increase the grade of hypertension to grade II and compare dosage variants, increase the duration of intervention, and expand the benefits of butterfly pea flower nanoparticles for other diseases.

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