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Effects of probiotic melon juice on blood pressure in patients with pre-hypertension

Efek jus melon probiotik terhadap tekanan darah pada penderita prehipertensi

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Abstract

Potassium intake can lower systolic and diastolic blood pressure, whereas low sodium consumption can increase blood pressure. Although the use of fruits and probiotics as alternative drinks to reduce blood pressure has been widely practiced, research on the combination of fruit juice and probiotics from melon juice is still very rare. This study aimed to measure the effect of administering fruit juice with a combination of probiotics and melon juice on blood pressure in prehypertensive patients. An experimental research design with a randomized group design was conducted at the Jembatan Kecil Health Center, Bengkulu City, in 2024. A total of 28 respondents were selected using purposive sampling, The instruments used were digital blood pressure and 24-hour recall form, with statistical analysis using ANOVA and Duncan's test. Results, showed that the average systolic and diastolic blood pressure before the intervention was 138/87 mmHg, and after the intervention dropped to 122/79 mmHg. There were differences in systolic (p=0,000) and diastolic (p=0,006) blood pressure between the treatment groups, with the third treatment showing the greatest effect. In conclusion, fruit juice with a combination of probiotic melon juice has a significant effect in reducing blood pressure in prehypertensive patients and has a harmless effect, which can be used as a non-medical treatment for prehypertensive patients.

Keywords: Melon juice, pre-hypertension, probiotics

Abstrak

Asupan kalium dapat menurunkan tekanan darah sistolik dan diastolik, sedangkan konsumsi natrium yang rendah dapat meningkatkan tekanan darah. Meskipun penggunaan buah dan probiotik sebagai minuman alternatif untuk menurunkan tekanan darah sudah banyak dilakukan, namun penelitian mengenai kombinasi jus buah dan probiotik dari jus melon masih sangat jarang. Penelitian bertujuan untuk mengukur pengaruh pemberian jus buah dengan kombinasi probiotik dari jus melon terhadap tekanan darah pada pasien pre-hipertensi. Desain penelitian eksperimen dengan rancangan acak kelompok (RAK), telah dilakukan di Puskesmas Jembatan Kecil, Kota Bengkulu, pada tahun 2024. Melibatkan 28 responden yang dipilih secara purposive sampling. Instrumen adalah tensi darah digital dan formulir recall 24 jam, dengan analisis statistik yaitu uji ANOVA dan Duncan. Hasil, menunjukkan rata-rata tekanan darah sistolik dan diastolik sebelum intervensi adalah 138/87 mmHg, dan setelah intervensi turun menjadi 122/79 mmHg. Terdapat perbedaan tekanan darah sistolik (p=0,000) dan diastolik (p=0,006) antara kelompok perlakuan, dan perlakuan ketiga menunjukkan pengaruh paling besar. Kesimpulan, jus buah dengan kombinasi jus melon probiotik memiliki efek yang signifikan dalam menurunkan tekanan darah pada pasien pre-hipertensi, serta memiliki efek yang tidak berbahaya, yang dapat digunakan sebagai pengobatan non-medis untuk pasien pre-hipertensi.

Kata Kunci: Jus melon, pre-hipertensi, probiotik

Introduction

Prehypertension and hypertension are significant health conditions that can trigger various complications, including cardiovascular diseases. Data from the Ministry of Health of the Republic of Indonesia show that the prevalence of hypertension in the population aged > 18 years will reach 308% by 2023, showing an alarming trend compared to previous years (Kemenkes, 2023). Increased potassium intake and reduced sodium levels have been shown to be effective in controlling blood pressure; however, further research is needed to explore more innovative interventions.

The latest data on the incidence of hypertension in Indonesia can be found in the Indonesian Nutrition Status Survey (INSS) for 2022. According to a survey, the prevalence of hypertension in the population aged > 18 years has increased compared to that in previous years. The results showed that hypertension is becoming a significant health problem in Indonesia, with blood pressure measurements showing an increasing prevalence rate (Kemenkes, 2022).

The latest data on the increase in hypertension in Bengkulu were obtained from the Indonesian Basic Health Survey (IBHS) 2023. Hypertension is a major health problem in Indonesia, including Bengkulu, with a yearly increase in prevalence. According to the IHBS 2023, hypertension is a significant risk factor for mortality and disability in the population, especially in those aged 18 years and over. Reports from previous IHBS show that the prevalence of hypertension in the adult population is increasing every year, and there are indications of an increase in the number of hypertension cases throughout Indonesia by 2022. It is estimated that approximately 34% of the adult population suffers from hypertension, and this figure is likely to be higher in certain regions such as Bengkulu (SKDI, 2023).

Hypertension can be treated pharmacologically and non-pharmacologically. Pharmacological treatment involves the use of antihypertensives. Non-pharmacological treatments include the use of herbal ingredients from fruits and vegetables; reducing stress; weight loss; increasing physical activity and exercise; limiting alcohol, sodium, and cigarette consumption; modifying diet; and stopping smoking (Nurhusna et al., 2018). Utilising natural (herbal) materials such as traditional herbal teas or teas that have been clinically or preclinically prepared, can help reduce blood pressure growth traditional herbal teas or teas that have been clinically or preclinically prepared, can help reduce blood pressure growth (Khasanah et al., 2019).

Natural ingredients (herbs) with functional food development are favored by the public because they are practical and easy to obtain; functional foods for hypertension that have been used are fruits and vegetables; however, in this study, avocado, roselle flowers, honey, yoghurt, and melon were used. Consuming avocados with a dose of 100 g of avocado made into juice with 150 ml of water and 2 tablespoons of honey and consumed regularly for 5 days lowers blood pressure in people with hypertension (Muzakar et al., 2023). In addition to consuming fruits, efforts to control blood pressure can benefit from modern therapy and the use of traditional herbal medicines or plants that have been tested clinically and preclinically to reduce blood pressure (Nabila, 2023).

Rosella flowers (*Hisbiscus Sabdarifa*) are an alternative traditional medicine for lowering blood pressure. The active compounds in rosella flowers that can lower blood pressure include phenolic anthocyanins, tyrosine, leucine, valine, glycine, and ascorbic acid. The active compounds contained in rosella flowers can help improve blood circulation by reducing the degree of viscosity (viscosity) of the blood, so that the work of the heart is lighter and blood pressure becomes lower. With a dose of 10 g of rosella flower petals in 200 ml of water, the BP can be reduced (Wijaya, 2020).

Functional foods differ from drugs because they are not used for treatment and cannot replace drugs (Chen et al., 2023). One of the functional products of spontaneous fermentation using lactic acid bacteria (LAB) is probiotic drinks. A popular and widely used functional food is often prepared from fermented milk in the form of yoghurt, with the development of several types of yogurt, including fruit yoghurt. Fruit yoghurt is supplemented with fruit (Jasmine et al., 2020).

Yoghurt is a form of dairy with high concentrations of casein and protein as well as calcium, magnesium, and potassium, which have

been associated with blood pressure-lowering effects. The nutritional composition of dairy products is one of several mechanisms that benefit blood pressure, and dairy products are a source of potassium that lowers blood pressure through its effects on smooth muscle clearance and vasodilation (Buendia et al., 2018).

Consuming at least 100 g of melon flesh, it contains calcium, phosphorus, and magnesium vitamins A. C. and E, and beta-carotene and lycopene are required for each fruit. Calcium in melons has a diuretic effect that helps the kidneys produce water and air, which reduces the volume of fluid in the body and makes the heart more elastic (Marliani, 2021).

Therefore, the purpose of this study was to measure the effect of administering fruit juice with a combination of probiotics from melon juice on blood pressure in prehypertensive patients at Jembatan Kecil Health Center, Bengkulu City, 2024.

Methods

This was an experimental study with a Randomized Group Design with a combination of four treatments: PO (leaflet control), P1 (100 g avocado, 10 g rosella flower, 20 ml honey, and leaflet), P2 (100 g probiotic (melo) and leaflet), P3 (100 g avocado, 10 g rosella flower, 20 ml honey combination of 100 g probiotic (melon), and leaflet). This study investigated the effect of a combination of fruit juice and probiotics on blood pressure in prehypertensive patients in the working area of the Jembatan Kecil Health Centre, Bengkulu City.

Sample size was determined as described by Federer (1991).

(n-1)(t-1) = 15
(n-1)(4-1) = 15
(n-1)(3) = 15
3n-3 = 15
3n = 18
n = 6

Description
n : Total sample size
t : Total of treatments

Based on the calculation using the federer formula, the sample size is six respondents, which means that the minimum number of respondents for each group is six, while for the drop put calculation, it is one respondent. The sample size in this study was seven people in each group; thus, a total of 28 respondents were obtained.

Sampling Technique

The sample in this study were pre-hypertension patients in the work area of the Jembatan Kecil Health Centre, Bengkulu City The technique used in sampling was purposive sampling, which means that the sample was taken by selecting research subjects based on the number of samples that had been determined based on the inclusion and exclusion criteria, namely inclusion criteria were patients is a prehypertension in the Jembatan Kecil Health Centre area, Age 45-59 years, blood pressure range 130-139 mmHg, patients do not take hypertension drugs before and during the intervention. While the exclusion criteria were the respondents who were not available during the study, and respondents who were sick during the study

Location and Time of Research

This study was conducted in the working area of Jembatan Kecil Community Health Centre, Bengkulu City, and the determination of the research location was gradually based on data obtained from the Bengkulu Health Office, which showed that the working area of Jembatan Kecil Community Health Centre, Bengkulu City, had a prevalence of pre-hypertension of 2,961 people who received health services by (39,55%). The study was conducted for one week from April 30 to May 11, 2024.

Data Collection And Data Analysis Techniques

Primary and secondary data were used in this study. The primary data collection was direct observation of interviews using questionnaires including sample identity, including name, age, gender, and address, while sample blood pressure data were obtained using an omicron digital tensimeter made in Japan in 2019 produced by PT Media Putra Nusantara.

Secondary data in the form of data on the highest prevalence of hypertension obtained from the City Health Office and the integrated recording and reporting system book of

Puskesmas pre-hypertension patients in the Jembatan Kecil Puskesmas area of Bengkulu City.

Data analysis with a normality test showed that all data for each sample group were normally distributed. This can be seen from the value of the level of significance of the Shapiro–Wilk test, which is greater than the specified p-value of > 0,05. To obtain the results of the analysis of the effect of administering fruit juice with a combination of probiotic melon juice on blood pressure in prehypertensive patients, ANOVA was used, followed by Duncan's test to compare treatment groups with good blood pressure reduction.

This study was approved by the KEPK Polytechnic Health Ministry of Health Bandung (NO 15/KEPK/EC/VI/2024). The limitation of this study is that researchers cannot fully control the food intake of respondents; therefore, intake outside the intervention that has been controlled by 3 × 4 h food recall cannot guarantee that the food mentioned by the respondent is actually consumed by the respondent or vice versa.

Result and Discussion

Respondent Characteristics.

The respondents in this study were aged 45-59 years in the working area of the Jembatan Kecil Health Centre, Bengkulu City, and their characteristics included age and gender, as shown in Table 1.

Tabel 1. Characteristics of pre-hypertension respondents

Respondent Characteristic	n	%
Age		
45-50 years old	12	42,9
51-59 years old	16	57,1
Sex		
Female	24	85,7
Male	4	14,3

Based on Table 1, the research findings indicate that the majority of respondents were aged between 51 and 59 years, accounting for 57,1% (16 individuals) of the total sample. This is in line with the research of Munalwalroh dkk (2023), where, for the characteristics of respondents based on age, more experienced hypertension at the age of 51-60 years, because as age increases, the risk of hypertension will also increase. Age is associated with endothelial dysfunction, where arterial hearing loss occurs, which can cause hypertension, especially systolic hypertension, in the elderly.

Average Systolic and Diastolic Blood Pressure in Prehypertensive Respondents

Table 2 shows the mean systolic and diastolic blood pressures before and after the intervention.

Tabel 2. Average systolic and diastolic blood pressure in prehypertensive respondents

Group and Variable		Pre group	Post group
		Mean ± Std.dev	Mean ± Std.dev
Control Treatment	Systolic (mmHg)	138 ±2,00	136,8 ± 1,676
	Diastolic (mmHg)	87± 2,517	85 ± 2992
Treatment 1	Systolic (mmHg)	13,4±2,936	124,4 ± 3,910
	Diastolic (mmHg)	87,1 ±2,743	84±2,059
Treatment 2	Systolic (mmHg)	138,1±1,676	130 ± 3,599
	Diastolic (mmHg)	83,7 ±2,138	83,5 ± 2,070
Treatment 3	Systolic (mmHg)	137,5 ±3,101	122,4 ± 4,036
	Diastolic (mmHg)	85,8±3,485	79,2 ± 4,680

Table 2 shows the average systolic and diastolic blood pressure after the intervention, namely in the control treatment group 135/85 mmHg, treatment group 1 124/83 mmHg, treatment group 2 130/84 mmHg, treatment group 3 122/79 mmHg. Therefore, the results show a decrease in blood pressure in respondents after being given fruit juice intervention with a combination of probiotic melon juice for 7 days as much as 200 ml Because of the calcium content in melons and rosella flowers, blood can become less elastic due to vasodilation, which can cause blood to become more fragile and result in peripheral damage.

Potassium can also limit the activity of angiotensin-converting enzyme, which means

that the renin-angiotensin conversion process is inhibited and does not result in an increase in blood pressure. It also inhibits the activation of the angiotensin-converting enzyme, which means that the renin-angiotensin conversion process is blocked and does not lead to an increase in blood pressure (Pitayanti & Yuliana, 2023). Potassium can reduce the activity of the renin- angiotensin system and change the peripheral and arterial blood flow that affects kidney function and change the peripheral arterial blood flow that affects kidney function Kalium.

Potassium can also limit the activity of angiotensin-converting enzyme activity, which means that the renin-angiotensin conversion process is inhibited and does not result in an increase in blood pressure (Pitayanti & Yuliana, 2023). Potassium can reduce the activity of the renin- angiotensin–converting system (Masyudi, 2018).

Effect of Fruit Juice with Melon Fruit Juice Probiotic Combination on Blood Pressure in Prehypertension

The average systolic and diastolic blood pressure after the intervention was obtained in the control treatment group 135/85 mmHg, treatment group 1 124/83 mmHg treatment group 2 130/84 mmHg treatment group 3 122/79 mmHg.

Therefore, the results showed a decrease in blood pressure in respondents after being given a fruit juice intervention with a combination of probiotic melon juice for 7 days as much as 200 ml because the potassium content in avocados, melons, and rosella flowers can reduce blood pressure because it can cause vasodilation, which can widen blood vessels, blood can flow more smoothly, and there is a decrease in peripheral resistance.

Tabel 3. Anova test result

	Variabel	n	Mean	Deviation	Min	Max	p-value
Pre	Systolic	28	138	2,378	132	140	0,942
	Diastolic	28	86	2,956	80	90	0,103
Post	Systolic	28	129	7,162	119	140	0,000
	Diastolic	28	83	3,811	70	90	0,006

The results of the anova test in table 3 show the difference in the average value of blood pressure of respondents in each treatment group PO, treatment P1, treatment 2 and treatment P3 Of all treatment groups, the results of systolic blood pressure (p= 0,000) and diastolic blood pressure (p= 0,005) indicate that each treatment group after the intervention there is a significant difference.

Tabel 4. Duncan test result

Post Systolic					Post Diastolic			
Group	n	1	2	3	Group	n	1	2
Treatment 3	7	122,43			Treatment 3	7	79,29	
Treatment 1	7	124,43			Treatment 1	7		83,57
Treatment 2	7		130,57		Treatment 2	7		84,29
Treatment 0	7			136,86	Treatment 0	7		85,57
p-value		0,288	1,000	1,000	p-value		1,000	0,271

Duncan's further test results to find out in detail which data groups are significantly different. Based on research showing that the best treatment group 3 was 200 ml (100 ml avocado juice, 100 ml probiotic melon fruit, and leaflet education), this research is in line with research (Apriza, 2019), giving avocado juice to 15 respondents as much as 200 cc/day for 7 days, the respondents experienced a significant decrease in blood pressure.

There were differences in systolic and diastolic blood pressures among the four groups that were administered the intervention. Systolic and diastolic blood pressure in the PO intervention group after being given an intervention in the form of education using leaflets about a low-salt diet three times in seven days. Providing for changes in blood pressure, education is a very important factor in increasing a person's understanding (Choudhry et al., 2022).

Providing education can increase a person's awareness, so that they can behave according to their knowledge (Erlina et al., 2021). Nutrition education is a planned effort to improve the nutritional status of the body by making behavioral differences related to the diet. Behavioral differences can be initiated by providing a stimulus in the form of information or knowledge that can change a person's behavior (Syifa et al., 2022). Based on the sodium intake from the average recall results, 1961 mg was higher than the daily nutritional adequacy of 1500 mg sodium. The average potassium intake obtained from the recall results was 1374 mg, which was lower than the daily potassium nutritional adequacy rate of 4700 mg.

Potassium and sodium consumption contributes significantly to food safety because the preparation process of potassium-containing foods can cause potassium levels to drop as the food is cooked and then re-cooked (Fitri et al., 2018). The recommended daily intake can reduce the risk of heart attack in women with high blood pressure and fall into the mild to moderate category, whereas a low intake of potassium causes an increase in blood pressure (Alppel et al., 2018).

In the P1 treatment, with the provision of 200 ml of fruit juice and leaflet education for prehypertensive patients consumed for seven consecutive days, there were changes in systolic and diastolic blood pressure and a decrease in blood pressure in respondents because avocado is a fruit that contains a source of monounsaturated fatty acids (pleic acid), vitamin E, folate, potassium, phytosterols, and an important source of fiber. All these nutrients play a major role in improving heart health. Oleic acid in avocados can reduce the blood pressure and cholesterol levels. It also contains potassium and folate, both of which are important for heart health (Apriza, 2019). Avocado juice contains flavonoids that affect the function of angiotensin-converting enzyme (ACE) function. ACE inhibition inhibits the conversion of angiotensin I to angiotensin II, causing vasodilation, which can lower peripheral resistance and blood pressure (Marliani, 2021).

Research has shown that potassium intake and sodium reduction significantly contribute to the management of hypertension. Potassium functions as a vasodilator that lowers vascular resistance, which, in turn, can reduce blood pressure. According to Alprizal (2019), the consumption of avocado juice and probiotics for seven consecutive days in respondents showed a significant reduction in systolic and diastolic blood pressure.

In Marliani's study (2021), avocado juice was found to contain various important nutrients, such as vitamin E, folate, and potassium, which play a role in maintaining heart health. In addition, flavonoids in the fruit can affect the function of angiotensin-converting enzyme (ACE), which plays a role in regulating blood pressure. ACE inhibition can reduce peripheral resistance, thereby lowering blood pressure.

Hypertension can be prevented by using non-pharmacological treatment, namely rosella flower decoction (Hisbiscus sabdariffa) where rosella flowers can reduce blood pressure due to the presence of active zat' content, namely Anthocyanins, Phenolics, Threonine Leucine, Valine, Glycine and Ascorbic Acid (Wijaya, 2020). In addition, they have bioactive compounds such as organic acids anthocyanins, and flavonoids, which have been reported to be responsible for antioxidant and anti-inflammatory activities (Najafpour et al., 2020).

Additionally, honey is beneficial in preventing hypertension owing to its strong antioxidant and anti-inflammatory properties. (Ramli et al., 2021). Flavonoids have the potential to prevent cell damage due to oxidative stress by donating hydrogen ions to neutralize the toxic effects of free radicals that inhibit angiotensin converting enzyme (ACE) activity. ACE inhibitors cause relaxation of the blood vessel endothelium, resulting in increased blood flow to the heart and decreased blood pressure (Fransiska et al., 2019). There was a significant effect of honey solution intervention with a dose of 35 and 70 g honey on systolic and diastolic blood pressure (Musyayyadah et al., 2019).

In the P2 treatment with the administration of 200 ml of probiotic melon juice and leaflet education to prehypertensive patients consumed for seven consecutive days, there were changes in systolic and diastolic blood pressure in respondents due to the bacterial content in probiotics from yoghurt, which can encourage the release of proteins that can reduce blood pressure.

Probiotics can directly or indirectly affect host physiology through the production of prebiotics such as short-chain fatty acids (SCFA) and secondary bile acids. More tolerant probiotics can adapt to extreme pH, high and low temperatures (Chen et al., 2023). Lactobacillus casei found in yogurt are probiotics that can encourage the production of isoleucine proline (IPP) and valine proline (VPP) from milk protein fermentation. These tripeptides can lower blood pressure by inhibiting the action of angiotensin-converting enzyme (ACE), an enzyme that produces angiotensin that can increase blood pressure. This effect is caused by the binding of IPP or VPP tripeptides to the reactive side of ACE (Buendia et al., 2018).

Probiotics, particularly yoghurt, have a positive effect on blood pressure regulation. Chen et al. (2023) showed that Lactobacillus casei bacteria in yoghurt can increase the production of bioactive peptides that lower blood pressure by inhibiting ACE activity. In addition, probiotics support the health of the gastrointestinal tract, which has a positive effect on metabolism and nutrient absorption.

One of the fruits that can reduce high blood pressure is melon, which contains enough potassium in melon so that it can function as a diuretic. Citrulline and arginine play a role in the formation of urea in the liver from ammonia and CO2, and urine output increases or is commonly referred to as a diuretic. Diuretics work by helping the kidneys remove salt and water, which reduces the volume of fluid throughout the body so that the heart's pumping power becomes lighter and reduces blood pressure. Melon, which also has a high lycopein content and diuretic effect, lowers blood pressure. Lycopein functions as an anti-oxidant and diuretic effect as it increases the flexibility of blood vessels so that the effect can facilitate blood circulation throughout the body and ultimately reduce the blood pressure of hypertensive patients (Marliani, 2021).

In the P3 treatment, with the administration of 200 ml of fruit juice with a combination of probiotic melon juice and leaflet education in prehypertensive patients consumed for seven consecutive days, there were changes in systolic and diastolic blood pressure. The decrease in blood pressure in respondents was due to the combination of two ingredients: there were active substances that could reduce blood pressure, one of which contained flavonoids as antioxidants; flavonoids can inhibit the clumping of blood pieces, stimulate the production of nitric oxide, which can dilate blood vessels, and inhibit the activity of angiotensin I-converting enzyme (ACE), which plays a role in the formation of angiotensin II, which causes high blood pressure. Angiotensin II constricts blood vessels and ACE inhibitors dilate blood vessels to allow more blood to flow to the heart resulting in a decrease in pressure (Alwie et al., 2020).

The combination of fruit juice and probiotics may provide multiple benefits in controlling blood pressure. The combination of flavonoids in fruit juice and probiotic activity can promote blood vessel relaxation and reduce inflammation, which are important for the control of hypertension. This finding suggests that a holistic approach using these two sources may provide better results for blood pressure management results.

Conclusion

There is an effect of giving fruit juice with a combination of probiotic melon juice in prehypertensive patients in the work area of Jembatan Kecil Health Centre, Bengkulu City, which means that giving fruit juice with a combination of probiotic melon juice can have a non-harmful effect and can be used as a non-pharmacological treatment for prehypertensive patients.

To reduce the problem of hypertension in Bengkulu, stakeholders such as the health department must conduct educational campaigns on the risks of hypertension and the importance of a healthy lifestyle. Nutritional counseling should also be strengthened, especially regarding a low-salt diet and potassium intake from fruits and vegetables. In addition, better access to health services and regular blood pressure checks is essential. Encouraging physical activity through joint sports activities and building multi-sectoral cooperation can strengthen hypertension prevention. Continuous research is needed to monitor the prevalence of hypertension and evaluate the effectiveness of existing programs.

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