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The potency of combination of tomato juice and sweet orange on blood pressure in pre-hypertensive people

Potensi kombinasi jus tomat dan jeruk manis terhadap tekanan darah pada pre hipertensi di PT Agri Andalas

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Abstract

Hypertension, if left untreated, causes complications in important organs such as the heart, eyes, kidneys, and brain. Tomatoes and sweet oranges have benefits in lowering blood pressure, but these two food ingredients have not been combined to be used as food ingredients in lowering blood pressure. The purpose of this study was to determine the effect of a combination of tomato and sweet orange juice on blood pressure in employees at the office of the PT Agri Andalas Seluma Regency. The research design was a pre-experiment with pre- and post-test designs. The subjects were employees at PT Agri Andalas, totaling 15 people, conducted by purposive sampling. The treatment was given a combination of juice in the form of 150 g of tomatoes and sweet orange juice as much as 50 ml then given, and water was added as much as 50 ml so as to produce a combination of tomato and sweet orange juice as much as 250 ml. The intervention was performed for 7 days. Results: The systolic blood pressure from136,1 mmHg decreased from 131,4 mmHg. Likewise in diastolic blood pressure, there was a change from 86,3 mmHg to 81,8 mmHg. There was a difference in systolic (p= 0,001) and diastolic (p= 0,001) blood pressure before and after treatment with a combination of tomato and sweet orange juice. In conclusion, the combination of tomatoes and sweet orange juice lowered blood pressure. The juice combination can be used as a functional food as an alternative for lowering blood pressure.

Keywords: Blood pressure, sweet oranges, tomatoes

Abstrak

Hipertensi apabila dibiarkan dan tidak diobati akan menyebabkan komplikasi pada organ tubuh penting seperti jantung, mata, ginjal dan otak. Tomat dan jeruk manis memiliki manfaat dalam menurunkan tekanan darah, tetapi kedua bahan pangan ini belum ada yang mengkombinasikan untuk dijadikan bahan pangan dalam menurunkan tekanan darah. Tujuan penelitian untuk mengetahui pengaruh pemberian kombinasi jus tomat dan jeruk manis terhadap tekanan darah pada karyawan di kantor Perseroan Terbatas (PT) Agri Andalas Kabupaten Seluma. Desain penelitian adalah pre-eksperiment dengan rancangan pre test and posttest design. Subjek adalah karyawan di PT Agri Andalas, berjumlah 15 orang dilakukan secara purposive sampling. Perlakuan yaitu diberikan kombinasi jus berupa gabungan dari tomat 150 gram dan perasan jeruk manis sebanyak 50 ml kemudian diberikan penambahan air sebanyak 50 ml sehingga menghasilkan jus kombinasi tomat dan jeruk manis sebanyak 250 ml. Pemberian intervensi dilakukan selama 7 hari. Hasil, terjadi perubahan tekanan darah sistolik dari136,1mmHg menurun menjadi 131,4 mmHg. Begitu juga pada tekanan darah diastolik, terjadi perubahan dari 86,3 mmHg menjadi 81,8 mmHg. Terdapat perbedaan tekanan darah sistolik (p=0,001) dan diastolik (p= 0,001) antara sebelum

dengan setelah diberikan jus kombinasi tomat dengan jeruk manis pada karyawan. Kesimpulan, kombinasi jus tomat dan jeruk manis berpengaruh terhadap penurunan tekanan darah. Kombinasi jus tersebut dapat dijadikan sebagai bahan pangan fungsional sebagai alternatif dalam menurunkan tekanan darah.
Kata Kunci: Tomat, jeruk manis, tekanan darah

Introduction

Hypertension is one of the leading causes of death globally and is categorized as a non-communicable disease. Lately we have begun to often see the incidence of hypertension at a relatively younger age in our society. This can be seen from the prevalence of hypertension in Indonesia in 2013 in the young age group, namely the age group of 18-24 years by 8,7% while from the results of the latest research in 2018 this figure has increased significantly to 13,2% at the age of 18-24 years. Hypertension is characterized by increased blood pressure in blood vessels, namely systolic blood pressure exceeds 140 mmHg and diastolic exceeds 90 mmHg (Kemenkes RI, 2018). Hypertension that is left will be the main risk of cardiovascular disorders (Wolak et al., 2019).

The World Health Organization (WHO) predicts that the prevalence of hypertension globally is 22% of the total world population. The African region has the highest prevalence of hypertension at 27%, while Southeast Asia ranks 3rd highest with a prevalence of 25% of the total population. Based on National Health Survey (NHS) in 2018, there was an increase in hypertension prevalence, namely from 2013 by 25,8% while in 2018 it was 34,1%. The prevalence of hypertension in the age group of 45-54 years is 45,3%, the prevalence of hypertension in men is 31.3%, while the prevalence in women is 36,8%. Riskesdas of Bengkulu Province in 2018 showed that hypertension data in Bengkulu Province were Kepahiang 34,26%, Lebong 34,07%, North Bengkulu 31,07%, Rejang Lebong 30,71%, South Bengkulu 21,62%, Muko-muko 26,09%, Central Bengkulu 27,83%, Bengkulu City 25,10%, Seluma 26,21%, Kaur 26,29% (Kemenkes RI, 2018).

Hypertension increases with age, this is due to decreased organ function so that it cannot be useful properly while at a young age can also be affected by hypertension which can be caused by a bad diet (Hasan, 2018). By giving fruits and vegetables can help lower blood pressure, such as research conducted by Hastuti & Sunanto, 2018 shows the results of research that by consuming fruits and vegetables it is better if fruits or vegetables are eaten fresh without cooking or extracted juice in other words served in the form of juice (Hastuti & Sunanto, 2018).

There are several types of fruits such as tomatoes and sweet oranges that can help in lowering blood pressure. Tomatoes have a very beneficial content for the body. Tomatoes have a potassium content of as much as 222 mg/100 grams. The potassium content in tomatoes can help in lowering blood pressure by inhibiting the release of renin which has an impact on increasing sodium and water expenditure (M. Ricky Ramadhian & Noviyanti Choirunnisa Hasibuan, 2016).

In addition, tomatoes contain lycopene 4.6 mg/100 grams, lycopene in tomatoes can help in lowering blood pressure because lycopene is an antioxidant. These antioxidants play a role by preventing hardening and thickening of the artery walls. Sweet orange is a fruit that contains many nutrients such as vitamin C, folate and potassium. Citrus fruits weighing 100 grams contain about 181 mg of potassium. Sweet oranges have a high-water content and also contain vitamin C which is very useful as an antioxidant for the body. Cell damage caused by free radicals can be prevented by the presence of vitamin C (Hidayah, 2019; Padila, 2013). Research conducted Marlina & Mujahid (2020), showed that after being given orange juice, there was a decrease in blood pressure in Tambaksogra Village.

Many studies have used tomatoes and sweet oranges as alternatives in lowering blood pressure. However, research by combining tomatoes and sweet oranges has never been done so whether by combining these two elements can have a more effective impact in lowering blood pressure. By combining these two ingredients into juice, tomatoes that have a sour taste of meat cause when consumed to taste less good so that when combined with citrus fruits to minimize the sour taste of

tomatoes so as to create a delicious and fresh taste. Therefore, researchers are interested in testing the effects of the combined use of tomato juice and sweet orange on the blood pressure of employees at PT Agri Andalas Seluma Regency in 2023.

Methods

The design of this study is pre-experimental with pre-test design in post-test. This research will be conducted at the PT Agri Andalas Seluma Regency office in February 2023. The sample consisted of 15 people taken through purposive salmpling techniques, the technique was based on consideration of inclusion and exclusion criteria. The sample size uses the following equation:

$$n = \frac{\sigma^2(Z_{1-\alpha/2} + Z_{1-\beta})^2}{(\mu_1 - \mu_2)^2}$$

Information:

n = Sample size

$Z_{1-\alpha/2}$ = Standard normal deviation for α (Standard Deviation α = 0,05 = 1,96)

$Z_{1-\beta}$ = Standard normal deviation for β (Standard Deviation β = 1,64)

μ1 = The mean value of the post group obtained from the literature

μ2 = The mean value of the pre group obtained from the literature

σ = Estimation of standard deviation from the difference between pretest and post test mean based on literature (Fitrina, 2013).

The inclusion criteria are willing to be respondents, aged 40-55 years, have systolic blood pressure 130-139 mmHg and diastolic 85-89 mmHg, do not take antihypertensive drugs, are not in medical care. As for the exclusion criterion is to have an allergy to tomatoes and sweet oranges.

Data collection by measuring blood pressure before the intervention and after the intervention. Data processing is carried out using SPSS software program.

Data analysis started from univariate which was used to describe the variables of the study, namely sex, age, blood pressure picture before and after the intervention. Furthermore, the normality test of data through the normality test was carried out using Shapiro-Wilk, which obtained the results of all variables in this study were not normally distributed ($p < 0,05$). Thus, statistical tests in proving the hypothesis are using the Wilxocon test with a CI of 95%. This research has been approved by the ethics committee of the Poltekkes Kemenkes Bengkulu Number KEPK/088/03/2023.

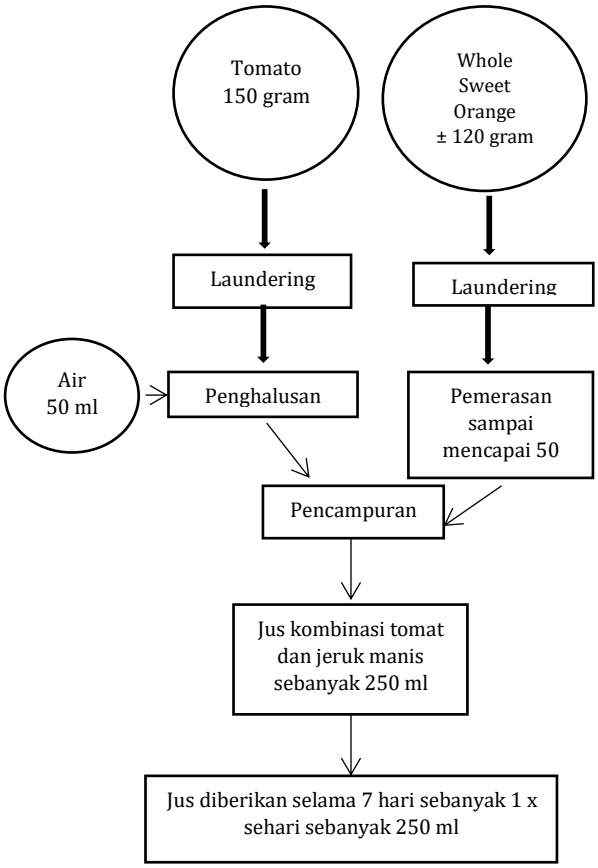

Figure 1. Flow chart of the research

Result and Discussion

The study involved as many as 15 employees at PT Agri Andalas Seluma Regency, consisting of 9 men and 6 women. Respondents in this study were aged 40-55 years (53,3%), and aged 45-55 years (46,7%). The description of systolic blood pressure by sex after the intervention for men was 132,4 mmHg while women were 133,5 mmHg and diastolic blood pressure for men was 81,5 mmHg while women were 81,3 mmHg. The description of blood pressure by age group for systolic blood pressure aged 40-55 years is 129,7mmHg while the age of 45-55 years is 128,6 mmHg and diastolic blood pressure for the age group 40-45 years is 82,1 mmHg while the age group of 45-55 years is 83,4 mmHg. Descriptively, the results of the study (Table 1) look descriptive.

Table 1 shows the characteristics of respondents by sex, dominated by men at 60 percent. Men have a higher risk of cardiovascular disease than women before menopause. Whereas after menopause, women have almost the same risk. This is because women experience menstrual periods every month, which can cause regular blood volume loss that will stop during menopause. Gender factors influence the incidence of certain non-communicable diseases, such as hypertension, with men experiencing hypertension more often than women (Rahmad, 2021).

The results of the study (Table 2) showed that the average systolic blood pressure before a combination of tomato juice and sweet orange was 136,1 mmHg and the diastolic was 86,3 mmHg. Furthermore, there was a decrease in blood pressure after being given a combination of tomato juice and sweet orange, namely systolic to 131,4 mmHg and diastolic to 81,86 mmHg.

Table 1. Descriptive of blood pressure by sex group and age

			Systolic (mmHg)				Diastolic (mmHg)			
Characteristic	n	%	Min	Max	Mean	SD	Min	Max	Mean	SD
Sex										
Male	9	60,0	124	137	132,4	2,445	80	84	81,5	1,245
Female	6	40,0	128	135	133,5	2,132	80	83	81,3	1,195
Age										
40-45 years	8	53,3	124	135	129,7	3,813	80	83	82,1	1,785
45-55 years	7	46,7	129	137	128,6	3,814	82	84	83,4	1,962

Min= Minimum; Max= Maximum; SD= Standard Deviation

Table 2. Blood pressure differences before and after the intervention of giving a combination of tomato juice and sweet orange.

Blood pressure	n	Mean	SD	Mean Difference ± SD	p-value
Systolic (mmHg)					
Before the intervention	15	136,1	2,559	4,7 ± 1,412	0,001
After the intervention	15	131,4	3,961		
Diastolic (mmHg)					
Before the intervention	15	86,3	1,345	4,4 ± 0,043	0,001
After the intervention	15	81,9	1,302		

Table 2 shows that there was a significant difference in systolic pressure (p = 0,001) and diastolic blood pressure (p= 0,001) between before and after giving a combination of tomato juice and sweet orange to employees at PT Agri Andalas Seluma Regency. This shows that the combination of tomato juice and malnis dalpalt oranges lowers blood pressure in employees at PT Agri Andalas Seluma Regency.

The results of the study were in accordance with previous studies, namely intervention by giving a combination of tomato juice with tomatoes as much as 150 grams plus 50 ml of water (Widyarani, 2019) and sweet orange as much as 50 grams (Hernawan et al., 2018), which found a decrease in blood pressure of 4,7 mmHg for systolic and 4,5 mmHg for diastolic. Some other studies that are in line, namely the research conducted by Widyarani (2019), show that giving tomato juice as much as 150 grams for 7 days can reduce blood pressure, which is an average systolic blood pressure of 157,2 mmHg to 142,4 mmHg, while diastolic blood pressure is 96,33 mmHg to 92,60 mmHg. Cholifah & Hartinah (2021) also reported that there was a decrease in blood pressure in hypertensive patients at Purwosari Kudus Health Center due to tomato juice.

Tomatoes contain ingredients such as lycopene, beta-carotene, and vitamin E, which are known as antioxidants that are effective in deactivating free radicals and slowing down the occurrence of atherosclerosis (Tabassum & Ahmad, 2011). Tomatoes that contain potassium can lower blood pressure, where potassium plays a role in controlling blood pressure by catalyzing renin, which plays a role in the angiotensin system, so that there is a decrease in

aldosterone secretion, which causes a decrease in sodium and water reabsorption in the kidneys (Asgary & Keshvari, 2013; Staruschenko, 2018).

Sweet oranges, in addition to containing potassium, also contain flavonoids that can lower blood pressure (Asgary & Keshvari, 2013). The sweet orange is a fruit that contains many nutrients, such as vitamin C, folate, and potassium. Oranges in 100 grams have a potassium content as high as 181 mg; sweet oranges have quite a lot of water content and contain vitamin C, which is useful as an antioxidant in the body. Vitamin C can prevent damage to cells due to the activity of free radical molecules (M. Ricky Ramadhian & Noviyanti Choirunnisa Hasibuan, 2016; Padila, 2013). The research conducted by Marlina & Mujahid (2020) showed a decrease in blood pressure in patients with high blood pressure in the Tambaksogra Village area, before and after consuming orange juice drinks.

Tomato and sweet orange juice contain potassium, which can lower blood pressure because potassium acts as an inhibitor of the angiotensin-converting enzyme. Sweet oranges also contain vitamin C, which acts as an antioxidant (Ali et al., 2021; Febriani & Zulfah, 2016). By combining two functional food ingredients, tomatoes are rich in potassium, which is beneficial to the body. Potassium functions as a diuretic, which can increase sodium and fluid expenditure. In addition to potassium, there is lycopene in tomatoes, where lycopene is a group of red pigment carotenoids found in fruits and vegetables. The levels of lycopene found in tomatoes can lower blood pressure by blocking the absorption of reactive oxygen in the endothelium, which causes blood vessels to widen (Engelhard et al., 2006). Lycopene is the most effective type of antioxidant among all carotenoids (Anlar & Bacanli, 2020). These caratenoids are high in antioxidants and can prevent the formation of reactive oxygen species (ROS) by donating one of their electrons so that they can disrupt free radicals from becoming balanced (Novitasari et al., 2021).

Vitamin C, found in oranges and tomatoes, is one of the antioxidants that can cause vasodilatation in vasoconstrictive blood vessels. When the level of antioxidants is insufficient or lower than free radicals, the cholesterol and fat found in the blood vessels will be prone to oxidation (Barreca et al., 2014). This will cause a decrease in vasodilatation and can cause an increase in blood pressure (Favela-Hernández et al., 2016). Vitamin C found in tomatoes also has lipid-reducing properties, including increased fecal excretion, reduced intestinal cholesterol absorption, and cellular LDL receptor activity (Cheng et al., 2017).

This study was limited to one treatment group and did not have a comparison group; the researchers only looked at the effect of the combination of tomato juice and sweet orange juice on blood pressure. Nevertheless, based on a study conducted over 7 days, giving a combination of tomato and sweet orange juice as much as once a day to each respondent could be concluded to have an effect on the reduction in blood pressure.

Conclusion

Intervention with a combination of tomato juice and sweet orange juice for 7 days affects systolic and diastolic blood pressure in employees at PT Agri Alndalas District of Seluma.

Suggest that the results of the intervention in this study could be an alternative for the public to make a combination of tomatoes and sweet orange as a drink that has a role as a non-pharmacological ingredient and can help in lowering blood pressure. This research can be a source of information for helping governments in the field of health combat non-communicable diseases.

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