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Effects of Red and Yellow Watermelon Juice on The Blood Pressure in Pre-Elderly Prehypertension

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Abstract*—Hypertension is a condition when there is an increase in systolic blood pressure above 140 mmHg and diastolic blood pressure above 90 mmHg. The more age can increase the risk of someone affected by hypertension. Non-pharmacological therapy is considered safer and has no unexpected side effects of pharmacological therapy. This research is aimed to know the impact of red and yellow watermelon juice on blood pressure in pre-elderly pre-hypertension at Posbindu Puskesmas Pasar Ikan Kota Bengkulu. Experimental quasi-research is used in this research. Subjects on this research are 15 respondents were divided into three groups: red watermelon juice group, yellow watermelon juice group, and control group — watermelon juice given once times a day as much as 200 ml for 14 days. Data was collected using a screening form and recall 3x24 hours. Statistical analysis was performed by One Way ANOVA and Paired samples T-test. There was a significant difference between the mean systolic blood pressure (p=0.015) of red watermelon group, systolic (p=0.005) and diastolic blood pressure (p=0.027) of yellow watermelon group before and after the intervention. There is a significant relationship between the red watermelon juice, yellow watermelon juice, and pre-elderly pre-hypertensive blood pressure.

Keywords*—Red watermelon juice, yellow watermelon juice, blood pressure, pre-elderly, pre-hypertension

I. INTRODUCTION

Hypertension is a condition when blood pressure in blood vessels increases chronically. It caused by the heart works harder to pump blood. If it is not checked correctly, the disease may interfere with the functioning of other organs, especially vital organs such as the heart and kidneys
[1]. Based on data from the WHO (World Health Organization) in 2013, the prevalence of hypertension in the world was 1 billion people. Prevalence of hypertension is predicted to be higher in 2025 to 1.15 billion cases, and it is equivalent to 29% of the total world population [2]. Aging causes a decrease in physiological function that causes non-infectious diseases that often arise in the elderly. Based on data from Health National Research in 2013 hypertension is the most common disease for the elderly [3]. Based on data most diseases in Bengkulu city from Dinas Kesehatan Kota Bengkulu in 2016, hypertension was ranks fourth with the sufferers is 9036 people [4].

From 20 Puskesmas in Bengkulu City, the highest prevalence of hypertension was in Puskesmas Pasar Ikan. There are 1578 cases of hypertension that sufferers dominated by pre-elderly (aged 45-59 years) as 764 cases of hypertension. There are two kinds of hypertension management there are pharmacology and non-pharmacologic therapy. Non-pharmacologic therapy is considered safer to avoid unexpected side effects of pharmacological treatment. According to the Hypertension Management Guidelines on Cardiovascular Disease 2015, one of the recommended non-pharmacological treatment is to apply a healthy lifestyle by increasing the intake of vegetables and fruits that can provide benefits in blood pressure reduction [5].

Renin-Angiotensin-Aldosterone System (RAAS) is an essential system in regulating blood pressure. Renin is an enzyme produced and secreted in renal juxtaglomerular cells, working enzymatically on other plasma proteins, a globulin called the renin substrate (angiotensinogen), to release the 10-amino peptide (angiotensin I). A few seconds after the formation of angiotensin I, a modifying enzyme, which is located in the pulmonary endothelium of the lung called Angiotensin Converting Enzyme (ACE), it will convert angiotensin I to 8-amino-acid peptide (angiotensin II) [6].

Angiotensin II can increase blood pressure through several mechanisms. The mechanism is vasoconstriction, salt retention, and fluid. Vasoconstriction occurs mainly in the arterioles and is slightly weaker in the veins. Constriction of the arterioles will increase peripheral resistance, resulting in increased arterial pressure [6].

Angiotensin II will increase the secretion of antidiuretic hormone (ADH) and make someone often feel thirsty. ADH is produced in the hypothalamus (pituitary gland) and works on the kidneys to regulate urine osmolarity and urine volume. Increased ADH, will cause urine to be excreted; it causes urine becomes concentrated and high in osmolarity. This condition causes the extracellular fluid volume to be increased by extracting intracellular fluid. As a result, the blood volume increases so that it raises blood pressure [7].

Angiotensin II also stimulates the secretion of aldosterone hormone from the adrenal cortex. Aldosterone works to regulate extracellular fluid volume. Aldosterone will reduce the excretion of NaCl (salt) by reversing it from the renal tubules. Increased concentration of NaCl will be diluted again by increasing the volume of extracellular fluid which will increase blood volume and blood pressure [7].

Watermelon can be used as a non-pharmacological therapy for hypertension. Potassium content in watermelon can reduce systolic and diastolic blood pressure by inhibiting renin release and increasing sodium and water excretion. Sodium and water retention is reduced due to

potassium and causes decreased plasma, cardiac output, peripheral pressure, and blood pressure [8].

There are several colors of watermelon flesh, there are red, pink, orange, yellow and white, but watermelon with red and yellow flesh are the most abundant on the market [9]. Based on the results of a study by Setyowati *et al*. (2012), respondents who were treated with 200 ml of red watermelon juice for 14 days experienced a decrease in blood pressure[8]. The purpose of this study is aimed to know the effect of red watermelon juice and yellow watermelon juice to blood pressure in pre-elderly pre-hypertension at Posbindu Puskesmas Pasar Ikan Kota Bengkulu. It is hoped that the results of this study can provide information to the public about the benefits of red watermelon juice and yellow watermelon juice to reducing blood pressure.

II. METHODS

Experimental quasi-research was used in this study. The design of this study used a two-factorial complete randomized design. The population in this study were all pre-hypertension patients aged 45-59 years in the working area of Puskesmas Pasar Ikan Bengkulu City who are still active in Posbindu with the total of patients based on data from Dinas Kesehatan Kota Bengkulu are 764 people [4].

A complete group, random design sampling technique, is used in this research. The subject in this research is that 15 respondents were divided into three groups: red watermelon juice group, yellow watermelon juice group, and control group.

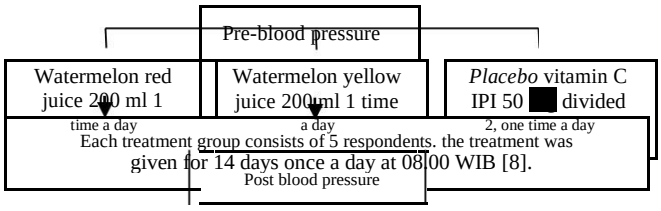

Figure 1. Experiment Design Scheme

The location of the research is in the working area of Puskesmas Pasar Ikan Kota Bengkulu by taking 3 Posbindu area there are Posbindu Melati, Pari Indah Berkas and Sedap Malam. The study was conducted in April 2018. The data collection technique is performed by filling screening form, 3 x 24-hour recall form and measuring blood pressure with Omron brand digital tension tool. Data analysis was performed by One Way ANOVA and Paired Sample T-test statistic test

III. RESULT

TABLE I. RESULTS OF ANALYSIS OF POTASSIUM CONTENT IN WATERMELON JUICE

Sample	Potassium Content (mg/100g)
Red watermelon juice	97,41
Yellow watermelon juice	107,12

Table I showed the potassium content in red watermelon juice is 97.41 mg / 100 grams while the potassium content in yellow watermelon juice is 107.12 mg / 100 gram

TABLE II. RESULTS OF PAIRED SAMPLES T-TEST IN THE RED WATERMELON JUICE TREATMENT GROUP

Variable		Mean ± SD	P *value*	n
SBP*	Pre	129,00 ± 4,183	0,015	5
	Post	112,80± 10,085		
DBP**	Pre	81,40± 4,393	0,053	5
	Post	74,80± 6,573		

*Systolic Blood Pressure **Diastolic blood pressure

Table II showed that the mean significance value of systolic blood pressure before and after the intervention is: p-value 0.015, p-value < 0.05, it means there is a significant difference the mean of systolic blood pressure in red watermelon juice treatment group before and after the intervention. The mean significance value of diastolic blood pressure before and after the intervention is p-value 0,053, p-value > 0,05, and it means there was no significant difference the mean of diastolic blood pressure in red watermelon juice treatment group before and after the intervention

TABLE III. . RESULTS OF PAIRED SAMPLES T-TEST IN THE YELLOW WATERMELON JUICE TREATMENT GROUP

Variable		Mean ± SD	P *value*	n
SBP*	Pre	132,40 ± 3,782	0,005	5
	Post	123,40 ± 3,647		
DBP**	Pre	82,20 ± 3,114	0,027	5
	Post	77,80 ± 3,962		

*Systolic Blood Pressure **Diastolic blood pressure

Table III showed that the mean significance value of systolic blood pressure before and after the intervention is: p-value 0,005, p value< 0,05 it means there is a significant difference the mean of systolic blood pressure in yellow watermelon juice treatment group before and after the intervention. The mean significance value of diastolic blood pressure before and after the intervention is p-value 0,015, p value< 0,05 it means there is a significant difference the mean of diastolic blood pressure in yellow watermelon juice treatment group before and after the intervention.

TABLE IV. RESULTS OF PAIRED SAMPLES T-TEST IN CONTROL GROUP PLACEBO VITAMIN C

Variable		Mean ± SD	P *value*	n
SBP*	Pre	129,80 ± 4,604	1,000	5
	Post	129,80 ± 4,764		
DBP**	Pre	82,20 ± 3,114	0,387	5
	Post	84,80 ± 3,962		

*Systolic Blood Pressure **Diastolic blood pressure

Table IV showed that the significance value of the mean systolic blood pressure of the placebo vitamin C control group. The significance value of systolic blood pressure before and after intervention: p-value 1,000, p-value > 0.05 it means there is no significant difference the mean of systolic blood pressure in control group placebo vitamin C before and after the intervention.

The significance value of the mean diastolic blood pressure in the placebo control group vitamin C before and after intervention: p-value 0.387, p-value > 0.05, which means that there was no significant difference the mean of diastolic blood pressure in control group placebo vitamin C before and after the intervention.

IV. DISCUSSION

Significant changes in blood pressure before and after intervention in red and yellow watermelon juice groups occur due to a decrease in the mean of blood pressure in the treatment group. The mean reduction in systolic blood pressure in the treatment group of red watermelon juice was similar with research conducted by Setiyowati *et al*. (2012), which showed a decrease in systolic and diastolic blood pressure in respondents after treated with 200 ml of red watermelon juice for 14 days [8].

The decrease in blood pressure in the yellow watermelon juice treatment group was also similar with the research conducted by Ramadhani Suci (2017), which showed a reduction in systolic and diastolic blood pressure in respondents after treated with 100 ml of yellow watermelon juice for seven days. The decrease in blood pressure in the treatment group of red watermelon juice and yellow watermelon juice caused by potassium content in the watermelon [10].

Potassium can decrease blood pressure because it can cause vasodilation that can dilate blood vessels; blood can flow more smoothly and reduce peripheral resistance. Potassium can inhibit the angiotensin-converting enzyme (angiotensin-converting enzyme inhibitor) so that the process of conversion of renin to renin-angiotensin is inhibited and there is no increase in blood pressure. Potassium also serves as a natriuretic and diuretic, which causes an increase in sodium and fluid excretion [11].

Watermelon also contains citrulline. Citrulline is a phytonutrient that can decrease blood pressure. Citrulline will be converted to arginine through the reaction of several enzymes. Arginine will increase the levels of nitric oxide which is efficacious to relax blood vessels and expedite the circulatory system so that it can help in the treatment of hypertension and other cardiovascular diseases. Citrulline and arginine also cause urea formation in ammonia and CO2, so that urine output increases. High potassium content can help the heart work and normalize blood pressure. [12].

The mean systolic and diastolic blood pressure before and after intervention in the placebo vitamin C control group was not significantly different, because vitamin C at low doses less affect the decrease in blood pressure. The results of recall 3 x 24 hours vitamin C placebo control group during the intervention, showed that the sodium intake in the vitamin C placebo control group during the intervention was highest among the other two groups.

The mean decrease in blood pressure in the treatment group of red watermelon juice was higher from the group of yellow watermelon juice treatment. It is due to some factors that affect blood pressure. There is a high sodium intake compared with potassium intake, high potassium sodium ratio, genetic factors, errors during blood pressure examination and lack of physical activity. Based on the recall results of 3 x 24 hours, the sodium intake in the group of yellow watermelon juice treatment was higher than the sodium intake in the red watermelon juice treatment group. Increased sodium intake causes the body to retain fluid, which increases blood volume. The condition caused by an increase in sodium intake affecting the activity of the mechanism hormone renin-angiotensin so that its production becomes excessive which in turn increases blood volume. Increased blood volume will cause blood pressure to rise [13].

The ratio of sodium potassium also affects blood pressure. The sodium content in yellow watermelon is higher compared to sodium in red watermelon, so the rate of potassium sodium to yellow watermelon juice is higher than the ratio of potassium sodium to red watermelon juice.

Based on screening data, four from the five respondents treated with yellow watermelon juice had a history of a family with hypertension, while in the watermelon juice treatment group only two from five respondents had a history of a family with hypertension. The case is related to an increase in intracellular sodium levels and a low ratio between potassium to sodium. Individuals with hypertension parents have twice the risk of suffering from hypertension than Individuals without hypertension parents [14].

Blood pressure will be measured high when measurements are not at the right time. Errors that occur include when the respondent is being deprived of sleep at night. Then the respondent speaks when the blood pressure is being measured. Blood pressure measurements are taken when the respondent is active. Thirty minutes before

measuring blood pressure, respondents ate or drank caffeine which can temporarily increase blood pressure. [15].

A proper blood pressure measurement procedure is in the morning when the body is in excellent condition after getting enough sleep at night, wear loose and comfortable clothing when blood pressure measurements, try to relax and do not talk when blood pressure is being measured. Blood pressure measurement is best done when sitting comfortably with your feet on the floor and your back against the back of the chair and repeat the measurement at five-minute intervals to determine a more accurate blood pressure [16].

Based on physical activity data on the screening form, in the treatment group of red watermelon juice, all five respondents routinely perform physical exercise activities every week. While in the treatment group of yellow watermelon juice only three from five respondents who do physical exercise activity regularly. Lack of exercise can also increase the risk of blood pressure become higher. People who are less mobile tend to have higher heart rate so that the heart muscle must work harder during contractions [15].

V. CONCLUSION

There is an effect of red watermelon juice and yellow watermelon juice to blood pressure in pre-elderly pre-hypertension at Posbindu Puskesmas Pasar Ikan Kota Bengkulu.

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