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The Effect Of Beetroot Juice (*Beta Vulgaris L*) And Star Fruit (*Averrhoa Carambola L*) On The Reduction Of Blood Pressure In Second Trimester Pregnant Women With Gestational Hypertension

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Abstract

Keyword :
Averrhoacarambola
L;
Beetroot Juice;
Beta vulgaris L;
Gestational
Hypertension;
Star Fruit

Background: Gestational hypertension is usually defined as high blood pressure that develops after 20 weeks of gestation in the absence of proteinuria. Beets and star fruit contain vitamins and minerals such as B vitamins and calcium, potassium, phosphorus, and iron, which can safely lower blood pressure in pregnancy. **Objective:** Determine the effect of beetroot juice (*Beta vulgaris L*) and star fruit (*Averrhoacarambola L*) on reducing blood pressure in pregnant women in the second trimester with gestational hypertension. **Method:** This pre-experimental research was a one-group pretest-posttest design with 200 ml/day of beet and starfruit juice intervention for two weeks. The samples taken were 15 second trimester pregnant women with gestational hypertension. The data taken is blood pressure before and after treatment—data analysis using paired t-test. **Results:** data on the mean systolic blood pressure before treatment is 146.53 mmHg and after treatment is 126.07 mmHg and the average diastolic blood pressure before treatment is 94.53 mmHg and after treatment is 91.13 mmHg. There is an effect of beet and star fruit juice administration on systolic and diastolic blood pressure in second-trimester pregnant women with gestational hypertension ($p < 0.05$). **Conclusion :** pregnant women with gestational hypertension is to treat hypertension using beet and starfruit juice so that hypertension can be treated immediately.

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Introduction

Hypertension is generally defined as a continuous increase in blood pressure of up to 140/90 mmHg. Hypertension is a common cause of cardiovascular disease, which causes heart failure, stroke, kidney failure, and ultimately death. Hypertension syndrome is more than just an increase in arterial pressure, although it is the aspect that is most familiar to the general public. The occurrence of hypertension increases with age. About 50% of people between the ages of 60 and 69 have hypertension, and the prevalence rises after age 70.¹ Hypertension during pregnancy complicates 10% of all pregnancies. About 40,000 women, coming from developing countries, die each year from preeclampsia or eclampsia. Preeclampsia alone is estimated to cause about 40% to 60% of maternal deaths in developing countries.² A hospital-based study conducted in South Africa showed that HDP contributed for 20.7% of maternal deaths in the country. Hypertensive disorders of pregnancy accounts for 19% of maternal deaths in Ethiopia³.

Hypertensive disorders during pregnancy increase the risk to both the mother and the fetus. The most significant impact associated with the pregnancy-specific syndrome is preeclampsia. Gestational hypertension is differentiated into higher and lower risk by the presence or absence of proteinuria⁴. Preeclampsia is generally diagnosed by an increase in blood pressure in pregnancy and proteinuria. Increases perinatal mortality fivefold and causes the death of 50,000 women each year worldwide. Gestational hypertension without proteinuria carries less risk to pregnancy and the fetus, whereas the main risk of hypertension that precedes pregnancy is preeclampsia's superimposition. The importance of differentiating these conditions can be seen in several classification schemes, where gestational hypertension with proteinuria is separated from gestational hypertension

without proteinuria and hypertension that precedes pregnancy⁵.

The division of hypertension in pregnancy is chronic hypertension, preeclampsia, eclampsia, chronic hypertension with superimposed preeclampsia, and gestational hypertension⁶. The cause of hypertension in pregnancy is not known. Many theories have been put forward about hypertension in pregnancy, but none of these theories are considered correct. The ideas of gestational hypertension that are currently widely adopted are the theory of placental vascularization disorders, the view of placental ischemia, free radicals, and endothelial dysfunction, the approach of intrauterine and fetal immunological intolerance, the idea of cardiovascular genetic adaptation, the theory of nutritional deficiencies and the theory of inflammation⁷.

The diagnosis of gestational hypertension is made in pregnant women with a blood pressure of 140/90 mmHg or more for the first time during pregnancy, but no proteinuria is found. Gestational hypertension is called transient hypertension if it does not develop into preeclampsia and blood pressure returns to normal after 12 weeks post-partum⁸.

The hallmark of preeclampsia syndrome is the discovery of proteinuria as an objective marker indicating extensive endothelial leakage. However, if the mother's blood pressure increases significantly, it will be dangerous for both the mother and the fetus if the increase in proteinuria is ignored because, in laboratory tests, proteinuria has not been detected. That is, 10% of eclampsia seizures can occur before the discovery of proteinuria⁹.

Gestational hypertension is usually defined as high blood pressure that occurs after 20 weeks of gestation in the absence of significant proteinuria and is generally characterized by good maternal and

fetal outcomes¹⁰. Several factors influence this incident. Maternal age (<20 or ≥35 years), primigravida, nulliparity, and increased body mass index are predisposing factors for hypertension in pregnancy¹¹. Women of reproductive age who are at the beginning of the end of their reproductive age are considered to be the most vulnerable to experiencing pregnancy complications. Two years after the first menstruation, a woman still allows pelvic growth between 2-7% and 1% height. The impact of less gestational age can cause complications during pregnancy, especially gestational hypertension¹².

Two types of therapy can be done to treat hypertension, namely pharmacology treatment using drugs and non-pharmacology therapy by modifying daily life patterns and returning to natural products—referring to the concept of back to nature by utilizing local materials that are widely available in society so that they are accessible to obtain. Beets and star fruit contain vitamins and minerals such as B vitamins and calcium, potassium, phosphorus, and iron. Potassium is an intracellular ion that functions in the sodium exchange mechanism. Increasing potassium intake in food intake can lower blood pressure because potassium spurs sodium loss through urine¹³.

Beets contain several active compounds such as carotenoids, glycine betaine, saponins, betacyanin, betanin, polyphenol and flavonoid. Beetroot rich in carbohydrates that are easy to become energy and iron, which helps the blood to fly oxygen to the brain. Beet red, color the combination of the purple pigment causes this betacyanin and the yellow pigment betasantin¹⁴. Beets are rich in nutritional contents such as folic acid (grow and replace damaged cells), potassium (smooths fluid balance inside body), vitamin C (growing tissue and normalizes blood vessels), magnesium (maintain muscle and nerve function), iron (energy metabolism and immune system body), copper (forms of blood

cells red), phosphorus (strengthens bones), coumarin (prevent tumors) and betacyanin. Beetroot contains anthocyanin of 51.50 mg / 100 gram up to 174.70 mg / 100 gram. Pigments contained in beetroot too can give a reddish-purple color which will make the ice cream color become more attractive without adding color synthetic¹⁵.

Star fruit (*Averrhoa carambola L*) is beneficial in helping to lower blood pressure because of its fiber, potassium, phosphorus, and vitamin C content¹⁶. Based on DASH (Dietary Approaches to Stop Hypertension) research, it is said that to lower blood pressure, and it is highly recommended to consume high potassium and fiber foods and low in sodium (PDSKI, 2015). The potassium content (potassium) in one star fruit 127 grams is 207 mg, and the fiber content is 5 g¹⁷.

Star fruit juice works to lower blood pressure by reducing antidiuretic hormone (ADH) and thirst. Antidiuretic hormone is produced in the hypothalamus and acts on the kidneys to regulate urine osmolality and volume. With a decrease in ADH, a lot of urine will be excreted to become more dilute with low osmolality. To concentrate it, the importance of intracellular fluid will be increased by withdrawing the extracellular fluid. Meanwhile, decreasing the concentration of NaCl will be focused on reducing the extracellular fluid. Coupled with a reduced thirst, so that fluid intake is also reduced. All of these mechanisms will result in a decrease in blood pressure¹⁸.

The mechanism of action of potassium is opposite to sodium. If sodium raises blood pressure, potassium works to lower blood pressure. Potassium, along with chloride, helps maintain osmotic pressure and acid-base balance in the body. Potassium maintains osmotic pressure in the intracellular fluid and partially binds to proteins. Potassium also helps activate enzyme reactions such as pyruvate kinase, which can produce pyruvic acid in the process of carbohydrate metabolism¹⁹. Consumption of 8 ml of beet and starfruit

juice every day can reduce the amount of LDL (Low-Density Lipoprotein) or levels of bad cholesterol and triglycerides. Also, beet and star fruit juice consumption can increase HDL (High-Density Lipoprotein) or acceptable cholesterol levels in the blood.

Method

This study used a pre-experiment with one group pretest-posttest design. At the pretest time, the researcher first measured the blood pressure; then, after the treatment (giving beet and star fruit juice), the post-test was carried out by measuring blood pressure again.

This research was conducted at the Sulaikah Midwife's Independent Practice, SumbermanjingKulon District, Malang Regency, in September-December 2019. The samples taken were 15 second trimester pregnant women with gestational hypertension. The sampling technique used purposive sampling with criteria: second trimester pregnant women with gestational age of 24 weeks, primigravida and multigravida, blood pressure $\geq 140/90$ mmHg, weight gain during normal pregnancy (9-12 kg), harmful urine protein, and willingness to become respondents.

Blood pressure is the power that is produced by blood against each unit area of the vessel wall blood as measured in a sitting back, after rest for 5 minutes with feet touching the floor and hands parallel to the heart using mercury sphygmomanometer performed by midwives who have been trained in measuring pressure blood. Blood pressure measurements were taken twice namely at the beginning before treatment and the end after treatment. The first blood pressure measurement was done 5 minutes before treatment and an interval of 60 minutes after giving evaluation treatment. Blood pressure data used is the result of the average size.

Ripe beet and star fruit juice are obtained fresh and processed using juicer, given as much as 1 cup (200 ml) per day for two weeks after giving blood pressure measurements. The formulation of making beet and star fruit juice with water is 30%:70%. Data analysis using paired t-test²⁰.

Ripe beetroot juice and star fruit are given once a day for 14 consecutive days. The subject's blood pressure was measured every day after being given beet and star fruit juice. When the fluid is given, the respondent must immediately drink it and be monitored by the researcher until it runs out.

Result And Discuss

Beet and Starfruit Juice on Systolic Blood Pressure in Second Trimester Pregnant Women with Gestational Hypertension.

During 14 days of observation, the subjects' blood pressure was measured. The result is that there is a difference in systolic blood pressure in subjects between before and after the intervention with beet and star fruit juice, as can be seen in Table 1.

Table 1. The difference in mean systolic before and after giving beet and star fruit juice

Systolic	Mean \pm SD	Difference	P-value
Before	146.53 \pm 2.8	20.47	0.012
After	126.07 \pm 3.8		

Based on the table 1, it can be seen that the mean (mean) systolic blood pressure before treatment is 146.53 mmHg and after treatment is 126.07 mmHg. The results of statistical tests (paired t-test) showed a p-value of 0.012 ($p < 0.05$), which means that there is an effect of the effect of beet and starfruit juice on systolic blood pressure in second-trimester pregnant women with gestational hypertension.

The Effect of Beet and Starfruit Juice on Diastolic Blood Pressure in Second Trimester Pregnant Women with Gestational Hypertension.

During 14 days of observation, the subjects' blood pressure was measured. The result is that there is a difference in diastolic blood pressure in subjects between before and after the intervention with beet and star fruit juice, as can be seen in Table 2.

Tabel 2. The difference of Diastolic Mean Before and After Giving Beet and Starfruit Juice

Diastolic	Mean± SD	Difference	P-value
Before	94.53±1.8	3.40	0.015
After	91.13±1.1		

Based on the table above, it can be seen that the average diastolic blood pressure before treatment is 94.53 mmHg and after treatment is 91.13 mmHg. The results of statistical tests (paired t-test) showed a p-value of 0.015 ($p < 0.05$), which means that there is an effect of the effect of beet and star fruit juice on diastolic blood pressure in pregnant women in the second trimester with gestational hypertension.

From the figure 1, it shows that after being given beet and starfruit juice 12 times for two weeks, it was found that the difference between the mean systolic blood

pressure was 20.47 mmHg and was statistically significant ($p < 0.05$), meaning that there was an effect of beet juice and Star fruit against systolic blood pressure in second trimester pregnant women with gestational hypertension. Meanwhile, when viewed based on the difference in mean scores after treatment, it shows a decrease in diastolic score of 3.40 mmHg and statistically significant ($p < 0.05$). There is an effect of beet and starfruit juice on diastolic blood pressure in second-trimester pregnant women with gestational hypertension (see figure 2)

This study's results are in line with research by Dyastuti et al., 2019 regarding the effects of starfruit on pregnant women with hypertension, concluding that consuming instant starfruit extract at a dose of 50 grams/day for 14 days can reduce blood pressure in pregnant women²¹. The research results by Malfita et al. 2017 concluded that there was an effect of giving star fruit and dragon fruit juice on blood pressure in hypertensive patients²². In line with the research of Ormesher L et al., 2018 on the effect of nitrate supplementation from beetroot juice on the blood pressure of pregnant women with hypertension, it is concluded that it significantly increases plasma and salivary nitrate/nitrite concentrations compared to placebo juice²³.

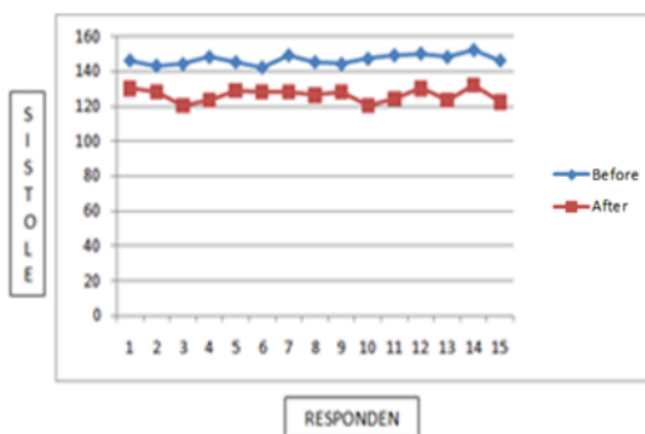


Figure 1. Systolic blood pressure before and after giving beet and starfruit juice

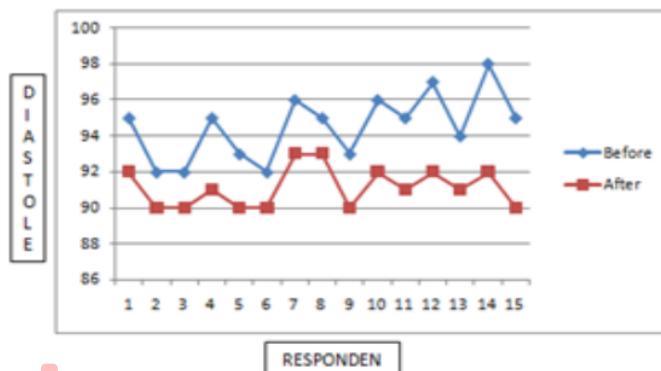


Figure 2. Diastolic blood pressure before and after giving beet and starfruit juice

The results of research by Tropea et al., 2020, regarding beetroot juice can reduce blood pressure and improve endothelial function in pregnant mice. However, beet juice does not affect fetal body weight in mice²⁴.

The results of a study by Volino et al., 2018, regarding a single dose of beetroot juice on the improvement of endothelial function in pregnant women concluded that the effect of consuming beetroot juice improves microvascular endothelial function but does not increase oxygen saturation²⁵. The results of research conducted by Kapil et al. (2015) showed a decrease in blood pressure, both systolic and diastolic, by administering 250 ml of beet juice²⁶. Beet juice given contains 6.4 mmol of nitrate. The nitrate content absorbed by the body will be converted into nitrite, relaxing muscle tissue to reduce blood flow. Naturally, beets can help healthy blood vessel function and fight homocysteine, which can damage blood vessels. A study in England stated that beet juice is as effective as nitrate tablets in controlling hypertension²⁰.

Star fruit contains high levels of potassium and low sodium so that it can be used as an anti-hypertensive drug. The potassium content in 1-star fruit weighing about 127 grams is 207 mg. This shows that star fruit's potassium has the most

significant other minerals²². Star fruit is not only useful in controlling blood pressure

and carbon dioxide in the blood. It also plays a role in smoothing the oxygen supply to the brain and helps balance fluids²¹.

The decrease in the respondent's blood pressure was caused by star fruit content, which is rich in potassium and low in sodium. In this case, the beginning of hypertension is through the formation of Angiotensin I, which is converted into Angiotensin II by ACE (Angiotensin I - Converting Enzyme) which has a role in increasing blood pressure through 2 primary actions, namely decreasing intracellular fluid and increasing extracellular fluid in the body. However, by giving star fruit therapy, which is high in potassium and low in sodium, to respondents who suffer from hypertension, then the two main actions have changed direction from the beginning. High potassium will be able to reduce the production or secretion of antidiuretic hormone (ADH) and thirst. This hormone acts on the kidneys to regulate osmolality and urine volume; by decreasing ADH, the urine excreted out of the body will increase so that it becomes dilute with low osmolality, to concentrate the importance of intracellular fluid will be increased by drawing fluid from the extracellular part.

Meanwhile, decreasing the concentration of NaCl will be focused by reducing the extracellular fluid, which will then lower blood pressure¹⁹.

The phytonitrate content in beets turns into nitrite when it is absorbed in the body. The function of nitrites in the body can relax muscle tissue and reduce blood flow to drop blood pressure. Beets can naturally help healthy blood vessel function and fight homocysteine, which can damage blood vessels²⁷.

This study concluded that beet and star fruit juice had a significant effect on reducing blood pressure in gestational hypertension. This is because the nutritional content in beets and star fruit is involved, including potassium, antioxidants, magnesium and high calcium. Magnesium plays an essential role in blood pressure control efforts by strengthening endothelial tissue and stimulating prostaglandins when serum magnesium is high in the blood and can increase glucose capture to reduce insulin resistance. Increased insulin resistance can increase catecholamine levels and sodium reabsorption in the kidneys to increase blood pressure.

This nutrient content causes a decrease in blood pressure in pregnant women in trimester 2. Reducing hypertension can be done by consuming fruits. The intervention given in this study was the provision of beet and star fruit juice.

Conclusion

There is a significant difference between diastolic systolic blood pressure before and after giving beet and starfruit juice in second trimester pregnant women with gestational hypertension ($p < 0.05$). Suggestion for pregnant women with gestational hypertension is to treat hypertension by using beet and star fruit juice so that hypertension can be resolved immediately.

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