



Impact of Citrus aurantium Juice Consumption on Gestational Hypertension in Pregnant Women

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ABSTRACT

Introduction: The Maternal Perinatal Death Rate (MMR) in Indonesia in 2023 is 4,129, based on data from the Maternal Perinatal Death Notification (MPDN). Hypertension in pregnancy is the presence of blood pressure of 140/90 mmHg or more after 20 weeks of pregnancy in women who were previously normotensive, or an increase in systolic pressure of 30 mmHg and/or diastolic pressure of 15 mmHg above normal values.

Objective: The objective was to determine the effect of consumption of sweet orange juice (Citrus aurantium) on the reduction of blood pressure (gestational hypertension) in pregnancy in the Working Area of the Campang Raya Health Center, Bandar Lampung in 2024.

Method: Research on the type of quantitative research. The research was conducted from January to February 2025 for 1 week in the working area of the Campang Raya Health Center in Bandar Lampung. Pre-Experimental design with pretest posttest with one group design Total population of 34 pregnant women with gestational hypertension, sample of 31 respondents. Purposive sample technique.

Result: The average blood pressure before consumption of sweet orange juice (Citrus aurantium) was 146.13, SD 3.085. Meanwhile, diastolic blood pressure means 103.71, SD 8.848. The average blood pressure after 121.61, SD 7.460. Diastolic blood pressure means 89.52, SD 6.995. The t-test obtained a p value of $0.000 < \alpha (0.05)$ meaning that H_a was accepted, which means that there is an effect of consumption of sweet orange juice (Citrus aurantium) on the reduction of blood pressure (gestational hypertension) in pregnancy in the Working Area of the Campang Raya Health Center Bandar Lampung in 2024.

Conclusion: By conducting this study, it can help pregnant women with gestational hypertension problems by consuming sweet oranges regularly can help lower blood pressure in pregnant women and reduce the risk of complications.

Keywords: gestational hypertension, pregnancy, sweet orange juice (Citrus aurantium)

Introduction

Hypertension in pregnancy is the presence of blood pressure of 140/90 mmHg or more after 20 weeks of pregnancy in women who were previously normotensive, or an increase in systolic pressure of 30 mmHg and/or diastolic pressure of 15 mmHg above normal values (Indriani, 2016). Hypertension in pregnancy is hypertension characterized by blood pressure $\geq 140/90$ mmHg after 20 weeks of pregnancy, accompanied by proteinuria ≥ 300 mg/24 hours (Nugroho, 2016)

Data from the World Health Organization (WHO) in 2022, the estimated incidence of hypertension in pregnancy worldwide ranges from 0.51% -38.4%. The cause of maternal death in Indonesia is still dominated by bleeding 28% and hypertension 29%, although other causes are still high at 24%. while in 2023 the incidence of hypertension in pregnancy worldwide ranges from 0.51%-38.4% (WHO, 2022-2023).

The Maternal Mortality Rate (MMR) in Indonesia in 2023 was 4,129, based on data from the Maternal Perinatal Death Notification (MPDN), the Ministry of Health's maternal death recording system. The high MMR is one of the challenges that Indonesia must face so that it becomes one of the national priority commitments, namely reducing maternal mortality during pregnancy and childbirth. The most common causes of maternal death in Indonesia are bleeding, hypertension in pregnancy and others. In 2022 the incidence of pregnancy hypertension (gestational hypertension) was around 5-15% of cases. In 2023 it was found that 35.3% of pregnant women experienced hypertension (gestational) (Ministry of Health of the Republic of Indonesia, 2022-2023).

In Lampung Province in 2022, there were 1,091 cases of hypertension (pre-eclampsia and eclampsia) and 125 cases (11.8%) of mothers who had been diagnosed with hypertension (gestational) by health workers, while the number of deaths due to hypertension was 24 cases. While in 2023 hypertension in pregnancy was 26%. Cases of preeclampsia occurred in 28% and the number of maternal deaths reached 26 cases with the highest incidence in the city of Bandar Lampung reaching 121 cases of gestational hypertension (Lampung Provincial Health Office, 2023). Hypertension is a disease that can affect anyone from the youngest to the oldest and does not discriminate between rich and poor. Of the approximately 90% of hypertension sufferers, the cause is not known for certain (Uta-miningsih, 2015). Hypertension is often called the "Silent Killer" because sufferers often feel a disorder/symptom without knowing the cause (Triyanto, 2017 in Marlina 2020).

Hypertension in pregnancy requires special treatment because it can reduce blood flow to the placenta, which will affect the supply of oxygen and nutrients to the baby. This will slow down the baby's growth and increase the risk during childbirth (Syafira, 2021). Hypertension in pregnancy is 5-15% of pregnancy complications and is one of the three highest causes of maternal mortality and morbidity. In Indonesia, the mortality and morbidity of hypertension in pregnancy are still quite high. This is caused by unclear etiology (Fandila, 2020 in Alvionita, 2022).

The factor that triggers the onset of hypertension is an unbalanced nutritional status. Changes in nutritional status characterized by increased body weight can directly affect changes in blood pressure (Riayadi et al, 2007). According to Alvionita (2022), sodium and potassium are the main cations in the body's extracellular fluids which function to regulate the body's fluid and acid-base balance and play a role in nerve transmission and muscle contraction. Excessive sodium intake can disrupt the body's balance, which can cause edema, ascites, and hypertension. Antihypertensive drugs currently used contain chemicals with toxic

side effects, including hypokalemia, cardiac arrhythmia, hypovolemia, shock, kidney failure, and so on. In addition, antihypertensive drugs are also relatively expensive and are used for life. This situation has caused many people to look back at traditional medicinal plants including fruits to treat hypertension such as oranges, celery, cucumbers, chayote, watercress, radishes, tomatoes, starfruit, noni, rosella, sambiloto, mahkota dewa, sweet starfruit, watermelon, carrots, avocados, bananas, apples and kiwi (Satuhu., et al., 2007 in Sukmawati 2017).

In addition to pharmacological therapy given to hypertension sufferers, non-pharmacological therapy can also be given, which is nutritional therapy carried out with hypertension diet management. For example, by limiting salt intake, maintaining potassium, calcium, and magnesium intake and limiting calorie intake if body weight increases. DASH (Dietary Approaches to Stop Hypertension) recommends that hypertensive patients consume lots of fruits and vegetables, increase fiber intake, and drink plenty of water. Herbal therapy is a good choice of therapy for hypertension sufferers (Dendy, et al., 2018 in Alvionita, 2022).

More and more epidemiological studies consistently show the protective effect of foods rich in polyphenols (fruit, tea, wine, cocoa or chocolate, and special citrus fruits) against several intermediate risk factors for CVD (Cerebro Vascular Disease) including Low Density Lipoprotein (LDL) cholesterol, high blood pressure, and endothelial dysfunction. Orange (*Citrus sinensis*) juice is also considered a good source of essential nutrients such as vitamin C, folate, and potassium. Vitamin C has recently been found to protect endothelial cells and LDL (Low Density Lipoprotein) from intra and extracellular oxidative stress and to reduce the risk of atherosclerosis. In addition, folic acid can lower plasma homocysteine concentrations and to restore endothelial dysfunction in patients with cardiovascular disease. (Asgary, 2018 in Marlina, 2020).

By consuming 3500 mg of potassium can help overcome excess sodium, so that with ideal blood volume can be achieved normal pressure. Potassium works to remove sodium from its compounds, making it easier to remove Sweet oranges have a higher potassium content compared to lemons, mandarins, grapefruit, and limes. Potassium is an important electrolyte for the body because it functions to convert nerve impulses to muscles in muscle contractions and maintain normal blood pressure (Hermawan, 2021).

Wibowo (2010) in Hermawan (2021) stated that potassium is an electrolyte that functions as a regulator of intracellular fluids, thus preventing the accumulation of fluid and sodium in cells that can increase blood pressure. Potassium also functions as a vasodilator in blood vessels. Vasodilation in blood vessels can reduce peripheral resistance and increase cardiac output so that blood pressure can be normal. In addition, potassium can inhibit the release of renin, thereby changing the activity of the renin angiotensin system. Therefore, high potassium is an important component in the process of lowering blood pressure. The number of pregnancy checks at the Campang Raya Health Center for the period August to October 2024 was 55 mothers in the first trimester, 44 mothers in the second trimester and 35 mothers in the third trimester. Meanwhile, the incidence of gestational hypertension was 31 cases from the first trimester to the third trimester. When a temporary interview was conducted with pregnant women with gestational hypertension problems, they said they did not understand how to overcome hypertension problems during pregnancy, were afraid that taking antihypertensive drugs in pregnant women would cause problems for the fetus they were carrying and were thinking too much because of economic problems.

Objective

It is known the effect of consuming sweet orange juice (*Citrus aurantium*) on reducing blood pressure (gestational hypertension) during pregnancy in the Campang Raya Bandar Lampung Health Center Working Area in 2024.

Method

This study employed a quantitative approach using a pre-experimental one-group pretest, posttest design to determine the effect of sweet orange juice (*Citrus aurantium*) consumption on reducing blood pressure in pregnant women with gestational hypertension. The study was conducted in the working area of the Campang Raya Health Center from January to February 2025.

The population consisted of all pregnant women diagnosed with gestational hypertension who attended antenatal care services at the health center during the study period, totaling 34 participants. A sample of 31 respondents was selected using purposive sampling based on the following inclusion criteria: pregnant women diagnosed with gestational hypertension, gestational age above 20 weeks, willing to participate in the study, and not consuming other non-pharmacological antihypertensive therapies during the intervention period. Respondents with severe pregnancy complications or incomplete participation during the intervention were excluded from the study.

The intervention was administered for seven consecutive days. Respondents were given sweet orange juice (*Citrus aurantium*) according to the predetermined intervention procedure. Blood pressure measurements were performed twice, namely before the intervention (pretest) and after the intervention period (posttest), using a calibrated sphygmomanometer. Systolic and diastolic blood pressure values were recorded in mmHg.

Data analysis was conducted using univariate and bivariate analyses. Univariate analysis was used to describe respondent characteristics and the mean blood pressure values before and after the intervention. Bivariate analysis was performed using the paired sample t-test to determine differences in blood pressure before and after the consumption of sweet orange juice. Statistical significance was determined at a p-value <0.05 with a 95% confidence interval. This study had received ethical approval from the appropriate health research ethics committee prior to data collection, and informed consent was obtained from all respondents before participation.

Result

Tabel 1. Comparison of Systolic and Diastolic Blood Pressure Before and After Sweet Orange Juice (*Citrus aurantium*) Consumption

Measurement results	N	Mean	Difference Mean	Std deviation	p-value	CI-95%	
Systolic blood pressure before	31	146.13	24.516	7.784	0.000	21.661-	
Systolic blood pressure after		121.61					27.371
Diastolic blood pressure before		103.71	14.194	11.697		0.000	9.903-
Diastolic blood pressure after		89.52					

Based on table above, it can be concluded that the results of the t-test obtained a p value of 0.000 < α (0.05) meaning H_a accepted, which means that there is an effect of consuming sweet orange juice (*Citrus aurantium*) on reducing blood pressure (gestational

hypertension) during pregnancy in the Campang Raya Bandar Lampung Health Center Working Area in 2024.

Discussion

Pregnant women are one of the groups that are vulnerable to nutritional problems, including anemia, Chronic Energy Deficiency (CED), and Obesity. There are several things that need to be considered during pregnancy, including the need for nutritional intake during pregnancy. Lack of nutritional intake in pregnant women and nutritional problems in mothers cause fetal growth and development disorders and increase the risk of babies experiencing LBW. The nutritional status and health of mothers is one of the critical periods that determine the nutritional status of toddlers or what is called the First 1000 Days of Life (HPK) which starts from 270 days during pregnancy and the first 730 days of the baby's life. The impacts caused by impaired fetal growth and development during pregnancy are permanent and long-term, including stunting, the risk of experiencing non-communicable diseases (PTM), and less than optimal quality of human resources. Therefore, improving nutrition through nutritional intake during pregnancy plays an important role in the child's golden period. Activities to improve nutrition and overcome nutritional problems in pregnant women carried out in the first thousand days of life are by improving the nutritional status of pregnant women through additional food and taking iron tablets for at least 90 tablets during pregnancy (Ministry of Health, 2013). Hypertension is associated with an increase in systolic or diastolic pressure or both. Hypertension can be defined as high blood pressure in patients where the systolic pressure is above 90 mmHg. In the elderly population, hypertension is a systolic pressure of 160 mmHg and a diastolic blood pressure of 90 mmHg (Smeltzer, et al., 2010; Majid, 2019). Hypertension is one of the important factors as a trigger for non-communicable diseases (NCD) such as heart disease, stroke, and others which are currently the number one cause of death in the world (Ministry of Health of the Republic of Indonesia, 2015). Hypertension is a disease that can attack anyone from the youngest to the oldest and does not discriminate between rich and poor. Of the approximately 90% of hypertension sufferers, the cause is not known for certain (Uta-miningsih, 2015). Hypertension is often called the "Silent Killer" because sufferers often feel a disorder/symptom without knowing the cause (Triyanto, 2017 in Marlina 2020).

Hypertension in pregnancy requires special treatment because it can reduce blood flow to the placenta, which will affect the supply of oxygen and nutrients to the baby. This will slow down the baby's growth and increase the risk during childbirth (Syafira, 2021). Hypertension in pregnancy is 5-15% of pregnancy complications and is one of the three highest causes of maternal mortality and morbidity. In Indonesia, the mortality and morbidity of hypertension in pregnancy are still quite high. This is caused by unclear etiology (Fandila, 2020 in Alvionita, 2022).

The content of oranges consists of potassium, sodium and Phytonutrients. The potassium content in oranges is needed to smooth blood circulation. The sodium content found in oranges helps lower blood pressure which can cause strokes, and Phytonutrients in oranges can increase blood flow throughout the body including to the brain. Women and men have the same risk factors for hypertension (Padila, 2013). Increasing blood pressure in addition to taking medication, usually also by changing lifestyle and diet properly. One diet that can be done to reduce blood pressure is oranges (citrus) (Padila, 2013). Sweet oranges are fruits that contain very high potassium, Mariani (2017) stated that several clinical studies have shown that increasing potassium intake can lower blood pressure. In their research,

Manurung and Wibowo (2016) also stated that Potassium can significantly lower blood pressure because it can cause vasodilation which can widen blood vessels so that blood can flow more smoothly and there is a decrease in peripheral resistance. In addition, potassium can inhibit the work of the angiotensin enzyme (angiotensin converting enzyme inhibitor) so that the process of converting renin to renin angiotensin is inhibited and there is no increase in blood pressure. Potassium also functions as a natriuretic and diuretic, which causes increased sodium and fluid excretion.

Research conducted by Mahendra, 2022 regarding the effectiveness of orange juice on hypertension consisted of 3 studies, 2 studies had results that were considered invalid and only 1 study had valid results. Valid research results were conducted by Valls et al. This study was conducted in Spain with a sample of 159 people. The results of the study showed that giving 500 mL/day of orange juice enriched with 1200 mg of hesperidine or standard orange juice with a natural hesperidine content of 690 mg for 3 months can reduce systolic and diastolic blood pressure ($p < 0.05$), but when compared between the two, orange juice enriched with 1200 mg hesperidine is more effective than standard orange juice so that overall it can be concluded that orange juice can significantly reduce systolic and diastolic blood pressure but if the dose is increased it will increase its effectiveness in lowering blood pressure.

According to researchers, the decrease in blood pressure occurs due to the effect of potassium contained in sweet oranges. Potassium which causes inhibition of the renin angiotensin system also causes a decrease in aldosterone secretion, resulting in a decrease in sodium and water reabsorption in the renal tubules. As a result of this mechanism, there is an increase in diuresis which causes a decrease in blood volume, so that blood pressure also decreases. In addition, potassium will also cause vasodilation of peripheral blood vessels, resulting in a decrease in peripheral resistance, and blood pressure also decreases.

From the results of the study that has been carried out, it shows that there is a change in blood pressure before and after being given tangerine consumption and respondents said that dizziness decreased, there were no prominent complaints. However, the decrease in each respondent varies, such as in the age category of 20-35 years, the decrease in blood pressure is greater, namely blood pressure drops by 15-45, while for ages 36-40 years, the decrease in blood pressure only drops by 5-40. This is because at the age of over 35 years it can cause hypertension in pregnancy due to the degenerative process that causes changes in the structure and function of peripheral blood vessels which makes pregnant women more susceptible to the risk of hypertension (Herli Gustiani, 2018).

While for the undergraduate education category, there is a greater decrease in blood pressure because the level of education can affect a person's ability and knowledge in establishing healthy living behaviors, especially preventing hypertension. The higher a person's level of education, the higher the person's ability to maintain and maintain their lifestyle to stay healthy and free from disease. For the job category, mothers who do not work experience a greater decrease in blood pressure compared to mothers who work because work can affect a person's stress levels which will affect blood pressure, especially in hypertension patients. For pregnant women who are respondents based on parity with the grandemultipara category, there is a slight decrease in blood pressure, this is because parity > 2 and ≥ 4 times is a parity that is at risk of experiencing hypertension and preeclampsia because mothers with high parity have experienced a decrease in reproductive system function.

Conclusion

Ha is accepted, which means that there is an effect of consuming sweet orange juice (*Citrus aurantium*) on reducing blood pressure (gestational hypertension) during pregnancy in the Campang Raya Bandar Lampung Health Center Working Area in 2024.

It can add insight to further research and can be used as reference material to conduct other research, and it is hoped that further researchers who will conduct the same research can add other variables such as consuming sweet orange juice with a combination of other ingredients.

Authors' contribution

Each author contributed equally in all the parts of the research. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

Conflict of interest

The researchers stated that there is no conflict of interest related to the implementation and publication of the results of this research. The entire research process, from planning, data collection, analysis, to report preparation, was carried out independently without any influence or pressure from any third party. A commitment to research ethics is upheld throughout the research process, ensuring transparency, accuracy and honesty in reporting results. Respondents' participation was voluntary with informed consent, and their confidentiality and privacy were maintained in accordance with applicable research ethics standards. With this statement, researchers hope that the research results can be trusted and used as a valid reference for the development of science and health practices related to ethnomedicine and reproductive health.

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