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CASE STUDY: THE EFFECT OF TOMATO JUICE ON BLOOD PRESSURE OF HYPERTENSIVE PATIENTS IN SUMBANG VILLAGE

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ABSTRACT

Background: Hypertension is when systolic blood pressure exceeds 140 mmHg and diastolic blood pressure exceeds 90 mmHg. Uncontrolled hypertension can cause various complications that can be fatal, especially in the cardiovascular system. Hypertension can be treated with pharmacological and non-pharmacological therapies. Non-pharmacological therapy can be done by consuming fruits and vegetables such as tomatoes. Tomatoes are believed to act as antioxidants, natural vasodilators, and diuretics that affect blood pressure. **Purpose:** This case study aims to determine the effect of tomato juice intervention on blood pressure in patients with hypertension. **Methods:** This research is a case study with a nursing approach that applies evidence-based interventions in patients with hypertension. There were 3 respondents in this study who met the inclusion criteria. **Result:** The intervention of tomato juice on the three respondents proved effective in reducing systolic and diastolic blood pressure. Tomato juice has various beneficial ingredients such as potassium, lycopene, vitamin C, folic acid, and magnesium, which are natural vasodilators, antioxidants, and diuretics that affect blood pressure and mood. **Conclusion:** The intervention of tomato juice as a nonpharmacological therapy in patients with hypertension can reduce blood pressure.

Keywords: Hypertension, lycopene, mood, potassium, tomato juice
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INTRODUCTION

Hypertension or high blood pressure is a high systolic level that exceeds 140 mmHg and a high diastolic level that exceeds 90 mmHg with a minimum of two measurements within 5 minutes. Hypertension can be caused by genetics and a sedentary lifestyle. Poor lifestyle includes lack of physical activity, high sodium consumption, smoking, obesity, and dyslipidemia. Uncontrolled hypertension can lead to various complications such as stroke, hypertensive retinopathy, hypertensive heart disease, coronary heart disease, chronic kidney disease, and arterial abnormalities. A prolonged increase in blood pressure needs to be detected early to get adequate treatment to avoid these bad consequences (Tanto C, 2014; Widyarani et al., 2019).

The hypertension prevalence rate in Indonesia is still relatively high. The report of Survei Kesehatan Indonesia (SKI) in 2023 showed that the prevalence of hypertension according to blood pressure measurements in Indonesia was 30.8%. The prevalence of hypertension based on measurement results in the age group 15-24 was 9.3%, age 25-34 was 17.4%, age 35-44 was 27.2%, age 45-54 was 39.1%, age 55-64 was 49.5%, age 65-74 was 57.8%, and age ≥ 75 was 64% (KEMENKES RI, 2023). The authors conducted a preliminary study related to data on hypertension patients in RW 07 Banteran Village, Sumbang, knowing that there were 56 adults and elderly people suffering from hypertension.

Hypertension can be treated with pharmacological therapy using drugs and non-pharmacological therapy with lifestyle modification. Lifestyle modification can be performed by exercising regularly and eating healthy foods. One of the healthy foods that can be a therapy for

hypertension is tomatoes. The content contained in tomatoes is an antioxidant that can counteract the free radicals by inhibiting the absorption of reactive oxygen to the endothelium that disrupts blood vessel dilatation, so it can reduce blood pressure (Widyarani et al., 2019).

Research by Cholifah & Hartinah (2021) shows that tomato juice is effective in reducing blood pressure values in hypertensive patients at the Purwosari Kudus Health Center. Juice is a fluid obtained by squeezing the fruit directly. Juice can be used as a healthy practical drink because it contains high vitamins and minerals (Munawaroh et al., 2023). Podungge et al. (2022) also proved in their research that 250 ml tomato juice consisting of 200 g tomato fruit, 50 ml water, and 5 g sugar and given 1x every morning before meals for 4 consecutive days can reduce blood pressure in menopausal women. Tomato juice contains a lot of potassium which can help lower blood pressure as it is an electrolyte that helps regulate intracellular fluid which prevents the accumulation of fluid and sodium in cells. The difference between this case study and research conducted by Podungge et al. (2022) is the respondents' age who were included in this study, aged 30-55 years, while in the reference journal the respondents included were menopausal women aged 40-50 years, with the difference in respondent criteria it is expected that this case study can provide a wider overview. Based on this description, the authors would like to find out the effect of giving tomato juice on reducing blood pressure in hypertensive patients.

METHOD

Research Design

This case study discusses the case managed in adults who experience hypertension in the community. This case study is qualitative research with a descriptive case study approach compiled from nursing care reports by applying Evidence-Based Practice (EBP) in the form of giving tomato juice to adults with hypertension. The author explained the therapy of giving tomato juice to lower blood pressure and gave verbal informed consent to the three clients. The three clients have met the inclusion criteria, namely suffering from hypertension, aged 30-55 years, not taking antihypertensive drugs, have no allergies to tomatoes, and are willing to be respondents until the research is completed.

Research Setting

This case study was conducted in Banteran Village, Sumbang Sub-district in September - October 2024.

Population

The population in this study was 56 adults with hypertension in RW 07 Banteran Village, Sumbang.

Sampling Technique

The sampling technique used in this study was purposive sampling. The inclusion criteria in this study were hypertensive patients with/without comorbidities, aged 30-55 years, not taking antihypertensive drugs, no history of tomato allergy, and willing to become respondents. Exclusion criteria in this study were taking herbal medicines, not following the schedule of consuming tomato juice on time, and being respondents in other studies.

Sample Size

The sample in this study were hypertensive patients with a total of 3 respondents.

Data Collection Tools and Technique

The authors assessed on October 16 2024, to the three clients. The client's blood pressure was measured 2x, which was at the time of assessment (pre-test) and when the 4th day of tomato juice intervention (post-test). blood pressure is measured using a digital sphygmomanometer. Based on the results of the assessment, the researcher gets a nursing problem that appears, the Risk of Ineffective Cerebral Perfusion associated with hypertension (D.0017) (PPNI, 2016). The nursing action plan that will be carried out to overcome the client's blood pressure problems is Vital Signs Monitoring (I.02060) and Dietary Education (I.12369) by monitoring blood pressure and providing nonpharmacological therapy by drinking tomato juice for 4 days to increase cerebral

perfusion (L.02014) with indicators of systolic blood pressure, diastolic blood pressure, and average blood pressure values improving. The administration of tomato juice intervention was carried out for 4 consecutive days, once every morning.

RESULT

Table 1. Intervention Results Data

Client	Pre-test Blood Pressure (mmHg)			Post-test Blood Pressure (mmHg)			Complaint
	Systole	Diastole	MAP	Systole	Diastole	MAP	
Client 1	181	103	129	164	87	112,67	Pre-test: The client said that her neck felt stiff. Post-test: No complaints
Client 2	154	104	120,67	147	98	114,33	Pre-test: the client said that her neck felt a bit stiff. Post-test: On day 3, client 2 said her left leg was sore but felt better after drinking tomato juice.
Client 3	150	97	114,67	136	98	110,67	Pre-test: No complaints. Post-test: On day 4, client 3 said her head was feeling a bit dizzy because her child was fussy.

Table 1 shows that blood pressure in the three respondents after the tomato juice intervention decreased compared to the measurement before giving tomato juice. This proves that giving tomato juice for 4 days can reduce blood pressure. After the tomato juice intervention, there was a decrease in systolic blood pressure in client 1 with a decrease in systolic blood pressure by 17 mmHg and a decrease of 16 mmHg in diastolic blood pressure. In client 2 there was a decrease in systolic blood pressure by 7 mmHg and diastolic blood pressure by 6 mmHg. The results of blood pressure measurements in client 3 have slightly increased in diastolic blood pressure by 1 mmHg and decreased systolic blood pressure by 14 mmHg. Overall, the decrease in systolic blood pressure in the three clients ranged from 7-17 mmHg, a decrease in diastolic blood pressure of 6-16 mmHg, and a decrease in MAP values of 4-16 mmHg.

DISCUSSION

The tomato juice was given in this study for 4 consecutive days every morning. Tomato juice was made by mixing 200 grams of tomatoes, 50 ml of water, and 5 grams of sugar. Respondents' blood pressure was measured twice, before the administration of tomato juice and the 4th day after the administration of tomato juice. The intervention of giving tomato juice is done to reduce blood pressure in adults who suffer from hypertension. This is in line with research conducted by Podungge et al., (2022) which proves in their research that giving tomato juice effectively lowers blood pressure.

Table 1 shows the results of blood pressure measurements on respondents before and administration of tomato juice. In client 1 there occurred a decrease in systolic blood pressure by 17 mmHg and a decrease in diastolic blood pressure by 16 mmHg. Similarly, with client 2, systolic blood pressure decreased by 7 mmHg and diastolic blood pressure decreased by 6 mmHg. However, client 3's diastolic blood pressure increased slightly by 1 mmHg, but his systolic blood pressure decreased by 14 mmHg. MAP (Mean Arterial Pressure) is the average value of systolic and diastolic blood pressure during one heartbeat cycle. MAP is obtained from the measurement of systolic blood pressure and diastolic blood pressure with normal values ranging from 70-100 mmHg (Putri et al., 2023). The MAP value in the three clients decreased significantly with a decrease of 4-16 mmHg. Overall, the blood pressure of the three clients decreased after giving tomato juice. This is congruent with the study conducted by (Podungge et al. 2022) which

proved that tomato juice given for 4 consecutive days can reduce blood pressure.

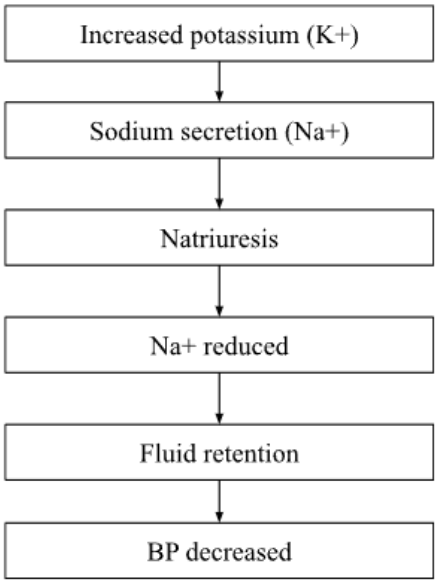
Complaints that occurred in client 1 and client 2 experienced improvements. Client 1 complained that his neck felt stiff during the first day of intervention, but on the 4th day of intervention the complaint was no longer felt and felt that his neck felt lighter and she felt her body felt more refreshed after drinking tomato juice for 4 days. Client 2 also said that she had better sleep, her neck was no longer stiff, and her left leg was not sore after drinking tomato juice. A slight difference occurred in client 3, where on the first day of the client 3 intervention had no complaints, but on the 4th day of intervention, the client complained that his head hurt because his child was fussy. Client 3 also said that after consuming tomato juice, client 3 felt that her body felt more refreshed. Tomatoes contain folic acid, lycopene, potassium and magnesium, vitamins, and flavonoids that affect mood related to hormones. Lycopene has been proven can reduce the progression of Alzheimer's disease by fighting cell damage. In addition, lycopene and flavonoids as antioxidants have also been shown to support memory function, attention, logic, and concentration. Antioxidants fight oxidative stress and inflammation that can cause damage to brain cells. Vitamin C as an antioxidant can reduce levels of the stress-causing hormone cortisol. Consumption of antioxidant-rich foods will increase feel-good chemicals in the brain and improve mood. Folic acid in tomatoes can prevent the accumulation of excess homocysteine which can inhibit the production of important neurotransmitters such as serotonin, dopamine, and norepinephrine in the body. Serotonin is known to affect mood and sleep quality and dopamine affects focus and motivation levels. This proves that clients feel more refreshed and complaints of sleeplessness experienced by clients are reduced after drinking tomato juice where there is an increase in serotonin and dopamine hormones. The content of potassium and magnesium as minerals also serves to relax muscle and nerve function, so it is in line with the results of the study that the neck stiffness experienced by clients is reduced after drinking tomato juice. (Magesh, 2022; Muntholib et al., 2021).

The reduction in blood pressure after tomato juice intervention is explained by the fact that tomatoes have ingredients that perform as antioxidants, natural vasodilators, and diuretics. Lycopene is a carotenoid pigment that gives tomatoes and other fruits their red color. Lycopene is known as one of the most effective antioxidants that can reduce oxidative stress by neutralizing free radicals in the body. Lycopene in tomatoes helps reduce blood pressure by improving endothelial function & reducing inflammation, and oxidation of fat in the blood vessels. Tomatoes contain other antioxidants such as vitamin C, vitamin E, beta-carotene, and flavonoids. These antioxidants work together to protect cells from oxidative damage by preventing the oxidation of LDL cholesterol, which triggers the formation of atherosclerotic plaques causing hypertension (Hsieh et al., 2022; Mozos et al., 2018).

Tomatoes also act as a natural vasodilator by increasing the production of nitric oxide (NO), which plays a very important role in blood vessel health. Nitric oxide (NO) is a vasodilator that helps dilate blood vessels which can reduce blood pressure by improving blood flow. Nitric oxide (NO) works by relaxing the smooth muscles in the walls of blood vessels, reducing vascular retention and lowering blood pressure. Tomatoes as an antioxidant (lycopene) and vasodilator help protect the endothelium from damage, promote cardiovascular health, and keep blood pressure within the normal range (Maniero et al., 2023; Mozos et al., 2018).

Tomatoes also have diuretic effects due to its water and potassium content. Potassium is an important mineral that can help regulate fluid and electrolyte balance in the body. Human body fluids are divided into intracellular fluid (ICF) and extracellular fluid (ECF). ICF is the fluid inside cells and is dominated by potassium and magnesium. ICF is responsible for

balancing cell metabolic activity, cell volume regulation, and intercellular communication. Meanwhile, ECF is a fluid that is outside the body cells and is dominated by sodium. ECF consists of interstitial and intravascular fluid. Interstitial fluid is a fluid that surrounds body cells that works in the transfer of nutrients, gases, and waste. Intravascular fluid is the fluid in blood vessels to transport blood cells, hormones, and nutrients. An increase in intravascular fluid such as sodium retention where hydrostatic pressure pushes fluid into the interstitital space causing fluid accumulation in the extracellular so that it can increase blood pressure with an increase in cardiac output and vascular resistance. Potassium in the body plays a role in reducing the effects of sodium through urine, reducing intravascular volume, and promoting vasodilation which can help lower blood pressure (Stadt et al., 2022; Suzumoto et al., 2023).



Potassium and sodium are positive cations that can not bond, but these two ions are related in the physiological mechanism of the sodium-potassium pump (Na+/K+ ATPase). The sodium-potassium pump plays an important role in the balance of potassium and sodium. This pump is a protein on the cell membrane that is active in transporting three sodium ions out of the cell and two potassium ions into the cell to maintain osmotic balance. When the consumption of potassium increases, the kidneys respond by increasing the excretion of sodium through urine (natriuresis) which reduces the volume of fluid in the blood vessels, leading to lower blood pressure. In addition, potassium also helps to widen blood vessels (vasodilation) which causes the relaxation of blood vessel walls (Hsieh et al., 2022; Kim et al., 2024; Octarini et al., 2023).

The results of blood pressure measurements taken on clients have different results, but overall there is a decrease in blood pressure in respondents. This can be due to external factors such as lifestyle, diet, or different health conditions of the respondents. Several factors can affect blood pressure, such as age, stress, unhealthy diet, physical activity, and others. Each client has different body conditions and life habits. During the intervention, some clients complained of experiencing health problems but some clients did not feel any complaints. In addition, clients also have different daily activities, some clients are stay-at-home moms and take care of their children at home and some clients have activities such as gardening and feeding their pet goats. This could be a factor that affects the results of blood pressure measurements (Indriani et al., 2021).

This study showed that there was a significant decrease in blood pressure in hypertensive patients after consuming tomato juice. Tomatoes with their various contents that act as antioxidants, diuretics, and natural vasodilators are very useful for supporting heart health and maintaining blood pressure. Regular consumption of tomato juice can be an effective nonpharmacological therapy to manage hypertension and improve health. Nonpharmacological therapy is very important in the management of hypertension because it has a lower risk of side effects commonly associated with drugs. Tjahjono et al. (2023) mentioned that hypertension management that focuses on nonpharmacological therapies such as maintaining body weight, reducing salt consumption, consuming vegetables and fruits, increasing physical activity, reducing smoking, and self-monitoring

blood pressure can maintain blood pressure in the normal range (Ballut et al., 2023; Maniero et al., 2023).

CONCLUSION

The intervention of giving tomato juice that has been carried out for 4 days proved effective in reducing blood pressure in hypertensive patients. The main ingredients in tomatoes such as lycopene and potassium work as an antioxidant, natural vasodilator, and diuretic by protecting the body from oxidative stress, maintaining the elasticity of blood vessels, and regulating electrolyte fluid balance. Vitamin C, folic acid, and magnesium also have an impact on mood as they increase the serotonin and dopamine hormones that provide a relaxing feeling and decrease cortisol which causes stress, helping to lower blood pressure. Tomato fruit is a fruit that is easy to find and relatively affordable so tomato fruit can be a practical choice of dietary recommendations for managing hypertension. This study can be used as a reference to apply tomato juice intervention to manage hypertension in hypertensive patients as an effort to reduce blood pressure levels.

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