

Volume: 14
Issue: 01
Years: 2024

Research Article

The Effect Of Administration Of Solanum Lycopersium Var Cerasiforme On Changes In Blood Pressure In Hypertension Patients

Dadi Hamdani^{1*}, Andan Firmansyah², Henri Setiawan³

¹Nursing Study Program, STIKes Muhammadiyah Ciamis, Indonesia

*Email Correspondent : dihamni92@gmail.com



Editor: KS
Received: 17/01/2024
Accepted: 19/04/2024
Published: 23/04/2024
Available Article:
10.33221/jiiki.v14i01.3119

Copyright: ©2024 This article has open access and is distributable under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the name of the author and the original source are included. This work is licensed under a **Creative Commons Attribution-Share Alike 4.0 International License**

Conflict of interest statement:
No conflict of interest.

Funding: STIKes Muhammadiyah Ciamis

Abstract

Background : Hypertension is still a problem for some people because treatment must be carried out regularly and requires regular visits to health facilities. This is a problem for some groups of society, along with the continued use of drugs that have side effects that they must consume with long-term use. Hypertension occurs when systolic blood pressure > 140 mmHg and diastolic blood pressure > 90 mmHg. Apart from medicines, we can also treat high blood pressure by using natural ingredients such as tomato juice. Tomato juice contains potassium and lycopene, which can lower blood pressure.

Objectives : To determine the effect of giving tomato juice on changes in blood pressure in hypertensive patients.

Methods : Quantitative research with a quasi-experimental design using a non-randomized control group pretest-posttest approach and a sampling technique using purposive sampling. The total sample was 62 respondents. Wilcoxon test and Mann-Whitney test were used for statistical tests.

Results : Wilcoxon test results for systolic and diastolic blood pressure in the intervention group were recorded for each p-value <0.05 before and after the intervention. The results of the Mann-Whitney test for systolic and diastolic blood pressure after intervention showed a p-value <0.05

Conclusion : Giving tomato juice (*Solanum lycopersicum*) affects changes in blood pressure in hypertensive patients, so it is recommended as an alternative non-pharmacological treatment option.

Keywords : blood pressure, hypertension, *solanum lycopersium var cerasiforme*

Introduction

Hypertension is still a significant problem throughout the world. WHO data, in 2022 as many as 22% of the world's population is estimated to suffer from hypertension, while in Southeast Asia, the incidence rate reaches 36%. The prevalence of hypertension in the age group 18 years and over in West Java was 29,4%.¹ Hypertension is a condition commonly encountered in primary healthcare and is the leading cause of mortality and

morbidity in Indonesia. Therefore, treatment of this disease is a widespread intervention carried out at various levels of healthcare facilities.² There are two types of treatment for hypertension: drug therapy using antihypertensive drugs and non-drug therapy such as lifestyle adjustments and the incorporation of natural products (returning to the wild).³ This is related to the concept of "returning to nature" and utilizing local ingredients rich in antioxidants, such as lycopene, which is widely utilized in society, one example being tomatoes (*Solanum lycopersicum*). Apart from tomatoes, lycopene is also found in watermelon, guava, papaya, grapefruit, and other red fruits.

Lycopene is commonly found in fresh tomatoes and other processed tomato products, such as tomato juice. Lycopene is one of the most potent antioxidants known and is the primary carotenoid in tomatoes. It is also a carotenoid pigment responsible for tomatoes' ripe red color.⁴ Lycopene is a critical intermediate in the biosynthesis of several carotenoids, including β -carotene, and is responsible for photosynthesis and photoprotection. Like all carotenoids, lycopene is a polyunsaturated hydrocarbon.² Tomatoes are rich in potassium, a mineral known for its ability to lower blood pressure. Potassium plays a crucial role in reducing and regulating blood pressure levels. As a potent diuretic, potassium aids in maintaining fluid balance, controlling blood pressure, and regulating acid-base equilibrium.⁵ Additionally, it promotes increased urine excretion and assists in the dissolution of stones within the urinary tract, bladder, and kidneys. The absorption of potassium is facilitated by its physiological interaction with sodium.⁶

According to Mu'min et al (2019), lycopene prevents the thickening and hardening of artery walls by controlling blood vessel smooth muscle tone, thereby helping regulate blood pressure.⁷ Research conducted by Astuti (2017) regarding the use of tomato juice on blood pressure in 44 hypertensive patients found that giving tomato juice affected blood pressure before giving tomato juice; six respondents initially suffered from first-degree hypertension, and six respondents suffered from second-degree hypertension after providing the juice. Tomatoes, the number of respondents decreased from 8 to 5 with prehypertension and 9 with grade one hypertension from a total of 14 respondents.⁸ Another study conducted by Wahyuni (2017) showed an antihypertensive effect after receiving pure tomato juice therapy for seven consecutive days in grade 1 primary hypertension patients.⁹ Research by Noor Kholifah (2021) at the Purwosari Kudus Community Health Center found that serving tomato juice was effective and affected blood pressure in hypertensive patients; the results of analytical tests proved this carried out using the Wilcoxon test with a significance value of $p(0.003) < 0.05$.¹⁰

Tomatoes come in diverse sizes and shapes, with cherry tomatoes being among the smaller variants. Despite being less common than regular tomatoes, cherry tomatoes offer numerous health advantages. These tomatoes, scientifically known as *Solanum lycopersicum* var. *cerasiforme*, are typically round or slightly oval, boasting a vibrant red hue. Their diameter is significantly smaller than that of standard tomatoes, with some being as small as coins. Originating from Central and South America, cherry tomatoes are predominantly red but can also be found in yellow, green, and even purple hues. While most cherry tomato varieties have a tart flavor, some are particularly delightful due to their high sugar content.¹¹ Tomatoes or *Langum* (*Solanum lycopersicum*) are Solanaceae family plants from Central and South America. Tomatoes are plants with a short life cycle, reaching a height of 1-3 meters. This plant has green, yellow, and red fruit, usually used in cooking as a vegetable or consumed directly without processing. Tomatoes belong to the same family as potatoes and eggplants, which contain alkaloids, making their stems and leaves inedible.⁸ Cherry tomatoes (*Solanum lycopersicum* var. *cerasiforme*) are widely favored for their superior quality and delicious flavor. They boast a vibrant red color and a sweeter taste compared to other tomato varieties, while also being rich in antioxidants and phytochemicals such as carotenoids, flavonoids, vitamin C, and various essential nutrients. Carotenoids, including lycopene, are powerful antioxidants crucial for maintaining overall

health. They protect against cancer, heart disease, oral diseases, and various malignancies, with lycopene being recognized as one of the most potent antioxidants among them.¹⁰

Hypertension is abnormally high blood pressure measured on at least three different occasions. Hypertension occurs when blood pressure exceeds 140/90 mmHg.¹ According to Nurarif et al. (2016), hypertension is an increase in systolic blood pressure of at least 140 mmHg or diastolic blood pressure of at least 90 mmHg. High blood pressure increases the risk not only of heart disease but also other diseases such as nerve, kidney, and blood vessels, and the higher the blood pressure, the higher the risk.¹² Based on the etiology, hypertension is categorized into two groups: primary hypertension and secondary hypertension. According to Nurarif et al. (2016), clinical hypertension is classified based on systolic and diastolic blood pressure as follows: Grade 1 (mild) with systolic readings of 140-159 and diastolic readings of 90-99; Grade 2 (Moderate) with systolic readings of 160-179 and diastolic readings of 100-109; Grade 3 (Severe) with systolic readings of 180-209 and diastolic readings of 110-119; Grade 4 (Very Severe) with systolic readings ≥ 210 and diastolic readings ≥ 120 . If left untreated for a prolonged period, complications associated with high blood pressure can damage the arterial endothelium and lead to atherosclerosis.¹²

Complications of high blood pressure include damage to body organs such as the heart, eyes, kidneys, brain, and prominent blood vessels. Hypertension is a significant risk factor for cerebrovascular disease (stroke, transient ischemic attack), coronary artery disease (myocardial infarction, angina pectoris), renal failure, dementia, and atrial fibrillation.¹³ This Research to determine the effect of giving tomato juice on changes in blood pressure in hypertensive patients.

Method

This research employs a quantitative quasi-experimental pre-and post-test design. Researchers measured respondents' blood pressure levels before and after administering the intervention, then calculated the intervention's impact on the changes using statistical analysis through the SPSS application. Research activities were conducted face-to-face. The study population consisted of patients visiting the As-Shofa Medika clinic, with a total sample size of 62 individuals divided into two groups: a treatment group of 31 individuals and a control group of 31 individuals. The inclusion criteria for the sample were individuals with hypertension who were willing to participate and did not withdraw during the research period. As previously explained, this study utilized a pre-post or quasi-experimental design with a control group.

The experiment utilized questionnaires and a sphygmomanometer to assess blood pressure levels. Eligible patients received guidance from researchers and were provided with the same cherry tomatoes. The prescribed tomato consumption was 150 grams of Solanum lycopersicum var cerasiforme, administered twice daily for seven days. Sampling was conducted using the purposive sampling method. All data in this research were processed using the SPSS statistical application to derive conclusions from the research questions.

Results

The results of this research can be described in the table below.

Table 1. Respondent Characteristics

Characteristics	Intervention		Control		Total	
	n	%	n	%	n	%
Age						
Early Age (20-39)	14	45	11	35	25	40
Middle Age (40-59)	17	55	20	65	37	60

The Effect of Administration of Solanum Lycopersium Var Cerasiforme on Changes in Blood Pressure in Hypertension Patients

Gender						
Male	8	26	13	42	21	34
Female	23	74	18	58	41	66

Based on the results of the univariate analysis of the intervention group in [Table 1](#), the age characteristics of the respondents were primarily middle-aged, namely in the age range of 40 to 59 years, with a total of 17 respondents (55%). Based on gender, the majority of respondents were female, namely 23 respondents (74%). In the control group, the age characteristics of the respondents were primarily middle-aged, namely 20 respondents (65%). Based on gender, the majority of respondents were female, namely 18 respondents (58%).

Table 2. Blood Pressure Before and After Intervention

Variable		Before	After
		Mean (min-max)	Mean (min-max)
Intervention	Systolic	145 (140-150)	130 (120-150)
	Diastolic	95 (80-100)	80 (70-100)
Control	Systolic	145 (140-150)	145 (140-160)
	Diastolic	95 (80-100)	95 (80-110)

Based on [Table 2](#), the analysis of blood pressure values in the intervention group before the intervention showed that the mean systolic blood pressure value was 145 mmHg with a minimum value of 140 mmHg and a maximum value of 150 mmHg. In comparison, in the control group, the mean systolic blood pressure value was 145 mmHg with a minimum value of 140 mmHg and a maximum of 150 mmHg. Diastolic blood pressure in the intervention and control groups obtained a mean value of 95 mmHg with a minimum value of 80 mmHg and a maximum of 100 mmHg.

The blood pressure values of respondents after the intervention in the intervention group showed that the mean systolic blood pressure value was 130 mmHg with a minimum value of 120 mmHg and a maximum value of 150 mmHg. In comparison, in the control group, the mean systolic blood pressure value was 145 mmHg with a minimum value of 140 mmHg and a maximum of 160 mmHg. Diastolic pressure after intervention in the intervention group found a mean value of diastolic blood pressure of 80 mmHg with a minimum value of 70 mmHg and a maximum value of 100 mmHg. In comparison, in the control group, a mean value of 95 mmHg was obtained with a minimum value of 80 mmHg and a maximum value of 110 mmHg.

Table 3. Changes in Blood Pressure Before and After in Both Groups

Variable		Before	After	P
		Mean (min-max)	Mean (min-max)	
Intervention	Systolic	145 (140-150)	130 (120-150)	0,001
	Diastolic	95 (80-100)	80 (70-100)	0,007
Control	Systolic	145 (140-150)	145 (140-160)	0,350
	Diastolic	95 (80-100)	95 (80-110)	0,750

Based on [Table 3](#), the p-value of the Wilcoxon statistical test for systolic blood pressure in the intervention group was 0.001, so it can be concluded that there was a decrease in systolic blood pressure in the intervention group before and after giving tomato juice. In the control group, the p-value = 0.350, so it can be concluded that systolic blood pressure did not decrease before and after in the control group.

Because the diastolic blood pressure in the intervention group reached a p-value = 0.007, it can be concluded that it decreased before and after giving tomato juice. In the control group, the p-value = 0.750, so it can be supposed that diastolic blood pressure did not reduce before and after in the control group. Based on the data above, it was found that systolic blood pressure and diastolic blood pressure decreased in the intervention group before and after the intervention with a p-value < 0.05, so it can be concluded that the intervention was effective in giving tomato juice on systolic and diastolic blood pressure in hypertensive patients.

Discussion

Based on the study results, there were changes in systolic and diastolic blood pressure in the intervention group before and after giving tomato juice. Tomato juice is a non-pharmacological treatment that can lower blood pressure in hypertensive patients because tomatoes contain lots of nutrients such as potassium and lycopene, which are very good for health.⁷ The potassium in tomato juice lowers systolic and diastolic blood pressure by inhibiting renin release and increasing sodium and water excretion. Renin circulates in the blood and catalyzes the breakdown of angiotensin I. Angiotensin I is converted into its active form, namely angiotensin II, with the help of ACE (angiotensin-converting enzyme). Angiotensin II is a vasoconstrictor and can increase blood pressure because it stimulates the release of aldosterone.¹⁴

Aldosterone increases blood pressure by retaining sodium and water. The potassium in tomato juice reduces sodium and water retention, thereby reducing plasma volume, cardiac output, peripheral pressure, and blood pressure. Potassium content significantly lowers blood pressure in hypertensive patients.¹⁵ A high potassium content increases its concentration in the intracellular fluid, which draws fluid from outside the cells and lowers blood pressure. In addition, potassium has a vasodilating effect (widening of blood vessels), which reduces total peripheral blood pooling and increases cardiac output. According to research by Hidayah (2018), tomato juice has diuretic properties apart from potassium and lycopene because of its high acidity, which lowers blood pressure and helps regulate peripheral and central nerves, which affect blood pressure.¹⁶

The lycopene in tomato juice, which contains antioxidants, stops or breaks the chain reaction of free radicals in the body and protects body cells from damage caused by free radicals. Antioxidants neutralize free radicals by donating their electrons, making them non-radical.² Lycopene also balances cholesterol and blood sugar levels by inhibiting the absorption of active oxygen in the endothelium, thereby preventing the widening of blood vessels, and can relax heart cells that become stiff due to cholesterol and blood sugar buildup.¹⁷ Lycopene has been proven to be a potent antioxidant, meaning it can prevent cell damage caused by free radicals caused by ROS (reactive oxygen species). Lycopene protects leukocytes from membrane damage caused by free radicals twice as effectively as beta-carotene. After being absorbed into the body, lycopene is stored in the liver, lungs, prostate, colon, and skin; its concentration in body tissues tends to be higher than that of other carotenoids. When lycopene levels increase in the blood, levels of oxidized compounds decrease. People with high levels of lycopene in their blood have a lower risk of developing various diseases. Lycopene prevents free radicals or ROS, which can cause oxidative stress, triggers the production of nitric oxide (NO) in the endothelium, and improves blood vessel function.¹⁷

According to research by Fadillah (2017), lycopene prevents the thickening and hardening of artery walls by regulating blood vessel smooth muscle tone, thereby helping regulate blood pressure.⁷ This research is also supported by research conducted by Astuti (2017), regarding the use of tomato juice on blood pressure in hypertensive patients. The results of the study showed that giving tomato juice affected blood pressure. Six respondents suffered from grade 1 hypertension if they gave tomato juice before giving tomato juice. Eight people suffering from second-degree hypertension responded to the

provision of tomato juice, resulting in a decrease in five people suffering from prehypertension and nine people suffering from first-degree hypertension from a total of 14 respondents.⁸

Another study conducted by Wahyuni (2017), showed an antihypertensive effect after receiving pure tomato juice therapy for seven consecutive days in grade 1 primary hypertension patients. Based on the explanation above, giving tomato juice lowered blood pressure in hypertensive patients. The reason is that the ingredients in tomato juice are not mixed with anything during manufacturing, so it can gradually reduce high blood pressure. Therapeutic communication is also essential; this builds a good relationship between researchers and respondents throughout the pre-dialogue, orientation, work, and final stages, builds a sense of mutual trust between researchers and respondents, and helps respondents feel this way. Allows them to express their dissatisfaction.⁹ This is supported by research by Maulana (2018), which states that therapeutic communication is structured communication aimed at the patient's recovery and well-being.¹⁸ The effectiveness of therapeutic communication between nurses and patients can build mutual trust and speed up the healing of physical and mental pain in patients. Therapeutic communication helps patients overcome problems that arise during treatment.

Based on the results of the Mann-Whitney statistical test, the systolic blood pressure between the intervention group and the control group after the intervention obtained a value of $p = 0.001 < 0.05$. While the diastolic blood pressure between the intervention group and the control group after the intervention obtained a value of $p = 0.010 < 0.05$, indicating that there is a difference in blood pressure systolic and diastolic between the intervention and control groups after the tomato juice intervention. This is because the intervention group was treated by drinking tomato juice for seven consecutive days, and tomato juice contains potassium and lycopene, which help lower blood pressure, while the control group did not receive treatment like the intervention group because not treated by drinking tomato juice.

Conclusion

Based on the research findings and discussion concerning the impact of tomato juice, it is evident that administering tomato juice affects changes in both systolic and diastolic blood pressure within the intervention group. Analysis results reveal a notable difference in blood pressure levels between the intervention and control groups. It is recommended that individuals with hypertension consume tomato juice regularly to effectively reduce their blood pressure.

Conflict of Interest Declaration

No conflict of interest.

Acknowledge

Thank to STIKes Muhammadiyah Ciamis.

Funding

STIKes Muhammadiyah Ciamis.

References

1. El Islamy I, Simamora L, Syahri A, Zaini N, Sagala NA, Dwi A. Faktor Determinan Kejadian Hipertensi di Desa Sikeben Kecamatan Sibolangit Kabupaten Deli Serdang. *Jurnal Ilmiah Universitas Batanghari Jambi*. 2023;23(1):601–7. Available from: <http://dx.doi.org/10.33087/jiubj.v23i1.2808>
2. Ismalia N, Zuraida R. Efek Tomat (*Lycopersion Esculentum* Mill) dalam Menurunkan Tekanan Darah Tinggi. *Majority*. 2016;5(4):107–11. Available from: <http://repository.lppm.unila.ac.id/20341/>

The Effect of Administration of Solanum Lycopersium Var Cerasiforme
on Changes in Blood Pressure in Hypertension Patients

3. Mohamad Roni Alfaqih, Mei Fitria Kurniati. Terapi Herbal Anti Hipertensi. GUEPEDIA; 2019.
4. Hadi AS. Khasiat Buah Tomat (*Solanum Lycopersicum*) Berpotensi Sebagai Obat Berbagai Jenis Penyakit. *Empiris: Journal of Progressive Science and Mathematics*. 2023;1(1):7–15. Available from: <https://doi.org/10.59698/empiris.v1i1.36>
5. Reius AA. Pengaruh Terapi Kombinasi Akupresur dan Jus Tomat Terhadap Hipertensi pada Menopause di Wilayah Kerja Puskesmas Yosomulyo Tahun 2021. 2021; Available from: <https://repository.poltekkes-tjk.ac.id/id/eprint/834/>
6. Sumbono A. Mineral Seri Biokimia Pangan Dasar. Deepublish; 2021.
7. Mu'min N, Rachmadi F, Fahdi FK. Pengaruh Pemberian Jus Tomat (*Solanum Lycopersicum*) Terhadap Perubahan Tekanan Darah Pada Penderita Hipertensi Di Wilayah Kerja Upk Puskesmas Kampung Dalam Kecamatan Pontianak Timur. *ProNers*. 2019;3(1). Available from: <https://dx.doi.org/10.26418/jpn.v3i1.42867>
8. Astuti E. Pemberian Jus Tomat Memengaruhi Penurunan Tekanan Darah pada Pasien Hipertensi di Tambak Asri RT 17 RW 06 Surabaya. *Jurnal Keperawatan*. 2017;6(2):8-Pages. Available from: <https://jurnal.stikeswilliambooth.ac.id/index.php/d3kep/article/view/75>
9. Wahyuni W, Suryani FE. Pengaruh Pemberian Terapi Jus Buah Tomat terhadap Penurunan Tekanan Darah pada Penderita Hipertensi Primer Stage 1 di Desa Monggot Kecamatan Geyer Kabupaten Grobogan. *URECOL*. 2017;345–50. Available from: <https://journal.unimma.ac.id/index.php/urecol/article/view/1429>
10. Cholifah N. Pengaruh Pemberian Jus Tomat Terhadap Tekanan Darah pada Penderita Hipertensi di Puskesmas Purwosari Kudus. *Jurnal Ilmu Keperawatan dan Kebidanan*. 2021;12(2):404–10. Available from: <https://ejr.umku.ac.id/index.php/jikk/article/download/1150/741>
11. Andreas Wilson Setiawan. Tomat Ceri, Buah Mungil dengan 10 Manfaat Besar [Internet]. *Hello Sehat*. 2023. Available from: <https://hellosehat.com/nutrisi/fakta-gizi/manfaat-tomat-cherry/>
12. Nurarif K, Kusuma K. Terapi Komplementer Akupresure. *Journal of Chemical Information and Modeling*. 2016;53(9):1689–99. 53(9), 1689–1699. Available from: <https://doi.org/10.1017/CBO9781107415324.004>
13. Oktavian Nur R, Budi Setyawan A. Pengaruh Pemberian Terapi Foot Massage pada Pasien dengan Tekanan Darah Tinggi: Literature Riview. 2021; Available from: <https://dspace.umkt.ac.id/handle/463.2017/2473>
14. Marlina R, Mujahid I. Efektifitas Jus Jeruk dan Jus Tomat Terhadap Hipertensi di Desa Tambaksogra Banyumas. *Human Care Journal*. 2020;5(3):786–97. Available from: <https://dx.doi.org/10.32883/hcj.v5i3.760>
15. La Ode Alifariki. *Epidemiologi Hipertensi: Sebuah Tinjauan Berbasis Riset*. Penerbit LeutikaPrio; 2020.
16. Savitri A. *Tanaman Ajaib! Basi Penyakit dengan TOGA (Tanaman Obat Keluarga)*. Bibit Publisher; 2016.
17. Ridwan M. *Mengenal, Mencegah, Mengatasi Silent Killer, "HIPERTENSI."* Hikam Pustaka; 2017.
18. Maulana Rahmat Hidayat. Efektivitas Laserpuncture Care dalam Menurunkan Tekanan Darah dan Tingkat Kecemasan serta Meningkatkan Ankle Brachial Index pada Lansia dengan Hipertensi. 2018; Available from: <https://repository.unair.ac.id/77055/>