




## The Effect of Yogurt Consumption with the Addition of Red Beet (*Beta Vulgaris*) on The Blood Pressure of Students in Carolina Dormitor

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ARTICLE INFORMATION	A B S T R A C T
<p>*Corresponding Author Name: Diyan Setyaji E-mail: <a href="mailto:diyansetyaji@stikespantirapih.ac.id">diyansetyaji@stikespantirapih.ac.id</a></p>	<p><i>Hypertension is a disease with a systolic blood pressure of more than 140 mmHg and a diastolic blood pressure of more than 90 mmHg. Yogurt and red beet (<i>Beta vulgaris</i>) have been known as foods containing potassium which is associated with lowering blood pressure. This study aims to determine the effect of giving yogurt with the addition of red beet on the blood pressure of college students in the Carolina Dormitory. This research was conducted with True Experiment Design, Pretest – Posttest with Control Group. The subjects used were 24 Carolina Dormitory students who were divided into 3 groups, including the control group (consuming yogurt), treatment group 1 (consuming yogurt and 50ml red beetroot), and treatment group 2 (consuming 100ml yogurt and red beetroot). The intervention was carried out in the afternoon for 6 days. Different test before and after intervention using paired t-test. Test the differences between groups using the One-Way ANOVA test. Potassium levels in each formulation were not significantly different (<math>p&gt;0.05</math>). Yogurt products with 100 ml of red beet have the highest potassium content. After receiving treatment for 6 days, all groups experienced a significant decrease in systolic and diastolic blood pressure (<math>p&lt;0.05</math>) compared to before treatment. Consumption of 100 ml of yogurt and 100 ml of red beetroot was able to reduce systolic blood pressure by 9.63 mmHg and diastolic blood pressure of 9.00 mmHg, but had no significant difference (<math>p&gt;0.05</math>) when compared to other groups. It can be concluded that the consumption of yogurt can lower blood pressure while the addition of beets to yogurt does not provide a significant difference in the effect of decreasing systolic and diastolic blood pressure.</i></p>
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## INTRODUCTION

Hypertension is the cause of various non-communicable diseases such as stroke and ischemic heart disease, the two diseases that are the highest cause of death in Indonesia (Trihono, 2013; Tawilah, 2015). The prevalence of hypertension in Southeast Asia reaches 36% (WHO, 2018). The results of Indonesian Health Basic Research 2018, the prevalence of hypertension is 34.1%. This figure has increased significantly when compared to the previous results in 2013 which was 25.8% (Risikesdas, 2013; 2018).

Various studies using non-pharmacological therapy have been carried out in treating hypertension, such as listening to classical music (Fitriani, 2020) and providing medicine boxes (Puspita, 2020) to increase the discipline and compliance of hypertensive patients with the therapy provided. Another non-pharmacological therapy that can be applied to prevent and treat hypertension is nutritional therapy. Milk consumption is reported to have a relationship with the incidence of hypertension (Wade, 2021). Pregnant women who consume yogurt have lower blood pressure than pregnant women who do not consume yogurt (Nita, 2019). In addition to the consumption of yogurt, eating fruits and vegetables can also lower blood pressure. Consumption of

red beet juice (*Beta vulgaris*) as much as 250 grams per day a week showed a decrease in systolic blood pressure of 10.41 mmHg and diastolic blood pressure of 8.94 mmHg in the study of Nandani and Sofyaningsih (2019). Devillya (2019) also said that the consumption of red beet can affect blood pressure.

The results of previous studies found inconsistent results regarding the benefits and impacts of consuming red beetroot. Bailey (2017) says that healthy people who consume 100 ml of red beet juice twice per day can reduce systolic and diastolic blood pressure. Research with hypertension patients who consumed 250 ml of red beet juice got a decrease in blood pressure (Kapil et al, 2015). Several previous studies found negative results regarding the impact of consuming red beets (*Beta vulgaris*) on blood pressure. Bondonno (2015) said that giving red beet juice (*Beta vulgaris*) did not affect blood pressure in ordinary people when given 250 ml of juice. In conditions of overweight, type 2 diabetes mellitus, and obesity, giving red beet juice (*Beta vulgaris*) also has no effect on blood pressure (Jajja et al, 2014; Gilchrist et al, 2013; Lara et al, 2015).

This study was conducted on college students who lived in the Carolina dormitory. They tend to have daily

activities, food consumption, and general characteristics such as relatively the same age. This study was conducted to determine the effect of the consumption of yogurt and red beet on the blood pressure of college students in the Carolina dormitory.

## METHODOLOGY

This research uses True Experiment Design, Pretest – Posttest with Control Group. This study compared the effect of yogurt consumption with the addition of red beet in the experimental group whose blood pressure samples were measured before and after being given treatment. The study was conducted in the Carolina dormitory on all 24 students. Each research group consisted of 8 respondents. The control group received 100 mL of yogurt daily. The first intervention group received 100 mL of yogurt and 50 mL of red beet juice every day. The second intervention group received 100 mL of yogurt and 100 mL of red beet juice every day. The intervention was carried out for 6 days. Yogurt is made through a fermentation process by *Lactobacillus plantarum* Dad-13. Other additives used are skim milk, sucrose, glucose, and yogurt flavor. Red beet juice was made with the ratio of red beet to water is 30: 70. The potassium content in the research material was analyzed using the

gravimetric method at the Food Analysis Laboratory, Universitas Gadjah Mada. This research has obtained Ethical Clearance from the Health Research Ethics Commission (KEPK) of Aisyiyah University Yogyakarta with the number No.2135/KEP-UNISA/VI/2022.

Researchers measured systolic and diastolic blood pressure before and after the intervention. In this study, nothing was given or done that could possibly affect blood pressure, such as respondents did not consume products with caffeine or carried out heavy intensity physical activity within 30 minutes before the measurement was taken. Respondents were asked to sit quietly and relax for 15 minutes before taking blood pressure measurements. The different test before and after intervention using paired t-test. Test the differences between groups using the One-Way ANOVA.

## RESULTS

**Table 1. Potassium Test Results**

Group	Repetition	Potassium (mg)	Mean	Sig.
F0 Control	1	372,4	313,3	0,604
	2	267,0		
	3	300,5		
F1	1	267,4	315,9	0,104
	2	337,9		
	3	342,5		
F2	1	353,7	371,4	0,326
	2	383,0		
	3	377,7		

(F0= 100 ml yogurt); (F1= 100 mL of yogurt and 50 mL of red beet juice); (F2= 100 mL of yogurt and 100 mL of red beet juice)

Table 1 contains the results of the analysis of potassium content for each treatment with 3 repetitions. From these three results, it was found that the formula for the second intervention group had the highest average potassium level of 371.4 mg. From the table, it can be seen that the more addition of red beetroot in yogurt products will increase the potassium levels in these products.

**Table 2. Comparison of Potassium Test Results**

Group	Comparison	Mean Diff	<i>p</i>
F0	F1	-2,61	0,219
Control	F2	-58,15	
F1	F0	2,61	
F1	F2	-55,53	
F2	F0	58,15	
F2	F1	55,53	

(F0= 100 ml yogurt); (F1= 100 mL of yogurt and 50 mL of red beet juice); (F2= 100 mL of yogurt and 100 mL of red beet juice)

Based on table 2, the results of the analysis using One-Way ANOVA, it is known that the average potassium content of 3 repetitions for each formula does not have a significant difference.

**Table 3. Results of Pretest and Posttest Systolic Blood Pressure Measurements**

	n	Mean SBP (pretest)	Mean SBP (posttest)	<i>p</i>
F0 Control	8	116,25 ± 11,37	106,88 ± 9,28	0,004
F1	8	116,88 ± 4,19	109 ± 6,21	0,015
F2	8	114,88 ± 6,72	105,25 ± 5,77	0,015

(F0= 100 ml yogurt); (F1= 100 mL of yogurt and 50 mL of red beet juice); (F2= 100 mL of yogurt

and 100 mL of red beet juice) (*p*: *p*-value Paired T-Test)

**Table 4. Results of Pretest and Posttest Diastolic Blood Pressure Measurements**

	n	Mean DBP (pretest)	Mean DBP (posttest)	<i>p</i>
F0 Control	8	73,25 ± 7,90	65,75 ± 4,43	0,028
F1	8	72,25 ± 6,25	67,5 ± 5,58	0,041
F2	8	74,75 ± 4,65	66,13 ± 4,64	0,004

(F0= 100 ml yogurt); (F1= 100 mL of yogurt and 50 mL of red beet juice); (F2= 100 mL of yogurt and 100 mL of red beet juice) (*p*: *p*-value Paired T-Test)

Based on tables 3 and 4, it is known that the highest average systolic blood pressure in the pretest is F1 which is 116.88 mmHg and the average diastolic blood pressure in the pretest is F2, which is 74.75 mmHg. While the highest average systolic blood pressure (SBP) in the posttest is F1 which is 109 mmHg and the average diastolic blood pressure (DBP) in the posttest is F1 which is 67.5 mmHg.

**Table 5. Pretest and Posttest Systolic Blood Pressure**

	n	Δ SBP	<i>p</i> <sup>1</sup>	<i>p</i> <sup>2</sup>
F0 Control	8	-9,38 ± 6,16	0,529	0,873
F1	8	-7,88 ± 6,93		
F2	8	-9,63 ± 8,45		

(F0= 100 ml yogurt); (F1= 100 mL of yogurt and 50 mL of red beet juice); (F2= 100 mL of yogurt and 100 mL of red beet juice) (*p*<sup>1</sup>: *p*-value homogeneity); (*p*<sup>2</sup>: *p*-value One-Way ANOVA)

The systolic and diastolic blood pressure data were then tested for normality of the data and then continued with the Paired T-Test test. Based on table 5 that the administration of yogurt and red beetroot got the results that there was a significant

decrease in systolic blood pressure in the control group (0.004), the first intervention group (0.015), and the second intervention group (0.015).

**Table 6. Pretest and Posttest Diastolic Blood Pressure**

	n	$\Delta$ DBP	$p^1$	$p^2$
F0 Control	8	-7,50 $\pm$ 7,69		
F1	8	-4,75 $\pm$ 5,36	0.411	0,418
F2	8	-9,00 $\pm$ 5,88		

(F0= 100 ml yogurt); (F1= 100 mL of yogurt and 50 mL of red beet juice); (F2= 100 mL of yogurt and 100 mL of red beet juice) ( $p^1$ : *p-value* homogeneity); ( $p^2$ : *p-value One-Way ANOVA*)

Table 6 also shows a significant decrease in diastolic blood pressure in the control group (0.028), the first intervention group (0.041), and the second intervention group (0.004). Based on tables 5 and 6, it is known that the highest average decrease in systolic and diastolic blood pressure was in the second intervention group, namely 9.63 mmHg for systolic and 9.00 mmHg for diastolic.

## DISCUSSION

Hypertension is a condition in which a person has a systolic blood pressure of more than 140 mmHg and a diastolic blood pressure of more than 90 mmHg in conditions of moderate to severe inactivity (WHO, 2018). How to minimize the severity and lower blood pressure is to eat foods rich in potassium and magnesium and with a low salt diet. One of the food products that contain various nutrients is yogurt based on animal milk and red beet

(*Beta vulgaris*). Red beets also contain nitrates which are useful in lowering blood pressure. Nitrates work as vasodilators which work to widen blood vessels and increase blood flow to the heart. This way of working will increase the supply of oxygen to the heart muscle and ease the heart's work in pumping blood (Kapil, 2015).

Food or drink can be used as non-pharmacological therapy that can be useful for lowering blood pressure, one of which is red beet (*Beta vulgaris*). Based on previous research, the use of red beetroot in the form of juice can reduce both systolic and diastolic blood pressure in hypertensive respondents (Bailey, 2017; Kapil et al, 2015). Giving yogurt and adding red beetroot for 6 days can affect the blood pressure of students in the Carolina Girls Dormitory. In this study, nothing was given or done that could possibly affect blood pressure, such as respondents did not consume products with caffeine or carried out heavy intensity physical activity within 30 minutes before the measurement was taken. The decrease in systolic and diastolic blood pressure after administration of yogurt and the addition of beets occurred significantly in the three groups with the highest average result of the decrease being in the second intervention group (giving 100 ml of

yogurt + 100 ml of red beetroot) namely systolic blood pressure decreased by 9, 63 mmHg and diastolic blood pressure decreased by 9 mmHg.

This result is in line with previous studies that used red beets in the form of juice associated with lowering blood pressure. Research conducted by Dewi and Astriana (2019), showed a decrease in systolic blood pressure of 15.86 mmHg and a decrease in diastolic blood pressure of 5 mmHg after giving beetroot juice 6 times a week in the elderly with hypertension conditions of 100 ml of juice. Several previous studies found negative results regarding the impact of consuming red beets (*Beta vulgaris*) on blood pressure. Bondonno (2015) said that giving red beet juice (*Beta vulgaris*) did not affect blood pressure in ordinary people when given 250 ml of juice. In conditions of overweight, type 2 diabetes mellitus, and obesity, giving red beet juice (*Beta vulgaris*) also has no effect on blood pressure (Jajja et al, 2014; Gilchrist et al, 2013; Lara et al, 2015).

In another study conducted by Kapil (2015) with a sample of patients with hypertension who consumed 250 ml of red beet juice to get a decrease in blood pressure. From studies that have been done previously, the decrease in systolic and

diastolic blood pressure is the effect of potassium contained in red beets at composition >50 ml.

In this research, the decrease in blood pressure after administration of yogurt with the addition of 50 ml and 100 ml of red beetroot was not significantly different compared to the administration in the control group. In the results of systolic blood pressure, it is known that the significant value is greater than 0.05 ( $0.873 > 0.05$ ), which means that the average decrease in systolic blood pressure in the three groups is not significantly different. In diastolic blood pressure, it is known that the significant value is greater than 0.05 ( $0.418 > 0.05$ ), which means that the average decrease in diastolic blood pressure in the three groups is not significantly different.

Low levels of potassium in the blood can be the cause of high blood pressure which is a continuous effect of a lack of low potassium intake, causing sodium retention which will stimulate sodium transporter activity in the kidneys (Adam, 2020). Transporters located in the lumen membrane of renal tubular cells are sodium-hydrogen exchanger type 3, sodium-potassium chloride cotransporter 2, sodium chloride cotransporter (NCC), and epithelial sodium channels and Na/K

ATP-ase pumps in the basolateral membrane. All sodium transporter activities will increase sodium reabsorption and retention so that blood volume increases (Andriani, 2017).

Consumption of yogurt and the addition of red beetroot (*Beta vulgaris*) within 6 consecutive days gave changes to systolic and diastolic blood pressure. The decrease in blood pressure in respondents was due to the potassium content in the 3 products tested. In 3 groups there was a decrease in systolic and diastolic blood pressure, all three of which had potassium levels >300 mg, but with the highest average found in the second intervention product, 100 ml yogurt + 100 ml red beetroot, which was 371.4 mg. These results are in line with previous research conducted by Hastuti (2021) which said that the potassium content in mixed fruit juices between watermelon and papaya as much as 409.1 mg and 304.6 mg in mixed fruit juices between tomatoes and papaya was able to lower systolic blood pressure and diastolic. The role of potassium is to control blood pressure in the renal tubules  $K^+$  kidney in the distal tubule. Changes in serum potassium can cause endothelial-dependent vasodilation with hyperpolarization of endothelial and vascular smooth muscle cells. Potassium can also inhibit the Renin-Angiotensin

System (RAS) resulting in a decrease in aldosterone secretion which causes a decrease in sodium and water reabsorption in the kidneys (Staruschenko, 2018). The decrease in blood pressure after giving yogurt and the addition of red beet occurred because both products are sources of food rich in potassium. The beginning of high blood pressure is through the formation of Angiotensin I which is converted into Angiotensin II by ACE (Angiotensin I-Converting Enzyme) which plays a role in increasing blood pressure through 2 processes, namely decreasing intracellular fluid and increasing extracellular fluid in the body. However, by giving yogurt and red beets which are high in potassium, both processes can be changed. Potassium can increase the concentration in the intracellular fluid and decrease the extracellular fluid which can cause blood pressure to fall. Furthermore, potassium is able to reduce the production of anti-diuretic hormone (ADH), so that there will be a process of spending sodium and fluid will increase. While the decrease in NaCl concentration will be focused on reducing extracellular fluid which will further lower blood pressure (Amran, 2010; Feby, 2013; Tulungnen, 2016).

100 ml of yogurt added with 100 ml of red beetroot had the highest average decrease

but did not differ significantly for other treatments in 6 days of administration. In Jayanti's research (2018) which examined the differences in red beet juice with the addition of star fruit and carrot juice given for 2 weeks, it obtained significantly different results on blood pressure in patients with hypertension. Retnaningsih's research (2020) also conveys the same thing, namely the administration of red beet juice and star fruit juice given within 2 weeks can produce significant differences in blood pressure of pregnant women. Jayanti (2018) gave 200 ml of red beet juice and Retnaningsih (2020) gave 250 ml of juice for each group, while in this study the researchers gave 100 ml of yogurt with 50 ml and 100 ml of red beet.

There was no significant difference in the average decrease in systolic and diastolic blood pressure in all these groups due to the content in each group, namely calcium. In the control group given yogurt where yogurt based on animal milk has calcium levels to lower blood pressure. Total calcium levels have a significant and negative correlation on systolic and diastolic blood pressure, which means that if the total calcium level in blood serum is low, blood pressure will increase significantly. The mechanism of calcium in the process of lowering blood pressure is that it can relieve smooth muscle

contractions in blood vessels assisted by potassium in smooth muscles (Puspita, 2015).

The difference between this study and previous studies is that this study used a control group who was given yogurt, whereas in previous studies there were various treatments such as giving water, giving fruit juice, and giving nothing. (Hastuti, 2021; Jayanti, 2018; Retnaningsih, 2020; Kapil, 2015). The control group with yogurt was able to lower blood pressure because yogurt contains calcium, potassium and magnesium which can lower blood pressure. Magnesium is able to control blood pressure by strengthening endothelial tissue and stimulating prostaglandins. When magnesium levels are high in the blood, it can increase glucose capture to reduce insulin resistance. If insulin resistance increases, it will increase catecholamine levels and the process of sodium reabsorption in the kidneys to increase blood pressure (Reny, 2020). So that in this study, those responsible for reducing blood pressure are multifactorial.

Consumption of yogurt with the addition of red beets can help people with hypertension to lower blood pressure and help maintain blood pressure.



Micronutrients that help and are responsible for lowering blood pressure are potassium, magnesium, and nitrates contained in these two ingredients. So that this intervention product can be applied as a non-pharmacological hypertension therapy pathway.

The advantage of this research from previous similar studies is the selection of a research design, namely True Experiment Design, Pretest – Posttest with Control Group where this study is able to determine the cause and effect relationship of the variables studied with clear research results. Then the selection of research respondents is the use of relatively homogeneous respondents. Homogeneous in this case is the respondent has a diet, stress level, and workload that is relatively the same so that it will get results that are not affected by factors that affect the respondent's blood pressure. However, there is a limitation in this study, namely the limited number of respondents. In this study only laboratory tests of one type of nutrient, namely potassium, it would be better if calcium, magnesium, and nitrate were also analyzed in laboratory testing because these substances also play a role in the process of lowering blood pressure.

## CONCLUSION

The three groups experienced a significant decrease in systolic and diastolic blood pressure after the intervention. The highest average decrease in blood pressure was the second intervention group with a decrease in systolic blood pressure of 9.63 mmHg and diastolic blood pressure of 9.00 mmHg. There was no significant difference between groups in the reduction of blood pressure. Giving 50 ml or 100 ml of red beet juice has not been able to have a significant impact on reducing blood pressure.

## REFERENCES

- Adam, L. & Aswad, A. (2020), Pemberian Jus Carica Papaya Terhadap Penurunan Tekanan Darah Pada Penderita Hipertensi", *Jambura Health and Sport Journal*, 2(2), pp. 60–67 (doi: 10.37311/jhsj.v2i2.7048)
- Amran Y, Febrianti, Irawanti L. (2010). Pengaruh Tambahan Asupan Kalium Dari Diet Terhadap Penurunan Hipertensi Sitolik Tingkat Sedang Pada Lanjut Usia. *Jurnal Kesehatan Masyarakat Nasional*. Jakarta. hal 129.
- Andriani, A. (2017), Pengaruh Pemberian Jus Pepaya Mengkaldalam Menurunkan Tekanan Darah Penderitahipertensi Di Puskesmas", *Jurnal Ipteks Terapan*, 11(4), p. 300. doi: 10.22216/jit.2017.v11i4.1188.
- Bailey SJ, Blackwell JR, Wylie LJ, Emery A, Taylor E, Winyard PG, Et Al. (2017). Influence Of Iodide

- Ingestion On Nitrate Metabolism And Blood Pressure Following Short-Term Dietary Nitrate Supplementation In Healthy Normotensive Adults. *Nitric Oxide*. 63:13–20.
- Bondonno CP, Liu AH, Croft KD, Ward NC, Shinde S, Moodley Y, Lundberg JO, Puddey IB, Woodman RJ, Hodgson JM. Absence of an effect of high nitrate intake from beetroot juice on blood pressure in treated hypertensive individuals: a randomized controlled trial. *Am J Clin Nutr*. 2015 Aug;102(2):368-75. doi: 10.3945/ajcn.114.101188. Epub 2015 Jul 1. PMID: 26135348.
- Devillya Puspita Dewi. (2019). Efektifitas Pemberian Jus Buah Bit (*Beta Vulgaris*. L) Sebagai Minuman Fungsional Penurun Tekanan Darah Pada Lansia. Volume 3 No. 1.
- Dewi Dp, Astriana K. (2019). Efektifitas Pemberian Jus Buah Bit (*Beta Vulgaris*. L) Sebagai Minuman Fungsional Penurun Tekanan Darah Pada Lansia. *Jurnal Riset Sains Dan Teknologi*. 3(1), 35-40.
- Feby HDA. (2013). Faktor-Faktor Yang Berhubungan Dengan Tekanan Darah Di Puskesmas Telaga Murni, Cikarang Barat. *Jurnal Ilmiah Kesehatan* 21(3).
- Gilchrist M, Winyard PG, Aizawa K, Anning C, Shore A, Benjamin N. (2013). Effect Of Dietary Nitrate On Blood Pressure, Endothelial Function, And Insulin Sensitivity In Type 2 Diabetes. *Free Radic Biol Med*. 60:89–97.
- Hastuti, Villa Dwi. (2021). Pengaruh Pemberian Jus Buah Terhadap Tekanan Darah Pada Penderita Hipertensi di Wilayah Kerja Puskesmas Air Bintunan Kabupaten Bengkulu Utara Tahun 2021. POLTEKKES KEMENKES Bengkulu.
- Jajja A, Sutyarjoko A, Lara J, Rennie K, Brandt K, Qadir O, Et Al. (2014). Beetroot Supplementation Lowers Daily Systolic Blood Pressure In Older, Overweight Subjects. *Nutr Res*. 34(10):868–75.
- Jayanti, Alvionita Mei. (2018). Perbedaan Efektivitas Antara Pemberian Jus Belimbing Manis dan Jus Wortel Terhadap Penurunan Tekanan Darah Penderita Hipertensi Di Posbindu Desa Pingkuk Wilayah Kecamatan Bendo Kabupaten Magetan. Keperawatan STIKES Bhakti Husada Mulia Madiun.
- Kapil V, Khambata RS, Robertson A, Caulfield MJ, Ahluwalia A. (2015). Dietary Nitrate Provides Sustained Blood Pressure Lowering In Hypertensive Patients: A Randomized, Phase 2, Double-Blind, Placebo-Controlled Study. *Hypertension*. 65(2):320–7.
- Lara J, Ogbonmwan I, Oggioni C, Zheng D, Qadir O, Ashor A, Et Al. (2015). Effects Of Handgrip Exercise Or Inorganic Nitrate Supplementation On 24-H Ambulatory Blood Pressure And Peripheral Arterial Function In Overweight And Obese Middle Age And Older Adults: A Pilot RCT. *Maturitas*. 82(2):228–35.
- Nandani AD, Sofyaningsih M. (2019). Pengaruh Pemberian Jus Bit Terhadap Tekanan Darah Penderita Hipertensi. *Jurnal Uhamka*. 4(1), 1-10.
- Nita Evrianasari, Ike Ate Yuviska, Suprihatin. (2019). Effect Of Yogurth Adduction In Blood Pressuredegression On Pregnant

- Woman With Hypertension. Jurnal Kebidanan Dan Kesehatan Tradisional. Vol. 4, No 2.
- Puspita Anggraini, Rusdi, Ermita Ibrahim Ilyas. (2015). Kadar Na<sup>+</sup>, K<sup>+</sup>, Cl<sup>-</sup>, dan Kalsium Total Serum Darah Serta Hubungannya dengan Tekanan Darah pada Penderita Hipertensi. Biologi FMIPA Universitas Negeri Jakarta (UNJ). (DOI : 10.21009)
- Retnaningsih, Reni, Tut Rayani Aksohni Wijiyanti. (2020). 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. Journal of Islamic Medicine. Vol 4 (2), Pages 106-114.
- Risikesdas. (2013). Profil Kesehatan Indonesia.
- Risikesdas. (2018). Profil Kesehatan Indonesia.
- Staruschenko, A. (2018). Beneficial Effects Of High Potassium Contribution Of Renal Basolateral K<sup>+</sup> Channels. Mid-Career Award For Research Excellence: AHA Journal.
- Tawilah JF. (2015). Indonesia: WHO Statistical Profile. Jakarta.
- Trihono. (2013). Riset Kesehatan Dasar. Kementerian Kesehatan RI. Jakarta: Badan Penelitian Dan Pengembangan Kesehatan Departemen Kesehatan Republik Indonesia.
- Tulungnen, Regina S., et al. (2016), Hubungan Kadar Kalium Dengan Tekanan Darah Pada Remaja Di Kecamatan Bolangitang Barat Kabupaten Mongondow Utama. Jurnal Kedokteran Klinik (JKK). Vol. 1 No. 2.
- Wade, Alexandra T., Benjamin A. G., Fayeza S. A., Merril F. E. (2021). Higher Yogurt Intake Is Associated With Lower Blood Pressure In Hypertensive Individuals: Cross-Sectional Findings From The Mainee-Syracuse Longitudinal Study. International Dairy Journal, 122.
- World Health Organization. (2018). Regional Office For South-East Asia. Department Off Suistainable Development And Healthy Environment. Non Communicable Disease : Hypertension.
- Fitriani, D., Pratiwi, R.D., Cahyaningtyas, P., Poddar, S. (2020). Effect of Classical Music on Blood Pressure in Elderly With Hypertension in Bina Bhakti Werdha Elderly Nursing Home, Indonesia. Mal J Med Health Sci 16(SUPP10): 142-144.
- Puspita, R.R., Rita Dwi Pratiwi, R.D., Indah, F.P.S., Tambunan, D.E.S., Yuniar, V.A. (2020). Pemberian Kotak Obat Harian Terhadap Kepatuhan Mengkonsumsi Obat Hipertensi Pada Pasien Hipertensi. Edu Dharma Journal, Vol 4 No 1.