

Dietary Sodium-Potassium Intake and Risk of Hypertension

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Abstract: Hypertension is a disease with a high mortality rate in Indonesia. Hypertension is an increase in systolic blood pressure >140 mmHg and diastolic blood pressure >90 mmHg. The prevalence of hypertension has increased significantly in patients aged 60 years and over. Many factors cause hypertension, one of which is a poor diet. The purpose of this study was to determine the effect of sodium and potassium intake on the incidence of hypertension in the elderly. The data or sources related to the relationship between potassium and potassium intake with hypertension in the elderly was used as a method in this research. The influence of sodium and potassium intake on the incidence of hypertension in the elderly is the result of research

1 INTRODUCTION

Hypertension is a disease that is often experienced by elderly people, both men and women. However, this does not rule out the possibility that teenagers or adults will not experience it. Hypertension is an early disease that can lead to chronic diseases such as heart disease, stroke and kidney disease. It is said to be hypertension if both distolic and systolic blood pressure exceeds the normal limit, namely 130/80 mmHg. The occurrence of hypertension in the body has many causal factors, most importantly an imbalance in the body's nutritional intake. Nutritional intake that can directly cause hypertension is sodium and potassium intake. Even though both are micronutrients, they are very important to pay attention to. Sodium intake itself is mostly found in ready-to-eat foods.

Every year the prevalence of hypertension according to WHO always increases, in 2011 it reached 1 billion people in the world. One of them is Indonesia. Apart from that, WHO also estimates that prevalence will continue to increase and predicts that as many as 29% of adults worldwide will experience hypertension by 2025. In 2020 there will be around 1.56 billion adults living with hypertension. Hypertension kills almost 8 billion people every year in the world and almost 1.5

million people every year in the East-South Asia region. About one third of adults in East-South Asia suffer from hypertension (WHO, 2018).

Excessive sodium consumption causes the body to retain fluid which can increase blood volume. Excessive sodium intake can reduce the diameter of the arteries, causing the heart to have to pump hard to push the blood volume through an increasingly narrow space, so that blood pressure rises resulting in hypertension. Hypertension needs to be prevented, prevention of hypertension can be done by always checking blood pressure regularly. If it cannot be prevented, then at least reduce it by reducing consumption of ready-to-eat food and reducing sodium and potassium consumption. Apart from the methods already mentioned, treating hypertension to avoid complications can be done through pharmacology or non-pharmacology

2 METHODS

This research is a review based on literature sourced from literature sources from the Google Scholar database. In the process of writing this literature, the keywords used are Hypertension, Sodium Intake, and

Potassium. The journals or articles used are limited, namely for approximately the last 5 years starting from 2019 to 2024. A total of 5,280 study articles and journals were found in the Google Scholar database. These studies were analyzed to obtain research results, namely a type of quantitative research conducted over approximately the last 5 years, with a

minimum of 27 respondents and a maximum of 191 respondents consisting of elderly people with hypertension. According to existing criteria, the number of journal studies and articles obtained was 15 studies, the majority of which were scientific journals and articles. We present the article screening process in the PRISMA diagram as follow

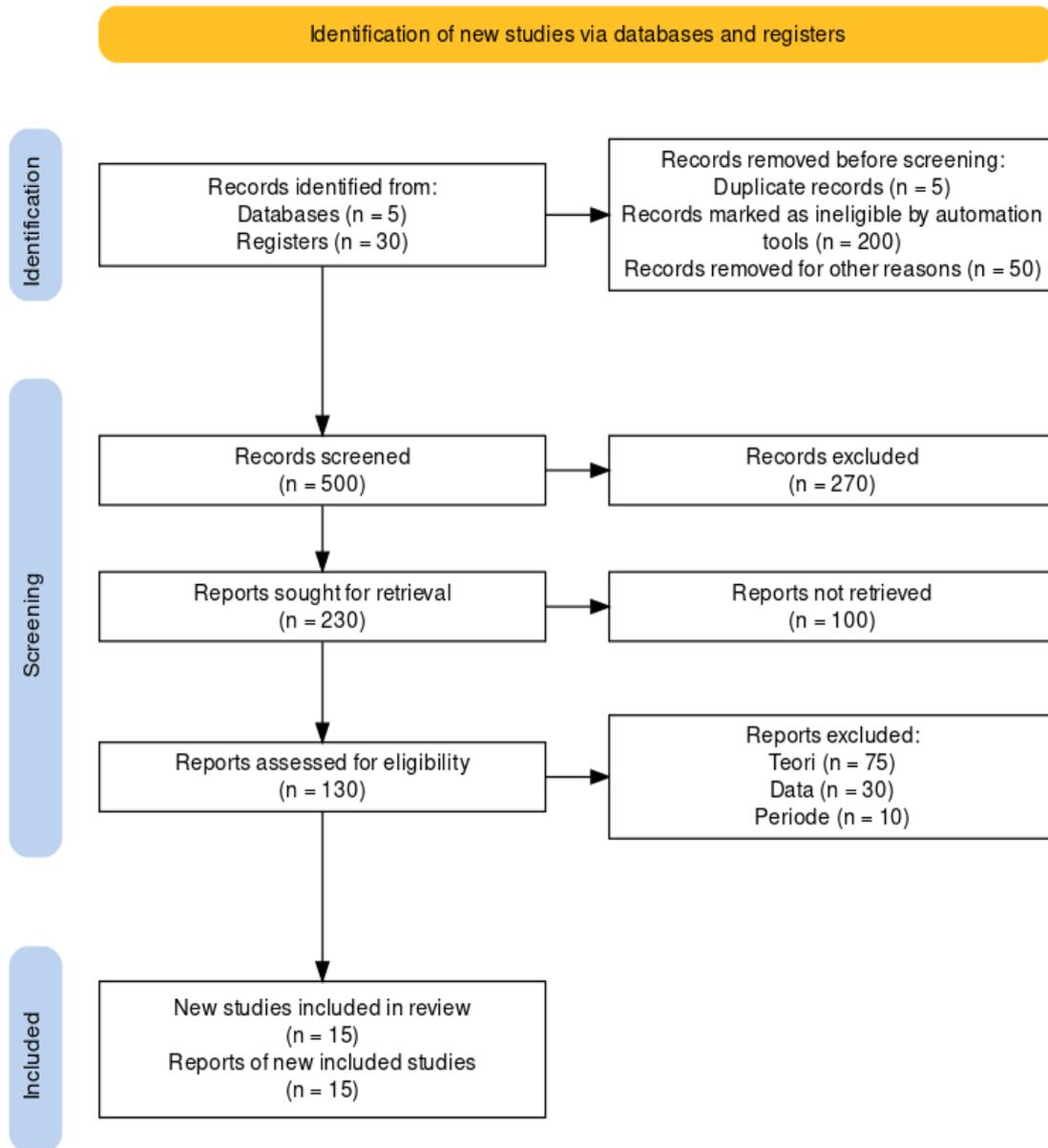


Figure 1: Prisma

3 RESULTS

A total of 15 articles that met the inclusion criteria and met the aims of the literature review were analyzed in more detail to obtain information

regarding potassium and sodium intake in relation to the risk of hypertension in the elderly. The two articles analyzed focused more on nutritional status in relation to hypertension. Five articles focused more on diet on the risk of hypertension. Meanwhile, other articles specifically discuss sodium and potassium intake on the risk of hypertension.

Table 1. Literature Review Summary

No	Author: Year	Topic	Method	Results
1.	M. Zulfikar Al – Fariqi: 2021	The relationship between nutritional status and the incidence of hypertension in the elderly at the Narmada Community Health Center, West Lombok	Descriptive analytical research with an approach <i>cross sectional</i> .	Study This proves that the nutritional status of the elderly is related Which significant with Incidence of hypertension experienced by the elderly at the Narmada Lombok Community Health Center West.
2.	Atin Rohatin and Cahyani Wira Prayuda: 2020	Relationship between sodium and potassium intake and hypertension in the elderly in the internal medicine clinic	Analytical descriptive research approach <i>cross sectional</i> .	Study This proves that excessive sodium intake and insufficient potassium intake can cause hypertension in the elderly in internal medicine clinics Hospital Majalengka
3.	Harleni Harleni, Siska Ratu Miranda: 2019	Connection Nutritional status, Intake Nutrition And Family History With Genesis Hypertension in the Elderly at the Community Health Center Lubuk Buaya Padang	Analytical descriptive research approach <i>cross sectional</i> .	Study this proves that no. There is a relationship between nutritional status and potassium consumption patterns with the incidence of hypertension. There is a relationship between fat and sodium consumption patterns and incident hypertension.
4	Meters Hamidah Haris Alhamidi, Sona Utari, Desti Ambar Wati, Riska Nur Suci Ayu Alifiyanti Muharramah: 2021	Connection Adequacy Level Sodium and Potassium with Hypertension in the Elderly Implementation Unit Technical Area Service Tresna Werdha Elderly Social Lampung in 2021	Quantitative survey research with analytics with design cross sectional	Study this proves that no be found relationship between adequate levels of sodium and potassium with incidence of hypertension in the elderly, Regional Technical Implementation Unit Tresna Elderly Social Services Werdha Lampung in 2021.
5	Yulia Fitri, Rusmikawati, Siti Zulfah, Nurbaiti: 2018	Sodium and Calcium Intake As a Factor Causing Hypertension in Age Carry on (Sodium And Potassium Intake As A Factor Causing Hypertension In The Elderly)	Analytical research with approaches Cross Sectional	Study it proves that higher sodium intake could have an impact To happen hypertension on elderly, while intake potassium no impact against hypertension in this age group in region community health center work Darul Imarah Regency Aceh Big.
6	Asrinawaty, Norfai: 2014	Relationship between nutritional status and the incidence of hypertension Elderly at Posyandu for the Elderly Cockatoos in Pelambuan Community Health Center Working Area	Observational research approach Cross Sectional	Study This proves that there is a meaningful relationship between nutritional status and incident hypertension, where elderly people with higher nutritional status are more at risk of experiencing mild, moderate or severe hypertension than those with normal and poor nutritional status in the work area Public health center Sealing.
7	Janu Purwono, Rita Sari,	Salt Consumption Patterns with Incident	Study Correlation analytics with	Study This prove that There is a relationship between salt consumption

No	Author: Year	Topic	Method	Results
	Wehad Ratnasari, April Budianto: 2020	Hypertension In the Elderly	approach Cross sectional	patterns and the incidence of hypertension in the elderly in the Puskesmas work area Gadingrejo.
8	Arifatul Hidayah, Ari Yuniastuti, Sri Ratna Rahayu: 2020	The Analysis of Saturated Fat, Sodium, Protein Intake and Body Mass Index on the Occurrence of Hypertension in the Elderly in Semarang Regency	The research used a case control approach	Study This proves that the intake of saturated fat, sodium, protein and Body Mass Index is Several factors influence the incidence of hypertension in the district Semarang.
9	Khikmats Sangadah: 2022	Relationship between Micronutrient Intake (Sodium, Potassium, Calcium, Magnesium) and Physical Activity with the Incident of Hypertension	Analytical observational research with case control design.	Study it proves that there is a relationship between sodium intake, intake potassium, and physical activity with events hypertension. There isn't any connection between calcium intake and magnesium intake With incidence of hypertension.
10	Irma Handayani, Aryanti Setyaningsih, Arwin Muhlis: 2024	Relationship between nutritional status and Knowledge level Balanced Nutrition Against Events Elderly Hypertension in Bulu District Sukoharjo Regency	Observational research with Cross Sectional research design	Study This proves that there is a relationship Between level of knowledge about balanced nutrition on the incidence of hypertension in the elderly in the District Hair Sukoharjo Regency.
11	Julwansa Saragih, Eva Anita Yunia: 2023	Connection Lifestyle With the incidence of hypertension in the elderly at the Pematang Siantar Army Hospital Year 2023	Quantitative research approach cross sectional.	Study This proves that there is a relationship between lifestyle and the incidence of hypertension in the elderly in army hospitals Year 2023.
12	Agus Nurika Nugroho, Antok Nurwidi Antara, Siti Uswatun Chasanah: 2016	Relationship between nutritional status and the incidence of hypertension For the Elderly in Girisekar Village, Panggang Health Center Working Area Ii Regency Gunungkidul	Analytical survey research approach cross sectional	Study This proves that there is a relationship between nutritional status and incidence of hypertension in the elderly in Girisekar Village
13	Asnia Zainuddin, Irma Yunawati: 2019	Sodium Intake And Fat Associated With Incident Hypertension In the Elderly in the Poasia Region Kendari City	Analytical research observational approach cross sectional.	Study it proves that sodium and fat intake of each individual is related to the incidence of hypertension in the elderly in the region Poasia Kendari City.
14	Atin Rohatin, Cahyani Wira Prayuda: 2020	Connection Sodium Intake, Potassium With Hypertension In Elderly At the Polyclinic Internal Diseases	The research uses an approach cross sectional	Study This proves that there is a relationship between sodium intake and hypertension in the elderly in the Internal Medicine clinic HOSPITAL Majalengka year 2017.
15	Chouk Norist Hasiando, M. Ikhsan Amar, Iin Fatmawati: 2018	Relationship Between Sodium Consumption Habits, Fat and Sleep Duration With Hypertension in the Elderly at the Cimanggis Health Center, Depok City 2018	The research uses an approach cross sectional	Study This proves that there is a relationship between habit sodium consumption, fat and duration sleep with hypertension in Cimanggis Community Health Center City Depok.

4 DISCUSSIONS

The Relationship of Potassium Intake on Hypertension

Hypertension sufferers generally have several influencing factors, starting from gender, sodium consumption, and age. There is research that there is no relationship between sodium intake and hypertension, because high blood pressure occurs not only due to high sodium intake at the moment, but also the buildup due to long-term sodium intake (Mitha et al, 2021). In other research, it was stated that sodium intake has a greater impact on the occurrence of hypertension in old age (Yulia et al, 2018), so that routine use of excessive amounts of sodium is one of the factors causing hypertension in old age. Apart from sodium intake, the nutritional status of the elderly has a significant relationship with the risk of hypertension (Zulfikar, 2021). Hypertension can occur as a result of the subject's long-term habit of consuming foods high in sodium and is supported by internal factors carried out as a form of lifestyle (Annisa Yuri, 2021). In other research, it is stated that the factors that influence an increase in blood pressure are factors that cannot be changed and can be changed. Sodium is included in the factors that can be changed in the influence of hypertension (Arifatul et al, 2020). Subjects who have a sodium intake of more than the 2013 RDA are more susceptible or even suffer from hypertension than subjects who have a sodium intake of less than the 2013 RDA who have a lower level of susceptibility to hypertension or even do not suffer from hypertension (Rahma et al, 2019).

The recommended sodium intake according to the 2013 AKG for men and women aged 30-49 years is 1500 mg. If intake exceeds the 2013 AKG recommendations, it can increase the risk of hypertension (Rahma et al, 2019). The majority of hypertension sufferers consume sodium in amounts greater than daily nutritional requirements, with 3557.40 mg with a minimum sodium intake of 1103 mg and a maximum of 8578 mg (Dyah and Rani, 2021). Excessive salt intake causes sodium retention in the kidneys, causing an increase in fluid volume which causes hypertension to occur (Martha et al, 2022). Food sources of sodium that are often consumed by hypertension sufferers are salted fish, pindang fish, soy sauce, sauces, biscuits, white bread and instant noodles (Rahma et al, 2019).

Besides The sodium for hypertension sufferers comes from table salt which is used daily as a spice in cooking, plus side dishes that exceed the minimum consumption limit (Wati et al, 2023). Looking at the conditions of previous research regarding the influence of sodium on the risk of hypertension in each person, it is not a definite factor, where when the subject consumes sodium, the subject does not directly develop hypertension (Chouk, 2018). Lifestyle is the main factor that triggers the highest hypertension, seeing that currently the consumption of fast food with uncontrolled sodium content, as well as the distribution of snacks and drinks containing sodium means that humans cannot regulate sodium intake according to the 2013 RDA limits (Atin, 2020). So, in the current conditions, it is most appropriate to control the intake of both food and drinks consumed daily, which should be regulated as best as possible, because the risk of hypertension increases if humans consume sodium in excess of the limit continuously.

Currently, the majority of people with hypertension are elderly (Atin, 2020), where their lifestyle when they were young did not control their food and drink intake. Looking at the current lifestyle where people do not look at the number of servings in food and drink packaging in circulation, so daily sodium intake can be excessive, resulting in hypertension. Therefore, there are several ways to prevent hypertension. Starting from reducing the use of table salt when cooking food. Table salt can also be replaced with Himalayan salt which has a lower sodium content than table salt. Apart from that, reducing consumption of fast food can also help reduce the risk of hypertension in old age. Apart from that, buying food and beverage products by looking at the number of measurements per serving in the packaging can prevent hypertension because it controls excessive sodium consumption in one day continuously (Mitha et al, 2021).

The Relationship of Potassium Intake on Hypertension

Potassium is a positively charged ion found in cells. Potassium is absorbed in the small intestine and excreted through urine as much as 80-90%, then the remainder is excreted through feces, sweat and gastric juices (Palmer and Clegg, 2016). Potassium plays an important role in maintaining fluid and electrolyte balance, acid-base balance in the body, muscle relaxation, and nerve transmission (Staruschenko,

2018). Potassium or potassium in the body functions by restoring the vasodilation effect, which reduces total peripheral pressure and reduces the heart's workload in pumping blood (Staruschenko, 2018). Low potassium intake can lead to increased blood pressure and renal vascular remodeling, which is an indication of vascular resistance in the kidneys. Efforts to reduce the incidence of hypertension include meeting the body's potassium intake needs (Ekmekcioglu et al., 2016).

Low potassium intake has adverse effects on health, especially in relation to hypertension. Potassium plays an important role in balancing sodium levels in the body. Potassium is the main ion in intracellular fluid. Consuming large amounts of potassium can lower blood pressure by increasing the concentration of potassium inside the cells, which attracts fluid from outside the cells. Potassium lowers blood pressure through a vasodilation mechanism, which reduces total peripheral resistance and increases cardiac output. In addition, potassium has a diuretic effect that helps lower blood pressure. Potassium can also influence the activity of the renin-angiotensin system (Ekmekcioglu et al., 2016).

Potassium's role in regulating peripheral and central nerves that influence blood pressure is also important. In addition, potassium helps maintain the elasticity of artery walls and optimizes their function, so that it can prevent narrowing of blood vessels (atherosclerosis) and reduce the risk of coronary heart disease and stroke (Adrogué and Madias, 2014).

Studies show that low potassium consumption is associated with an increased risk of hypertension. Research in various areas, such as in Pajang Village and the Ambal II Community Health Center working area, shows a negative relationship between potassium intake and blood pressure. Individuals with low potassium intake have a higher risk of developing hypertension than those with adequate potassium intake.

In research at the Ambal II Community Health Center, for example, respondents with insufficient potassium intake had a 2.68 times higher risk of developing hypertension ($p=0.035$, $OR=2.68$). However, based on the results of statistical tests in this study, it shows that there is no significant relationship between calcium intake and the incidence of hypertension in the Ambal II Community Health Center working area ($p=0.163$). This research is the same as Sinarti's research, et al (2017) obtained results that there was no significant relationship between potassium intake and the

incidence of hypertension (Mulyasari, Pontang and others, 2017), in line with research by Amelia Eka Putri (2020) that there was no significant relationship between potassium intake and hypertension (Putri, 2022). The majority of respondents, both in the low potassium intake category and the sufficient potassium intake category, suffered from hypertension. This could be caused by other factors, one of which is cultural factors that influence people's eating patterns.

However, scientifically, potassium deficiency can weaken heart muscle contractions, affecting blood pressure. When potassium intake is insufficient, parathyroid hormone stimulates the release of calcium from the bones into the blood to maintain balance. Blood calcium will bind to free fatty acids, causing blood vessels to harden and thicken, reducing the elasticity of the heart, which ultimately increases blood pressure (Liu et al., 2018). Overall, the literature underscores the importance of increasing potassium intake as part of a dietary strategy for the prevention and management of hypertension, contributing to better cardiovascular health in general.

5 CONCLUSIONS

Based on the research results, it can be concluded that many studies state that excessive salt intake can cause sodium retention in the kidneys, causing an increase in fluid volume which causes hypertension to occur. Food sources of sodium that are often consumed by hypertension sufferers are salted fish, pindang fish, soy sauce, sauces, biscuits, white bread and instant noodles. Lifestyle is the main factor that triggers the highest hypertension, seeing that currently the consumption of fast food with uncontrolled sodium content, as well as the distribution of snacks and drinks containing sodium means that humans cannot regulate sodium intake according to the 2013 RDA limits. And as for the relationship between potassium intake low levels can lead to increased blood pressure and renal vascular remodeling, which is an indication of vascular resistance in the kidneys. Efforts to reduce the incidence of hypertension include meeting the body's potassium intake needs. Low potassium intake has adverse effects on health, especially in relation to hypertension.

6 REFERENCES

- Alhamidi, M. H. H., Utari, S., Wati, D. A., Ayu, R. N. S., & Muharramah, A. (2022). Hubungan Tingkat Kecukupan Natrium dan Kalium dengan Hipertensi pada Lanjut Usia Unit Pelaksana Teknis Daerah Pelayanan Sosial Lanjut Usia Tresna Werdha Lampung Tahun 2021. *Journal of Holistic and Health Sciences (Jurnal Ilmu Holistik dan Kesehatan)*, 6(1), 35-41.
- Antara, A. N., Nugroho, A. N., & Chasanah, S. U. (2022). Hubungan status gizi dengan kejadian hipertensi pada lanjut usia di Desa Girisekar Wilayah Kerja Puskesmas Panggang II Kabupaten Gunungkidul. *JURNAL KESEHATAN SAMODRA ILMU*, 13(1), 7-10. <https://doi.org/10.55426/jksi.v13i1.187>
- Da Usfa, M., Hasni, D., Birman, Y., & Febrianto, B. Y. (2023). Hubungan Asupan Kalium dengan Hipertensi pada Perempuan Etnis Minangkabau. *Jurnal Gizi*, 12(2), 52-63.
- Ekaningrum, A. Y. (2021). Hubungan Asupan Natrium, Lemak, Gangguan Mental Emosional, Dan Gaya Hidup Dengan Hipertensi Pada Dewasa Di DKI Jakarta. *Journal of Nutrition College*, 10(2), 82-92.
- Fitri, Y., Rusmikawati, R., Zulfah, S., & Nurbaiti, N. (2018). Asupan natrium dan kalium sebagai faktor penyebab hipertensi pada usia lanjut. *Action: Aceh Nutrition Journal*, 3(2), 158. <https://doi.org/10.30867/action.v3i2.117>
- Handayani, I., Setyaningsih, A., & Muhlshoh, A. (2023). Hubungan Status Gizi dan Tingkat Pengetahuan Gizi Seimbang terhadap Kejadian Hipertensi Lansia Di Kecamatan Bulu Kabupaten Sukoharjo. *JUMANTIK (Jurnal Ilmiah Penelitian Kesehatan)*, 9(1), 50. <https://doi.org/10.30829/jumantik.v9i1.15070>
- Ilham, D., Harleni, H., & Miranda, S. R. (2019). Hubungan Status Gizi, Asupan Gizi Dan Riwayat Keluarga Dengan Kejadian Hipertensi Pada Lansia Di Puskesmas Lubuk Buaya Padang. 2(1).
- Martha Farameita, Desti Ambar, Riska Nur, A. R. (2022). JGK-Vol.14, No.2 Juli 2022. *Hubungan Asupan Natrium, Kalium Dan Lemak , Kebiasaan Olahraga, Riwayat Keluarga Dan Kualitas Tidur Dengan Kejadian Hipertensi*, 14(2), 207-215. *Jurnal Gizi dan Kesehatan Universitas Ngudi Waluyo jurnalgizi*.
- Melini, D. O. C. W., & Tanuwijaya, R. R. (2021). Jurnal Status Gizi. *Jurnal Nutrisia*, 23(2), 101-108.
- Purwono, J., Sari, R., Ratnasari, A., & Budianto, A. (2020). POLA KONSUMSI GARAM DENGAN KEJADIAN HIPERTENSI PADA LANSIA SALT CONSUMPTION PATTERN WITH HYPERTENSION IN ELDERLY. 5(1).Rahma, A., & Baskari, P. S. (2019). Pengukuran Indeks Massa Tubuh, Asupan Lemak, Dan Asupan Natrium Kaitannya Dengan Kejadian Hipertensi Pada Kelompok Dewasa Di Kabupaten Jombang. *Ghidza Media Jurnal*, 1(1), 53.
- Rohatin, A., & Prayuda, C. W. (2020). Hubungan Asupan Natrium, Kalium Dengan Hipertensi Pada Lansia Di Poliklinik Penyakit Dalam. *Jurnal Fakultas Ilmu Kesehatan Kuningan*, 1(1), 10-14.
- Sangadah, K. (2022). HUBUNGAN ASUPAN ZAT GIZI (NATRIUM, KALIUM, KALSIMUM, MAGNESIUM) DAN AKTIVITAS FISIK DENGAN KEJADIAN HIPERTENSI. *Nutrizione: Nutrition Research And Development Journal*, 2(3), 12- 20.
- Wati, H. H., Sutjiati, E., & Adelina, R. (2023). Hubungan Asupan Natrium, Karbohidrat, Protein, dan Lemak dengan Tekanan Darah pada Penderita Hipertensi. *Nutriture Journal*, 2(2), 114