



IMPORTANT STRATEGIES FOR PREVENTING HYPERTENSION THROUGH RISK FACTOR APPROACHES

Ali Napih Nasution*, Chrismis Novalinda Ginting, Reza Arfan Siregar

Master of Public Health, Universitas Prima Indonesia, Jl. Sekip Jl. Sikambing, Simpang, Sei Putih Timur I, Medan Petisah, Medan, North Sumatera 20111, Indonesia

*alinapihnasution@unprimdn.ac.id

ABSTRACT

Hypertension causes high morbidity (sickness) and mortality (death). Hypertension occurs as a result of interactions and various risk factors that a person has. Multiple studies have linked various risk factors to the emergence of hypertension. The research aims to determine the Essential Hypertension strategy through a risk factor approach at the Asy-Asyifa Clinic. The research design used was an analytical study with a case-control study design by selecting cases who suffered from essential hypertension and controls who did not suffer from essential hypertension. Primary data collection was carried out directly by researchers using research instruments in the form of questionnaires. In fact, the results of this study determined that age is related to the incidence of hypertension. The higher the age group, the more often the incidence of hypertension. The results of the Chi-Square statistical test with a value of $p = 0.06$ mean that there is a significant relationship between obesity and the incidence of hypertension. The results of the Chi-Square statistical test with a value of $p = 0.048$ mean that there is an essential relationship between people who smoke and the incidence of hypertension. In this study, there was no significant relationship with the Chi-Square statistical test with a value of $p = 0.020$, meaning that there was a meaningful relationship between people who consumed much salt and the incidence of hypertension. The variables influencing essential hypertension are obesity, salt consumption, and age. The dominant variable that influences essential hypertension at the Asy-Asyifa Clinic in Medan is the obesity variable. Regular exercise and a balanced diet are crucial to maintaining a healthy weight.

Keywords: essential hypertension; prevention strategy; obesity; smoke

First Received 10 December 2023	Revised 18 December 2023	Accepted 30 December 2023
Final Proof Received 18 February 2024	Published 22 February 2024	
How to cite (in APA style) Nasution, A., Ginting, C., & Siregar, R. (2024). Important Strategies for Preventing Hypertension Through Risk Factor Approaches. Indonesian Journal of Global Health Research, 6(1), 419-428. https://doi.org/10.37287/ijghr.v6i1.2689 .		

INTRODUCTION

Hypertension (High Blood Pressure). It is a disease with a comprehensive and integrated long-term impact, causing high levels of morbidity (illness) and mortality (death). The prevalence of hypertension in the world at the age of >25 years reaches 38.4%, with Indonesia having a higher prevalence compared to several countries such as Bangladesh, Korea, Nepal, and Thailand (Krishnan et al., 2011). The danger of uncontrolled hypertension can cause dangerous complications, such as coronary heart disease, stroke, kidney problems and vision problems (Ambaw, 2018). Classification of blood pressure based on normal systolic and diastolic pressure <120 systolic (mmHg) < 80 Diastolic (mmHg), Prehypertension 120-159 systolic (mmHg), 80-90 diastolic (mmHg), Stage I 140-159 systolic (mmHg), 90-99 Diastolic (mmHg), Stage II and III ≥ 160 systolic (mmHg), ≥ 100 diastolic (mmHg), (The Seventh National Committee in detection evaluation 2003).

In Indonesia, hypertension affects 25.8% of people over 18 years. The West Java province has the highest prevalence of 29.4%. Hypertension increases the risk of coronary heart disease up to 3 times, which can be further increased up to 16 times when combined with hypercholesterolemia and smoking. (Basic Health Research, 2013) (Krishnan et al. 2017). Hypertension occurs when a person's blood pressure exceeds normal limits, with diagnostic limits being systolic pressure >140 mmHg and diastolic pressure >90 mmHg. Based on recent data, the prevalence of hypertension in Indonesia at the age of >18 years reached 34.1%, with high variation between provinces (Sianturi, 2017). Hypertension is a condition where a person's blood pressure exceeds the standard limits. Worldwide, it affects 38.4% of people over 25 years old. In Indonesia, it affects 34.1% of those over 18 years old. South Kalimantan has the highest prevalence at 44.1%, and Papua has the lowest at 22.2%. Hypertension is most prevalent in the age groups of 31-44 years, 45-54 years, and 55-64 years. (Basic Health Research, 2018).

Risk factors for hypertension include age, family history, and lifestyle, such as smoking. Men have a higher risk than women. Blood pressure classification involves normal range, prehypertension, stage I, and stages II and III. Hypertension is the leading cause of death in hospitals in North Sumatra Province, with the number of deaths due to hypertension reaching 27.02% in 2017 (Solehatul et al., 2018). Both men and women face an equal risk of hypertension, with men having a higher likelihood of developing this condition than women. The risk increases for women after the age of 65 (Palmer, 2017). Individuals with a family history of hypertension, mainly primary or essential hypertension influenced by genetics, are at a higher risk. At the Asyfa Clinic in Medan City, hypertension stands out as the most prevalent health issue among both outpatients and inpatients (Hafiz Muhammad, 2016). Hypertension ranks second as the leading risk factor for ischemic heart disease caused by infarction. Hypertension is the second largest disease suffered by inpatients and outpatients at Asy-Asyifa Clinic (Lubis HR, 2018), with a high risk of stroke. Research is needed to understand the management strategy of Essential Hypertension through a risk factor approach at Asy-Asyifa Clinic.

METHOD

Researchers conducted the study at Asy-Asyifa Clinic in Medan City, selecting it for its lack of prior research on essential hypertension prevention strategies through a risk factor approach. The study lasted for four months, conducted from July to October 2022. The sampling method was purposive, where the researchers' selected cases and controls from the same population based on known risk factors for essential hypertension to minimize bias. This study used an analytic case-control study design to investigate essential hypertension. Cases with essential hypertension and controls without the condition were selected for comparison. Retrospective data were collected by examining questionnaires and diagnostic examination records to assess subjects' exposure. Primary data collection involves using questionnaires as a research instrument, a method in which respondents answer a set of questions or statements provided by the researcher (Sugiyono, 2019, p. 199). Data was collected by distributing an online questionnaire to visiting respondents via Google Forms. The Likert scale, used to measure attitudes, opinions, and perceptions, provides a structured starting point for formulating instrument items, usually questions, to assess variables of interest. Answer strongly agree (score 4), agree (score 3), don't agree (score 2), Strongly disagree (score 1) (Sugiono, 2019).

The collected data is processed and analyzed descriptively and analytically, considering the odds ratio and food test. Analyze all variables to describe each variable examined in this study

as a risk factor for hypertension. Bivariate analysis determined the correlation between the independent and dependent variables. The analysis results will identify which independent variables correlate statistically with the dependent variable (Prasetyo,2017). The data type is categorical, so the analysis technique used is chi square. Multivariate analysis was carried out to analyze risk factors that influence the incidence of hypertension through logistic regression analysis (Anisa,2016).

RESULTS

Respondents in this study totaled 140 people, consisting of 70 people suffering from essential hypertension and a control group who did not suffer from essential hypertension, 70 people, distributed according to the characteristics presented in Table 1.

Table 2.
Distribution of Characteristics of Essential Hypertension Sufferers According to Age, Education, Occupation at Asy-Asyifa Clinic Medan

Characteristics	Case		control	
	f	%	f	%
Age:				
≥ 55 Old	51	72,9	37	52,9
< 55 Old	19	27,1	33	47,1
qualification:				
1. elementary school	2	3,3	9	12,9
2. junior high school	15	21	10	14,3
3. senior high scholl	21	30	29	41,4
4. worker	32	45,7	22	31,4
Work :				
1. official	27	19,3	29	41,4
2. enterpriser	4	2,5	3	4,3
3. housewife	14	20,0	12	17,1
4. pension	25	35,7	26	37,1
Religion:				
1. Islamic	29	41,4	31	44,3
2. Kristiani Protestan	21	30,0	3	4,3
3. Katolic	20	28,6	36	51,4

Table 2 shows that among the 70 essential hypertension cases, most (72.9%) were ≥55 years old, 45.7% had university education, and 41.4% were civil servants. In addition, 41.4% were Muslim. In contrast, among the 70 controls without essential hypertension, most (52.9%) were also ≥55 years old, 41.4% had a high school education, 41.4% were civil servants, and 44.3% were Muslim.

Table 3.
Characteristics of Hypertension Sufferers According to Ethnicity

Number	Clan	casus		control	
		f	%	f	%
1	mandailing	1	1,4	-	7
2	pakpak	10	14,3	9	12,9
3	minang	7	10,0	5	7,1
4	Batak toba	39	55,7	33	47,1
5	jawa	2	2,9	9	12,9
6	karo	8	11,4	5	7,1
7	aceh	1	1,4	-	2,9
8	nias	-	-	3	4,3
9	melayu	1	1,4	2	72
10	simalungun	-	-	3	4,3
11	padang	1	1,4	1	1,4

Table 3, it is evident that among the 70 cases of hypertension sufferers, the majority (55.7%) belonged to the Toba Batak tribe. Conversely, among the 70 controls without essential hypertension, the majority (47.1%) were also from the Toba Batak tribe.

Table 4.
Distribution of the Proportion of Essential Hypertension Cases and Controls Based on Age Variables at the Asy-Asyifa Clinic in Medan

No	Age (Year)	Casus		Control		Total	P Value	OR 95% (CI)
		F	%	F	%			
1	> 55	51	72,9	37	52,9	88	0,023	2,394
2	<55	19	27,1	33	47,1	51		(1,182-4,848)
Total		70	100	70	100	140		

Table 4 showed that hypertension was more prevalent in individuals aged 55 or above, with 72.9% cases, compared to 47.1% controls in the same age group (<55). Statistical tests revealed a significant correlation between age and hypertension ($p < 0.05$). Those aged 55 or above were 2.394 times more likely to develop essential hypertension than those under 55, with a statistically significant confidence level of 95%.

Table 5.
Distribution of Proportions of Essential Hypertension Cases and Controls Based on Obesity Variables at Asy-Asyifa Clinic Medan

No	Obesitas	casus		control		Total	P Value	OR 95% (CI)
		f	%	f	%			
1	obesity	37	52,9	20	28,6	57	0,006	2,803
2	Dont obesity	33	47,1	50	71,4	83		(1,393-5,641)
Total		70	100	70	100	140		

Table 5 showed that hypertension was more common in obese individuals, at 52.9% than in those with a lean body type, at 71.4%. The P value was < 0.05 , indicating a significant association between obesity and essential hypertension. The Odds Ratio (OR) of 2.803 suggested that people with hypertension were 2.083 times more likely to be obese. This finding was significant at a 95% confidence level..

Tabel 6.
Distribusi Proporsi Kasus Hipertensi Esensial dan Kontrol Berdasarkan Variabel Rokok di Klinik Asy-Asyifa Medan

No	Smoking	casus		control		Total	P Value	OR 95% (CI)
		F	%	F	%			
1	Smoke	29	41,4	17	24,3	46	0,048	2,205 (1,069-4,550)
2	Don't Smoke	41	58,6	53	75,7	94		
Total		70	100	70	100	140		

Smoking was found to be significantly associated with essential hypertension, based on Table 6. The prevalence of essential hypertension in smokers was 41.4% in cases, compared to 75.7% in non-smoking controls. The Odds Ratio was 2.205, indicating that individuals with essential hypertension were 2.205 times more likely to be smokers. This association was considered statistically significant at the 95% confidence level.

Table 7.

Distribution of the Proportion of Essential Hypertension Cases and Controls Based on Alcohol Variables at the Asy-Asyifa Clinic in Medan

No	Alkohol	casus		control		Total	P Value	OR 95% (CI)
		f	%	f	%			
1	Drink alcohol	14	20,0	8	11,4	22		
2	Dont alcohol	56	80,0	62	88,6	118		
Total		70	100	70	100	140		

Table 7. The incidence of hypertension is less in controls for people who drink alcohol, namely 20.0%, while in the case of people who do not drink alcohol, it is 88.6%. The study found that essential hypertension is significantly associated with alcohol consumption ($P < 0.05$). Individuals with essential hypertension are 1.938 times more likely to have consumed alcohol than non-drinkers at a 95% confidence level. The OR value is in the interval 756-4.964.

Table 8.

Distribution of Proportions of Essential Hypertension Cases and Controls Based on Salt Consumption Variables at Asy-Asyifa Clinic Medan

No	Consumption salt	Kasus		Kontrol		Total	P Value	OR 95% (CI)
		f	%	f	%			
1	Lost	68	97,1	69	84,3	127	0,020	6,339 (1,350- 29,761)
2	Little	2	2,9	11	15,7	13		
Total		70	100	70	100	140		

Table 8 shows that people who consume more salt have a much higher incidence of hypertension (97.1%) than those who consume less salt (15.7%). The statistical test yielded a P value of < 0.05 and an Odds Ratio of 6.339, indicating that those with essential hypertension are 6,339 times more likely to have consumed more salt. At a 95% confidence level, the odds ratio (OR) falls between 1.350 and 29.761.

Table 9.

Risk factors for essential hypertension with cases and controls without essential hypertension at the Asy-Asyifa Clinic in Medan.

Variabel	casus		control		P Value
	f	%	f	%	
Age					
> 55	51	72,9	37	42,9	0,023
< 55	19	27,1	33	47,1	
Obesity					
lost	37	52,9	20	28,6	0,006
fast	33	47,1	50	71,4	
Consumption salt					
Lost	68	97,1	59	84,3	0,020
Littel	2	2,9	11	15,7	
smock					
smocking	29	41,4	17	24,3	0,048
Dont smock	41	56,8	53	75,7	
Alcohol					
Drink alcohol	14	20,0	8	11,4	0,246
Dont drik alcohol	56	80,0	62	88,6	

Analisis Multivariat In this modeling, all candidates are tried together, then. Variables with a P value » of 0.05 will be removed sequentially, starting from the most significant P value (Backward Selection), starting from the variables smoking and drinking alcohol.

Table 10.

Multiple Logistic Regression Test to Identify Variables That Will Be Included in the Model with a P Value < 0.05

Variabel	B	P	OR	95% CI
Age	-1,370	0,001	0,254	111-583
Obesity	-1,416	0,001	0,243	106-557
Smoke	-655	0,130	0,519	223-1,212
Drink Alcohol	676	0,243	1,967	632-6,118
Consumption salt	-3,266	0,003	0,38	0,00-0,333
constant	3,539	0,026	34,430	

After gradually removing variables with a p value < 0.05, we obtained three variables that would be included as candidate models, namely: Salt Consumption, Obesity, Age, the results in. The results of this research are in line with research conducted by Paat (2014) entitled The Relationship Between Alcohol Consumption and Smoking Status and the Incident of Hypertension in Men Aged 40-65 Years in Motoling 2 Village, Motoling District, South Minahasa Regency, which was obtained from respondents who smoked with a history of hypertension. totaling 71 respondents (53.0%), with the results of the Chi Square statistical test proving that there is a relationship between smoking status and the incidence of hypertension in men aged 40-65 years with a value of $p = 0.001$. Or ≤ 0.05 . Smoking is one of them factors that trigger hypertension. With smoking it is related to the amount cigarettes smoked in a day and how much can you spend Price & Wilson. (2013).

Table 11.

Multiple Logistic Regression Test Results to Identify Variables That Will Be Included in the Risk Factor Model for Essential Hypertension at the Asy-Asyifa Clinic.

Variabel	B	P	OR	95% CI
Salt Consumption	-32,253	0,03	0,039	0,004-0,337
Obesity	-1,285	0,03	0,277	0,124-0,615
Age	-1,206	0,02	0,029	0,136-0,660
constant	4,406	0,00	81,904	

Overall percentage 64.3%. Then you get fashion! logistic regression in the form of the following equation:

With this equation model we can estimate the risk factors for logistic events (risk factors for essential hypertension):

$$Y = 4406 - 3253 x_1 - 1285 x_2 - 1,206 x_3$$

X1: Consumption salt

X2: Obesity

X3 : Age

Overall this model can predict. The high/low influence of risk factors in relation to the incidence of essential hypertension was 64.3% (overall percentage 64.3%).

DISCUSSION

Relationship between age and the incidence of essential hypertension

The Chi-Square test showed a significant association between age and hypertension ($p=0.023$). Essential hypertension is 2.394 times more likely to occur in people aged ≥ 55 than those aged < 55 , with a 95% confidence interval of 1.182-4.848. Age is a significant factor influencing hypertension incidence, especially in older age groups. In addition, this study aligns with previous studies, such as those conducted by WHO (1978) and FE. Susilat and Keplan (1994) highlighted the correlation between age and coronary artery-related problems, especially in male patients..

Relationship between obesity and the incidence of essential hypertension

Obesity is significantly associated with hypertension, according to a recent study. The Odds Ratio indicates that hypertensive individuals are 2.083 times more likely to be obese than those without obesity. A higher BMI correlates with an increased risk of hypertension. Obesity, defined as $BMI \geq 27$, is a risk factor for hypertension, characterized by increased cardiac output and blood circulation. Individuals who are overweight or obese by more than 20% above regular body weight face double the risk of hypertension compared to non-obese individuals (Anggara, 2013). This is different according to the Indonesian Ministry of Health (2014) regarding World Hypertension Day which states that stress causes hypertension. In the walls of the heart and several blood vessels there is a receptor that always monitors changes in blood pressure in the arteries and veins. If it detects changes, these receptors will send a signal to the brain so that blood pressure returns to normal. The brain responds to these signals by releasing hormones and enzymes that affect the work of the heart, blood vessels and kidneys. When stress occurs, what is released is the hormone epinephrine or adrenaline. This hormonal activity increases blood pressure periodically. If stress is prolonged, the increase in blood pressure becomes permanent. The results of this study are in line with research conducted by Lidia (2018) which shows the test results statistics with the obtained Chi Square p-value 0.071 ($p\text{-value} > 0.05$) which meaning there is no relationship between levels stress with the incidence of hypertension in Elderly at the Inpatient Health Center Cempaka.

Relationship between smoking and essential hypertension

This study showed a significant relationship between smoking and hypertension, as evidenced by the Chi-Square statistical test with a p-value of 0.048. The Odds Ratio (OR) of 2.205 indicates that individuals with essential hypertension are 2.205 times more likely to be smokers than non-smokers. Research conducted by Jose Roesma supports this relationship. Cigarette smoke contains over 4000 harmful chemicals, directly increasing heart rate and blood pressure and causing cardiovascular complications. Nicotine in cigarettes triggers the release of adrenaline, leading to abnormal functioning of the heart, nerves, and brain. Experts such as Dr. Logan Clendening and Dr. Emil Bogen emphasize the narrowing of blood vessels and increased blood pressure caused by smoking, with long-term effects contributing to the formation of atheroma in the arteries. Smoking is implicated in renal artery problems, leading to severe hypertension, especially in elderly patients with arterial disease Lidia, Rina (2018).

Relationship of Alcohol to the Incident of Essential Hypertension

The study found no significant relationship between alcohol consumption and the incidence of essential hypertension, as indicated by a p-value greater than 0.05. In some cases, only 20% reported alcohol consumption, whereas in controls who did not have essential hypertension, the percentage was 86.6%. The Odds Ratio (OR) of 1.938 suggests that individuals with essential hypertension are 1.938 times more likely to have a history of alcohol consumption compared to those who do not, with a 95% confidence interval between 0.756 and 4.964. The research aligns with Hendra Budiman's study, revealing a rise in average blood pressure with alcohol intake exceeding three glasses per day. Leonard M. also associates alcohol with disruptions in carbohydrate metabolism, increased blood pressure, thrombosis risk, and heightened catecholamine synthesis. High blood pressure may be caused by excessive alcohol consumption. To reduce blood pressure, limit alcohol intake to two units per day. Regular blood tests can help detect potential issues related to alcoholism (Alphonse, 2018).

Essential Relationship between salt consumption and the incidence of essential hypertension

The study revealed a significant association between high salt consumption and the incidence of hypertension. In some cases, 97.1% reported consuming much salt, whereas only 2.9% of controls had a similar habit. The Chi-Square statistical test yielded a p-value of 0.020, indicating this strong correlation. The Odds Ratio (OR) of 6.339 suggests that individuals with essential hypertension are 6.339 times more likely to have a history of consuming much salt compared to those who consume less. The 95% confidence interval for the OR value is between 1.350 and 29.761. Consistent with Sidabutar R.P. and Wigono's research in 1990, salt intake ranging from 5 to 15 grams per day was linked to an increased prevalence of hypertension. High sodium intake can lead to hypertension, but individual sensitivity to sodium varies and can be influenced by genetics. Populations with low salt intake, such as the Eskimo population, have a lower incidence of hypertension. An internal study found a standardized relationship between sodium intake and blood pressure in over 10,000 people aged 20 to 59 from 52 research centers, taking into account age, gender, body mass index, and alcohol consumption (Novitasary M D, 2018).

Essential The Most Dominant Risk Factors for Essential Hypertension

logistic regression analysis found three significant factors influencing essential hypertension: Salt Consumption, Obesity, and Age. Obesity was the most critical predictor variable, having the highest Odds Ratio (OR) value. A higher OR means a greater likelihood of the exposure factor contributing to hypertension. These OR values were adjusted for other variables, revealing obesity as a crucial determinant in hypertension development..

Essential Hypertension Prevention Strategy Through Obesity Risk Factor Approach at Asy-Asyifa Clinic

1. Avoid overweight (obesity) Avoid overweight (obesity) by maintaining a normal or not excessive body weight.

Limiting fat consumption is essential to maintain optimal blood cholesterol levels and prevent potential health risks. Elevated blood cholesterol can obstruct arteries over time, impeding blood circulation and exacerbating hypertension. The American Heart Association recommends restricting dietary cholesterol intake to no more than 300 mg per day to reduce the likelihood of cholesterol-related complications.

2. Regular exercise

For hypertension sufferers, it is recommended to do dynamic exercise, namely: Exercise that does not use too much energy, for example brisk walking, Jogging), swimming, cycling with dynamic exercise will improve blood flow to the muscles, and improve muscle metabolism.

CONCLUSION

Research conducted at the Asy-Asyifa Clinic in Medan reveals a significant association between essential hypertension and three factors: obesity, age, and salt consumption. The study indicates that individuals aged ≥ 55 years are 2.394 times more likely to develop essential hypertension compared to those aged < 55 years. Similarly, obesity is identified as a considerable risk factor, with individuals categorized as obese being 2.803 times more prone to essential hypertension than non-obese counterparts. Additionally, high salt consumption exhibits a substantial link, as those who consume a lot of salt face a 6.339 times higher likelihood of essential hypertension than those with lower salt intake. These findings emphasize the importance of addressing modifiable factors, specifically advocating for achieving normal body weight and reducing salt intake to less than 15 grams per day for individuals with hypertension. In summary, the influential variables identified in this study are obesity, salt consumption, and age, with obesity emerging as the dominant predictor of

essential hypertension at the Asy-Asyifa Clinic in Medan.

REFERENCES

- Anonymous. (2020). North Sumatra Health Profile 2000, Level I Health Service Office.
- Ambaw et al. 2018. Adherence to Antihypertensive treatment and associated factors among patients on Follow Up at University of Gondar Hospital, Northwest Ethiopia, Vol.12, No,282, Hal 1-6
- Annisa, A Fitria, 2016, Faktor yang Berhubungan dengan Kepatuhan Berobat Hipertensi pada Lansia di Puskesmas Pattingallong Kota Makasar. Universitas Hassanuddin.
- Anggara, Febby Dwi & Nanang. (2013). Faktor faktor yang Berhubungan dengan Tekanan Darah Tinggi di Puskesmas Telaga Murni, Cikarang Barat Tahun 2012. Jurnal Ilmiah Kesehatan. Vol.5. No 1.
- Alphonse, Angelina. 2018. Factors Affecting Treatment Compliance Among Hypertension Patients In Three District Hospital – Dar Es Salaam. Disertasi: Universitas. Muhimbili.
- Budiman, H. (2019). The Role of Nutrition in the Prevention and Management of Hypertension. Medika, No. 12.
- Bustan, M. N. (2020). Epidemiology of Non-Communicable Diseases. PT. Rineka Cipta Jakarta.
- Gunawan, Lanny. (2019). High Blood Pressure Hypertension. Kanisius Publishers.
- Hul, A. (2020). Heart Disease Hypertension and Nutrition. Translator Wendra Ali. Bumi Aksara Jakarta.
- Kaplan, N. M. (2018). Systematic Hypertension Mechanism and Diagnosis. Philadelphia: Saunders Company.
- Kaplan, N. M. (2019). Primary Hypertension Pathogenesis in Clinical Hypertension.
- Kemenkes RI. (2014). Hari Hipertensi Sedunia. www.depkes.go.id.
- Kumar V., Abbas AK., Fausto N. 2005. Hypertensive Vascular Disease. Dalam: Robin and Cotran Pathologic Basis of Disease. Edisi ke-7. Philadelphia: Elsevier Saunders .p 528-529.
- Hafiz. Muhammad bin Mohd Arifin. (2016). Faktor-Faktor Yang Berhubungan Dengan Kejadian Hipertensi Pada Kelompok Lanjut Usia Di Upt Puskesmas Petang I Kabupaten Badung Tahun 2016. E-Jurnal Medika Udayana Volume 5 Nomor 7
- Lidia, Rina (2018). Hubungan Tingkat Stres Dengan Kejadian Hipertensi Pada Lansia di Puskesmas Rawat Inap Cempaka. Jurnal Keperawatan Suaka Insan (JKSI). Voume 3 No. 1 (2018)

- Novitasary M D, Mayulu N, Kawengian S E S., 2013. Hubungan Antara Aktivitas Fisik dengan Obesitas pada Wanita Usia Subur Peserta Jamkesmas di Puskesmas Wawonasa.
- Prasetiyo. (2017). Hubungan tingkat Pengetahuan Tentang Hipertensi dengan Upaya Pencegahan Kekambuhan Hipertensi Pada Lansia Di desa Blulukan Kecamatan Colomadu Kabupaten Karanganyar. Surakarta : UMS
- Palmer, Anna dan Williams. 2017. Tekanan Darah Tinggi. Jakarta. Erlangga.
- Paat, Ivana, G.O. (2014). Hubungan Antara Konsumsi Alkohol Dan Status Merokok Dengan Kejadian Hipertensi Pada Laki-laki Usia 40-65 Tahun Di Desa Motoling 2 Kecamatan Motoling Kabupaten Minahasa Selatan.
- Price & Wilson. (2013). Patofisiologi, Konsep Klinis Proses-Proses Penyakit Edisi 6. Jakarta: EGC
- Sidabutar, R. P., & Wigono, P. (2019). Internal Medicine Volume H, Hall's Essential Publisher FK-UI Jakarta.
- Sastroasmoro et al. (2020). Basics of Clinical Research Methodology. II Edition.
- Tommy, Steven Johannes. (2019). Essential Hypertension: Latest Diagnosis and Treatment in Adults. Faculty of Medicine and Health Sciences, University of Indonesia, Jakarta, Indonesia vol. 46, no. 3 years. 2019.
- World Health Organization (WHO). (2019). For Management of Hypertensions Sub Committee, 3. Hypertension