

STUDY OF DOMINANT RISK FACTORS OF HYPERTENSION IN INDONESIAN: LITERATURE REVIEW

*(Studi Literatur: Faktor-faktor Risiko yang Dominan pada Kejadian
Hipertensi di Indonesia)*

Farah Nadiyah^a, Dwie Soelistyorini^b, Sutomo Rum Teguh Kaswari^a, Rany Adelina^{a*}

^aUndergraduate Program in Applied Nutrition and Dietetics, Department of Nutrition, Poltekkes Kemenkes Malang, Malang, East Java, Indonesia

^bD3 Nutrition Study Program, Department of Nutrition, Poltekkes Kemenkes Malang, Malang, East Java, Indonesia

* Penulis korespondensi

Email: rany_adelina@poltekkes-malang.ac.id

ABSTRACT

Hypertension is a condition when the circulating blood pressure is too high. Hypertension is often referred to as the silent-killer because the symptoms are often without complaints so the patient does not know he has hypertension and only known after complications occur. Given its high prevalence and affecting the quality of human resources. This research aimed to assess various factors that influence the incidence of hypertension. This research used a systematic review with the Preferred Reporting Items for Systematic Reviews and Meta-analyses methods. The total number of journals screened was 1.107 journals and 147 journals were identified. After being identified, 25 journals were obtained based on the inclusion criteria to be included in the systematic review. The research used secondary data from Riskesdas 2018 and then analyzed using 25 accredited national journal articles. The library search strategy obtained comes from databases, namely Google Scholar, Researchgate, Pubmed, Science Direct, and Scopus published in 2017-2021. Data analysis was carried out by examining in depth to find similarities and differences in research findings, then adding the latest relevant findings and synthesis of researchers. The results showed that the risk factors for hypertension were divided into 2, namely modifiable risk factors and non-modifiable risk factors. The most dominant risk factor for hypertension in modifiable risk factors is family history. Meanwhile, the most dominant non-modifiable factor is diet (fat consumed). Of the various risk factors that exist, the most dominant risk factor in the incidence of hypertension in Indonesia is fat consumption.

Keywords: factor, dominant, hypertension, Indonesia

ABSTRAK

Hipertensi adalah suatu kondisi ketika tekanan darah terlalu tinggi. Hipertensi sering disebut sebagai silent-killer dikarenakan gejalanya seringkali tanpa keluhan sehingga penderita tidak mengetahui dirinya mengidap hipertensi dan baru diketahui setelah terjadi komplikasi. Mengingat prevalensinya yang tinggi dan mempengaruhi kualitas sumber daya manusia. Penelitian ini bertujuan untuk mengkaji berbagai faktor yang mempengaruhi kejadian hipertensi. Penelitian ini menggunakan sistematik review dengan metode Preferred Reporting Items for Systematic Review dan Meta-analisis. Jumlah keseluruhan jurnal yang discreening sebanyak 1.107 jurnal dan teridentifikasi sebanyak 147 jurnal. Setelah diidentifikasi, diperoleh 25 jurnal berdasarkan kriteria inklusi untuk diikutsertakan dalam sistematik review. Penelitian ini menggunakan data sekunder Riskesdas 2018 yang kemudian dianalisis menggunakan 25 artikel jurnal nasional terakreditasi. Strategi pencarian pustaka diperoleh dari database yaitu Google Scholar, Researchgate, Pubmed, Science Direct, dan Scopus yang diterbitkan tahun 2017-2021. Analisis data dilakukan dengan menelaah secara mendalam untuk menemukan persamaan dan perbedaan temuan

penelitian, kemudian menambahkan temuan terbaru yang relevan dan sintesis peneliti. Hasil penelitian menunjukkan bahwa faktor risiko hipertensi dibagi menjadi 2 yaitu faktor risiko yang dapat dimodifikasi dan faktor risiko yang tidak dapat dimodifikasi. Faktor risiko hipertensi yang paling dominan pada faktor risiko yang dapat dimodifikasi adalah riwayat keluarga. Sedangkan faktor yang tidak dapat dimodifikasi yang paling dominan adalah diet (lemak yang dikonsumsi). Dari berbagai faktor risiko yang ada, faktor risiko yang paling dominan terhadap kejadian hipertensi di Indonesia adalah asupan lemak.

Kata kunci: faktor, dominan, hipertensi, Indonesia

INTRODUCTION

The past few years have seen an epidemiological transition. Epidemiological transition is a change in the pattern of disease and death which was initially dominated by infectious diseases and turned into non-communicable diseases. One of the diseases that has become a serious problem lately is hypertension. Hypertension is still a major problem in the world, both in developing countries including Indonesia and in developed countries. The World Health Organization (WHO) has estimated that by 2025, approximately 1,5 billion people in the world will have hypertension each year and causing 8 million deaths per year worldwide and 1,5 million deaths every year in the Southeast Asia region (Kemenkes, 2019). Result data Riskesdas (2018) shows that the prevalence of hypertension based on measurement results in the population aged 18 years in Indonesia has increased from 2013 to 2018 from 25,8% to 31,7% (Riskesdas, 2018).

The high prevalence of hypertension in Indonesia can cause quite severe complications, as well as affect a fairly large increase in health costs and affect the quality of human resources (Kemenkes, 2019). So it is very necessary to have a control program. However, hypertension can be prevented by knowing the risk factors. Based on the etiology, there are two risk factors cause hypertension, namely non-modifiable risk factors such as age, gender, and heredity/genetic, and modifiable risk factors such as obesity, smoking, lack of physical activity, excessive salt consumption,

dyslipidemia, alcohol consumption, and psychosocial and stress (Lewis et al., 2007). Based on this background, the authors want to know the dominant risk factors associated with the incidence of hypertension, so that early prevention of the disease can be done.

METHOD

This study uses a systematic review with the Preferred Reporting Items for Systematic Reviews and Meta-analyses method or commonly called PRISMA. The literature search steps are (1) Determining the topic, (2) Formulating the Population, Exposure, Outcome, and Study Design (PEOS). The PEOS formula is presented in Table 1. (3) Create keywords. (4) Searching for literature in the database according to the keywords that have been created. (5) Document search results in the PRISMA flow chart. Diagram Drawing flow Literature Review presented in Figure 1.

Data processing is done by grouping and analyzing data based on risk factors for hypertension that cannot be changed and risk factors that can be changed. Each risk factor is sorted by the level of Odd Ratio (OR) from the highest to the lowest so that the dominant risk factor is obtained.

RESULT & DISCUSSION

Participants

Respondents in this review were all patients with hypertension in all regions in Indonesia. The majority of study respondents numbered above 50 people. The lowest number of study respondents was 30 people

and the highest number of respondents was 416 people. The total respondents from the

Table 1. PEOS Format in Literature Review

Population	Patients with hypertension in Indonesia
Exposure	Risk factors
Outcome	Dominant risk factors for hypertension in Indonesia
Study Design and publication type	Quantitative, case-control, and cross-sectional design
Publication years	2017 – 2021
Language	Indonesia

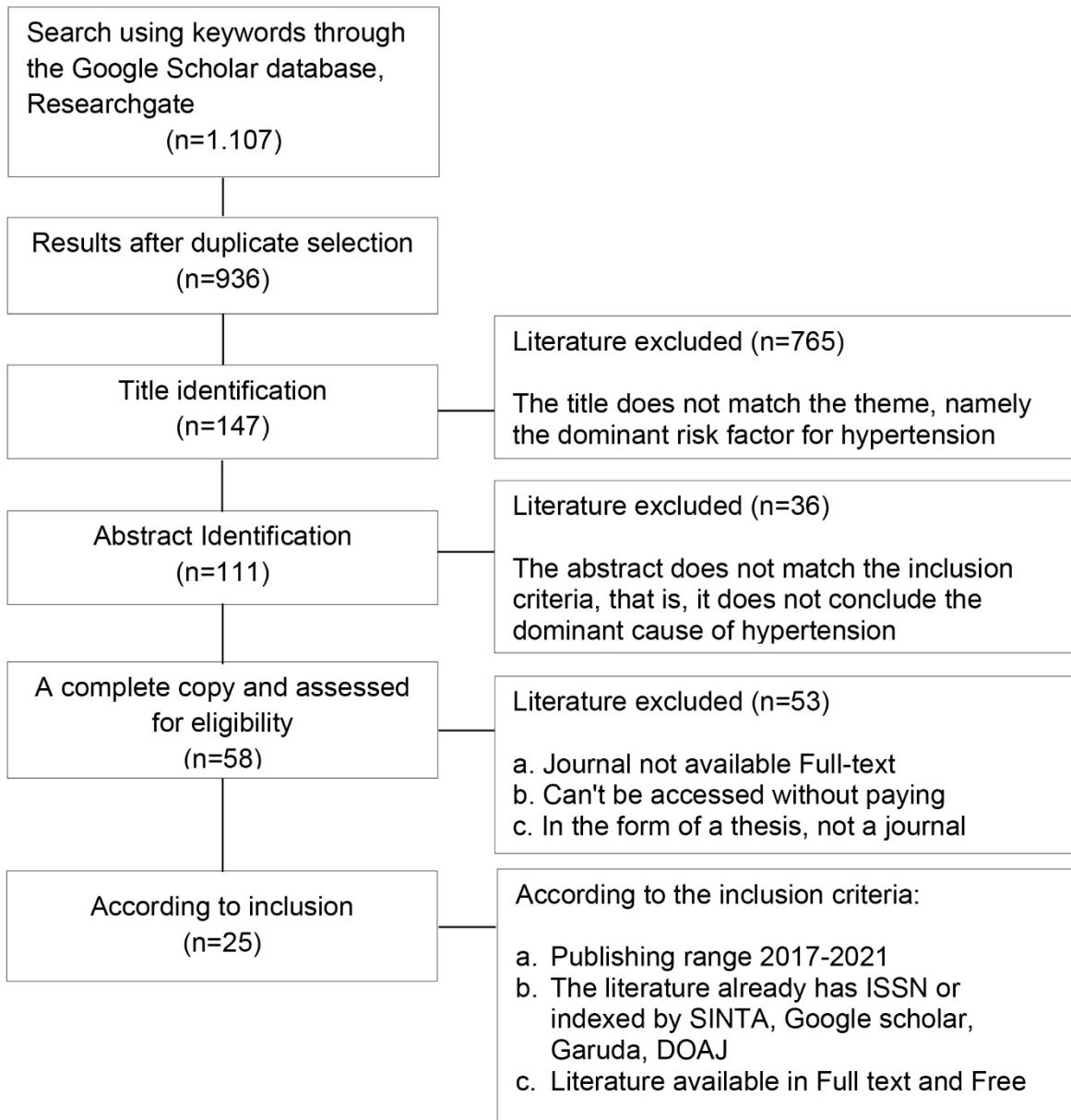


Figure 1. Flowchart Literature Review Based on PRISMA 2009

literature findings were 3,731 people, with an average age of 20-70 years. The gender of majority of respondents is male, and the nutritional status of majority of respondents is obese and has a poor lifestyle. These unfavorable lifestyles include a lack of physical activity, consumption of sodium, coffee, and excessive amounts of alcohol. The results of the literature search are presented in Table 2 and Table 3.

Risk Factors Associated with Hypertension

Based on the results of a literature study on publications, several risk factors for hypertension are described, namely:

Non-Modifiable Risk Factors

Age

Based on the results of the literature study, there was a significant relationship between the age factor and the incidence of hypertension. The results of statistical tests on an average person with the age of more than 40 years have a risk of developing hypertension 1-9,63 times riskier (Agustina et al., 2018; Ekarini et al., 2020; Nuraeni, 2019; Oktaviarini, Hadisaputro, & Chasani, 2019; Piter Sinaga & Silvia Vera, 2019; Rizkiah, 2017; Sartik et al., 2017).

With increasing age, there were changes in the arteries in the body to become wider and stiffer which results in reduced capacity and recoil of blood accommodated through the blood vessels. This reduction causes the systolic pressure to increase. Increasing age also disrupts neurohormonal mechanisms such as the renin-angiotensin-aldosterone system and also causes increased peripheral plasma concentrations and also the presence of Glomerulosclerosis due to aging and intestinal fibrosis resulting in increased vasoconstriction and vascular resistance, resulting in increased blood pressure (Nuraeni, 2019).

However, in the research results of Agustina et al., (2018) and Oktaviarini et al., (2019), there was no significant relationship between age and risk factors for hypertension. This is contrary to the theory and the results of other studies which state

that with increasing age, a person's blood pressure increases where age > 40 years is the dominant factor that affects hypertension (Dwi Anggara & Prayitno, 2013). This is also due to hormonal changes, stress, fatigue, and uncontrolled eating patterns.

Gender

Based on the results of the literature study, there was a significant relationship between gender and the incidence of hypertension. The male gender has a risk of about 1,07 – 7,6 times higher for hypertension compared to the female sex (Angesti et al., 2018; Arda et al., 2018; Ekarini et al., 2020; Nuraeni, 2019; Oktaviarini et al., 2019; Piter Sinaga & Silvia Vera, 2019; Rizkiah, 2017; Sartik et al., 2017).

Research result from Oktaviarini, et al., (2019) stated that the male gender has a risk 6,58 times the risk of developing hypertension compared to women. This is because plasma renin activity (prorenin and renin levels) in men is usually higher than in women, which will affect the synthesis of AT II in the renin-angiotensin system [16]. In addition, testosterone can directly stimulate sodium reabsorption through the proximal renal tubule. Androgen receptors localized to the proximal renal tubule can affect the synthesis of components of the Renin-Angiotensin System (RAS) thereby causing an increase in the production of AT II in the kidney and thereby affecting blood pressure. According to research from Sullivan & Gillis, (2016) has identified several possible mechanisms of increased blood pressure associated with sex. This relates to the impact of different roles on the immune system of women and men. The strong anti-inflammatory immune profile in women may play a role in limiting the rise in blood pressure. Whereas in men, the immune profile tends to be weaker so there was a gap in the mechanism of increasing blood pressure (Sullivan & Gillis, 2016).

Family History

Based on the results of the literature study, there was a significant relationship

Table 2. Literature Study Results

No	Risk Factor	Literature
1.	Non-modifiable risk factors associated with the incidence of hypertension: a. Age (1 - 9.63) b. Gender (1.07 – 7.6) c. Family history (0.117 – 13.3)	Agustina <i>et al.</i> , (2018); Andika & Safitri, (2019); Angeline <i>et al.</i> , (2020); Angesti <i>et al.</i> , (2018); Arda <i>et al.</i> , (2018); Doanaresta <i>et al.</i> , (2020); Maita, (2017); Musfirah & Masriadi, (2019); Nuraeni, (2019); Oktaviarini, Hadisaputro, Chasani, <i>et al.</i> , (2019); Piter Sinaga & Silvia Vera, (2019); Rizkiah, (2017); Sartik <i>et al.</i> , (2017); Tri Solehaini <i>et al.</i> , (2018)
2.	Modifiable risk factors associated with hypertension are: a. Dietary habit – Sodium Consumption (0.41-17.62) – Consumption of Potassium (1.15-2.32) – Fat Consumption (1.13-32.3) b. Smoking behavior (0.417-3.89) c. Obesity (0.46-12.16) d. Physical activity (0.24-2.11) e. Oral Contraceptives (3.8-10.5) f. Education (1.5-2.39) g. Stress (0.63-10.92) h. Caffeine (1.12-4.9) i. Alcohol (0.6-11.91)	Agustina <i>et al.</i> , (2018); Andika & Safitri, (2019); Angeline <i>et al.</i> , (2020); Angesti <i>et al.</i> , (2018); Arda <i>et al.</i> , (2018); Ayuningtiyas & Sari, (2021); Doanaresta <i>et al.</i> , (2020); Ekarini <i>et al.</i> , (2020); Kartika <i>et al.</i> , (2021); Kurnianingtyas <i>et al.</i> , (2017); Maita, (2017); Mayasari <i>et al.</i> , (2018); Musfirah & Masriadi, (2019); Nirwana Perangin-angin, (2020); Nuraeni, (2019); Oktaviarini <i>et al.</i> , (2019); Piter Sinaga & Silvia Vera, (2019); Putu Sudayasa & Rahayu Safitriyas Yasin, (2017); Rizkiah, (2017); Salman <i>et al.</i> , (2020); Sartik <i>et al.</i> , (2017); Simamora <i>et al.</i> , (2019); Tri Solehaini <i>et al.</i> , (2018); Yulia & Nuzula, (2019); Yulistina <i>et al.</i> , (2017)

between genetic factors in families who have a history of hypertension and the incidence of hypertension. In addition, based on the results of statistical tests, an average person with a nuclear family history of hypertension has a risk between 0,117 – 13,3 times the risk of developing hypertension (Agustina *et al.*, 2018; Andika & Safitri, 2019; Angesti *et al.*, 2018; Arda *et al.*, 2018; Doanaresta *et al.*, 2020; Ekarini *et al.*, 2020; Maita, 2017; Musfirah & Masriadi, 2019; Nuraeni, 2019;

Piter Sinaga & Silvia Vera, 2019; Sartik *et al.*, 2017; Simamora *et al.*, 2019; Tri Solehaini *et al.*, 2018).

Genetic factors that have a role in the incidence of hypertension, give two forms of hypertension, namely hypertension that is inherited by Mendelian or called monogenic hypertension and hypertension that is influenced by many genes (polygenic hypertension). Monogenic hypertension (monogenic hypertension) has been

Table 3. Original Article Included in Review

No	Authors and years	Study design, sample, variable, instrument, analysis	The outcome of the analysis factors	Summary of results	JBISkor
1	Agustina et al., (2018)	Design: A case-control Sample: 50 Variable: Risk factors for hypertension in women of reproductive age Instruments: Questionnaires and Health Office data Analysis: chi-square and binary Logistics	Obesity, exercise, alcohol consumption, stress, family history, age.	The most influential (dominant) risk factor in the incidence of hypertension is heredity and there is a relationship between obesity, stress, and family history.	70%
2	Angesti et al., (2018)	Design: Cross-sectional Sample: 152 Variable: Instrumen: sphygmomanometer, microtoise, digital scales, form Food Frequency Questionnaire (FFQ), questionnaire Perceived Stress Scale, questionnaire Physical Activity Questionnaire for Adolescents (High Senior School) Analysis: chi-square and multiple logistic regression	Nutritional status (BMI/U), nutritional intake (intake of sodium, fat, potassium, and calcium, consumption of fruit and vegetables), lifestyle factors (duration of sleep, stress, and physical activity), gender and family history of hypertension.	There is a significant relationship between family history and BMI/U with the incidence of hypertension.	87%
3	Arda et al., (2018)	Design: A case-control Sample: 202 Variable: A hypertension risk factor in Public Health Center Instruments: medical records, questionnaires Analysis: Odd Ratio (OR) test chi-square	Occupation, gender, smoking behavior, history of hypertension coffee consumption.	Family history is the dominant factor for hypertension.	60%
4	Maita, (2017)	Design: cross-sectional. Sample: 176 Variable: Determinants of hypertension in the elderly Instrument: Questionnaire Analysis: multiple logistic regression.	History of hypertension, salt consumption patterns, body mass index, smoking habits, physical activity.	There is a relationship between a history of hypertension and the incidence of hypertension and there is no relation with other variables.	75%

Table 3. Original Article Included in Review (Continued)

No	Authors and years	Study design, sample, variable, instrument, analysis	The outcome of the analysis factors	Summary of results	JBI Skor
5	Musfirah & Masriadi, (2019)	Design: case control Sample: 68 Variable: Analysis of hypertension risk factors in Puskesmas Instrument: -Analysis: chi-square and Odd Ratio (OR)	Family history, education level, income level, physical activity.	Family history is the dominant factor in the incidence of hypertension.	60%
6	Andika & Safitri, (2019)	Design: cross-sectional Sample: 774 Variable: a risk factor for hypertension in General Hospital Instruments: - Analysis: chi-square test	Age, gender, occupation, stress, coffee consumption, obesity, and family history.	There is a significant relationship between age, obesity, and family history with the incidence of hypertension and the most dominant risk factor is a family history.	75%
7	Nuraeni, (2019)	Design: cross-sectional Sample: 210 Variables: Age and gender are at risk for the incidence of hypertension Instruments: questionnaire and measurement of blood pressure, weight, and height Analysis: chi-square. statistic test	Age, income, heredity, sport, occupation, and education.	Factors associated with hypertension are age, opinion, and heredity. Whereas The most dominant factor is age.	87%
8	Oktaviarini et al., (2019)	Design: a case-control Sample: 76 Variables: Risk factors for hypertension in employees Instrument: -Analysis: Regression	Age, gender, family history, smoking habits, type of work, years of service, workload, sedentary behavior, coffee drinking habits.	Significant risk factors with hypertension are gender and type of work, sedentary behavior.	70%

Table 3. Original Article Included in Review (Continued)

No	Authors and years	Study design, sample, variable, instrument, analysis	The outcome of the analysis factors	Summary of results	JBI Skor
9	Rizkiah, (2017)	Design: a case-control Sample: 278 Variables: Sociodemography and physical activity with the incidence of hypertension in pre-adolescents Instrument: Questionnaire Analysis: Chi-Square	Age, gender, knowledge, type of work, sports activities, smoking.	The results showed that there was a significant relationship between age, gender, knowledge, sports activities, and smoking with the incidence of hypertension in pre-marital sex.	70%
10	Ekarini et al., (2020)	Design: cross-sectional Sample: 70 Variable: Factors related to hypertension in adulthood Instrument: Questionnaire Analysis: chi-square and multiple logistic regression	Age, gender, genetics, obesity, smoking, lack of physical activity, excessive salt consumption, psychosocial and stress.	There is a relationship between age and lack of physical activity with the incidence of hypertension and the most dominant variable is age with OR 2.9.	87%
11	Angeline et al., (2020)	Design: cross-sectional Sample: 416 Variables: Factors that affect the high pressure on the Pilot Instrument: medical record data Analysis: Chi-Square	Age, obesity, smoking habits, alcohol consumption habits, pulse rate, total flying hours.	There is a significant relationship between age, obesity, smoking habits, and alcohol consumption habits. The most dominant factor is age factor.	75%
12	Sartik et al., (2017)	Design: cross sectional Sample: 390 Variables: Risk factors and incidence of hypertension Instruments: - Analysis: chi-square and multiple logistic regression	Age, gender, education, occupation, family history, smoking habit, length of smoking, type of cigarette, number of cigarettes/day, exercise habits, BMI.	There is a significant relationship between age, family history, smoking habits, exercise habits, and Body Mass Index with the incidence of hypertension. The most dominant factor influencing the incidence of hypertension is age.	63%

Table 3. Original Article Included in Review (Continued)

No	Authors and years	Study design, sample, variable, instrument, analysis	The outcome of the analysis factors	Summary of results	JBI Skor
13	Doanaresta et al., (2020)	Design: a case-control Sample: 70 Variable: Risk factors for hypertension in female farmers aged 45-65 years Instruments: Mercury sphygmomanometer, digital and microtoise scales, Bioimpedance Analysis (BIA), International Physical Activity Questionnaire (IPAQ), Depression Anxiety Stress Scale-42 (DASS-42), food recall 3x24 hours, questionnaire Analysis: logistic regression	BMI, percent body fat, family history of hypertension, smoking habits, physical activity, stress, sodium intake.	The main risk factors for hypertension are sodium intake, family history of hypertension, and stress.	70%
14	Kurnianingtyas et al., (2017)	Design: a case-control Sample: 37 Variable: Risk factors for hypertension in high school students Instruments: recall form, form 1 <i>Physical Activity Level</i> (PAL) Analysis: Chi-Square and Logistics Regression test	Excess carbohydrates, excess fat, excess sodium, potassium, magnesium, calcium, light physical activity, obesity.	The risk factors for hypertension are excessive sodium intake, light physical activity and obesity.	60%
15	Tri Solehaini et al., (2018)	Design: cross-sectional Sample: 200 Variable: A hypertension risk factor Instrument: - Analysis: Chi-Square	Family history, stress, salt consumption, consumption of fatty foods, consumption of vegetables and fruit, tobacco users.	Consumption of fatty foods, stress, family history, and excessive salt consumption are risk factors for hypertension.	75%

Table 3. Original Article Included in Review (Continued)

No	Authors and years	Study design, sample, variable, instrument, analysis	The outcome of the analysis factors	Summary of results	JBI Skor
16	Yulistina et al., (2017)	Design: cross-sectional Sample: 50 Variables: Risk factors for hypertension at menopause age Instrument: Food Frequency Question-Tionry (FFQ) form, questionnaire Analysis: Spearman rank	Stress, physical activity, fat intake, sodium intake.	There is a relationship between food intake, stress, and physical activity during menopause age. However, sodium intake has a higher risk level for hypertension.	63%
17	Salman et al., (2020)	Design: cross-sectional Sample: 83 Variable: The dominant factor of hypertension in the elderly Instruments: questionnaire, Food Frequency Questionnaire (FFQ), Depression Anxiety Stress Scale 42. questionnaire Analysis: Chi-Square and Multiple Logistics Regression test	Exercise habits, rest habits, fat consumption, sodium, and stress levels.	Exercise habits, rest habits, fat consumption, sodium consumption, and stress levels are associated with the incidence of hypertension. The most dominant factor is the level of stress.	63%
18	Mayasari et al., (2018)	Design: Cross-sectional Sample: 338 Variables: Factors that influence the incidence of hypertension in the Healthy Living Community Movement (GERMAS) activities Instruments: - Analysis: Chi-Square and multiple logistic regression	Physical activity, consumption of fruits and vegetables, smoking.	There is a relationship between physical activity, consumption of fruits and vegetables, and smoking. Multivariate results show that the most influential with the incidence of hypertension is fruit or vegetable consumption.	63%

Table 3. Original Article Included in Review (Continued)

No	Authors and years	Study design, sample, variable, instrument, analysis	The outcome of the analysis factors	Summary of results	JBI Skor
19	Yulia & Nuzula, (2019)	Design: Case Control Sample: 30 Variables: Risk factors for hypertension in young adults Instrument: interview result form Analysis: Chi-Square and logistic regression	Nutritional status, coffee consumption, stress level, physical activity, medication adherence.	Nutritional status (BMI) which is the dominant factor in the incidence of hypertension is statistically significant.	70%
20	Nirwana Perangin-angin, (2020)	Design: cross-sectional Sample: 71 Variable: Time of using combination drug contraception Instruments: - Analysis: Chi-Square	Length of use of contraception.	Contraceptive use time of 4 years has a 10.5 times chance of experiencing an increase in blood pressure compared to the time of use < 4 years.	63%
21	Putu Sudayasa & Rahayu Safitrinings Yasin, (2017)	Design: case-control Sample: 136 Variable: Duration of oral contraceptive use Instrument: Interview result form Analysis: Chi-Square and Odds Ratio	Length of use of contraception.	The duration of use of oral contraceptives is related and a risk factor that affects the incidence of hypertension.	60%
22	Ayuningtiyas & Sari, (2021)	Design: cross-sectional Sample: 252 Variable: Duration of oral contraceptive use with blood pressure Instruments: questionnaire and blood pressure meter Analysis: Spearman Rank test	Duration of contraceptive use.	There is a significant relationship between the duration of using oral contraceptives or pills with systolic blood pressure.	75%

Table 3. Original Article Included in Review (Continued)

No	Authors and years	Study design, sample, variable, instrument, analysis	The outcome of the analysis factors	Summary of results	JBI Skor
23	Simamora et al., (2019)	Design: case-control Sample: 136 Variables: Family history, obesity, and psychosocial stress on the incidence of hypertension in women of childbearing age Instruments:- Analysis: conditional logistic regression	Obesity, stress, family history.	The most dominant variable is obesity.	70%
24	Kartika et al., (2021)	Design: case-control Sample: 72 Variable: A hypertension risk factor in the Public Health Center area Instrument: Questionnaire sheet Analysis: chi-square	Obesity, smoking, stress.	There is a relationship between obesity and smoking with the incidence of hypertension.	70%
25	Piter Sinaga & Silvia Vera, (2019)	Design: cross-sectional Sample:719 Variable: Factors related to the incidence of hypertension in the elderly Instrument: a questionnaire in the form of some written statements Analysis: chi-square and linear regression	Age, gender, family history, BMI, smoking habits, drinking alcohol.	There is a significant relationship between age, family history of the disease, smoking BMI, and stress with the incidence of hypertension in the elderly.	50%

reported to result from mutations in at least 10 genes. Abnormalities that underlie monogenic hypertension due to gene mutations are disorders of renal tubular proteins that play a role in sodium transport disorders. Hypertension that is influenced by many genes (polygenic hypertension) is caused by several major and minor genes. Several genes involve systems that play a role in the mechanism of hypertension, namely the Renin-angiotensin-aldosterone (RAA) system, the G-protein or signal transduction pathway system, and the nor androgenic system (Lubis, 2008).

According to Black and Hawks in Syaifuddin, (2006) states that someone who has a family history of hypertension will have a greater risk of developing hypertension. This happens because, for someone who has a family history of hypertension, several genes will interact with the environment and cause an increase in blood pressure. A patient who has a genetic trait of hypertension if left naturally without therapeutic intervention, together with his environment will cause his hypertension to develop and in about 30 or 50 years signs and symptoms will appear. Sharing exposure or sharing of exposure from the habits of other family members can unconsciously increase the risk of hypertension. Hypertension tends to decline in the next generation (Musfirah & Masriadi, 2019).

Modifiable Risk Factors

Sodium Consumption

Based on the results of the literature study, there was a significant relationship between diet or sodium consumption with the incidence of hypertension. Eating patterns have a risk of about 0,418 –17,62 times higher for hypertension compared to someone who has a good diet (Angesti *et al.*, 2018; Doanaresta *et al.*, 2020; Ekarini *et al.*, 2020; Kurnianingtyas *et al.*, 2017; Maita, 2017; Salman *et al.*, 2020; Tri Solehaini *et al.*, 2018; Yulistina *et al.*, 2017).

In Indonesia, the consumption of salt or the amount of sodium in the food consumed by the community is one of the causes of

hypertension. Generally, Indonesian people like to consume dishes that are coconut milk and seasoned. Research result from Salman *et al.*, (2020) shows that sodium consumption has a relationship with the incidence of hypertension in Cempaka Public Health Center, South Kalimantan. The research shows that most people with hypertension often consume foods that contain high sodium an average of 2-3 times/day such as soy sauce, seasonings, salted fish, and biscuits. This is closely related to the eating habits of the people of South Kalimantan who are accustomed to consuming salted fish and soy sauce as a complement.

A person is said to consume excess salt if his salt intake is above 6 grams/day (WHO) or has a sodium level of more than 200 mg in blood plasma. Salt consumed daily consists of sodium and chloride ions. Sodium itself is a cation that is abundant in extracellular fluid, water, and the substance of the outer cavity of cells. The normal concentration in serum is 136-145 mEq/L. Sodium is absorbed into the blood vessels from high salt consumption resulting in water retention, so blood volume increases. This causes an increase in blood pressure. High sodium intake will cause excessive release of the natriuretic hormone which will indirectly increase blood pressure (Purwono *et al.*, 2020).

Potassium Consumption

Based on the results of the literature study, there was a significant relationship between the consumption of potassium or potassium with the incidence of hypertension. The results of statistical tests on average lack of potassium consumption have a risk of developing hypertension 1,158-2,325 times riskier (Angesti *et al.*, 2018; Mayasari *et al.*, 2018; Tri Solehaini *et al.*, 2018).

Fruits and vegetables have a fairly high potassium content. Potassium in physiology and its use in the human body acts as a diuretic (stimulates urine output in humans) so that it will increase sodium expenditure and inhibit renin expenditure which will result

in changes in the renin-angiotensin system. In addition, potassium itself is the main ion in the intracellular fluid where a high intake of potassium will increase its concentration in the intracellular fluid. This will draw fluid from the extracellular which results in a decrease in blood pressure to become more stable or normal. Vegetables and fruit also contain other elements such as magnesium, pectin, and fiber. This is related to blood pressure in humans, magnesium itself has a function as a vasodilator in coronary and peripheral arteries (Firmansyah et al., 2020).

The theory is in line with the research results of Mayasari et al., (2018) that consumption of fruit or vegetables <2 servings/day will have a 2,37 times greater chance of suffering from hypertension compared to respondents who consume 2-3 servings of fruit or vegetables/day. Increasing the consumption of fruits and vegetables is one of the efforts to prevent and help treat hypertension. One of the hypertension diets, namely the DASH diet (Dietary Approaches to Stop Hypertension) has recommended consuming more fruits and vegetables because they contain many important minerals such as potassium, magnesium, and fiber so that blood pressure remains normal (Mukti, 2019).

Fat Consumption

Based on the results of the literature study, it was found that there was a significant relationship between high-fat consumption and the incidence of hypertension. Someone who consumes high fat has a risk of 1,13-32,3 developing hypertension when compared to those who consume low fat (Kurnianingtyas et al., 2017; Salman et al., 2020; Tri Solehaini et al., 2018; Yulistina et al., 2017).

Based on research results by Tri Solehaini et al., (2018) someone who eats fatty foods of more than 67 grams/day has a risk of developing hypertension as much as 32,3 times greater when compared to someone who eats fatty foods 67 grams/day. The research is relevant to the research

results of Salman et al., (2020) show that fat consumption has related to the incidence of hypertension. Most of the respondents in the study who had hypertension, often consumed foods that contain high fat such as coconut milk, chicken, beef, and fried foods and the use of oil for frying is mostly oil that has been used more than once.

Excessive consumption of fat can increase the risk of hypertension because it will increase cholesterol levels in the blood. The cholesterol will stick to the walls of blood vessels which over time will be blocked due to plaque in the blood called atherosclerosis. Plaque that forms will cause blood flow to narrow so that blood volume and blood pressure will increase (Morrel, 2007).

Smoke

Based on the results of the literature study, it was found that there was a significant relationship between smoking and the incidence of hypertension. A person who has a smoking habit has a 0,417-3,89 risk of developing hypertension when compared to non-smokers (Angeline et al., 2020; Arda et al., 2018; Ekarini et al., 2020; Kartika et al., 2021; Mayasari et al., 2018; Oktaviarini, Hadisaputro, & Chasani, 2019; Piter Sinaga & Silvia Vera, 2019; Rizkiah, 2017; Sartik et al., 2017).

According to health experts, cigarettes contain a lot of nicotine which can cause an increase in heart rate, increase blood pressure, lower HDL cholesterol levels, increase LDL cholesterol levels, and accelerate atherosclerosis (Tiolong, 2014). According to Junaidi, (2010), Cigarettes contain various substances that can damage the lining of the artery walls, which in turn will form plaque or crust in the arteries. This crust or plaque causes the arteries to narrow, so greater pressure is needed to pump blood until it reaches the organs that need it. This then causes hypertension. From the results of the literature obtained 8 journals stated that smoking behavior is associated with the incidence of hypertension and 3 journals stated that there was no relation between

smoking behavior and the incidence of hypertension. Thus, based on existing theories and journals, smoking was found to be a risk factor for the incidence of hypertension.

Obesity

Based on the results of the literature study, it was found that there was a significant relationship between obesity and the incidence of hypertension. Statistically, obesity has a risk of 0,46 – 12,16 times higher than non-obese (Agustina *et al.*, 2018; Andika & Safitri, 2019; Angesti *et al.*, 2018; Ekarini *et al.*, 2020; Kartika *et al.*, 2021; Maita, 2017; Piter Sinaga & Silvia Vera, 2019; Simamora *et al.*, 2019; Yulia & Nuzula, 2019).

This is because, in obesity, peripheral resistance is reduced, while the sympathetic nerves are elevated with low plasma renin activity. Obesity is associated with increased intravascular volume and cardiac output. Being overweight increases the risk of cardiovascular disease for several reasons. The greater the body mass, the more blood is needed to supply oxygen and nourishment to the body's tissues. This means that the volume of blood circulating through the blood vessels increases, which puts greater pressure on the arterial walls (Rokhuswara & Syarif, 2017).

Obesity can be measured through Body Mass Index status and abdominal circumference measurements. In measurements using abdominal circumference, obesity is included in the category of central obesity, if the abdominal circumference is more than 90 cm for men and >80 cm for women. When the process of lipolysis of visceral fat occurs, it will increase free fatty acids which can put the body in a state of hyperinsulinemia, it can affect the occurrence of sodium retention and vascular hypertrophy which can lead to hypertension (Cunha *et al.*, 2012). This theory is in line with the research of Mafaza *et al.*, (2018) which shows that abdominal circumference has a significant relation with the occurrence of hypertension.

Physical Activity

Based on the results of the literature study, it was found that there was a significant relationship between physical activity and the incidence of hypertension. Statistically, lack of physical activity has a risk of 0,24-2,11 times higher than that of regular physical activity or sports (Agustina *et al.*, 2018; Ekarini *et al.*, 2020; Mayasari *et al.*, 2018; Musfirah & Masriadi, 2019; Nuraeni, 2019; Rizkiah, 2017; Sartik *et al.*, 2017).

Physical activity is the movement of limbs that causes energy expenditure which is very important for maintaining physical and mental health and maintaining a healthy quality of life throughout life. Regular physical activity for at least 30 minutes a day, at least 3-5 times a week. Regular and adequate physical activity can strengthen the heart muscle so that the heart can pump more blood with minimal effort. In effect, the work of the heart becomes lighter so that the resistance to the artery walls is reduced. Thus, blood pressure also decreases (Junaidi, 2010).

The theory is in line with research by Mayasari *et al.*, (2018) that physical activity of fewer than 30 minutes a day has the risk of developing hypertension 1,97 times higher than physical activity of more than 30 minutes/day. The research is also relevant to research by Rizkiah, (2017) and Sartik *et al.*, (2017) which state that someone who does not exercise has a risk of 1,77-1,98 times more risk than those who exercise regularly. However, there are differences with the results of the study by Agustina *et al.*, (2018) which states that there is no relation between physical activity and the incidence of hypertension with an odd ratio value of 2,1. Based on the findings of the literature and existing theories, the researcher argues that lack of physical activity is also one of the risk factors for hypertension.

Oral Contraception

Based on the results of the literature study, it was found that there was a significant relationship between the use of

oral contraceptives and the incidence of hypertension. Statistically, oral contraceptives have a risk of 3,8-10,5 times higher than not using oral contraceptives (Ayuningtiyas & Sari, 2021; Nirwana Perangin-angin, 2020; Putu Sudayasa & Rahayu Safitri Yasin, 2017).

These results are in line with a theory that reveals that women have natural estrogen and progesterone content in the body. The estrogen component in the pill blocks the maturation of the follicles in the ovaries, while the estrogen component strengthens the ability of estrogen to prevent ovulation. Under normal circumstances, estrogen and progesterone are produced by the ovaries, due to the influence of follicle-stimulating hormone (FSH) and luteinizing hormone (LH) released by the pituitary, which will affect the endometrium so that the menstrual cycle occurs. In the use of oral contraceptives, estrogen and progesterone given will result in high levels of estrogen and progesterone in the blood, so the feedback mechanism will work so that the Renin Angiotensin Aldosterone system in the body will be disrupted (Putu Sudayasa & Rahayu Safitri Yasin, 2017).

Prolonged use of oral contraceptives can result in hormonal imbalance. If there was no balance in the hormones estrogen and progesterone in the body, it will be able to affect the level of blood pressure and the condition of the blood vessels ((Saifuddin, 2007) (Putu Sudayasa & Rahayu Safitri Yasin, 2017)). Synthetic estrogen and progesterone hormones that function to inhibit fertility will have certain effects on the body, namely increasing blood pressure which is manifested by hypertension (Guyton, 2007).

Education

Based on the results of the literature study, there was a significant relationship between educational factors and the incidence of hypertension. The level of education is less at risk 1,5-2,39 times greater than someone with higher education

(Musfirah & Masriadi, 2019; Nuraeni, 2019; Sartik et al., 2017).

This is also supported by the theory according to Soekidjo Notoatmodjo, who says that education in general is all planned efforts to influence other people, whether individuals, groups, or society so that they do what is expected by educators. Education can also affect health, the higher a person's level of education, the level of health awareness increases. Elementary school education criteria reduce the risk of developing hypertension by 66%, while those with junior high school education are around 72%, this concludes that the higher a person's education level, the lower the risk of suffering from hypertension (Musfirah & Masriadi, 2019).

According to the researcher, the level of education can affect hypertension because it relates to a person's knowledge of the surrounding disease. The level of education indirectly affects a person's blood pressure because the level of education affects a person's lifestyle, such as smoking habits, alcohol consumption habits, food intake, and physical activity.

Stress

Based on the results of the literature study, it was found that there was a significant relationship between stress factors and the incidence of hypertension. Based on the results of statistical tests, on average, someone who experiences stress has a risk of between 0,63-10,92 times the risk of developing hypertension (Andika & Safitri, 2019; Doanaresta et al., 2020; Salman et al., 2020; Yulia & Nuzula, 2019).

Stress is often associated with hypertension. In a state of stress, the body will produce the hormone adrenaline which causes the heart rate to increase which increases blood pressure. If the state of stress lasts long enough and is not managed properly, the body will adjust to the situation and there will be pathological changes. Stress can trigger the activation of the sympathetic nervous system which results in

an intermittent (erratic) rise in blood pressure. When a person experiences stress, the hormone adrenaline will be released and will then increase blood pressure through arterial contraction (vasoconstriction) and an increase in heart rate. If stress continues, blood pressure will remain high, so the person will experience hypertension (Stefhany, 2012).

Based on the research results, most people experience stress due to work, stress due to relations, stress due to low socioeconomic status, and stress due to racial discrimination. These factors can change the response of the sympathetic nervous system, namely by releasing catecholamines which cause an increase in heart rate, cardiac output, and blood pressure (Spruill, 2010).

Coffee Consumption

Based on the results of a literature study, it was found that there was a significant relationship between caffeine (coffee consumption) and the incidence of hypertension with an odd ratio value of 1,12 – 4,9 times compared to someone who did not consume coffee (Andika & Safitri, 2019; Arda *et al.*, 2018; Oktaviarini, Hadisaputro, & Chasani, 2019; Yulia & Nuzula, 2019).

Caffeine can stimulate the vasomotor center and direct stimulation of the myocardium causes an increase in blood pressure. People who do not consume coffee have a lower blood pressure than people who consume 1-3 cups/per day, and people who consume 3-6 cups of coffee/day have higher blood pressure (Palmer & Williams, 2007). The theory is in line with the research results of Arda *et al.*, (2018) which state that someone who consumes coffee more than 2 cups/day has a 3,2 times higher risk of developing hypertension than those who do not consume coffee. However, there was a difference with the results of Andika & Safitri, (2019) which states that coffee consumption is not associated with the incidence of hypertension. This is because 80% of the respondents in the study did not consume coffee.

Alcohol

Based on the results of the literature study, it was found that alcohol consumption was not associated with the incidence of hypertension. Statistically, alcohol consumption has a risk of 0,6-11,91 higher than those who do not consume alcohol (Agustina *et al.*, 2018; Piter Sinaga & Silvia Vera, 2019; Sartik *et al.*, 2017).

However, it does not mean that alcohol consumption is not at risk of hypertension. Excessive consumption of alcohol will increase the risk of hypertension in a person. Alcohol increases sympathetic nerve activity because it can stimulate the secretion of corticotrophin-releasing hormone (CRH) which will eventually increase blood pressure (Piter Sinaga & Silvia Vera, 2019). Consuming alcoholic beverages can increase cortisol levels in the blood so that the volume of red blood cells and blood viscosity increases, as a result, the heart works hard to pump blood throughout the body so that blood pressure increases (Kasron, 2012).

Based on the results of the analysis of the literature study that has been obtained and carried out according to existing procedures. This research also has limitations, namely in this literature study, it collects data with instruments in the form of data sources in journals, which allows the data obtained to be less valid because it is not carried out directly.

CONCLUSION

Based on the assessment of various risk factors for hypertension in Indonesia, it is divided into 2, namely irreversible risk factors and non-modifiable risk factors. The most dominant risk factor for hypertension in Indonesia is the non-modifiable risk factor, namely family history. Meanwhile, the most dominant modifiable risk factor is diet-related fat consumption. Of the various risk factors, the most dominant risk factor for hypertension in Indonesia is fat consumption.

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DECLARATION

Conflict of Interest

The authors declare there is no potential conflict of interest. All authors have read and approved the final version of the manuscript and agree to be responsible for all aspects.

REFERENCES

- Agustina, W., Oktafirnanda, Y., & Wardiah, W. (2018). Faktor Risiko yang Berhubungan dengan Kejadian Hipertensi pada Wanita Usia Reproduksi di Wilayah Kerja Puskesmas Langsa Lama Kota Langsa. *Jurnal Bidan Komunitas*, 1(1), 48. <https://doi.org/10.33085/jbk.v1i1.3927>.
- Andika, F., & Safitri, F. (2019). Faktor Risiko Kejadian Hipertensi di Rumah Sakit Umum Daerah dr. Zainoel Abidin Provinsi Aceh. *Journal of Healthcare Technology and Medicine*, 5(1), 148. <https://doi.org/10.33143/jhtm.v5i1.342>.
- Angeline, C., Ivone, J., & Pratama, A. (2020). Influencing Factors of Hypertension on Fixed-Wing Pilots. *Journal of Medicine and Health*, 2(6). <https://doi.org/10.28932/jmh.v2i6.2771>
- Angesti, A. N., Triyanti, T., & Sartika, R. A. D. (2018). Riwayat Hipertensi Keluarga Sebagai Faktor Dominan Hipertensi pada Remaja Kelas XI SMA Sejahtera 1 Depok Tahun 2017. *Buletin Penelitian Kesehatan*, 46(1), 1–10. <https://doi.org/10.22435/bpk.v46i1.41>
- Arda, Z. A., Ali, R., & Mustapa, M. (2018). Hipertensi dan Faktor Risikonya di Puskesmas Motolohu Kabupaten Pohuwato. *Gorontalo Journal of Public Health*, 1(1), 032. <https://doi.org/10.32662/gjph.v1i1.148>
- Ayuningtias, R., & Sari, S. R. (2021). Hubungan Durasi Penggunaan Kontrasepsi Oral Dengan Tekanan Darah Akseptor Kontrasepsi Di Wilayah Kerja Puskesmas Harapan Raya Pekanbaru Tahun 2020. *Al-Insyirah Midwifery*, 10(1), 14–20. <https://doi.org/https://jurnal.stikes-alinsyirah.ac.id/index.php/kebidanan>
- Cunha, A. R., Umbelino, B., Correia, M. L., & Neves, M. F. (2012). Magnesium and Vascular Changes in Hypertension. *International Journal of Hypertension*, 2012. <https://doi.org/10.1155/2012/754250>
- Doanaresta, D., Probosari, E., & Purwanti, R. (2020). Faktor Risiko Kejadian Hipertensi Pada Petani Wanita Usia 45 – 65 Tahun di Puskesmas Karangawen II Kabupaten Demak. *Buletin Penelitian Kesehatan*, 48(1). <https://doi.org/10.22435/bpk.v48i1.2664>
- Dwi Anggara, F. H., & Prayitno, N. (2013). Faktor-Faktor Yang Berhubungan Dengan Tekanan Darah Di Puskesmas Telaga Murni, Cikarang Barat Tahun 2012. *Jurnal Ilmiah Kesehatan*, 5(1).
- Ekarini, N. L. P., Wahyuni, J. D., & Sulistyowati, D. (2020). Faktor - Faktor Yang Berhubungan Dengan Hipertensi Pada Usia Dewasa. *JKEP*, 5(1), 61–73. <https://doi.org/10.32668/jkep.v5i1.357>.
- Firmansyah, Y., Ernawati, E., Prawiro, E. L., ... E. E.-J. M. S., 2020, undefined, Luciana Prawiro, E., Ernawati, E., & Prawiro, E. L. (2020). Sistem Skoring Untuk Memprediksi Kejadian Hipertensi Pada Usia Produktif Di Kota Medan (Preliminary Study). *Jurnal Muara Sains, Teknologi, Kedokteran Dan Ilmu*

- Kesehatan, 4(1), 55.
<https://doi.org/10.24912/jmstkik.v4i1.6013>.
- Guyton, A. C. (2007). *Buku Ajar Fisiologi Kedokteran*. EGC.
- Junaidi, I. (2010). *Hipertensi : pengenalan, pencegahan, dan pengobatan / Iskandar Junaidi ; penyunting, Dortje Tandung ; penyelaras akhir, Sheilla Karmelita | OPAC Perpustakaan Nasional RI*. Bhuana Ilmu Populer.
- Kartika, M., Subakir, S., & Mirsiyanto, E. (2021). Faktor-Faktor Risiko Yang Berhubungan Dengan Hipertensi Di Wilayah Kerja Puskesmas Rawang Kota Sungai Penuh Tahun 2020. *Jurnal Kesmas Jambi*, 5(1), 1–9. <https://doi.org/10.22437/jkmj.v5i1.12396>
- Karon. (2012). *Kelainan Dan Penyakit Jantung Pencegahan Serta Pengobatannya*. Nuha Medika.
- Kemkes. (2019a). *Hari Hipertensi Dunia 2019 : "Know Your Number, Kendalikan Tekanan Darahmu dengan CERDIK."* Direktorat P2PTM. <http://p2ptm.kemkes.go.id/subdit-penyakit-kanker-dan-kelainan-darah/hari-hipertensi-dunia-2019-know-your-number-kendalikan-tekanan-darahmu-dengan-cerdik>
- Kemkes. (2019b, May). *Hipertensi Penyakit Paling Banyak Diidapi Masyarakat*. Kementerian Kesehatan Republik Indonesia.
- Kurnianingtyas, B., Suyatno, S., & Kartasurya, M. (2017). Faktor Risiko Kejadian Hipertensi Pada Siswa Sma Di Kota Semarang Tahun 2016. *Jurnal Kesehatan Masyarakat Universitas Diponegoro*, 5(2), 70–77.
- Lewis, S. L., Heitkemper, M. M., Dirksen, S. R., O'brien, P. G., & Bucher, L. (2007). *Medical Surgical Nursing: Assesment and Management of Clinical Problems*. (Seventh ed). Mosby Elsevier.
- Lubis, H. R. (2008). *Hipertensi Ginjal - USUpress - Universitas Sumatera Utara*. USU Press.
- Mafaza, R. L., Wirjatmadi, B., & Adriani, M. (2018). Analisis Hubungan Antara Lingkar Perut, Asupan Lemak, Dan Rasio Asupan Kalsium Magnesium Dengan Hipertensi. *Media Gizi Indonesia*, 11(2), 127. <https://doi.org/10.20473/mgi.v11i2.127-134>.
- Maita, L. (2017). Determinan Hipertensi pada Lansia di Puskesmas Sidomulyo Kota Pekanbaru. *Jurnal Kesehatan*, 8(2), 199. <https://doi.org/10.26630/jk.v8i2.488>.
- Mayasari, M., Farich, A., & Sary, L. (2018). Faktor-Faktor Yang Mempengaruhi Kejadian Hipertensi Pada Kegiatan Gerakan Masyarakat Hidup Sehat (Germas) Di Puskesmas Rawat Inap Kedaton Kota Bandar Lampung. *Jurnal Kesmas (Kesehatan Masyarakat) Khatulistiwa*, 5(2), 56. <https://doi.org/10.29406/jkkm.v5i2.1569>.
- Morrel. (2007). *Kolesterol*. Erlangga.
- Mukti, B. (2019). Penerapan DASH (Dietary Approach to Stop Hypertension) pada Penderita Hipertensi. *Jurnal Ilmiah PANNMED (Pharmacist, Analyst, Nurse, Nutrition, Midwivery, Environment, Dentist)*, 14(2), 17–22. <https://doi.org/10.36911/PANNMED.V14I2.610>.
- Musfirah, M., & Masriadi, M. (2019). Analisis Faktor Risiko dengan Kejadian Hipertensi di Wilayah Kerja Puskesmas Takalala Kecamatan Marioriwawo Kabupaten Soppeng. *Jurnal Kesehatan Global*. <https://doi.org/10.33085/jkg.v2i2.4316>
- Nirwana Perangin-angin. (2020). Waktu Penggunaan Kontrasepsi Pil Kombinasi

- yang Berhubungan dengan Kasus Kenaikan Tekanan Darah dalam Wilayah Kerja Puskesmas Martapura I Kabupaten Banjar Provinsi Kalimantan Selatan. *EMBRIO*, 12(1), 43–50. <https://doi.org/10.36456/EMBRIO.V12I1.2292>
- Nuraeni, E. (2019). Hubungan Usia Dan Jenis Kelamin Beresiko Dengan Kejadian Hipertensi Di Klinik X Kota Tangerang. *Jurnal JKFT: Universitas Muhammadiyah Tangerang*, 4(1).
- Oktaviarini, E., Hadisaputro, S., & Chasani, S. (2019). Probabilitas Perilaku Sedentari Terhadap Hipertensi Pada Pegawai Daerah Perimeter Pelabuhan. *Jurnal Ilmiah Permas: Jurnal Ilmiah STIKES Kendal*, 9(1), 12–21. <https://doi.org/10.32583/pskm.9.1.2019.12-21>.
- Oktaviarini, E., Hadisaputro, S., Chasani, S., Suwondo, A., Setyawan, H., Pelabuhan Kelas Semarang, K. I., Kesehatan Masyarakat Undip, F., & Kedokteran Undip, F. (2019). Faktor yang Berisiko Terhadap Hipertensi pada Pegawai di Wilayah Perimeter Pelabuhan (Studi di Kantor Kesehatan Pelabuhan Kelas II Semarang). In *JEKK* (Vol. 4, Issue 1).
- Palmer, A., & Williams, B. (2007). *Tekanan darah tinggi*. Erlangga.
- Piter Sinaga, J., & Silvia Vera, N. (2019). Faktor Yang Berhubungan Dengan Kejadian Hipertensi Pada Lansia Di Posyandu Lansia Di Wilayah Kerja Puskesmas Simpang Bahjambi Kabupaten Simalungun. *Jurnal Penelitian Kesmas*, 2(1), 64–74. <https://doi.org/10.36656/jpkisy.v2i1.161>
- Purwono, J., Sari, R., Ratnasari, A., & Budiarto, A. (2020). Pola Konsumsi Garam dengan Kejadian Hipertensi pada Lansia. *Jurnal Wacana Kesehatan*, 5(1), 531–542.
- Putu Sudayasa, I., & Rahayu Safitrinias Yasin, E. (2017). Hubungan Lama Pemakaian Kontrasepsi Oral Dengan Hipertensi. *Prosiding Seminar Nasional Riset Kuantitatif Terapan 2017*, 1(1). <http://ojs.uho.ac.id/index.php/snrkt2017/article/view/3242>
- Riskesdas. (2018). *Kementrian Kesehatan, Badan Penelitian Dan Pengembangan Kesehatan, Hasil Utama RisKesDas*.
- Rizkiah, F. (2017). Hubungan Antara Sosiodemografi Dan Aktivitas Fisik Dengan Kejadian Hipertensi Pada Prausila Yang Berkunjungke Puskesmas Pangkalan Baru Kabupaten Bangka Tengah Tahun 2017. *Jurnal Ilmiah Kesehatan Masyarakat STIKES Abdi Nusa Pangkalpinang*, 1(1), 1–6.
- Rokhuswara, T. D., & Syarif, S. (2017). Hubungan Obesitas dengan Kejadian Hipertensi Derajat 1 di Pos Pembinaan Terpadu Penyakit Tidak Menular (Posbindu PTM) Kantor Kesehatan Pelabuhan Bandung Tahun 2016. *Jurnal Epidemiologi Kesehatan Indonesia*, 1(2). <https://doi.org/10.7454/EPIDKES.V1I2.1805>.
- Salman, Y., Sari, M., & Libri, O. (2020). Analisis Faktor Dominan terhadap Kejadian Hipertensi pada Lansia di Puskesmas Cempaka. *Jurnal Dunia Gizi*, 3(1), 15. <https://doi.org/10.33085/jdg.v3i1.4640>
- Sartik, S., Tjekyan, R. S., & Zulkarnain, M. (2017). Risk Factors and the Incidence of Hypertension in Palembang. *Jurnal Ilmu Kesehatan Masyarakat*, 8(3), 180–191. <https://doi.org/10.26553/jikm.2017.8.3.180-191>
- Simamora, L., Sembiring, N. P., & Simbolon, M. (2019). Pengaruh Riwayat Keluarga,

- Obesitas Dan Stress Psikosial Terhadap Kejadian Hipertensi Pada Ibu Pasangan Usia Subur Di Wilayah Kerja Puskesmas Simalingkar. *Jurnal Mutiara Ners*, 2(1), 188–194.
<http://114.7.97.221/index.php/NERS/article/view/601>
- Spruill, T. M. (2010). Chronic psychosocial stress and hypertension. *Current Hypertension Reports*, 12(1), 10–16.
<https://doi.org/10.1007/s11906-009-0084-8>.
- Stefhany. (2012). *Hubungan Pola Makan, Gaya Hidup, Dan Indeks Massa Tubuh Dengan Hipertensi Pada Pra Lansia Dan Lansia Di Posbindu Kelurahan Depok Jaya*. Universitas Indonesia.
- Sullivan, & Gillis. (2016). Sex Differences in Hypertension: Recent Advances. *Hypertension*, 68(6).
- Syaifuddin. (2006). *Anatomi fisiologi: Untuk mahasiswa keperawatan* (M. Ester (ed.); Ed.3). EGC.
- Tiolong, A. (2014). *Waspada!!! penyakit-penyakit mematikan tanpa gejala menyolok* (cet 1). Buku Biru.
- Tri Solehaini, D., Novita Eka Rini, W., & . A. (2018). Faktor Risiko Hipertensi Di Kelurahan Sungai Asam Wilayah Kerja Puskesmas Koni Kota Jambi. *Jurnal Kesmas Jambi*, 2(2), 33–44.
<https://doi.org/10.22437/jkmj.v2i2.6552>
- Yulia, R., & Nuzula, F. (2019). Faktor-Faktor Yang Berhubungan Dengan Kejadian Hipertensi Tidak Terkendali Pada Dewasa Muda Di Wilayah Kerja Puskesmas Genteng Kulon. *JURNAL ILMIAH KESEHATAN RUSTIDA*, 06(01), 14–19.
- Yulistina, F., Maryati Deliana, S., & Eunike Raffy Rustiana, D. (2017). Korelasi Asupan Makanan, Stres, Dan Aktivitas Fsisik Dengan Kejadian Hitensi Pada Usia Menopause. *Unnes Journal of Public Health*, 6(1).