The Relationship of Risk Factors to the Incidence of Hypertension in Pre-Elderly and Elderly (Study in Ternate City)

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ARTICLE INFORMATION

ABSTRACT

Hypertension, commonly known as hypertension, is a chronic disease. Every day, the number of cases of hypertension in pre-elderly and elderly is increasing, and it can have a variety of consequences, including: reduced quality of life, difficulties in social and physical functioning, and increased pain and mortality due to complications. This study aims to identify the relationship between risk factors and the incidence of hypertension in the elderly and geriatric population in the city of Ternate. This study was a cross-sectional study using univariate and bivariate analyzes, to determine the relationship between risk factors and the incidence of hypertension in pre and elderly individuals. Samples were selected by cluster random sampling technique and using blood pressure checks and questionnaires containing structured questions. This study was conducted in the Ternate Public Health Center (PUSKESMAS) with 299 respondents from pre-elderly and elderly aged ≥45 years old. The research uncovered five factors that with a significant relationship with hypertension. Those factors are age, family history, salt intake, obesity, and dyslipidemia. On the other hand, there are three factors that have no significant relationship with hypertension, which is gender, smoking habits, and alcohol consumption.

Keywords: Hypertension, Ternate City, Elderly, Pre Elderly

INTRODUCTION

High blood pressure or hypertension is a chronic condition in which the blood pressure in the arteries rises, causing the heart to work harder to pump and circulate blood through the blood vessels. High blood pressure is known as the silent killer because patients with hypertension are mostly asymptomatic (Ibekwe, 2015). A person is diagnosed with hypertension if blood pressure measurements at multiple visits show a systolic pressure of 140 mmHg and/or a diastolic pressure of 90 mmHg (Flack & Adekola, 2020). According to the 2017 American Heart Association (AHA) hypertension guidelines, stage 1 hypertension is systolic blood pressure in the range of 130-139 mmHg or diastolic blood pressure in the range of 80-89 mmHg (Unger et al., 2020).

According to the International Society of Hypertension (ISH, 2020), hypertension is the leading cause of death worldwide, it kills approximately 10.4 million people each year. According to global data, approximately 1.39 billion people had high blood pressure in12010. However, the prevalence of hypertension is shifting from high-income areas to low-income areas, with an estimated 349 million hypertensive patients living in high-income countries and 1.04 billion hypertensive patients living in low-income countries (Riskesdas, 2018). According to Basic Health Study (Riskesdas) 2018, the prevalence of hypertension in Indonesia is 34.11%. This represents an increase from 25.9% in Riskesdas hypertension prevalence in 2013. It is estimated that only one-third of Indonesian hypertension cases are diagnosed, while the rest remain undiagnosed. In North Maluku, the prevalence of hypertension is 24.65%. According to Ternate Municipal Health Department data, hypertension was the fourth leading cause of pain in Ternate, with 633 new cases in 2020 (DINKES, 2020).

Hypertension is one of the major risk factors for cardiovascular diseases such as stroke, coronary artery disease, heart failure, and end-stage renal disease. Therefore, prevention of hypertension is essential to prevent and reduce complication rates in hypertensive patients. There are two types of factors involved in the development of hypertension: Modifiable risk factors include obesity, high sodium intake, low potassium intake, alcohol consumption, and reduced physical activity. Several studies have shown that interventions with modifiable risk factors can lower blood pressure and even prevent the development of hypertension (Ibekwe, 2015).

Seniors citizens are those over the age of 60. Blood pressure in the elderly increases with age due to the thickening of blood vessel walls, and collagen builds up in the muscle layer. This condition narrows and hardens blood vessels, increasing blood pressure and increasing the risk of high blood pressure in older people. The prevalence of hypertension is very high in the age group of ≥ 60 years old, with an estimated 60% to 80% of the elderly population and 2 out of every 3 elderly people estimated to have hypertension (Burhan, Mahmud, & Sumiaty, 2020). Hypertension in the elderly can lead to decreased quality of life, difficulty in social and physical functioning, increased pain and death from complications (Sinulingga & Samingan, 2019). Based on this contextual background, it is necessary to study the risk factors for hypertension in the elderly.

LITERATURE REVIEW

Defining Hypertension

Hypertension is a steady increase in systemic arterial blood pressure, leading to complex disorders that affect the entire cardiovascular system. All types and stages of hypertension are associated with increased risk of target organs of disease, including heart attack, kidney disease, and stroke (McCance & Huether, 2014).

According to the World Health Organization (2021), hypertension is a serious condition because it is a leading cause of premature death worldwide. Blood pressure is the force produced by blood circulation against the arterial walls of the body. Blood pressure is written in two numbers. The first number is systolic, which is the pressure in blood vessels when the heart is contracting, and the second number, diastole is the pressure in blood vessels when the heart is at rest. Diagnosis is made if blood pressure is measured daily and systolic pressure is 140 mmHg on both days and/or diastolic pressure is 90 mmHg on both days.

Epidemiology

Based on World Health Organization (2021) data, the prevalence of hypertension is estimated at 1.28 billion adults between the ages of 30-79. Two-thirds of his hypertensives live in middle and low-income countries. About 46% of adults with high blood pressure are unaware of the condition. It is also estimated that 42% of hypertensive patients are diagnosed and treated. About 21% of adults, or 1 in 5 people have high blood pressure under control. The country region with the highest prevalence of hypertension is Africa with an estimated 27%, and the country with the lowest prevalence of hypertension is the Americas with an estimated 18%. The prevalence of hypertension varies by region and income group within the state.

Etiology and Risk Factors

Causes and risk factors for hypertension are age, sex, family history, smoking, alcohol consumption, excessive salt intake, obesity, and dyslipidemia. With aging, changes occur in the structure of blood vessels as a result of degenerative processes. In other words, systolic blood pressure rises due to a decrease in the elasticity of the arterial wall, and after the age of 45, collagen material accumulates in the muscle layer, causing the arterial wall to thicken and the artery to narrow and harden (Nurmalita, Annisaa, Pramono, & Sunarsih, 2019; Syafrianti, Adelin, Malik, & Khomeini, 2021; Thesman, 2019; Tirtasari & Kodim, 2019).

Additionally, gender is a risk factor for those suffering from hypertension. Men are 1.18 times more likely to have high blood pressure than women. This tendency is due to hormonal factors and sex chromosomes. In women who have not yet reached menopause, the hormone estrogen provides protection against high blood pressure in the body. This is because estrogen plays a role in lowering blood pressure by stimulating the production of nitric oxide, which affects vasodilation. However, in menopausal and postmenopausal women, estrogen levels decrease. This condition provides protection against hypertension in women. After menopause, androgens also play a role in raising blood pressure. This is because androgens affect the renal nephrons with sodium reabsorption and stimulate the angiotensin-renin system (Syafrianti et al., 2021; Thesman, 2019; Tirtasari & Kodim, 2019).

As for family history, a person with a history of hypertension is twice as likely to have high blood pressure if he has a history of hypertension. If both parents have hypertension, the risk of developing hypertension is 50-70% whereas for older adults without hypertension, the risk developing hypertension is 4-20%. A genetic predisposition to hypertension is considered polygenic. Hypertension is also associated with congenital disorders related with sodium excretion, insulin and insulin sensitivity, sympathetic nervous system activity, the renin-angiotension-aldosterone system "RAAS" and sodium or calcium cell membrane transport (McCance & Huether, 2014; Syafrianti et al., 2021).

In addition, smoking is one of the risk factors for hypertension. Smoking one cigarette a day raises systolic blood pressure by 10 to 25 mmHg and heart rate by 5 to 20 beats per minute. A study conducted by the Heart Research of England found a difference in systolic blood pressure of 2 mmHg between smokers and non-smokers, and in each case he was measured at intervals of four years over a period of 16 years. A smoker's risk of high blood pressure depends on the number and type of cigarettes smoked each day, not on the duration of smoking. The smoking grade category uses the Brinkman index which is the number of cigarettes smoked per day multiplied by the duration of smoking. Multiply results between 0 and 200 are light smokers, between 200 and 600 are moderate smokers, and above 600 are heavy smokers. The more cigarettes smoked, the higher the risk of hypertension (Susi & Ariwibowo, 2019).

Regarding alcohol consumption, the association between heavy alcohol consumption and hypertension has been demonstrated in various epidemiological studies. About 5% of hypertension is caused by alcohol. This study showed an effect between alcohol consumption and the development of hypertension. Similarly, a study conducted on adult men in South Korea found that those who consumed 30g of alcohol per day had an increased risk of hypertension. Alcohol's effect on raising blood pressure gas already been demonstrated. The mechanism by which alcohol increases blood pressure is still unknown. However, increased cortisol levels, red blood cell mass, and blood viscosity are thought to increase blood pressure (Malonda, 2019).

Regarding salt intake, based on the analysis of researchers in several journals, it was concluded that excessive salt intake, rather than low-salt diet, may increase the severity of hypertension in hypertensive people. The worse a person's salt intake pattern, the higher and potentially more severe hypertension (Libri, Abdurrachim, & Mariana, 2015).

Additionally, obesity experienced in humans can lead to hypertension, based on the results of several journal analyses. This condition is due to the fact that the obese person needs a large amount of blood to carry oxygen and nutrients to the body's tissues.   Thus,   the volume   of   blood circulating   in the blood vessels increases, and the work of the heart will also be faster, increasing blood pressure (Tiara, 2020).

Dyslipidemia and hypertension in the elderly can increase systolic and/or diastolic pressure, often with multifaceted clinical implications in ischemic stroke patients. Furthermore, there is a positive correlation between high cholesterol and systolic diastolic pressure. However, compared to hypertriglyceridemia and low HDL, LDL has little on the formation of atheroma and minimal effects on blood pressure elevation (Kamajaya, Lestari, & Yasa, 2016).

Classification of The Elderly

Restrictions for the elderly according to WHO include: The median age group is145-59 years old; Elderly from 60-74 years old; Old age between 75-90 years; Very old age is over 90 years old.

Classification of Hypertension

The definition of hypertension is: Systolic blood pressure (TDS) >140 mmHg and/or diastolic blood pressure (TDD) >90 mmHg. The Joint National Committee for the Prevention, Detection, Evaluation and Treatment of Hypertension (JNC VI) and the World   Health Organization/International   Society of Hypertension Guidelines Subcommittee are used to classify hypertension. Systolic-diastolic hypertension is diagnosed when TDS ≥140 mmHg and TDD ≥90 mmHg. Isolated Systolic Hypertension (HST) is present when TDS is ≥140 mmHg and TDD is <90 mmHg. The definition of hypertension from WHO is shown in Table 1.

Table 1. Definition of hypertension for the World Health Organization

JNC 7 Pressure categories	JNC 6 Pressure categories	Systolic blood pressure	And/or	Diastolic blood pressure (mmHg)
Usual	Optimal	< 120	And	<80
Prehypertension		120-139	Or	80-89
-	Usual	< 130	And	< 85
-	Normal-High	130-139	Or	85-89
Hypertension	Hypertension			
Degree 1	Degree 1	140-159	Or	90-99
Degree 2		≥160	Or	>/=100
	Degree 2	160-179	Or	100-109
	Degree 3	≥180	Or	>/=110

The classification of hypertension according to JNC VII and JNC VI can be seen in table 2.

Table 2. Classification of hypertension according to JNC VII and JNC VI

Category	Systolic	Diastolic
Optimal	<120	<80
Normal	<130	<85
Normal-high	130-149	85-89
1st degree hypertension (mild)	140-159	90-99
Subgroup: *borderline*	140-149	90-94
Hypertension of the 2nd degree (moderate)	160-179	100-109
3rd degree hypertension (severe)	≥180	≥110
Isolated systolic hypertension	≥140	<90
Subgroup: *borderline*	140-149	<90

Figure 1. Research Roadmap
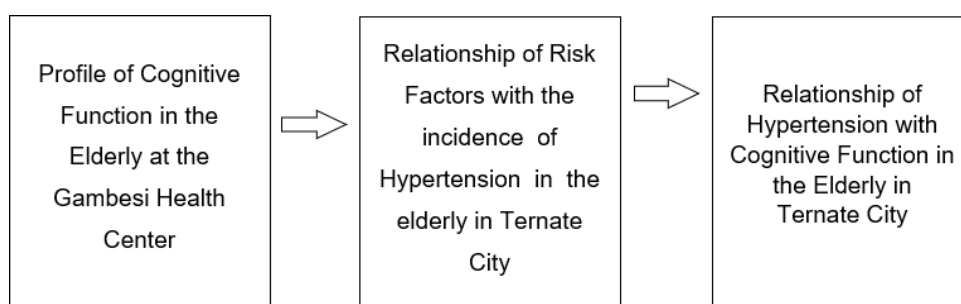
RESEARCH METHODS

This research was carried out from June 2022 – August 2022 which was conducted at the Puskesmas area of Ternate City/Ternate Island (Puskesmas Kota, Siko, Kalumata, Kalumpang, Sulamadaha, Jambula, Bahari Berkesan, Gambesi)

The research sample was the elderly who came to the Puskesmas. The inclusion criteria for the study sample are:
1. The elderly are aged >=45 years
2. Older people can communicate well and understand reading clearly to respond to statements in the questionnaire.
3. Willing to be the subject of research by filling out an informed consent sheet.
4. Elderly people who come to PUSKESMAS

The exclusion criteria in this sample are:
1. Elderly people who do not come during data collection
2. Elderly people who do not want to take data

The samples in this study were selected through the Cluster random sampling technique. The selection of samples begins with grouping PUSKESMAS - PUSKESMAS in Ternate City, then taking PUSKESMAS that are affordable and located in the Ternate Island area. Then, from the PUSKESMAS, a sample of elderly with a population provision of 1000 elderly is taken using the following Slovin formula:

$$N= N/(1+(Nxe^2)$$
$$= 1000/(1+1000x0.052)$$
$$= 286 \text{ samples} ====299 \text{ Samples}$$

The sample will be divided into several health centers studied. The variables studied were age, gender, genetic factors, smoking history, history of consuming alcohol, excessive salt consumption, obesity, and dyslipidemia.

The data collection tool is in the form of a questionnaire with structured questions. The data collection results were then processed using SPSS using univariate analysis and bivariate analysis to see the relationship of risk factors with the incidence of hypertension in the elderly.

Figure 2. Research Flowchart
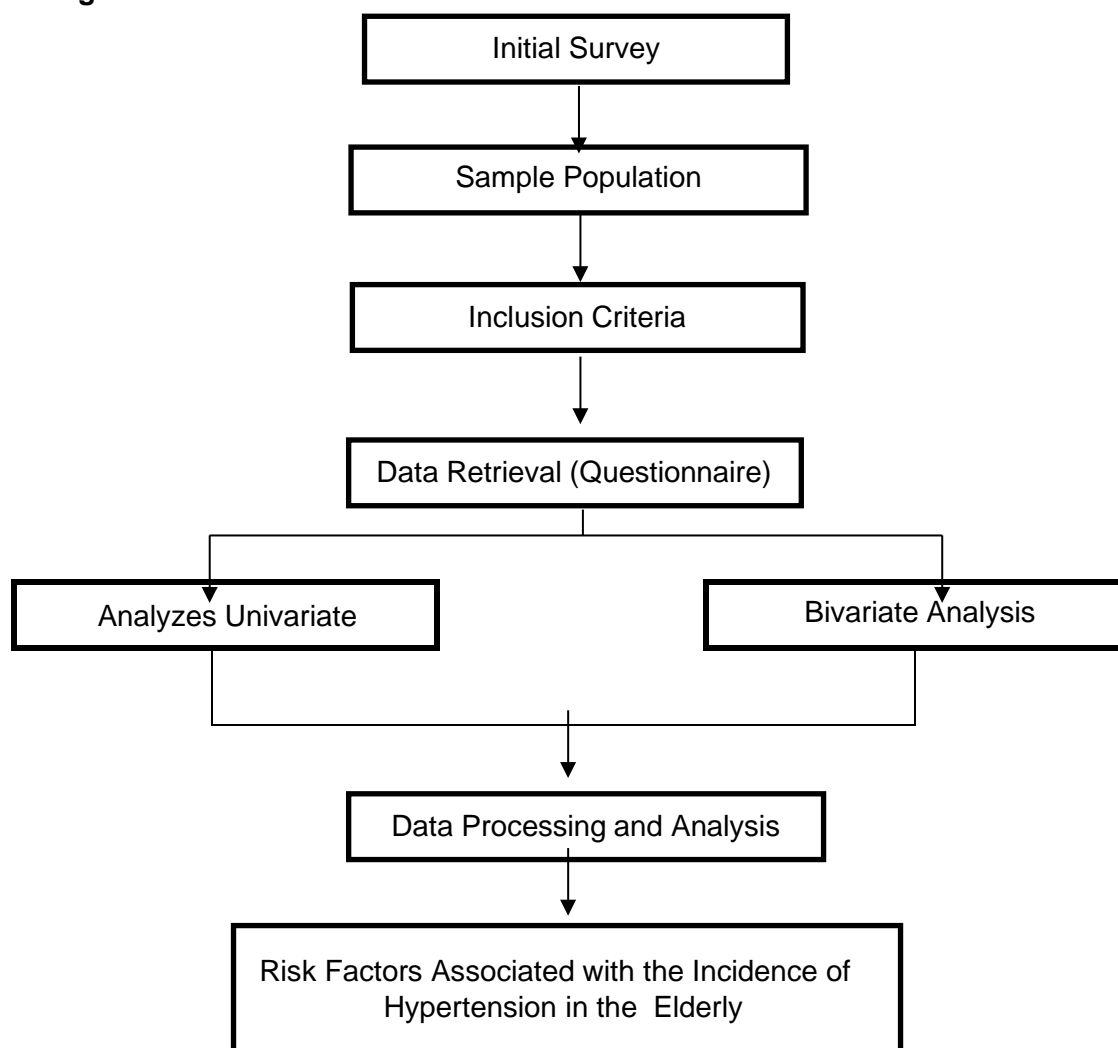
RESULTS

This study was conducted on the pre-elderly and elderly populations in 8 PUSKESMAS in Ternate City, with as many as 299 respondents. Based on the research results, the demographic characteristics of the respondents can be seen.

Table 3. Distribution of Demographic Characteristics of Respondents

Demographic	Frequency	Percentage
Age 45 - 70 Years > 70 Years Old	272 27	91 9
Gender Male Women	78 221	26.1 73.9

Based on table 4, it can be seen from the total sample of 299 respondents that there was a difference in the age distribution of the study subjects. The study subjects in the

age group of 45-70 years were 272 people (91%), and in the age group >70 years, as many as 27 people (9%). In addition, the sex characteristics of the study subjects were mostly female, namely, 221 people (73.9%), while the study subjects were male, as many as 78 people (26.1%).

Incidence of Hypertension in the Elderly
It can also be seen that the study subjects were diagnosed with hypertension and undiagnosed with hypertension.

Table 4. Distribution of Respondents Diagnosed with Hypertension

Distribution of Respondents Diagnosed	Frequency	Percentage
Hypertension	180	60.2
No Hypertension	119	39.8
Total	299	100

From the table above, it can be seen from the total research subjects totaling 299 respondents that 180 people (60.2%) were obtained from the study subjects who were diagnosed with hypertension and 119 people (39.8%)

Relationship of Age with the Incidence of Hypertension in the Elderly
Based on the results, it can be seen the relationship between age and hypertension in the elderly.

Table 5. Relationship of Age with Hypertension in the Elderly

Age	Hypertension		Total	Significance	OR	The
	Yes	Not				
45 - 70 Years	157	115	272			
> 70 Years	23	4	27	0.005*	4.221	1.418 - 12.511
Total			299			

The results show that the study subjects diagnosed with hypertension were 157 people aged 45-70 years and 23 more than 70 years old. The study subjects who were not diagnosed with hypertension were 115 people aged 45-70 years and four people aged more than 70 years. Obtained a p = 0.005, it was concluded that there was a significant relationship between age and hypertension in the elderly. The Odds Ratio test shows that people aged>70 years old have 4.221 greater chances of suffering from hypertension compared to people around the age of 45-70 years old.

Gender on Hypertension in the Elderly
Based on the research results, the relationship between sex and hypertension in the elderly can be seen.

Table 6. Sex Relationship with Hypertension in the Elderly

Gender	Hypertension		Total	Significance	OR	The
	Yes	Not				
Man	45	33	78			
Woman	135	86	221	0.599*	1.151	0.681 - 1.945
Total			299			

The analysis showed that 135 respondents diagnosed with hypertension were female, and 45 were male. Eighty-six people undiagnosed with hypertension had a female gender, and 33 were male. Obtained a p = 0.599, it can be concluded that there is no significant relationship between sex and hypertension in the elderly.

Relationship of Family Derivative Disease History with Hypertension in the Elderly
The results show the relationship between a family history of hypertension and hypertension in the elderly.

Table 7. Relationship of Family History with Hypertension in the Elderly

Family History of Hypertension	Hypertension		Total	Significance	OR	The
	Yes	Not				
Yes	88	22	110			
Not	97	97	189	0.000*	4.217	2.440 - 7.291
Total			299			

The analysis results obtained by respondents diagnosed with hypertension were 88 people with a family history of hypertension and 97 people who did not have a family history of hypertension. In addition, 22 people who were undiagnosed with hypertension had a family history of hypertension, and 97 people did not have a family history of hypertension. Therefore, obtaining a p-value =0.000, it can be concluded that there is a significant relationship between the family history of hypertension and hypertension in the elderly. The Odds Ratio test shows that people with family history of hypertension have 4.217 greater risk of suffering from hypertension compared to people without family history of hypertension.

The Relationship Between Smoking Habit and hypertension in the Elderly
The analyses indicate the relationship between smoking habits and the incidence of hypertension in the elderly.

Table 8. Relationship of Smoking with Hypertension in the Elderly

Smoke	Hypertension		Total	Significance	OR	The
	Yes	Not				
Yes	23	25	48	0.058*	.551	.296 - 1.025
Not	157	25	251			
Total			299			

The analysis results were obtained from a total sample of 299 samples, and there were 23 smokers diagnosed with hypertension and as many as 157 people who were not smokers who were diagnosed with hypertension. Obtained a p = 0.058, it can be concluded that there is no significant relationship between smoking habits and hypertension in the elderly.

The Relationship between Alcohol Consumption and Hypertension in the Elderly
Based on the research results, the relationship between alcohol consumption and the incidence of hypertension in the elderly can be seen.

Table 9. Relationship of Alcohol Consumption with Hypertension in the Elderly

Consumption of Alcohol	Hypertension		Total	Significance	OR	The
	Yes	Not				
Yes	2	1	3	0.818*	1.326	.119 - 14.787
Not	178	118	296			
Total			299			

The analysis results were obtained from a total sample of 299; there were as many as two people who consumed alcohol diagnosed with hypertension; from this sample, as many as 178 people who did not consume alcohol were diagnosed with hypertension. Therefore, obtaining a value of p = 0.818, it can be concluded that there is no significant relationship between alcohol consumption and hypertension in the elderly.

Relationship of Salt Consumption with Hypertension in the Elderly
The analyses show a relationship between salt consumption and hypertension in the elderly.

Table 10. Relationship of Salt Consumption with Hypertension in the Elderly

Salt Consumption	Hypertension		Total	Significance	OR	The
	Yes	Not				
High Salt	66	23	89			
Low Salt	114	96	210	0.001*	.414	.240 - .715
Total			299			

The analysis results were obtained from a total sample of 299 samples, 66 people who consumed high-salt foods diagnosed with hypertension and 114 people who consumed low-salt foods diagnosed with hypertension. Obtained a p = 0.001, it can be concluded that there is a significant relationship between salt consumption and hypertension in the elderly. The Odds Ratio test shows that people with higher salt consumption have 0.414 greater risk to have hypertension compared to people with lower salt intake.

The Relationship between Obesity and Hypertension in the Elderly
The results highlight the relationship between obesity and the incidence of hypertension in the elderly.

Table 11. Relationship of Obesity with Hypertension in the Elderly

Obesity	Hypertension		Total	Significance	OR	The
	Yes	Not				
Yes	118	57	175			
Not	62	62	124	0.002*	2.070	1.290 - 3.323
Total			299			

The analysis results were obtained from a total sample of 299; there were 118 people with obesity diagnosed with hypertension and 62 people with obesity who were diagnosed with hypertension. Obtained a p = 0.002, it can be concluded that there is a significant relationship between obesity and hypertension in the elderly. The Odds Ratio test shows that people with obesity have 2.07greater risk to have hypertension compared to non-obese people.

Relationship of Dyslipidemia with Hypertension in the Elderly
Based on the results, the relationship between dyslipidemia and the incidence of hypertension in the elderly can be seen.

Table 12. Relationship of Dyslipidemia with Hypertension in the Elderly

Dyslipidemia	Hypertension		Total	Significance	OR	The
	Yes	Not				
Yes	76	37	113			
Not	104	82	186	0.052*	1.620	.994 - 2.638
Total			299			

The analysis results were obtained from a total sample of 299; 76 people with dyslipidemia diagnosed with hypertension and as many as 104 people with dyslipidemia diagnosed with hypertension. Obtained a p-value = 0.052, it can be concluded that there is a significant relationship between dyslipidemia and hypertension in the elderly. The Odds Ratio test shows that people with dyslipidemia have 1.62 chances to have hypertension compared to people without dyslipidemia.

DISCUSSION

Relationship of Age with Hypertension in the Elderly
The results of $p<0.05$ (p = 0.005) show a significant relationship between age and the incidence of hypertension. This research is in line with the research showing a relationship between the ages and the incidence of hypertension. The Odds Ratio test also shows that elderly people have 4.221 greater risk to have hypertension compared to pre-elderly people.

The risk of hypertension at an advanced age is higher because as a person ages, there is a buildup of collagen in the muscle layer, which causes the arterial walls to thicken. Therefore, the walls of the arteries will slowly become narrower and stiffer. This condition causes pressure on the blood vessels, and the heart will pump stronger, causing hypertension in an elderly person (Sudarmin, Fauziah, & Hadiwiardjo, 2022; Thesman, 2019). Once people reach the pre-elderly and elderly stage, there will be decrease in biological abilities in confronting disease, especially metabolic disease in this case hypertension. Pre-elderly and elderly people also have the lower physique activity, this condition happen because pre-elderly and elderly people tend to have osteoporosis and many others musculoskeletal disease. This lack physique activity can lead to sedentary lifestyle that may end up with hypertension on pre-elderly and elderly people.

Gender on Hypertension in the Elderly
Bivariate analysis result shows a value of $p>0.05$ (p= 0.599), this result shows no relationship between the gender and the incidence of hypertension in the elderly. This study, in line with research conducted in Alue Bili Geulumpang village, North Aceh Regency, showed no relationship between gender and hypertension in the elderly. Therefore, it is said that gender has no influence on hypertension, where the male gender suffers more from hypertension than women, with a ratio of increased systolic blood pressure of about 2.29 mmHg. The same is also stated in the study stating that sex factors do not have a significant relationship with hypertension (Rahmadhani, 2021; Wahyuni, Ibrahim, & Agustina, 2022).

In contrast, there is a relationship between the gender and the incidence of hypertension. Female has a higher risk of suffering from hypertension than men when women enter old age and experience menopause. This condition is because the estrogen hormone will decrease in the secretion of HDL (High-Density Lipoprotein) in the body, so it can triggering increase in blood pressure (Sudarmin et al., 2022; Thesman, 2019; Wahyuni et al., 2022). But, in some research there has been some results that shows men have higher risk to have hypertension, this results have some connection with men's smoking habit, etc (Oktavia, Rizal, & Hayati, 2021).

Relationship of Family History of Disease with Hypertension in the Elderly
Based on the results, a p-value = 0.000 was obtained. Therefore, this result can be concluded that there is a significant relationship between the family history of hypertension and the incidence of hypertension in the elderly. This research is in line with the research stating that there is a meaningful relationship between genetic factors and hypertension. Furthermore, same results were found in a study in Alue Bili Geulumpang Village, North Aceh Regency, which obtained a p-value =0.005, concluding there was a relationship between family history and hypertension (Rahmadhani, 2021). The Odds Ratio test shows that people with family history of hypertension have 4.217 greater risk to suffer from hypertension compared to people without family history of hypertension.

A person with a family history who has a disease such as hypertension more often suffers from the same disease. If a person has a close family with a history of hypertension, it increases the risk fourfold. It was found that some had a hereditary history of hypertension but did not suffer from hypertension. This tendency can be influenced by lifestyle and prevention to minimize the risk of hypertension. Moreover, a person with no hereditary history of hypertension does not mean he will not suffer from hypertension. This tendency is due to other factors that can affect hypertension(Sudarmin et al., 2022).

Relationship of Smoking History with Hypertension in the Elderly
In the analysis that was carried out, 23 smokers who were diagnosed with hypertension and 157 non-smokers who were diagnosed with hypertension, from the sample obtained a p-value =0.058. Therefore, it can be concluded that there is no significant relationship between smoking habits and hypertension. Imelda and Sjaaf also obtained the same results in a study at the Lubuk Minturun Cold Water Health Center; it was found that 52% of heavy smokers with normal blood pressure with a p-value = 0.846.

However, different results were obtained by research conducted by (Widianto, Romdhoni, Karita, & Purbowati, 2019) at Puskesmas I Kembaran, and a p-value = 0.023 was obtained, which showed that lifestyle, including smoking, had a significant relationship with hypertension. This condition is because cigarettes have various ingredients that affect cardiovascular function, including nicotine, which can cause vasoconstriction of blood vessels. In addition, carbon monoxide in cigarettes is also able to increase blood pressure. This is because oxygen is more bound by carbon monoxide, so the heart tries to pump the oxygen needed by the body.

Several factors influenced the difference in the results of this study. This result includes most of the respondents are non-smokers, which amounted to 157 samples, and most of the samples were dominated by women amounted to 221 samples.

The Relationship between Alcohol Consumption and Hypertension in the Elderly
According to the analysis, two alcohol drinkers were diagnosed with hypertension, and 178 abstainers were diagnosed with hypertension. Bivariate analysis shows a p-value = 0.818, we can conclude that there is no significant association between alcohol consumption and hypertension.

However, some researchers found different results in a study conducted at North Tomohon Health Center, obtaining a p-value = 0.003 and a significant association between alcohol consumption and hypertension. The effect of alcohol on raising blood pressure is still unknown, but it is believed it can increase cortisol levels, red blood cell mass and blood viscosity, which are thought to play a role in raising blood pressure. The discrepancy in the results of this study was influenced by several factors, including the high number of 178 alcohol-free samples (Malonda et al., 2012).

Relationship of Excessive Salt Consumption with Hypertension in the Elderly
In the analysis above, 66 people consuming high-salt foods diagnosed with hypertension and 114 people consuming low-salt foods diagnosed with hypertension received a p-value =0.001 means that there is a significant association between excessive salt consumption with hypertension. The Odds Ratio test also shows that people with higher salt intake will have 0.414 greater risk to suffer from hypertension compared to people with lower salt intake. The same result was also reported by Hamzah, Akbar, Langingi, and Hamzah (2021) a study conducted at the Moribah Health Center Department found a p-value = 0.014, allowing us to conclude that there is a link between diet and hypertension. Excessive salt intake will increase extracellular fluid, causing intracellular fluid to be pumped out, increasing the amount of extracellular fluid, affecting blood volume, and causing hypertension.

However, a study by Malonda et al. (2012) yielded different results. A study conducted at the North Tomohon Health Center yielded a p-value = 0,700, so we can conclude that there is no significant association between salt intake and hypertension. The different result may occur because there is a large differentiation between number of samples in Malonda's study.

The Relationship between Obesity and Hypertension in the Elderly
According to the analysis performed, 118 obese individuals and 62 non-obese individuals were diagnosed with hypertension in the sample, a p-value = 0.002 was obtained it can be concluded that there is a significant association between obesity and hypertension. The Odds Ratio test shows that people with obesity have 2.07 greater risk to have hypertension compared to non-obese people. Individuals with hypertension have a 2.07 times chances to suffer from hypertension compared to non-obese individuals. The same results were obtained in a study conducted by (Asari & Helda, 2021) at the PB Selayang II Health Center, Medan. A p-value of 0.001 was obtained and obese patients have chances up to 4.42 times of suffering from hypertension compared to non-obese person.

Higher levels of fat can raise blood cholesterol levels, which can lead to atherosclerosis, which narrows arteries, which causes the heart to work harder and leads to hypertension. Obesity also a sign that shows number of metabolic disease such as diabetes and hypertension. People with obesity tend to have a sedentary lifestyle with lower physique activity and unhealthy diet this condition may lead to development of diabetes. Diabetic condition will also leads to the forming of plaque inside blood vessels, thus will also lead to increase of pressure inside blood vessels.

Relationship of Dyslipidemia with Hypertension in the Elderly

In the analysis carried out, 76 people with dyslipidemia diagnosed with hypertension and 104 people with dyslipidemia who were diagnosed with hypertension from the sample obtained a p-value = 0.052 so that it can be concluded that there is a significant relationship between dyslipidemia and hypertension. Furthermore, individuals with dyslipidemia also had a 1.62 times chance of developing hypertension compared to individuals who did not have a dyslipidemia condition.

The same result was obtained by Putri, Suyasa, and Budiapsari (2021) in Bali, and a p-value= 0.00 was obtained to conclude a significant relationship between dyslipidemia and hypertension. Low-Density Lipids (LDL) and total cholesterol are factors in the occurrence of dyslipidemia. The increase in lipolysis causes the levels of free fatty acids to increase so that dyslipidemia occurs, and this also affects the performance of the cardiovascular system, such as lowering endothelial function and increasing arterial stiffness, which causes hypertension. Increasing of Low Density Lipids, triglycerides, and total cholesterol will also lead to forming of atherosclerosis that will make blood vessels becomes more stiff, and also narrowing inside blood vessels that may lead to hypertension.

CONCLUSION

From these results it can be concluded that there is a significant association between age and the incidence of hypertension. However, no significant association was found between sex and the development of hypertension. A family history of hypertension is also important. In contrast, there was no significant association between smoking and the development of hypertension. Likewise, there was no significant association between alcohol consumption and the development of high blood pressure. Significant association were also found between salt intake with the onset of hypertension, obesity with the onset of hypertension, and dyslipidemia with the onset of hypertension. This results also shows that there are still many people with hypertension, so it is crucial to do some early prevention for the puskesmas. The results of this study also provide recommendations for future research. Future studies should increase the number of samples from different public health centers. The proposal also includes combining more exploratory methods with primary history studies.

ACKNOWLEDGMENT

DECLARATION OF CONFLICTING INTERESTS

The authors declared no potential conflicts of interest

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