Research Article

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The Relationship between Body Mass Index and Smoking History on Incidence Rate of Hypertension in the Elderly

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Abstract

Background: Hypertension in the elderly is a chronic disease that is resulted from various risk factors. The incidence of hypertension increases in the elderly, with a prevalence of 60-80% per year from the entire elderly population. A total of 1311 elderly who suffers from hypertension have a history of smoking and abnormal body mass index (BMI), so this research was conducted to determine how significant the risk of these two factors is.

Objective: To analyze the relationship between BMI and smoking history on the incidence of hypertension in the elderly in the Public Health Center of Rendeng.

Methods: This research design was cross-sectional with a purposive sampling technique in elderly hypertensive patients in the Public Health Center of Rendeng by checking blood pressure and conducting interviews to fill out questionnaires. The data were analyzed by using the Spearman correlation test, and the test was strengthened using the C contingency correlation test.

Results: This research used samples of 99 people. The results of the Spearman correlation test on BMI obtained a significant value (p) of 0.001 (p<0.05), and a history of smoking obtained a significant value (p) of 0.330 (p>0.05).

Conclusion: There was a relationship between BMI and the incidence of hypertension in the elderly in the Public Health Center of Rendeng. However, there was no significant relationship that existed between smoking history.

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INTRODUCTION

Hypertension is a condition in which systolic blood pressure is 140 mmHg or diastolic pressure 90 mmHg with measurements twice and an interval of five minutes in a state of rest [1]. According to a study by the World Health Organization, hypertension causes 9.4 million deaths and covers 7% of the world's disease burden. According to data from the WHO, there were around 600 million hypertensives worldwide in 2014. The African region had the highest incidence, at about 30%, and the Americas had the lowest prevalence, at about 18%[2]. The prevalence rate is estimated to increase by 7.4% annually until 2050[3]. Based on medical record reports on the data profile of the Public Health Center of Rendeng in Kudus, there were pretty high cases of hypertension. Hypertension cases were experienced by all age groups, especially in the elderly. According to the data profile in the Public Health Center of Rendeng, from January to December 2019, 9,618 elderly patients underwent examinations in the Public Health Center Rendeng, and there were 1,311 elderly patients with high blood pressure following the criteria for blood pressure in hypertension.

Hypertension in the elderly appears as a chronic disease and arises as a result of various factors. Hypertension is divided into risk factors that cannot be modified: age, race, heredity, and gender. Other modifiable factors include alcohol consumption, smoking, obesity, diet, stress, lack of activity, and exercise[4]. The incidence of hypertension is very high, especially in elderly patients over 60 years, with a prevalence of 60-80% per year in the entire elderly population. Research conducted in the Sao Paulo region, which discovered a prevalence of 70% among the elderly of the entire population, also supports this situation[5].

Based on the high data of hypertensive patients receiving treatment in the Public Health Center of Rendeng, research was conducted to analyze the relationship between body mass index (BMI) and smoking history on the incidence of hypertension in the elderly. This condition was because people did not know the effect and influence of BMI on blood pressure health. Furthermore, long-term hypertension can lead to heart failure through left ventricular hypertrophy and systolic dysfunction[6].

METHOD

This research was conducted by using a research design that is Cross Sectional. This research was a type of observational analytic research. The population used all hypertensive patients of the same age or above 60 years in the Public Health Center of Rendeng. All elderly hypertensive patients in the Public Health Center of Rendeng who met the inclusion criteria for the research were included in the sample. The inclusion criteria of the sample were people over 60 with uncontrolled and controlled hypertension and people over 60 with blood pressure readings of 140/90 mmHg at the moment of measurement and who were willing to participate. The exclusion criteria in selecting samples were respondents who refuse to be used as samples, respondents who are not cooperative, and respondents who have died. The drop-out criteria in this research was an elderly patient with hypertension who had short-term memory. The number of samples needed in this study was 92 people, but the researchers used a sample of 99 people through the purposive sampling technique by collecting

data through blood pressure checks and conducting interviews to fill out questionnaires. This research used an instrument in the form of a questionnaire containing the patient's identity, smoking history, and the results of measuring vital signs and patient anthropometry. The research data results can be analyzed statistically to find the meaning, which was carried out computerized using the IBM SPSS Statistics 25 program. The statistical test used the Spearman correlation test and was strengthened using the C contingency correlation test. Therefore, this research was non-parametric. The ethics committee approved this research in Universitas Muhammadiyah Surabaya, as evidenced by issuing a certificate of appropriate research ethics with the number 032/KET/II.3/AU/F/2020.

RESULTS

This research was conducted in the Public Health Center of Rendeng on 99 samples that matched the inclusion and exclusion criteria. Classification of blood pressure using the INASH 2019 guidelines, hypertension was divided into grades 1, II, III, and isolated systolic[7]. Older respondents have hypertension, with grade 1 hypertension blood pressure criterion (66.7 percent) at the time of measurement and grade 2 hypertension blood pressure criteria for the remaining respondents (33.3 percent).

Table 1. Frequency Distribution of Respondents' Characteristics

Characteristics	Hypertension Grade 1		Hypertension Grade 2		N	Percentage
	N	%	N	%		
Age						
60-74 years old	59	59.6	31	31.3	90	90.9
75-80 years old	7	7.1	2	2.0	9	9.1
Gender						
Man	16	16.2	7	7.1	23	23.2
Woman	50	50.5	26	26.3	76	76.8

Source: Irawati, 2022

Table 2. The Relationship Between BMI and the Incidence Rate of Hypertension in the Elderly

Risk Factor	Hypertension Grade 1		Hypertension Grade 2		p-value	R-value
	N	%	N	%		
Body mass index						
Thin	6	6.1	2	2.0		
Normal	45	45.5	14	14.5	0.001**	0.340
Obesity	14	14.1	18	18.2		
Smoking History						
Light	58	58.6	31	31.3		
Currently	5	5.1	2	2.0	0.330	-0.099
Heavy	2	2.0	1	1.0		

*Note: the p-value is calculated by the contingency coefficient test C, the significance value is based on the p-value <0.05, and the sign ** indicates statistically significant or significant. Source: Irawati, 2022*

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Table 3. The Relationship Between BMI and the Incidence Rate of Hypertension in the Elderly

Risk Factor	Hypertension Grade 1		Hypertension Grade 2		p-value	R-value
	N	%	N	%		
Body mass index						
Thin	6	6.1	2	2.0	0.192	0.130
Normal	45	45.5	14	14.5	0.014**	0.240
Obesity	14	14.1	18	18.2	0.001**	0.318
Smoking History						
Light	58	58.6	31	31.3	0.346	0.094
Currently	5	5.1	2	2.0	0.782	0.028
Heavy	2	2.0	1	1.0	0.214	0.124

*Note: the p-value is calculated by the contingency coefficient test C, the significance value is based on the p-value <0.05, and the sign ** indicates statistically significant or significant. Source: Irawati, 2022*

Table 1 shows that hypertension is mostly suffered by the elderly aged 60-74 years and the sex that suffers from hypertension is women. Women are at risk of developing hypertension after menopause because of the decrease in the hormone estrogen, which plays a role in the health of blood vessels. The age factor also affects the neurohormonal and renal dysregulation system in which the kidneys of elderly hypertensive patients can reduce the Glomerular Filtration Rate (GFR), which causes a decrease in sodium activity so that the body can become excess intracellular calcium and sodium. This condition can trigger the blood vessels to become in a state of vasoconstriction[8,9].

Based on table 2, significant results were obtained for the body mass index because the p-value was less than 0.05, which was 0.001. The history of smoking had no significant result with a p-value of 0.330. High body mass index can cause hypertension as a form of body compensation for large body mass. The amount of body mass causes an increase in the amount of blood circulating in the blood vessels because the need for blood increases. Therefore, the body's adaptation to this condition increases blood pressure[9].

Table 3 shows a relationship between BMI in the standard and obese categories on the incidence of hypertension in the elderly with p values of 0.014 and 0.001 and had a reasonably strong relationship level. The relationship between smoking history and the incidence of hypertension in the elderly was insignificant and had a low strength value.

DISCUSSION

This research found that the average result of someone who had entered the criteria for the elderly suffering from hypertension a lot as women. It compared to men because they had 76.8% of the total sample. This result occurred because the women who had entered menopause had lower estrogen levels. This condition can lead to a decrease in HDL levels which function in maintaining healthy blood vessels by decreasing HDL levels and high LDL levels in the body, which can be at risk or can affect the occurrence of atherosclerosis which can increase blood pressure[5,10]. According to the findings of research conducted in the Public Health Center of Rendeng on the relationship between body mass index and the incidence of hypertension in elderly people, hypertension grade 1 had a percentage of (69.2 percent), and

grade 2 had a significantly higher percentage, which was body mass index with the obesity category, which had a percentage level of (52.9 percent). It was a body mass index that was increasingly leading to obesity that can affect the high blood pressure level in patients with hypertension in the elderly. This result was supported by a significance value (p) of 0.001.

The results of the contingency coefficient test between the standard and obese categories of body mass index on the incidence of hypertension had a lower significance value with a low to moderate relationship strength value. This result meant that the BMI in the standard and obese categories had a moderate level of relationship. Therefore, it can be stated that there was a more substantial relationship level causing hypertension in the elderly in the Public Health Center of Rendeng.

In people with a BMI in the obesity category, the pathophysiological theory started from three main things that can cause hypertension: insulin hormone resistance, autonomic system disorders, and structural and functional abnormalities of blood vessels. A person's blood vessels regulate arterial pressure, which controls baroreceptor reflexes' nervous and hormonal systems. Arterial stiffness can also be a factor in increasing blood pressure[11,12]. Obesity is an unstable condition in a person where the energy received is higher than the energy used. In someone with obesity, in line with the condition of increasing intravascular fluid volume and cardiac output where blood pressure was influenced by the volume of fluid that fills the blood vessels in obese conditions, the pumping power of the heart and circulating volume in the blood vessels can be higher compared to

someone with a body mass index. normal category[13–15]. Since the more body mass, the more blood volume was needed to vascularize body tissues, resulting in greater pressure on the wall of the arteries[16,17].

The results of this research were in line with research from Nugraheni, A. et al. (2019) stated in the results that the Spearman test has a significance value (p) of 0.010, which had a value smaller than alpha (α) which was 0.05 and had a Spearman correlation coefficient value of 0.401 which meant it had a moderate level of relationship strength[18]. The research also stated that someone who had a nutritional status above the normal category in someone who had entered old age had a more significant impact on experiencing the incidence of hypertension. This condition was related to hormonal influences in the body, such as increased levels of the hormone insulin and aldosterone in the blood plasma in someone who was obese. The increased aldosterone hormone can cause water and Na retention in the blood, which causes an increase in blood pressure, and the aldosterone hormone can also reduce the excretion of Na in the glomerulus, causing blood pressure to increase to a state of hypertension. Another thing about the BMI in the obesity category was that people with excess weight tend to have difficulty moving freely to be able to move freely. It takes much energy to vascularize body tissues, and the heart must pump blood and increase pressure in the body's blood vessels [18,19]. Another research in line with this result was Ding et al. It stated that research in China showed that obesity and decreased physical activity were significantly associated with a high risk of hypertension, high cholesterol, and diabetes. While drinking alcohol is only associated with hypertension. And

smoking is not associated with cardiometabolic conditions.[20]

The research in the Public Health Center of Rendeng on the impact of smoking history on the incidence of hypertension in the elderly found that the Spearman correlation test had a significance value (p) of 0.330 and a Spearman correlation coefficient value of -0.099, indicating that there was no significant relationship or effect between smoking history and the incidence rate of hypertension in the elderly and only a shallow level of association. The results of the Spearman test were strengthened using the contingency coefficient correlation test, where the history of smoking in the light category had a significance value (p) of 0, 346. It meant that there was no significant relationship (less statistically significant) and the coefficient value (r) was 0.094, which had a shallow relationship. The results of the other contingency coefficient tests on a history of moderate smoking also indicated that there were results at a significance value (p) of 0.782 and a coefficient value (r) of 0.028. It could be concluded that there was no significant relationship between a history of moderate smoking and the incidence of hypertension in the elderly. There was only a weak level of relationship strength. The contingency coefficient test on the history of smoking in the heavy category had a significance value of 0.214. Therefore, it can be stated that the history of smoking in the heavy category did not have a significant relationship (less statistically significant). The calculation of the Odds Ratio showed that the calculation estimated how much the influence of risk factors on a person's disease. The OR calculation showed that the result of about 0.690 meant 0.69 times the risk of hypertension, with the most significant risk of causing hypertension

of 2.788. It meant that someone who smokes has the most significant risk of 2.788 times causing hypertension.

The findings of this research supported the previous research by Hafidz et al. (2016), which found no relationship between smoking and the prevalence of hypertension in elderly people. It was demonstrated by the research's findings with a significance value (p) of 0.128, and this may be due to the high proportion of respondents who did not smoke or fall into the light category but had a history of cigarette exposure and cigarette smoke.[1,20]. Older women who did not smoke were most likely caused by exposure to cigarette smoke by those around them. Therefore, exposure to cigarette smoke can affect their health for a few years until they enter old age. The scientists stated that the chemicals in cigarettes, such as cigarette smoke, can affect the health of someone around them who does not smoke. The impact of cigarette smoke cannot be directly felt in the short term. However, after a few years, it can be felt about 10-20 years after exposure since the chemicals from cigarette smoke can accumulate in the body[1,21].

CONCLUSION

Based on the research results and the discussion described, it can be concluded that there is a significant relationship between BMI in normal and obese categories and the incidence of hypertension in the elderly. There is no significant relationship between smoking history and the incidence of hypertension in the elderly. The frequency of the female gender is higher than the male gender. Hypertension with grade 1 classification has a higher percentage. For further research, it is recommended to be more detailed in examining how much risk

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is associated with degenerative diseases. This research has drawbacks; namely, it does not include samples of elderly patients with hypertension without a smoking history.

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