



## Blood Glucose Level, Blood Pressure, and Medication Behavior are related to Cardiovascular Complication in Hypertension Patient at Sikumana Public Health Center

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### Abstract

*Hypertension tends to be incurable and can only be controlled, including to prevent cardiovascular complications. The purpose of this study was to look at the relationship of age, gender, blood glucose level, blood cholesterol level, blood pressure, and medication behavior (consumption of drugs and health control) with the incidence of cardiovascular complications in patients with hypertension at the Public Health Center in Sikumana-Kupang City. This study used a cross sectional design with a sample of 87 hypertension patients. Data analysis used Rank Spearman's Test ( $\alpha = 0.01$ ). There were 50 respondents who had cardiovascular complications in the form of non-hemorrhagic stroke complications (NHS), complications of coronary artery diseases (CAD), NHS and CAD complications, and complications of angina pectoris. Analysis of Rank Spearman indicated age had  $p = 0.404$  and  $r = 0.091$ , gender had  $p = 0.161$  and  $r = -0.152$ , blood glucose level had  $p = 0.000$  and  $r = -0.390$ , blood cholesterol level had  $p = 0.272$  and  $r = -0.119$ , blood pressure had  $p = 0.000$  and  $r = +0.417$ , drug consumption had  $p = 0.000$  and  $r = +0.439$ , and health control had  $p = 0.000$  and  $r = +0.490$ . It was concluded that there were significant relationships between blood glucose levels, blood pressure, and medication behavior (which consists of the consumption of hypertension drugs and health control) with the incidence of cardiovascular complications in patients with hypertension at the Sikumana Public Health Center in Kupang City.*

### INTRODUCTION

Indonesia is experiencing *double burden diseases*, it is a non-communicable disease and an infectious disease as well as a health problem which is an important concern in the community. One of the non-communicable diseases that threatens the health of the people of Indonesia today is hypertension. Hypertension is a chronic cardiovascular disease where blood pressure rises by more than 140 mmHg. Hypertension tends to be incurable and can only be controlled to prevent other disorders. Hypertension that is not handled properly will damage the function of the heart and blood vessels (cardiovascular) which affects

the health of various organ functions such as the heart, brain, eyes and kidneys. Complications of hypertension have caused 9.4% of deaths worldwide each year. Complications of hypertension have caused 45% of deaths due to complications of heart disease, and 51% of deaths due to complications become stroke. Data in the Data and Information that the Heart Health Situation at the Ministry of Health of the Republic of Indonesia in 2014 shows that deaths caused by cardiovascular complications in hypertensive patients such as coronary heart disease and stroke are serious complications in hypertensive patients who are expected to continue to increase to 23.3 million

deaths in in 2030.

The results of Basic Health Research in 2013 showed that the prevalence of hypertension complications in Nusa Tenggara Timur Province has exceeded the national prevalence. The results of basic health research in 2013 concerning hypertension complications showed that complications of hypertension in coronary heart disease in Nusa Tenggara Timur Province had the highest prevalence nationally at 4.4%, where the prevalence of national coronary heart disease was recorded at 1.5%. The Ministry of Health in 2014 explained the prevalence of stroke was 12.1% the same as the national prevalence, and the prevalence of kidney failure 0.3% was above the national prevalence of 0.2%.

Sikumana Health Center in Kupang City is one of the Health Centers in Kupang City with the highest prevalence of hypertension in Kupang City. Research of Israfil et al. (2017) showed the number of patients with hypertension that was recorded as many as 292 people with a prevalence of visits every month ranging from 199-270 people. As many as 40 people had complications with 5 of them were died in 2016, 3 of them were died in 2017 (January, February and September), and 1 of them had moved domicile. The results of research by Israfil et al. (2017) showed that 70% of patients suffering from hypertension at the Sikumana Health Center had complications of vascular damage in the brain (non-haemorrhagic stroke), and 30% had complications of vascular damage to the heart (cardio) that causes chronic artery diseases or coronary heart disease.

The government through the ministry of health has established several risk factors that can lead to complications in patients with hypertension. The Ministry of Health of the Republic of Indonesia in 2013 explained the risk factors for cardiovascular complications in hypertension patients. They are age, gender, blood pressure, blood glucose level, blood cholesterol level, and smoking. Compliance with medication consumption and routine health control are the main actions in preventing complications of non-communicable diseases including hypertension.

The purpose of this study was to look at the relationship of age, gender, blood pressure, blood cholesterol level, blood glucose level, and medication behavior (which consists of the consumption of hypertension drugs and health control) with the incidence of cardiovascular complications in patients with hypertension at the Sikumana Public Health Center in Kupang City.

## METHOD

This study was an observational study with a cross sectional design. The population in the study were 292 patients with hypertension recorded at the Sikumana Public Health Center in Kupang City. The study sample was 87 patients who met the inclusion criteria. Criteria for the inclusion of respondents were those who had hypertension, could read and write, had a minimum of primary school education, and were willing to become research respondents by signing an informed consent. The independent variable consisted of age, gender, blood pressure, blood cholesterol level, blood glucose level, and medication behavior (which consisted of taking hypertension medication and health control). The dependent variable in this study was cardiovascular complications in patients with hypertension at the Sikumana Public Health Center in Kupang City. The research instrument used was a questionnaire. Data collected by interview and identification of medical record data. Data were analyzed by Spearman's Rank Correlation statistical test with a significant value  $\alpha < 0.01$ . The study was conducted in October 2018.

## RESULTS AND DISCUSSION

The results of the analysis using the Spearman's Rank Correlation test ( $\alpha = 0.01$ ) showed that the variables that were significantly related to cardiovascular complications in patients with hypertension at the Sikumana Public Health Center in Kupang were blood glucose levels, blood pressure, and medication behavior (consisting of hypertension medication consumption) and health control. All of these significant variables have a weak correlation level because they have a value of  $r < 0.5$ . Of all the significant variables, health control behavior has the strongest correlation level because  $r$  closes to 0.5 ( $r = 0.490$ ). The results of the analysis for the cholesterol level variable in this study cannot be used as a basis for generalization due to the large number of missing data.

Cardiovascular complications are dangerous complications that are at risk for patients with hypertension. The results of this study indicate that 21.8% of people with hypertension at the Public Health Center in sikumana have experienced vascular complications to the brain or non-haemorrhagic stroke (NHS), 16.1% experienced vascular complications to the heart or coronary artery diseases (CAD), 3.4% had vascular complications to the brain and heart (NHS + CAD), and found another 1.1% had experienced other cardiovascular complications, namely angina pectoris. The results of this study are supported

Table 1. Distribution and results of statistical analysis of the relationship of various variables with cardiovascular complications in patients at the Sikumana Public Health Center in Kupang City

Variable	Cardiovascular complications				Total	p	r
	Yes		No				
Ages							
< 50 years old	0	0.0%	7	100%	7	0.404	+0.091
≥ 50 years old	13	46.4%	15	53.6%	28		
≥ 60 years old	24	46,2%	28	53.8%	52		
Gender							
Male	18	50.0%	18	50.0%	36	0.161	-0.152
Female	19	37.3%	32	42.7%	51		
Glucose blood(mg/ dL)							
N.A	6	100.00%	0	0.00%	6	0.000*	-0.390
< 126	20	51.28%	19	48.72%	39		
≥126	11	26.19%	31	73.81%	42		
Blood cholesterol (mg/dL)							
N.A	33	44.59	41	55.41	74	0.272#	-0.119#
>154	1	25.00	3	75.00	4		
>193	1	25.00	3	75.00	4		
>231	2	50.00	2	50.00	4		
>270	0	0.00	1	100.00	1		
Blood pressure (mmHg)							
>120	5	17.86%	23	82.14%	28	0.000*	+0.417
>140	15	42.86%	20	57.14%	35		
>160	12	66.67%	6	33.33%	18		
>180	5	83.33%	1	16.67%	6		
Medication Behavior							
Drug consumption							
Obedient	7	21.88%	25	78.13%	32	0.000*	+0.439
Sometimes	12	34.29%	23	65.71%	35		
Never	18	90.00%	2	10.00%	20		
Health Control							
Routine	7	21.88%	25	27%	32	0,000*	+0.490
Sometimes	13	36.11%	23	23%	36		
Never	17	89.47%	2	0%	19		

 $\alpha = 0.01$ 

# = cannot be generalized because of missing data

\* = significant association

by Priya et al. (2016) study which shows that coronary artery disease and retinopathy are the most common complications in patients with hypertension. Research Fihaya et al. (2017) also found the most common complications of hypertension are heart attacks and strokes. Persistent hypertension or high blood pressure can cause damage to the epithelial cells of the tunic artery

intima (vascular). This damage stimulates atherosclerosis and thrombus formation which will inhibit the flow of oxygen-rich blood to target organs such as the heart, brain, kidneys, and eyes (Noerhadi, 2008). This condition is a pathophysiological change in the body that is generally not realized by people with hypertension. The results of the Abate et al. (2019) study found that most

hypertensive patients were not aware of risk factors and warning signs of stroke.

The results of this study showed there was no significant relationship between age and cardiovascular complications in patients with hypertension at the Sikumana Public Health Center in Kupang City ( $p = 0.404$  and  $r = +0.091$ ). This study is in accordance with the results of research by Bangsawan & Purbianto (2013) which found that there was no relationship between age and the speed of the occurrence of complications of heart failure in patients with hypertension. Although there is no significant relationship, in Table 1 it can be seen that the majority of patients with hypertension who have cardiovascular complications are >60 years old. Age >60 years is old age where a person experiences changes in physiology and pathophysiology in the circulatory system. Decreased blood vessel elasticity and increased cardiac muscle strength are the main factors in the high risk of cardiovascular complications in patients with hypertension above the age of 60 years (Ganong & McPhee, 2010).

The results of this study indicate that there is no significant relationship between gender and cardiovascular complications in patients with hypertension at the Sikumana Public Health Center in Kupang City ( $p = 0.161$  and  $r = -0.152$ ). This study is consistent with the results of research by Bangsawan & Purbianto (2013) who found that there was no significant relationship between sexes with the speed of complications, heart failure in clients with hypertension. Although it does not have a significant relationship, in Table 1 it can be seen that the majority of patients with hypertension who experience complications are women. This finding is in accordance with the results of Kumar et al. (2018) who found 61% of respondents in the study were female. The research result of Anjani et al. (2016) also found that 60% of respondents in their study of hypertension complications were women. Female sex has a risk of cardiovascular disorders that are quite vulnerable. This happens because along with age there will be a decline in the function of the hormone estrogen and the hormone progesterone in women. The reduced function of the two hormones causes a decrease in fat catabolism and increased damage to blood vessels or vascular (Ganong & McPhee, 2010).

The results of this study indicate that there is a significant relationship between blood glucose levels and cardiovascular complications in hypertensive patients at the Public Health Center in Sikumana, Kupang City ( $p = 0.000$  and  $r = -0.390$ ). The results of this study are consistent

with the results of a study conducted by Weyker, et al. (2007) which showed that >50% of patients with hypertension also have diabetes mellitus. Increased blood glucose levels can cause damage to vascular blood vessels which cause damage to various vital organs. Increased blood glucose or hyperglycemia can cause thickening of the basal membrane of small blood vessels such as blood vessels of the heart, brain, kidneys and eyes. This microvascular thickening results in ischaemia and decreased oxygen and nutrient delivery to tissues which causes tissues in target organs such as the heart, brain, kidneys and eyes to suffer from oxygen and nutrient deficiencies that have an impact on functional impairment (Corwin, 2000).

The results of this study indicate that there is no significant relationship between blood cholesterol levels and cardiovascular complications in patients with hypertension at the Public Health Center in sikumana, Kupang city. ( $p=0,272$  and  $r = -0,119$ ). The results of the analysis cannot be used as a basis for generalization because of the large amount of missing data. The results of other studies generally show a link between cholesterol levels and the incidence of cardiovascular complications, including research from Heni (2017). Heni (2017) found that there was a significant relationship between cholesterol levels and hypertension levels. Heni (2017) found that patients who had blood cholesterol levels >200-230 mg/dL had high blood pressure (140 - 159 / 90-99 mmHg) up to 160-179 / 100-109 mmHg).

The results of this study indicate that there is a significant relationship between blood pressure and cardiovascular complications in patients with hypertension at the Public Health Center in Sikumana, Kupang City ( $p = 0.000$  dan  $r = +0.417$ ). Table 1 shows that the majority of patients with hypertension who have cardiovascular complications have a history of systolic blood pressure >140 mmHg and >160 mmHg. The results of this study are consistent with the results of the study Yue et al. (2018) found that patients with hypertension in stage 1 who had an increase in blood pressure up to 140/90 mmHg or more had a cardiovascular risk 3.01 times compared with those who maintained blood pressure <130/80 mmHg. High blood pressure results in decreased perfusion in various tissues of vital organs such as the heart and brain. This decrease in tissue perfusion results in the heart and brain tissue does not get adequate oxygen supply. Decreased tissue oxygen causes the tissue to experience hypoxia and for a long time results in ischemia or tissue death (Ganong & McPhee, 2010). Blood pressure is a modifiable risk factor for cardiovas-



cular disease, kidney disease, and stroke (Anoop et al., 2018)

The results of this study indicate that there is a significant relationship between drug consumption habits and cardiovascular complications in patients with hypertension at the Public Health Center in Sikumana, Kupang City ( $p=0.00$  dan  $r=+0,439$ ). Table 1 shows that hypertensive patients who have cardiovascular complications are patients who have a history of not taking antihypertensive drugs. The results of this study are consistent with the results of the study of Yausef et al. (2019) who found that only 30.7% of men and 35.1% of women who took antihypertensive drugs controlled their blood pressure. Inability to consume drugs of antihypertension has been a factor associated with the incidence of cardiovascular complications in patients with hypertension in this study. The results of this study are consistent with the results of the study of Abegaz et al. (2017) who found that the right treatment tends to develop target organ damage (TOD) which is very slow, meaning that non-compliance in taking antihypertensive drugs will accelerate damage to target organs or target organs damage in patients with hypertension. Researchers found that non-compliance with the consumption of drugs of anti-hypertension is caused by patients feeling no complaints, forgetting, and busy with daily activities. This finding is in accordance with the results of the study of Pirasath et al (2017) who found that patients do not know the status of their disease, patients have poor medication adherence on the grounds for forgetting and disruption of daily routine. Ivanova & Petrova (2009) in their research found that treatment in patients with hypertension is very important in efforts to prevent complications. Anti-hypertension drugs are the only drugs that can be used to maintain blood pressure within normal limits. Treatment with drugs of antihypertension is done to prevent various complications of hypertension and to maintain systolic blood pressure  $<140$  mmHg and or diastolic blood pressure  $<90$  mmHg. Non-compliance with taking antihypertensive drugs causes instability in blood pressure of patients with uncontrolled hypertension that is at risk of various complications.

The results of this study indicate that there is a significant relationship between health control habits and cardiovascular complications in patients with hypertension at Public Health Center in Sikumana, Kupang City ( $p = 0.000$  and  $r = +0.490$ ). Table 1 shows that the majority of patients with hypertension who experienced cardiovascular complications were those who had a

history of never having health control in a health facility (19.5%). The results of this study are supported by research results of Abegaz et al. (2017) who found that non-compliance with clinical practice guidelines is a risk factor for damage to target organs. The government has determined that efforts to control and prevent hypertension complications are carried out by periodic health checks and following doctor's orders. Prevention of complications of hypertension can be done by "*CERDIK* and *PATUH*". "*CERDIK*" means "smart". "*PATUH*" means "obedient". "*CERDIK* and *PATUH*" is the slogan of the health campaign of the Ministry of Health of the Republic of Indonesia in controlling non-communicable diseases. "*CERDIK* and *PATUH*" is an abbreviation of several instructions that can help control non-communicable diseases. "*C*" the word "*Cerdik*" stands for "periodic health check", and "*P*" in the word "*Patuh*" stands for "check health regularly and follow the doctor's advice". This slogan is very important to be implemented by all sufferers of non-communicable diseases including patients with hypertension so that the dangers of complications can be known and prevented early. Health education provided can help hypertensive patients to prevent hypertension complications and for good adherence to treatment (Kongarasan & Shah, 2018)

## Conclusions

The results showed 21.8% of respondents with hypertension at the results of this study indicate that there is a significant relationship between health control habits and cardiovascular complications in patients with hypertension at the Public Health Center in Sikumana, Kupang City experienced vascular complications to the brain or non-hemorrhagic stroke (NHS), 16.1% experienced vascular complications to the heart or coronary artery diseases (CAD), 3,4 % had vascular complications to the brain and to the heart (NHS + CAD), and another 1.1% had other cardiovascular complications, namely angina pectoris. Incidence of cardiovascular complications in patients with hypertension at the Public Health Center in Sikumana-Kupang city is related to blood glucose levels, blood pressure, and treatment behavior which consists of compliance with drug consumption and health control habits. Promotive and preventive activities must continue to be improved in an effort to improve the compliance of patients with hypertension in the consumption of drugs of antihypertension, health control, and routine blood sugar and blood pressure checks as recommended.

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