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The Correlation of Age, Gender, Heredity, Smoking Habit, Obesity, and Salt Consumption with Hypertension Grade in Cirebon, Indonesia

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ABSTRACT

Background: Hypertension is one of the most global killer diseases that causes death. The World Health Organization estimated around 1.5 billion people in the world will be diagnosed with hypertension every year. The increasing incidences of hypertension in the world may be affected by several predictors including age, sex-linked, heredity, smoking habit, obesity, and salt consumption. This study has objective to examine those predictors to hypertension grade.
Methods: This research was used observational analytic method with cross-sectional study. This study involved 136 respondents who came to Kalijaga Permai Public Health Center, Cirebon City. The variables were measured by microtoise, sphygmomanometer, stethoscope, scales, and questionnaires. Spearman correlation test and logistic regression test was analyzed for this study.
Results: 59.9% of respondents were in hypertension grade 1 and 54% of respondents were in high risk age. The bivariate results revealed that age, sex-linked, heredity, and salt consumption were statistically correlated with hypertension grade (p=0.001). However, smoking habit and obesity were not statistically correlated. Multivariate analysis found that those who add extra salt were 3.3 times more likely to have hypertension grade 2 and those in high risk age were 3.1 more likely to have hypertension grade 2 as well. Compared with female and those who have negative heredity, male and positive heredity were 2.7 times more likely to have hypertension grade 2.
Conclusion: Salt consumption, age, sex-linked, heredity was significantly correlated with hypertension grade. Salt consumption was a risk factors which has the highest impact. Public health center should educate people about the recommendation of daily salt intake to prevent the excessive intake that may affect hypertension.
Keywords: hypertension, smoking habit, obesity, salt consumption, age, gender, heredity
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1. Introduction

Hypertension is one of the most global killer diseases that cause death in which the number of cases keeps increasing year after year (Setyanda et al., 2015). The World Health Organization estimated that around 1.5 billion people in the world are diagnosed with hypertension disease every year (Setyanda et al., 2015). Hypertension is a "silent killer disease" that has symptoms which looks like another disease and shows different symptoms for every person.

Based from the Indonesian survey sample registration system 2014, hypertension was ranked the fifth disease causing death of all ages next to stroke, heart-related disease, DM and TB with 5.3% (Kemenkes RI, 2014). The National hypertension prevalence, referring to the Indonesian Baseline Health research 2018, reached 8.4% (Kemenkes RI, 2018). The hypertension prevalence in West Java is greater than the national figure (Kemenkes RI, 2018). The hypertension prevalence in Cirebon itself reached 28.9% (Kemenkes RI, 2018). Meanwhile, community health center of Kalijaga Permai occupies the first rank of hypertension cases in Cirebon with 90.63% in 2016 (Dinas Kesehatan, 2016). Ninety-five percent people with hypertension did not know they got diagnosed as a primary or secondary type of hypertension (Sulastri et al., 2012). Several mechanisms that might contribute to the hypertension have been identified, but none of the theories expressly states the pathogenesis of hypertension (Sulastri et al., 2012). The cases of hypertension in the world are affected by two types of risk factors, changeable risk factors such as obesity, salt consumption, stress, smoking habits and unchangeable risk factors such as age, gender, heredity, race (Kemenkes RI, 2014).

Hypertension generally develops at the age of 36 - 45 years which is mainly due to reduced blood vessel elasticity (Semet et al., 2016). It is in line with the results of research conducted in Karanganyar Regency using the case control design. When the age group of 25-35 years is compared with the age group of 36-45 years, it is proven that the latter group age is a risk factor for hypertension (Sugiharto, 2007). On the contrary, Novitaningtyas found that age did not have a significant effect on the hypertension grade (Novitaningtyas, 2014).

Hypertension is closely related to physical activity (Maharani, 2014). The research conducted by Lina and Tanti in hospital 45 Kuningan shows the proportion of men suffering from primary hypertension was 71.9%. The statistical test results obtained are smaller than the significant numbers meaning that the risk of experiencing primary hypertension for men is 4.182 greater than that of women. However, the study by Sofyan shows that sex variables were not related to stroke (Sofyan et al., 2015). Hypertension could be obtained from parents; therefore, the chance of being diagnosed by primary hypertension in a person will be quite large. A research carried out in Karanganyar Regency with a case control design shows that family history was proven to be a risk factor for hypertension (Sugiharto, 2007). Meanwhile, a study on the relationship between family history and hypertension by Jane A. shows that there was no relationship between family history and hypertension (Ratulangi et al., 2016). Smoking is one of the health problems where the solution has not been found in Indonesia. A study by Yashinta Octavian regarding the relationship of smoking to the grade of hypertension in men aged 35-65 years in the city of Padang shows that hypertension is triggered by smoking time and type of cigarette (Setyanda et al., 2015). In addition, a study Renny Fitriana about the risk factors for hypertension degrees in adolescents in the working area of the health center in the city of Pekanbaru shows that there is no correlation with hypertension (Ratulangi et al., 2016).

Obesity is excessive fat accumulation that occurs in the body area consisting of subcutaneous fat and intra-abdominal fat. Based on Demi Sulastri's research on Hypertension research in the city of Padang, there was a correlation between the cases of obesity and hypertension (Sulastri et al., 2012). It is different from the study by Andrew Johanes Ratulangi in Bolaan District, North Mangondouw, sowing that there was no correlation between blood pressure and obesity (Ratulangi et al., 2016).

Sodium and potassium are the main cations in the body's extracellular fluid which have the function of regulating the body's fluid and acidic balance and play a role in nerve transmission and muscle contraction (Atun et al., 2014). In a study conducted by Listiyaningsih Atun regarding the correlation between salt consumption and hypertension, the results show that high salt consumption can increase the risk of high blood pressure. The ratio of potassium sodium can't increase the risk of high blood pressure (Atun et al., 2014). On the contrary, a study by Renny Fitriani shows that salt consumption is not proven against the degree of hypertension (Ratulangi et al., 2016). In a journal from the American physiology society, it was found that salt consumption was a factor that has a major influence on the cases of hypertension. This has been proven by the effect of an endogenous hormone that causes an increase in the sympathetic system. In experiments conducted in mice, when mice were injected with endogenous hormone antibodies, a significant decrease in pressure occurred (Blaustein et al., 2011).

Based on previous researches, there were still conflicting results about the correlation among hypertension risk factors. Thus, in this study, we summarize risk factors that directly correlate age, sex-linked, heredity smoking habit, obesity, and salt consumption with hypertension grade in the community health center of Kalijaga Permai, Cirebon, Indonesia.

2. Method

This research used an observational analytic method with cross-sectional study. The sample size for the present study was calculated using slovin formula by taking prevalence of hypertension as 90.63% and permissible error as 5% with 95% confidence interval (Dinas Kesehatan, 2016). Meanwhile, the minimum sample size was calculated as $n = 136$.

Consecutive sampling was used for sampling technique. Inclusion criteria were patients who came to community health center of Kalijaga Permai with $\geq$140/90 mmHg and were diagnosed of having primary hypertension. Exclusion criteria were patients who didn't give a permission to be respondents and diagnosed by secondary hypertension.

Data was collected by the author with informed consent. Authors did blood pressure measurement using sphygmomanometer and stethoscope, body mass index measurement using weight scale and microtoise, and age, sex type, smoking habit, salt consumption measurement using the questionnaire.

High risk age included the respondents in age group of 36-year-old or older. Low risk age included the respondents in age group of under 36-years-old, as seen on questionnaire (Sugiharto, 2007). Sex types were defined from a questionnaire based from their look (Maharani, 2014). Heredity was defined positive when the respondent has parents with a history of hypertension and it would be negative when the respondent has no parents with history of hypertension (Sugiharto, 2007). Current daily smoker was defined as those who were smoke cigarettes daily; light smoker only have 1 to 10 cigarettes a day, while medium to moderate smoker have more than 11 cigarettes a day (Setyanda et al., 2015). Obesity was classified using WHO International BMI classification: BMI < 18.5 was classified as "underweight"; < 16.00, "severe thinness"; 16.00–16.99, "moderate thinness"; 17.00–18.49, "mild thinness"; 18.50-24.99, "normal range"; BMI $\geq$ 25.00, "overweight"; 25.0-29.99, "pre obese"; $\geq$30.00, "obese"; 30.00-34.99, "obese class I"; 35.00-39.99, "obese class II"; and > 40.00, "obese class III." (Kemenkes RI, 2014)

Salt consumption was defined with scoring from the questionnaire. It was divided into two groups, adding amount of extra salt group and not adding amount of extra salt group. Extra salt was defined as at least the score in salt consumption section is 4 or more. Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 8) classification was used for hypertension. Hypertension is defined as systolic BP level of ≥140 mmHg and/or diastolic BP level of ≥90 mmHg or being previously diagnosed as hypertensive by any health professional (Bell et al., 2015).

Once the data have been collected, data will be proceeded by editing, coding, processing, tabulating, entering, and cleaning. It was analyzed with univariate statistics (distribution and percentage) to summarize the data. Other statistical tests like spearman rho's test were applied to find out correlation between the subjects. Logistic regression was applied to identify the most impact risk factors for hypertension. The significance level of 0.05 was used in this statistical process.

3. Results

Table 1 showed total of 137 study subjects were interviewed for the survey. Out of these, 64 (46,7%) were female subject and 73 (53.3%) were male. The median age (±SD) of the study subjects was 33.0

(±11.9) years and for male and female it was 34.0 (±11.9) years and 35 (±11.8) years, respectively. Majority of the study subjects has parents diagnosed by hypertension (56.2%). Regarding at dietary salt intake, most of the subjects constantly add high amount off extra salt. Only 13 samples (9.5%) experienced obesity and 33 samples (24,1%) has medium to moderate smoking habit. This cross-sectional community-based study identified prevalence of hypertension grade 1 and hypertension grade 2 in kalijaga permai public health center, which was 59.9% and 40.1%, respectively.

Table 1. Characteristic of the respondents

Characteristics	Number of respondents	Percentage
Age		
Low risk	63	46
High risk	74	54
Sex-linked		
Female	64	46.7
Male	73	53.3
Heredity		
Negative	60	43.8
Positive	77	56.2
Smoking habit		
Not a smoker	73	53.3
Light-smoker	31	22.6
Medium to moderate-smoker	33	24.1
Obesity		
Negative	124	90.5
Positive	13	9.5
Salt consumption		
Did not add amount of extra salt	65	47.4
Add extra salt	72	52.6
Hypertension level		
Grade 1	82	59.9
Grade 2	55	40.1

3.1 Bivariate analysis

The correlation of smoking habit, obesity, natrium consumption, age, sex-linked, and heredity towards hypertension level were analyzed using spearman correlation test with p<0.05.

Table 2. Correlation of risk factors towards Hypertension grades

Characteristics	Hypertension		p value	r
	Grade 1	Grade 2		
Age				
Low risk	57	17	0.001	0.380
High risk	25	38		
Sex-linked				

Female	58	17	0.001	0.367
Male	26	38		
Heredity				
Negative	48	12	0.001	0.453
Positive	34	43		
Smoking habit				
Not a smoker	45	35	0.224	0.105
Light-smoker	23	8		
Medium to moderate-smoker	14	19		
Obesity				
Negative	77	47	0.100	0.141
Positive	5	8		
Salt consumption				
Did not add amount of extra salt	53	12	0.001	0.420
Add extra salt	29	43		
Total	82	55		

Table 2 shows that there are some correlations of age (p=0.001), sex-linked (p=0.001), hereditary (p=0.001), and salt consumption (p=0.001) with hypertension grade. Grade 2 hypertension was more prevalent in the age group of 36–77 years, while grade 1 hypertension was prevalent in the group of under the 36 years. The rate of grade 2 hypertension was higher among males. Positive family history of hypertension shows more chances to be diagnosed of having grade 2 hypertension. Eating food with some extra salt was found to be risk factors for being hypertensive in this study. Considering the rest, neither smoking habit (p=0.224) nor obesity (p=0,100) have a correlation with Hypertension grade.

3.2 Multivariate analysis

The prevalence ratio of smoking habit, obesity, natrium consumption, age, sex-linked, and heredity with hypertension level was analyzed using logistic regression test with 95% CI.

Table 3. Prevalence ratio of risk factors with Hypertension grades

Characteristics	Wald	df	Sig.	Exp(B)	95% CI for Exp(B)	
					Lower	Upper
Heredity	4.689	1	0.030	2.743	1.100	6.837
Sex-linked	5.333	1	0.021	2.698	1.162	6.266
Ages	7.068	1	0.008	3.141	1.351	7.303
Salt consumption	6.603	1	0.010	3.247	1.322	7.975
Constant	33.287	1	0.000	0.001		

Table 3 shows that salt consumption has the most impact risk factor with hypertension grade (p=0.010, PR=3.247, C.I.=95%) followed by age (p=0.008, PR=3.141), heredity (p=0.021, PR=2.743), and sex-linked (p=0.030, PR=2.698). Salt consumption, age, heredity and sex-linked were significantly related to hypertension grades. Being female, younger in age, and staying away from any kind of addiction could serve as protective factors against hypertension.

4. Discussion

Indonesia is one of the developing countries with a rapid demographic and epidemiological transition. This cross-sectional community-based study identified prevalence of grade 1 hypertension and grade 2 hypertension in the community health center of Kalijaga Permai of 59.9% and 40.1%, respectively. In this study, age was found to be an important risk factor for hypertension (p=0.001). As one gets older, the prevalence of hypertension among both the sexes was found. Similar findings were reported by a study in Universitas Diponegoro confirming that hypertension mostly develop between the age group of 36-45 year instead of the age group of 25-35 years. Generally, hypertension will develop when the age reaches 36-years-old (Sugiharto, 2007). As one gets older, the aorta and arteries walls will be stiffened and it contributes to the high prevalence of hypertension in the older age group (Sugiharto, 2007).

In this research, men exhibit higher prevalence of grade 2 hypertension than women (M: 53.3% and W: 46.7%) (p=0.001), respectively. Similarly, a study by Jangi P shows most men from 45-years-old got diagnosed with hypertension higher than women (Jangid et al., 2015). Men are suspected of having a lifestyle that tends to increase blood pressure compared to women. However, the prevalence of hypertension in menopause women increases because the estrogen increased High Density Lipoprotein to defend arteries from arthrosclerosis (Maharani, 2014).

Our study shows that family history of hypertension is susceptible with increasing blood pressure (p=0.001). It will give more chances to a person diagnosed by hypertension. It is in line with the finding before. In a family history of affected individuals, there is an abnormality in the angiotensinogen gene that plays an important role in the process of producing angiotensin suppression substances (Gunawan, 2007). Another theory says it happens because of the problem in parasympathetic nerve activity (Ambasari et al., 2013).

Our results show that adding some extra salts were found to be a risk factor for being hypertensive (p=0.001). The results show that it is the most impactful correlation between salt intake and hypertension (p=0.010, PR=3.247, C.I.=95%). Some previous studies show that salt intake was positively related to hypertension (Atun et al., 2014). In this new paradigm, high dietary salt raises cerebrospinal fluid [Na+] through the Na+-sensing circumventricular organs of the brain to increase sympathetic nerve activity (SNA), a major trigger of vasoconstriction. Plasma levels of endogenous ouabain (EO), and the Na+ pump ligand elevated, as well. Remarkably, high cerebrospinal fluid [Na+]-evoked and locally secreted (hypothalamic) EO participates in a pathway that mediates the sustained increase in SNA. This hypothalamic signaling chain includes aldosterone, epithelial Na+ channels, EO, ouabain-sensitive $\alpha2$ Na+ pumps, and angiotensin II (ANG II). The EO increases, hypothalamic ANG-II type-1 receptor and NADPH oxidase and decreases neuronal nitric oxide synthase protein expression. The aldosterone-epithelial Na+ channel-EO-$\alpha2$ Na+ pump-ANG-II pathway modulates the activity of brain cardiovascular control centers that regulate the BP set point and induce sustained changes in SNA (Blaustein et al., 2011).

Smoking remains to be one of the biggest problems in Indonesia. WHO confirmed in 2007 that Indonesia reached the top 5 most smokers in the world (Setyanda et al., 2015). This study indicates the negative correlation between tobacco use and hypertension (p=0.224). It is supported by other studies such as (Ratulangi et al., 2016). However, there are other studies with contradictory findings (Green et al., 1986; Lee et al., 2001). For instance, some researchers have reported lower blood pressure levels found among smokers compared to former smokers and increases in blood pressure after smoking cessation. The results from a male steel workers' follow-up have revealed that the rate of hypertension among continuous smokers was lower than never-smokers and ex-smokers. As a result, it is still unclear to what extent cigarette smoking is a risk factor for the development of hypertension (Green et al., 1986; Lee et al., 2001; Narkiewicz et al., 2005; Oncken et al., 2001).

There was negative correlation between increasing BMI and increasing rate of hypertension (p=0,100), which was consistent with other studies (Ratulangi et al., 2016). However, there are other studies with contradictory findings. Obesity is associated with increased morbidity and mortality due to hypertension, diabetes, dyslipidemia, and cardiovascular and renal diseases. Obesity clearly induces hypertension. The mechanism by which obesity directly causes hypertension is under investigation. Activation of the sympathetic nervous system (SNS), the amount of intra-abdominal and intra-vascular fat, sodium retention leading to increase in renal reabsorption, and the renin-angiotensin system, are considered to have important functions in the pathogenesis of obesity-related hypertension, a chronic medical condition in which the blood pressure is persistently at >140/90 mmHg but not at the normal level which is defined as 100–140 and 60–90 mmHg for systolic and diastolic pressure, respectively (Jiang et al., 2016). In obese patient, there is a desire striving to keep healthy.

This study has several limitations. Obesity was measured only by body mass index without measuring abdominal circumference; thus, there was an opposite result on relation between increasing BMI and hypertension. Smoking was measured only by current smoking behavior (status classification: non-smokers, current smokers and former smokers; cigarette consumption classification: light smokers, heavy smokers and so on) to analyze the effects of smoking on health without knowing the cigarette types. Salt consumption was not measured in an objective way using tablespoon. All of these limitations can be overcome by changing the questionnaire. For the future, study on salt consumption as the impactful risk factor could be developed. Tablespoon measurement could be used to know how much salt one eats on a daily basis since this study shows that salt consumption was the most impactful subject among the other and this study takes times.

5. Conclusion

From the discussion, it can be concluded that salt consumption, age, sex-linked, and hereditary have significant correlation with hypertension grades; in addition, salt consumption has the highest impact (p=0.010, PR=3.247, C.I.=95%) among the other risk factors found in the community health center of Kalijaga Permai, Cirebon. For future study, it is recommended to provide another study on salt consumption correlation with hypertension grade by an objective measurement.

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Conflict of Interest

There is no conflict of interest.

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