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Association between smoking and hypertension as a disease burden in Sidoarjo: a case-control study

M. Farid Dimjati Lusno[1*], Setya Haksama[1], Anis Wulandari[1], Shyamkumar Sriram[2], Syahrania Naura Shedysni[3], M. Rifqo Hafidzudin Farid[3], Abdul Fattah Farid[4], Syadza Zahrah Shedyta[5]

[1]Faculty of Public Health, Universitas Airlangga, Surabaya, Indonesia
[2]Arnold School of Public Health, University of South Carolina, Columbia, United States
[3]Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia
[4]Faculty of Pharmacy, Universitas Airlangga, Surabaya, Indonesia
[5]Husada Utama Hospital, Surabaya, Indonesia

Abstract

Noncommunicable diseases (NCDs) became major caused of premature death and disease burden which rising disproportionately among low-income and lower-middle-income countries. There are common modifiable behavioral risk factors include tobacco smoking. In Indonesia there were 147.510 Cardiovascular (CVD) death caused by tobacco use which is 26% of all CVD deaths each year. The link between smoking and hypertension is still far to be completely identified. This study aims to analyze the relationship of smoking to hypertension. The study conducted with case control approach. The sampling method use probability sampling with the samples 172 respondents consist of 76 cases and 76 control. Hypertension patient data is obtained based on secondary data that has been owned by the public health center service (Puskesmas). The finding showed that smoking (p=0,01, OR=3,1), early age of smoking (p=0,00, OR=6,5) with starting 6 – 19 years old higher OR then 20-33 years old (p=0,00,OR=4), duration of smoking (p=0,00, OR=9,9) in a group with 30 – 53 years of smoking higher than 9 – 29 years of smoking (p=0,0, OR=8,2), and type of cigarettes (p=0,001, OR=3,4). Smoking has association to hypertension as the modifiable factor. The decision maker needs to be concerned especially for NCD's program by preventing hypertension.

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Introduction

Noncommunicable diseases (NCDs) continues to be one of the majors caused of premature death worldwide (World Health Organization, 2014). This burden is rising disproportionately among low-income and lower-middle-income countries (World Health Organization, 2017). NCDs are by far the leading cause of death worldwide. In 2016, they were responsible for 71% (41 million) of the 57 million deaths which occurred globally. The major NCDs responsible for these deaths highest reached by cardiovascular diseases (17.9 million deaths, accounting for 44% of all NCD deaths and 31% of all global deaths); followed

CONTACT : **M. Farid Dimjati Lusno** faridlusno@fkm.unair.ac.id

by cancers (9 million deaths, 22% of all NCD deaths and 16% of all global deaths); chronic respiratory diseases (3.8 million deaths, 9% of all NCD deaths and 7% of all global deaths); and diabetes (1.6 million deaths, 4% of all NCD deaths and 3% of all global deaths). There are four major NCDs. Those are cardiovascular diseases include cancers, diabetes, and chronic respiratory diseases.

Raised blood pressure, also known as hypertension, is a major risk factor for coronary heart disease, chronic kidney disease, and ischemic, as well as hemorrhagic, stroke. There has been set for further targets relate to the reduction in NCD risk factors including both behavioral risk factors (the harmful use of alcohol, physical inactivity, salt/sodium intake and tobacco use) and metabolic risk factors (raised blood pressure, raised blood glucose and obesity) (Damasceno, 2016).

The rise of NCDs is particularly visible in Southeast Asia, such as Indonesia where caused by limited resources and related with the social determinants of health. There are common modifiable behavioral risk factors (e.g. tobacco smoking, harmful use of alcohol, unhealthy dieting, and physical inactivity) and biological risk factors (e.g. hypertension, overweight/obesity, or a combination of risk factors like the cardio-metabolic syndrome) (Schröders et al., 2017).

East Java Province as one of the densest provinces in Indonesia has higher prevalence of cardiovascular disease than the national prevalence (Riskesdas, 2018). Sidoarjo as one of side urban area has high prevalence of hypertension (Dinkes, 2018). This also include the importance of public health center service (Yunevy & Haksama, 2013)

Hypertension is considered one of the most important preventable causes of morbidity and mortality (Ain et al., 2015). Hypertension has been found to be associated with an unhealthy lifestyle, including tobacco smoking, a lack of physical activity, and alcohol consumption (World Health Organization, 2017). The result of previous study showed that among men having quit tobacco use and depressive symptoms were positively associated with hypertension, while current tobacco use was negatively associated with hypertension (Peltzer & Pengpid, 2018)

Smoking and hypertension claimed that smoking is a cause of hypertension despite inconsistent results in the literature (Sohn, 2018). Cigarette smoking is a known risk factor for cardiovascular disease (CVD), but the association between smoking and blood pressure is unclear (Li et al., 2017). Many observations identify cigarette smoke as a factor causing a functional and initially transient damage primarily of the endothelium and reduced tolerance to exercise stress testing because of the effects of nicotine and carbon monoxide. At the time, the functional damage became an irreversible pathological damage with ischemic lesions of the myocardium and artery vessel atherosclerosis (Leone, 2015). In Indonesia there were 147.510 Cardiovascular (CVD) death caused by tobacco use which is 26% of all CVD deaths each year. Mean age at initiation of daily smoking at 17,6 years which imply to increase of earlier risk of heart disease in younger people (World Health Organization, 2018).

The link between smoking and hypertension is still far to be completely identified. Usually a smoker begins to smoke as before as the appearance of the blood pressure disorder. Therefore, confusion exists to assess whether hypertension will appear spontaneously and independently in the individuals affected or, on the contrary, is a result of smoking habit (Leone, 2015).

The program of preventing and controlling sickness, death and disability from cardiovascular disease need to put in higher concern. So that, there will be aware of helping current tobacco users to quit tobacco for healthier heart, prevent people from starting tobacco use, and combine tobacco with the following strategies for effective prevention of

CVD (World Health Organization, 2018). However, the priority may come easy with real evidence. Therefore, this study aims to analyses the association between smoking and hypertension.

Materials and Methods

This case–control study included population age ≥ 17 years old. The population are people from community in work area of Public Health Care Centre (Puskesmas) Sedati and Waru , Sidoarjo district. The majority of respondents are between 36 – 45 years old. Sample was calculated using Hosmer & Lemeshow based on probability sampling which come up total of sample 76 cases and 76 control. All samples total 152 respondents. Cases samples were obtained from those who has systolic blood pressure ≥ 140 mmHg and / or diastolic blood pressure ≥ 90 mmHg, on repeated examinations. Systolic pressure is the main reference in determining the diagnosis of hypertension. Hypertension patient data is obtained based on secondary data that has been owned by the Puskesmas. The people who are in cases sample will be evaluated the result based on retrospective study.

All research subjects gathered the primary information by answering questionnaire. The research being held on Mei 2018.

The independent variable consists of smoking status, early age of smoking, duration of smoking, and types of cigarettes. The dependent variable is hypertension.

Both of primary data from questionnaire and secondary data from Puskesmas were analyzed univariate and bivariate. Finally, the data was analyzed using relation chi-square and logistic regression tests with spss software.

Results and Discussion

The demographic characteristics of the respondents showed that most of the respondents were females 51,30% which is not far differences number than the males 48,30%. Based on age group, most of the subjects were in ≥ 35 years old 85,4% specifically between 36-45 years old 35,5% from total subjects. The education background has showed that most subjects 39,5% are graduated from senior high school. The jobs were dominated by factory workers, helpers, pedicab drivers 23% and farmers 20,4%. All modifiable risk factors studied vis-à-vis obesity, lack of physical activity, inadequate fruits and vegetable intake, diabetes, smoking, and alcohol use were significantly different in proportion among cases and controls. Obesity, lack of physical activity, smoking, and diabetes were found to be significant risk factors for hypertension after adjusting for other risk factors (Pilakkadavath & Shaffi, 2016).

Smoking to hypertension

Based on the Chi-Square statistical test, the value of p = 0.01 was obtained. This shows a significant relationship between smoking and hypertension with OR value of 3.1 obtained in smoking variable. Smoker has 3.1 times greater risk of hypertension than nonsmoker.

In a fully adjusted logistic regression model, former smokers had increased OR (95% CI) of 1.48 (1.01, 2.18) of hypertension and current smokers had not increased OR (95% CI) of 0.83 (0.61, 1.12), compared with non-smokers. This result has in line with previous study which mentioned no significant associations were found between smoking and the risk of incident respiratory diseases, hypertension, and myocardial infarction in the group younger than 35 (Gao et all, 2017). Among study participants aged between 36–55 and 56–80,

smoking was positively associated with the risk of incident respiratory diseases, hypertension and myocardial infarction from the life- course perspective, and the risk increased with age. In contrast, the results from a current view showed inverse associations between smoking and the risk of the diseases mentioned above (Gao et al., 2017).

Bivariate analysis showed that factors significantly related to stroke were smoking status (p-value = 0.011, OR = 2.6), past hypertension (p-value = 0.00, OR = 6), past diabetes (p-value = 0.015, OR = 5.7), and unhealthy diet (p-value = 0.00, OR = 5.7). Multivariate analysis showed that factors significantly affecting stroke were smoking status, past hypertension, and an unhealthy diet. In conclusion, smoking, past hypertension, and an unhealthy diet are factors affecting the incidence of stroke (Imanda et al., 2019). Respondents with poor sleep quality had 1.39 higher odds ratio of experiencing hypertension compared to respondents who had good sleep quality after being controlled by variables of gender, age, smoking status, physical activity, and nutritional status. (Poor-good sleep quality = 1.39, 95% CI 1.20-1.61 p=0.000) (Nugroho et al., 2020). Nearly all women were non-smokers (96.3%) compared to 32.8% of men (Oddo et al., 2019). The study among men only former tobacco use was positively associated with hypertension, while current tobacco use was negatively associated with hypertension. Among smokers in this study the number of cigarettes smoked per day (Mean=11.7) did not differ between hypertensives and non-hypertensives (Mean: 11.9) (P=0.150). It is possible that the impact of current tobacco use on hypertension is delayed, and, thus, current tobacco use may not be closely correlated with hypertension (Peltzer & Pengpid, 2018). In its turn, hypertension plays harmful effects on the heart, kidney and arterial tree, mainly coronary, carotid and cerebral vascular structures, by its complications, the target organs of which are the same of cigarette smoke. There is evidence that the association of cigarette smoking with hypertension exponentially increases the risk of cardiovascular disease and events when compared to that of each of these factors singly acting (Leone, 2015).

In men, smoking was the most prevalent risk factor; approximately two-thirds of men were current smokers compared with only 2% of women, which wholly explains the dominance of smoking (Hussain et al., 2016).

Smoking can increase blood pressure by stimulating the sympathetic nervous system. When a person smokes, the active substance interleukin 6, and can lead to oxidative stress. Oxidative stress will trigger some reaction in the body, such as insulin resistance. If this happens, bioavailability endothelium which has a function to inhibit atherogenesis and protect blood vessels will decrease which trigger its happening raises blood pressure, atherosclerosis (Elisabeth et al., 2017).

Early smoking to hypertension

The age category of early smoking 6-19 years compared with no smoking based on the logistic regression statistical test obtained p value = 0.00. This value indicates that there is a significant influence between the early age of smoking 6-19 years with hypertension. In the early age category of smoking 6-19 years (OR = 6,5) showed that the early age of smoking 6-19 years has a risk of hypertension 6.5 times greater than not smoking.

The age category of early smoking 20 - 33 years compared to not smoking based on the logistic regression statistical test obtained p value = 0.008. This value indicates that there is a significant influence between the initial age of smoking 20-33 years with hypertension. In the early age category of smoking 20 - 33 years (OR=4). This shows that the initial age of smoking 20 - 33 years has a 4 times greater risk of developing hypertension compared to not smoking.

The short-term adverse health effects caused by cigarette smoking can be observed in smokers immediately or soon after they begin smoking. The health effects of cigarette smoking thus begin at or near the age of initiation of cigarette smoking, which is usually in adolescence. To highlight the immediacy of the adverse impact of smoking on health, this report uses a life-course perspective by considering health effects of smoking according to the various stages of life, which include childhood, adolescence, and young adulthood as well as middle and late adulthood, when most of the chronic disease burden imposed by smoking occurs (Public Health Implications of Rising the Minimum Age of Legal Access to Tobacco Products, 2015).

The duration of smoking to hypertension

The duration of smoking 30 - 53 years compared to not smoking based on the logistic regression statistical test obtained p value = 0.00. This value shows that there is a significant influence between the duration of smoking 30 - 53 years with hypertension. Based on duration category of smoking 30 - 53 years (OR=9.9) shows that the duration of smoking between 53 and 53 years has a risk of hypertension 9.9 times greater than not smoking.

The duration of smoking 9 - 29 years compared to not smoking based on the logistic regression statistical test obtained the value of p = 0.00. This value indicates that there is a significant influence between the duration of smoking 9-29 years with hypertension. For duration 9 - 29 years smoking category (OR=8.2) shows that 9 - 29 years smoking has a risk of hypertension 8.2 times greater than not smoking. From the previous study, has been mentioned that it is possible that the impact of current tobacco use on hypertension is delayed, and, thus, current tobacco use may not be closely correlated with hypertension (Peltzer & Pengpid, 2018).

Types of Cigarettes to Hypertension

The category of non-filter cigarettes compared to not smoking based on the logistic regression statistical test obtained the value of p = 0.001. This value indicates that there is a significant effect between types of non-filter cigarettes with hypertension. In the category of non-filter cigarettes, an OR value of 7.6 was obtained. This shows the type of non-filter cigarettes has a risk of hypertension 7.6 times greater than not smoking.

Categories of filter cigarette types compared to nonsmoking based on logistic regression statistical tests obtained p value = 0.051. This value indicates that there is no significant effect between filter cigarette types and hypertension.

Some studies focused on specific groups of smokers such as women, diabetes patients, and physicians. A few studies reported on the use of smoke- less tobacco, betel quid chewing, or more recently the use of electronic cigarettes (Schröders et al., 2017). In other study, We defined a current smoker If he said “yes” to the question, “Have you ever chewed tobacco, smoked a pipe, smoked self-rolled cigarettes, or smoked cigarettes/cigars?” and “still have” to the question, “Do you still have the habit or have you totally quit?” Otherwise, he was defined as a current non-smoker (Sohn, 2018).

Table 1. Cross tabulation smoking status, early age of smoking, duration of smoking, and types of cigarettes from cases sample and control samples from Puskesmas Sedati and Waru area , District Sidoarjo year 2018.

Variables	Variables				p-value	OR	95% CI	
	Category		Category					
	n	%	n	%				
Smoking status								
Yes	47	61,8	26	34,2	0,01*	3,1	1,607	6,045
No	29	38,2	50	65,8		1		
Early age of smoking								
6-19 years old	30	39,5	8	10,5	0,00*	6,5	2,618	15,969
20 – 33 years old	17	22,4	18	23,7	0,008*	4	1,427	11,050
Not smoking	29	38,2	50	65,8		1		
Duration of smoking								
30-53 years	33	45,8	6	8,2	0,00*	9,9	3,696	16,312
9 – 29 years	10	13,9	15	20,5	0,00*	8,2	2,530	26,900
Not moking	29	40,3	52	71,2				
Types of Cigarettes								
Non-filter	18	23,7	4	5,3	0,001*	7,6	24,735	
Filter	28	36,8	21	27,6	0,051	3,4	11,458	
Not smoking	30	39,5	51	67,1		1		

*shows a significant association

Conclusions

The study has showed the association smoking to hypertension. The smoking status has clear association to hypertension with many previous study. The finding of early age of smoking, duration of smoking and types of cigarettes became new detailed result explaining the association mentioned. However, more detailed sample need to put in further research a head. Moreover, the categorical need to represent the population. The study would raise concerned from decision maker especially to linkage the program of NCDs especially in preventing hypertension.

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