Rwanda Medical Journal RMJ

ORIGINAL ARTICLE Open Access

Impact of first- and second-hand smoking on cardiac diseases in Yogyakarta, Indonesia: a preliminary cross-sectional study

Authors: P. E. Nirmala Dewi[1,*]; M. Octavia[2]; W. Himawan[3]; D. Sugiyo[4,5]

Affiliations: *[1]Department of Pharmacy Profession, Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Yogyakarta, Indonesia; [2]School of Pharmacy, Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Yogyakarta, Indonesia; [3]Rumah Sakit Umum Daerah Wates, Yogyakarta, Indonesia; [4]Department of Nursing, Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Yogyakarta, Indonesia; [5]Muhammadiyah Steps, Universitas Muhammadiyah Yogyakarta, Indonesia*

ABSTRACT

INTRODUCTION: Toxic agents from cigarette smoke can affect the cardiovascular system, especially coronary heart disease (CHD). The implication to the second-hand smoker was 80%–90%, similar to the first-hand smoker. This study aimed to provide preliminary data on the smoking effect among first- and second-hand smokers according to cardiac diseases in Yogyakarta, Indonesia.

METHODS: This descriptive cross-sectional study was conducted by prospectively collecting data from two secondary hospitals in Yogyakarta, Indonesia. The collected data were descriptively analyzed to compare the first- and second-hand smokers to the variables. ANOVA or the Mann-Whitney Test, was also used to obtain the correlation of each variable across both smoking groups.

RESULTS: Among the 101 participants, we found that smoking habits can have a similar or even higher impact among second-hand smokers compared to first-hand smokers with respect to congestive heart failure (CHF) diagnoses (48% vs. 56%), IHD diagnoses (36% vs. 27.9%), suffering chest pain (39.3% vs. 27.8%), and shortness of breath (38.7% vs. 33.3%).

CONCLUSION: Smoking habits can increase the risk of CHD, especially CHF, and IHD, among first-, and second-hand smokers. Indonesia's government should protect second-hand smokers and limit the exposure of first-hand smokers to cigarettes.

Keywords: Coronary heart disease, Smoke, Second-hand smoke, Smoking

INTRODUCTION

The risk of smoking was proven years ago. In 1989, a study reported the significant risk of smoking habits on coronary artery disease, specifically myocardial ischemia [1]. Cardiovascular disease has been reported to be responsible for more than 17 million deaths annually, with 10% of them due to tobacco use and second-hand smoke [2]. A similar risk was found between males and

***Corresponding author:** Pramitha Esha Nirmala Dewi: pramithaesha@umy.ac.id, Department of Pharmacy Profession, Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Yogyakarta, Indonesia; **Potential Conflicts of Interest (CoI):** All authors: no potential conflicts of interest disclosed; **Funding:** All authors: Universitas Muhammadiyah Yogyakarta financially supported this study as a research grant for the junior lecturer; **Academic Integrity.** All authors confirm that they have made substantial academic contributions to this manuscript as defined by the ICMJE; **Ethics of human subject participation:** The study was approved by the local Institutional Review Board. Informed consent was sought and gained where applicable; **Originality:** All authors: this manuscript is original has not been published elsewhere; **Review:** This manuscript was peer-reviewed by three reviewers in a double-blind review process; **Type-editor:** Emilia (USA).

Received: 15th February 2023; **Initial decision given:** 04th March 2023; **Revised manuscript received:** 13th September 2023; **Accepted:** 27th October 2023.
 Publisher: Rwanda Biomedical Centre (RBC)/Rwanda Health Communication Center, P. O. Box 4586, Kigali. ISSN: 2079-097X (print); 2410-8626 (online)

Citation for this article: P. E. Nirmala Dewi; M. Octavia; W. Himawan et al. Impact of first- and second-hand smoking on cardiac diseases in Yogyakarta, Indonesia: a preliminary cross-sectional study. Rwanda Medical Journal, Vol. 80, no. 4, p. 26-32, 2023. https://dx.doi.org/10.4314/rmj.v80i4.4

females of having myocardial infarction due to tobacco smoke, particularly among young adults [3]. The Centers for Disease Control and Prevention reported that second-hand smoke exposure at home or work could increase the risk of developing cardiac disease by 25%–30% and stroke by 20%–30% [4]. A study in Indonesia found 991,331 morbidity cases related to smoking habits, and 21.6% of them suffered from chronic diseases due to smoking, with an estimated cost of US$2177 million (2.5% of the 2015 gross domestic product) [5].

Coronary heart disease (CHD) is reported as one of the most frequent causes of smoking and has one of the highest treatment costs [5]. A study found that the toxic agents from second-hand smoke significantly affected the cardiovascular system. The mortality rate of second-hand smoke was 80%–90%, similar to that of first-hand smoke, even with only minutes to hours of smoke exposure [6]. A second-hand or passive smoker is a person exposed to smoke from a first-hand or active smoker in a particular area, such as public services, social places, households, transportation, and workplaces [7]. This study aims to identify the smoking effect among first- and second-hand smokers according to cardiac diseases as the preliminary data from the CHD population in Yogyakarta, Indonesia, which still has an unclear profile or condition.

METHODS

This was a descriptive cross-sectional study conducted by collecting data prospectively. This study was approved by the ethics committee of the Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Yogyakarta. Data were derived from all outpatient medical records of patients diagnosed with CHD. In-depth interviews were also performed among the patients to explore their smoking history and grouped them into first-hand (active) and second-hand (passive) smokers [8]. All the data obtained from the interview was double-checked by the responsible Cardiologist and nurse. Patients with no smoking history or who could not remember their smoking history/exposure were not involved in this study. The study included all the eligible 101 patients with CHD who visited the cardiology outpatient department at two secondary hospitals in Yogyakarta, Indonesia, in December 2018. Data related to patient's characteristics, laboratory results, symptoms during CHD treatment, comorbid diseases, and direct medical cost at outpatients setting were collected from patient's medical records and payment receipts for this study. The collected data were analyzed descriptively to compare the first- and second-hand smokers to the selected variables. Descriptive statistics were used to present the proportion of each variable among the involved

Table 1: Baseline characteristics

Variable	Total (n = 101)	%	P-value
Gender			<0.001
Male	57	56.4	
Female	44	43.6	
Age (mean ± SD)	60.87 ± 12.79		0.600
Body weight (mean ± SD)	59.89 ± 13.22		0.008
Smoking exposure			0.023
First-hand smoker	18	17.8	
Second-hand smoker	83	82.2	
Comorbidity			
Hypertension	35	34.7	0.035
Diabetes mellitus	9	8.9	0.041
Asthma	6	5.9	0.052
Tuberculosis	1	1.0	0.445
Dyspepsia	1	1.0	0.354
Others	19	18.8	0.564

participants. ANOVA or the Mann-Whitney test was used to identify the association between the smoker groups and particular variables such as cardiac problems, patient characteristics, and symptoms. A P-value <0.05 was used to indicate statistical significance. All participants voluntarily signed the informed consent before the study commencement.

RESULTS

Baseline characteristics: Overall, 101 patients with CHD were included in the study, with a significantly higher number of 57 (56.4%) male than 44 (43.6%) female patients (p<0.001). None of the CHD patients were excluded in this prospective study.

Main diagnosis profile among smokers: This study collected the main diagnosis among the patients to identify the pattern of diagnosis suffered by smokers. As shown in Table 2, congestive heart failure (CHF) was predominant among smokers. First-hand smokers had a higher incidence (56%) of CHF than second-hand smokers (48%). However, second-hand smokers were more commonly diagnosed with IHD than first-hand smokers (p=0.033), with 36% and 27.9%, respectively.

Symptoms during treatment: Symptoms during a month of treatment according to their cardiac diseases were recorded to observe the discrepancies of smoking impact between first- and second-hand smokers.

Table 2: Cardiac disease profile among smokers

Diagnosis	Frequency		P-Value
	First-hand smoker	Second-hand smoker	
	(%)	(%)	
Arrhythmia	16.8	10.8	0.258
Congestive heart failure	56	48	0.451
Ischemic heart disease	27.9	36	0.033
Others	0	5.2	0.132

Table 3: Reported symptoms during treatment

Symptoms	Frequency		P-Value
	First-hand smoker	Second-hand smoker	
	(%)	(%)	
Palpitation	16.7	4.8	0.514
Chest pain	27.8	39.3	<0.001
Shortness of breath	33.3	38.7	0.141
No symptom	5.6	4.2	0.355
Cough	5.6	1.2	0.112
Swollen ankles or feet	5.6	1.8	0.445
Dyspepsia	5.6	1.2	0.053
Fatigue	0	4.8	0.225

The mean age of the participants was 60 years, weighing approximately 60 kg. As shown in Table 1, a significantly higher number of patients (82.2%) were passive (second-hand) smokers (p=0.023), whereas only 18 (17.8%) were active (first-hand) smokers. Of the 101 patients, 34.7% suffered from hypertension as a comorbidity (p=0.035).

The most common symptom experienced by first-hand smokers was shortness of breath (33.3%), whereas the frequency of experiencing shortness of breath (p=0.141) and chest pain (p<0.001) was higher among second-hand smokers, with 38.7% and 39.3%, respectively, as shown in Table 3.

Table 4: Correlation of smoking and body weight

Smoking exposure	Mean body weight	SD	p-value
First-hand smoker	58.37	13.18	0.008
Second-hand smoker	66.89	11.26	

SD: Standard deviation

Table 5: Correlation of smoking and blood pressure

Blood pressure	Mean	SD	p-value
Systolic			
First-hand smoker	119.72	18.90	0.358
Second-hand smoker	124.88	13.11	
Diastolic			
First-hand smoker	78.37	8.34	0.914
Second-hand smoker	78.89	6.98	

SD: Standard deviation

Smoking impact on body weight: A correlation test was used to identify the impact of smoking between smoking exposure and body weight. Table 4 shows second-hand smokers had lower body weight than first-hand smokers. The Mann-Whitney test showed a significant association between smoking exposure and body weight (p=0.008), indicating that smoking habits could affect the body weight of smokers.

Smoking impact on blood pressure: A correlation test between smoking exposure and blood pressure did not show a significant impact. Although the impact of smoking exposure on blood pressure was not significant, the average systolic blood pressure second-hand smokers was higher than the first-hand smokers', as shown in Table 5. In contrast, the diastolic blood pressure among first- and second-hand smokers was relatively similar.

Laboratory result profile of first- versus second-hand smokers: Generally, the laboratory results between first- and second-hand smokers were in the normal range among all parameters except for fasting blood sugar (FBS) and 2-hour postprandial test (FBS2PP). Both first- and second-

Table 6: Laboratory results among smokers

Parameters	First-hand smoker		Second-hand smoker	
	Mean	SD	Mean	SD
Leukocytes (µL)	13.40	0.53	8.15	3.12
Erythrocytes (µL)	5.09	0.21	4.27	0.72
Hemoglobin (g/dL)	15.63	0.42	12.58	2.07
Hematocrit (%)	48.03	2.00	38.73	5.93
Platelets (K/L)	246.33	30.09	231.23	66.92
FBS (mg/dL)	143.50*	36.06	128.44*	46.28
FBS2PP (mg/dL)	285.00*	–	213.14*	83.20
SGOT (U/L)	33.00	–	33.93	41.16
SGPT (U/L)	18.00	–	25.57	23.72
LDL (mg/dL)	99.57	15.52	105.06*	70.08
HDL (mg/dL)	42.29	8.65	45.19	14.81
Total cholesterol (mg/dL)	165.00	19.41	165.19	32.98
Triglyceride (mg/dL)	118.14	35.47	126.80	76.12

*SD: Standard deviation; *: Abnormal result*

hand smokers had abnormal blood glucose levels for FBS or FBS2PP. Their blood glucose levels exceeded 125 mg/dL for FBS and 180 mg/dL for FBS2PP, indicating that their smoking habits significantly affected their blood glucose levels. The average LDL level of the second-hand smokers was reported to be abnormal (>100 mg/dL) but found to be predominantly normal compared to first-hand smokers, as shown in Table 6.

Cost burden per visit among smoker groups: The present study collected the medical cost from the hospital's database to identify how much patients should pay for their treatment per visit. The average medical cost per visit of second-hand smokers was higher than that of first-hand smokers (IDR 158.519 vs. 75.067). Thus, second-hand smokers spend more money than first-hand smokers to continue their treatment, typically visiting once a month.

DISCUSSION

The disability, death, and cost burden due to CHD are more significant than other illnesses worldwide. CHD was reported to be significantly higher in smokers than in nonsmokers [9,10]. A higher nicotine level from cigarettes was found to be the cause of atherosclerosis for smokers. Moreover, cigarette smoke could induce new CHD events and increase the progression of the disease by more than 80% [9]. This study found that the 101 patients suffering from CHD were second-hand smokers. A previous study reported that second-hand smokers were most frequently exposed to public services. Smoke exposure was significantly associated with CHD complications and the number of hospital admissions [7].

Some arrhythmias, such as atrial fibrillation (AF), were positively correlated with smoking habits; the higher the smoking dose, the higher the risk of developing future AF. The prevalence of AF was higher in smokers at 9.5% than in nonsmokers at 7.8%, and AF will impact the reoccurrence of AF for 10 years, with a 15% increased risk [11]. Smoking habits among patients with AF increased the risk of subsequent ischemic stroke and bleeding during anticoagulation treatment [12]. In addition to AF, smoking was correlated with other arrhythmias, such as supraventricular arrhythmia, atrioventricular junctional arrhythmia, and ventricular arrhythmia. The pathogenesis of arrhythmia among smokers has been proven due to the arrhythmogenic property of nicotine as the main constituent of tobacco smoke [13]. The alterations of ventricular recovery time were mentioned to correlate with ventricular arrhythmogenesis among both passive and active smokers. The generation of cardiac arrhythmias was contributed by augmented myocardial performance. In addition, the oxygen demand increased as a result of the heart rate, arterial blood pressure, and plasma catecholamines that increased during smoking due to nicotine release to the blood circulation [14].

Regarding the main diagnosis found in the current study, CHF has the highest number of diagnoses among first- and second-hand smokers. This result was in line with another study reporting cigarette smoking as a significant risk factor for bigger left ventricular mass, systolic blood pressure abnormality, and number of hospitalizations due to CHF [15]. Moreover, the systolic blood pressure profile among second-hand smokers in this study was significantly higher than that among first-hand smokers. Regarding the symptoms presented during data collection, this study reported chest pain and shortness of breath as the most common symptoms among smokers and higher in second-hand smokers during cardiac treatment. Generally, chest pain/angina and shortness of breath are the typical symptoms that frequently occur among patients with CHD [9,16]. This study showed that second-hand smokers suffered chest pain and shortness of breath more frequently than first-hand smokers. Thus, the World Health Organization (WHO) recommends that countries provide a smoking-free environment and related policies for protecting second-hand smokers [2]. Furthermore, the WHO reported that CVD deaths comprised 10% of smoking attributes [17]. The diagnosis of HF followed by persistent smoking activities was proven to lead to prolonged HF outcomes and reduce the treatment efficacy of HF [17]. The risk of coronary artery disease as the major cause of HF was attributed to smoking, increasing systolic and diastolic blood pressure, and oxidative stress [17].

This study also found that smoking habits could significantly affect body weight; first-hand smokers had significantly higher body weight than second-hand smokers. A previous study showed a correlation between smoking cessation and weight changes [18]. Another study found that nicotine

dependence due to active smoking habits was positively related to the intensity of general food cravings as well as cravings for foods with high ingredients of fats, sweets, and carbohydrates/ starches [19]. This report supported the present data regarding the high FBS and FBS2PP among first- and second-hand smokers. In contrast, other studies demonstrated that an active smoking habit was associated with lower body weight and could increase the possibility of being underweight among first-hand smokers [20,21]. However, those studies also stated that smoking frequency and body weight had no linear result, and appropriate body weight management should not be associated with smoking [20,22].

The economic burden related to smoking habit affects not only the high out-of-pocket expenses for cigarettes per month, which is 20.5 thousand IDR/pack, but also the direct cost of health care, estimated at US$2177 million, which has become a substantial burden for Indonesia [5]. This study's cost burden among smokers also became a concern, showing that the direct medical cost per visit was IDR 75.067 and IDR 158.519 for first- and second-hand smokers, respectively. The higher cost among second-hand smokers could be attributed to the higher number of symptoms during therapy.

This study was limited in the number of study sites; it involved only two secondary hospitals with a study period of only a month and could only reach 101 participants. However, this study was the first study that compared the smoking impact among first- and second-hand smokers instead of only one group of smokers, which could be used as preliminary data to depict the situation of the CHD population due to smoking habit in Yogyakarta. Despite the limited statistical analysis due to the limited time for data collection, this study collected the data prospectively. Thus, this study could explore more data on the smoking impact among the two groups of smokers instead of performing this individually.

CONCLUSION

Smoking habits can heighten the risk of CHD, especially CHF and IHD, and diabetes mellitus among first- and second-hand smokers. Second-hand smokers specifically suffered more symptoms during therapy and more expenses per visit. Thus, the Indonesian government should develop a policy to protect second-hand smokers and limit first-hand smoker's cigarette access. Further study with a bigger sample size is needed to capture the whole condition of the CHD population due to smoking habits in Indonesia.

REFERENCES

1. Barry, J.; Mead, K.; Nabel, E.G.; Rocco, M.B.; Campbell, S.; Fenton, T.; Mudge, G.H.; Selwyn, A.P. Effect of Smoking on the Activity of Ischemic Heart Disease. JAMA 1989, 261, 398–402.
2. World Health Organization Cardiovascular Harms from Tobacco Use and Secondhand Smoke: Global Gaps in Awareness and Implications for Action; ITC Project, World Health Organization, and World Heart Federation: Ontario, 2012.
3. Hbejan, K. Smoking Effect on Ischemic Heart Disease in Young Patients. Heart Views Off. J. Gulf Heart Assoc. 2011, 12, 1–6, doi:10.4103/1995-705X.81547.
4. Centers for Disease Control and Prevention Health Effects of Secondhand Smoke: Office on Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion Available online: https://www.cdc.gov/tobacco/data_statistics/fact_sheets/index.htm (accessed on 25 October 2022).
5. Kristanti, D.; Herminiati, A. Characteristics of Physical, Chemical, and Organoleptic Properties of Inulin-Enriched Pudding as a Complementary Food. IOP Conf. Ser. Earth Environ. Sci. 2019, 251, 012032, doi:10.1088/1755-1315/251/1/012032.
6. Barnoya, J.; Glantz, S.A. Cardiovascular Effects of Secondhand Smoke. Circulation 2005, 111, 2684–2698, doi:10.1161/CIRCULATIONAHA.104.492215.
7. Abu-Baker, N.N.; Al-Jarrah, E.A.; Suliman, M. Second-Hand Smoke Exposure Among Coronary Heart Disease Patients. J. Multidiscip. Healthc. 2020, 13, 109–116, doi:10.2147/JMDH.S238984.
8. Mahassni, S.H.; Ali, E.Y.I. The Effects of Firsthand and Secondhand Cigarette Smoking on Immune System Cells and Antibodies in Saudi Arabian Males. Indian J. Clin. Biochem. 2019, 34, 143–154, doi:10.1007/s12291-018-0739-9.
9. Yathish, T.R.; Manjula, C.G.; Srinivas, R.D.; Gayathree, L. A Study on the Association of Coronary Artery Disease and Smoking by a Questionnaire Method. J. Clin. Diagn. Res. 2011, 5, 264–268.
10. Amiri, P.; Mohammadzadeh-Naziri, K.; Abbasi, B.; Cheraghi, L.; Jalali-Farahani, S.; Momenan,

A.A.; Amouzegar, A.; Hadaegh, F.; Azizi, F. Smoking Habits and Incidence of Cardiovascular Diseases in Men and Women: Findings of a 12 Year Follow up among an Urban Eastern-Mediterranean Population. BMC Public Health 2019, 19, 1042, doi:10.1186/s12889-019-7390-0.
11. Watanabe, I. Smoking and Risk of Atrial Fibrillation. J. Cardiol. 2018, 71, 111–112, doi:10.1016/j.jjcc.2017.08.001.
12. Albertsen, I.E.; Overvad, T.F.; Lip, G.Y.H.; Larsen, T.B. Smoking, Atrial Fibrillation, and Ischemic Stroke: A Confluence of Epidemics. Curr. Opin. Cardiol. 2015, 30, 512–517, doi:10.1097/HCO.0000000000000205.
13. D'Alessandro, A.; Boeckelmann, I.; Hammwhöner, M.; Goette, A. Nicotine, Cigarette Smoking and Cardiac Arrhythmia: An Overview. Eur. J. Prev. Cardiol. 2012, 19, 297–305, doi:10.1177/1741826711411738.
14. Kayali, S.; Demir, F. The Effects of Cigarette Smoking on Ventricular Repolarization in Adolescents. Einstein São Paulo 2017, 15, 251–255, doi:10.1590/S1679-45082017AO3945.
15. Kamimura, D.; Cain, L.R.; Mentz, R.J.; White, W.B.; Blaha, M.J.; DeFilippis, A.P.; Fox, E.R.; Rodriguez, C.J.; Keith, R.J.; Benjamin, E.J.; et al. Cigarette Smoking and Incident Heart Failure. Circulation 2018, 137, 2572–2582, doi:10.1161/CIRCULATIONAHA.117.031912.
16. Barnett, L.A.; Prior, J.A.; Kadam, U.T.; Jordan, K.P. Chest Pain and Shortness of Breath in Cardiovascular Disease: A Prospective Cohort Study in UK Primary Care. BMJ Open 2017, 7, e015857, doi:10.1136/bmjopen-2017-015857.
17. Son, Y.-J.; Lee, H.-J. Association between Persistent Smoking after a Diagnosis of Heart Failure and Adverse Health Outcomes: A Systematic Review and Meta-Analysis. Tob. Induc. Dis. 2020, 18, 05, doi:10.18332/tid/116411.
18. Pieroni, L.; Salmasi, L. The Effect of Smoking Habit Changes on Body Weight: Evidence from the UK. Econ. Hum. Biol. 2016, 20, 1–13, doi:10.1016/j.ehb.2015.11.002.
19. Chao, A.M.; White, M.A.; Grilo, C.M.; Sinha, R. Examining the Effects of Cigarette Smoking on Food Cravings and Intake, Depressive Symptoms, and Stress. Eat. Behav. 2017, 24, 61–65, doi:10.1016/j.eatbeh.2016.12.009.
20. Wang, Q. Smoking and Body Weight: Evidence from China Health and Nutrition Survey. BMC Public Health 2015, 15, 1238, doi:10.1186/s12889-015-2549-9.
21. Jitnarin, N.; Kosulwat, V.; Rojroongwasinkul, N.; Boonpraderm, A.; Haddock, C.K.; Poston, W.S.C. The Relationship Between Smoking, Body Weight, Body Mass Index, and Dietary Intake Among Thai Adults: Results of the National Thai Food Consumption Survey. Asia Pac. J. Public Health 2014, 26, 481–493, doi:10.1177/1010539511426473.
22. Audrain-McGovern, J.; Benowitz, N. Cigarette Smoking, Nicotine, and Body Weight. Clin. Pharmacol. Ther. 2011, 90, 164–168, doi:10.1038/clpt.2011.105.