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Factors Related to Cafe Worker's Lung Capacity in Pontianak, Indonesia

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Abstract

Exposure to cigarette smoke in public places affects the human population lung capacity. Cafe workers are a population susceptible to cigarette smoke exposure. This study aimed to analyze the risk factors associated with the lung capacity of cafe workers. This study used an observational method with a cross-sectional approach. The sample was composed of 74 participants. Data collection was carried out by interviewing and observing respondents. Exposure to inhaled smoke was measured using interviews and a spirometer checking lung capacity. The Chi-square test was used to determine the relationship between risk factors and lung capacity. The results showed a significant relationship between age (p-value = 0.006) and the lung capacity of cafe workers. The older person had, the greater the risk of decreased lung function. There was a significant relationship between cigarette smoke exposure, age, and the lung capacity of cafe workers. The intervention needs to be done to make a preventive measure by establishing non-smoking area regulations in public spaces and monitoring the workplace environment.

Keywords: cafe workers, cigarette smoke, exposure, lung capacity, workplace

Introduction

Occupational health and safety need to be applied in every workplace. It is because occupational health and safety help to achieve optimal work productivity so that every worker can work safely and avoid health problems.[1] For workers to work safely, prevent health problems and achieve productivity at work, promotive, preventive, curative, and rehabilitative efforts are needed.[2] The application of occupational health and safety needs to be done for workers in the formal and informal sectors.[3,4] Occupational diseases and accidents can occur due to poor working conditions, such as air pollution by solid particles in the form of dust and smoke, which can reduce the quality of life for workers in the workplace.[5-7] Among diseases that can cause death, 34% originate from cancer, 24% occupational accidents, 21% respiratory diseases, 15% cardiovascular disease, and 5% are caused by other factors.[8]

One of the causes of respiratory disease in the workplace is exposure to cigarette smoke. It is one of the causes of respiratory disease in the workplace. Cigarettes are a combination of complex chemicals: carbon monoxide, hydrogen cyanide, nitrogen oxides, benzene, formaldehyde, acrolein, phenol, nicotine, nitrosamines, and other gases. Many chemicals in it can cause health problems, one of which is respiratory disease.[9] Passive smoke can affect the respiratory tract, and both who smoke actively or passively can develop health problems.[10]

Exposure to cigarette smoke causes increased airway inflammation and the onset of respiratory symptoms, such as asthma, bronchitis, and chronic obstructive pulmonary disease.[11] Exposure to secondhand smoke is one of the air pollutants. As many as 35% of women, 33% of men, and 40% of children from 192 countries worldwide are exposed to passive smoke indoors.[12] According to the Global Adults Tobacco Survey, restaurants and cafes are public places that are most susceptible to its spread (85.4%).[12] Cafe workers are a group of passive smokers and vulnerable to it. The World Health Organization (WHO),[13] stated that there is no safe limit for exposure to other's smoke; separating smoking and ventilation spaces will not reduce smoke inhalation. A total of 70 cafes and restaurants employees

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experienced moderate restrictions.[14] Cigarette smoke exposure is a risk factor for decreased lung function status, causing health risks.[15]

The effect of smoke exposure affects the functional lung capacity of workers. Finding cafes or restaurants indoors and outdoors in Pontianak City is not difficult; they are spread along the roads.[16] The number of cafes and restaurants is also in line with the smoking culture. Pontianak City has a Regional Regulation/*Peraturan Daerah* (PERDA) No. 10 of 2010 concerning non-smoking areas. However, implementing of a smoke-free zone in cafes and restaurants is complicated to implement. Many cafes and restaurants still give visitors the freedom to smoke indoors or outdoors or even provide smoking rooms. This study aimed to analyze the relationship of exposure to cigarette smoke, age, gender, working period, working length, and air conditioning with the lung capacity of cafe workers. This study was conducted in Pontianak City because it is one of the cities that has a strong hangout culture.[16]

Method

The study design used was cross-sectional. The total population used was all workers at 24 cafes with permits from One-Stop Integrated Agency and Investment Office of Pontianak City. However, 15 cafes were willing to participate, two refused, and seven were no longer operating. There was a total population of 15 licensed cafes with 92 workers. According to Sugiyono,[17] if the total population was less than 100 workers, all can be used as a study sample. The sample in this study is the total population with inclusion and exclusion criteria, and 74 workers met the requirements. The study was carried out from January 2019 to June 2019. The inclusion criteria of the study sample were no history of lung-related diseases, such as pneumonia, tuberculosis, bronchitis, and asthma,[18] and normal nutritional status (a balance between the amount of energy that entered the body and energy released from outside the body according to individual needs). The body mass index (BMI) was used by calculating weight divided by height squared. The threshold value of BMI with a normal category is 18.5-25.0 kg/m^2.[19] The exclusion criterion was if the workers were unwilling to participate in the study activities.

This study's data collection techniques were carried out by interview, observation, and examination. Respondent characteristic data, such as age, gender, working period, and working length, were obtained using interviews using questionnaires. The data was collected before work and rest. Data on cigarette smoke exposure and air conditioning system (air conditioner/AC and fans) were obtained using interviews and observations by questionnaires and checklists. The data was collected when the workers worked. The lung capacity categorized as normal if forced vital capacity (FVC) $\geq$ 80% and forced expiratory volume in one second (FEV1) $\geq$ 75% and disruption if FVC < 80% and FEV1 < 75%. The data was measured by examination using a spirometer and checked according to the American Thoracic Society Standardization of Spirometry guidelines.[20] The data was collected after the respondent finished working. Data collection officers were enumerators who had been trained while lung capacity checks were carried out.

The management of data was using a statistical analysis program included the stages of editing, coding, scoring, entry, tabulating, and analyzing the study data processing method included the following: 1) editing (data checking), which was cleaning and preparing the data that had been collected, answers were complete, clarity and suitability; 2) coding (code giving) was the identification and classification process by giving symbols in the form of numbers on each respondent's answer based on the variables studied; 3) scoring (scores) consisted of giving a score to the data that had been coded, and then assigning a value and weight to the data; and 4) tabulating (entering data in a table), which was doing data entry, compiling and calculating the data that had been coded into a table. Furthermore, the data processing results were analyzed descriptively and underwent inferential analysis. Descriptive analysis data was presented in tables, presentations, frequency, and narration. Bivariate analysis with statistical tests using the Chi-square test was used to analyze whether or not there was a relationship between the independent and dependent variables. Multivariate analysis using logistic regression test or binary logistic regression with a 95% confidence level (α = 5%) was performed.

Results

The variable-frequency distribution among cafe workers in Pontianak City was seven variables divided into several categories, as shown in Table 1. Table 1 shows that 22 (29.7%) cafe workers were exposed to cigarette smoke. There were 52 cafe workers aged $\geq$ 20 years (70.3%) and dominated by female workers (40; 54.1%). Sixty-nine workers had an average working period of less than five years (93.2%), and 39 workers had a $\geq$ 7 hours/day length of work (52.7%). The types of air conditioning system used in the observation area were fans and air conditioners (64.9%). The lung capacity of 52 cafe workers showed normal categories (70.3%).

Based on Table 2, the number of respondents exposed to cigarette smoke is the same; 50% experiencing interference and 50% normal. The statistical results showed the p-value of 0.028 (odds ratio (OR) = 3.7; 95% confidence interval (CI) = 1.281-10.848), indicating a

relationship between cigarette exposure and lung capacity in cafe workers. Workers who experienced lung capacity disorders (54.2%) were less than 20 years old. The statistical results showed the p-value of 0.006 (OR = 5; 95% CI = 1.701-14.934), indicating a relationship between age and lung capacity in cafe workers. Many workers who experienced lung capacity disorders were male (32.4%). The statistical results showed the p-value of 0.841 (95% CI = 0.464-3.424), indicating no relationship between gender and lung capacity in cafe workers. Approximately 40% of workers who had a work period of ≥ 5 years experienced lung capacity disorders. Statistical results showed a p-value of 0.630 (95% CI = 0.253-10.526), indicating no relationship between years of service and lung capacity in cafe workers. Workers who had a work period of ≥ 7 hours/day experienced lung capacity disorders (30.8%). The result of statistical analysis was a p-value of 1.000 (95% CI = 0.409-3.021), which means that there is no relationship between the length of work and the lung capacity of cafe workers. Workers who used AC experienced lung capacity disorders (38.5%). The

Table 1. Distribution of Cafe Workers in Pontianak City

Variable	Category	n	%
Exposure to cigarette smoke*	Inhalation	22	29.7
	Not inhaled	52	70.3
Age	<20 years	22	29.5
	≥20 years	52	70.3
Gender	Male	34	45.9
	Women	40	54.1
Working period	≥5 years	5	6.8
	<5 years	69	93.2
Working length	≥7 hours/day	39	52.7
	<7 hours/day	35	47.3
Air conditioning system	Fan	13	17.6
	Air conditioner (AC)	13	17.6
	Fan and AC	48	64.9
Lung capacity	With disruption	22	29.7
	Normal	52	70.3

Notes: Sources: Primary Data, 2019
*Respondents as passive smoker

Table 2. Bivariate Analysis of Factors Related to the Lung Capacity of Cafe Workers

Variable	Category	Lung Capacity						p-value[a]	OR	95% CI
		With Distraction		Normal		Total				
		n	%	n	%	n	%			
Cigarette smoke exposure	Inhalation	11	50	11	50	22	22	0.028*	3.7	1.281-10.848
	Not inhaled	11	21.2	41	78.8	52	52			
Age	<20 years	12	54.2	10	45.5	22	100	0.006*	5	1.701-14.934
	≥20 years	10	19.2	42	80.8	52	100			
Gender	Male	11	32.4	23	67.6	34	100	0.841*	-	0.464-3.424
	Female	11	27.5	29	72.5	40	100			
Working period	≥5 years	2	40	3	60	5	100	0.630*	-	0.253-10.526
	<5 years	20	29	49	71	69	100			
Working length	≥7 hour/day	12	30.8	27	69.2	39	100	1.000*	-	0.409-3.021
	<7 hour/day	10	28.6	25	71.4	35	100			
Air conditioning system	Fan	1	7.7	12	92.3	13	100	0.150*	-	-
	Air conditioner (AC)	5	38.5	8	61.5	13	100			
	Fan and AC	16	33.3	32	66.7	48	100			

Notes: Source: Primary Data, 2019
[a]Chi-square, α = 5%, *Significance p-value≤0.05, OR = Odds Ratio, CI = Confidence Interval

Table 3. Multivariate Analysis of Factors Related to the Lung Capacity of Cafe Workers

Variable	β	SE	Wald	df	Sig[a]	Exp(B)	95% CI for Exp(B)	
							Lower	Upper
Age	-2.144	0.654	10.762	1	0.001	0.117	0.033	0.422
Gender	-1.029	0.623	2.727	1	0.099	0.357	0.105	1.212
Cigarette smoke exposure	0.566	0.631	0.806	1	0.369	1.761	0.512	6.061
Working period	0.292	1.109	0.069	1	0.792	1.339	0.152	11.763
Working length	0.152	0.607	0.063	1	0.802	1.164	0.355	3.822
Air conditioning system	1.798	1.210	2.207	1	0.137	6.038	0.563	64.733
Constant	-0.259	3.299	0.006	1	0.938	0.772		

Notes: Source: Primary Data, 2019
[a]Logistic regression test or binary logistic regression test, α = 5%, *Significance p-value≤0.05
SE = Standard Error, df = degrees of freedom, Exp(B) = Exponent B (Odds Ratio), CI = Confidence Interval

statistical value of p-value = 0.150 shows no relationship between air conditioning system and lung capacity in cafe workers. Based on Table 3, the results of the age analysis had a significant value compared to other variables (p-value = 0.001; 95% CI = 0.033-0.422).

Discussion

Based on the bivariate statistical analysis, there was a relationship between exposure to cigarette smoke and lung capacity in cafe workers in Pontianak City (p-value = 0.028; OR = 3.7; 95% CI = 1.281-10.848). Smoking can cause health problems, especially respiratory problems, including lung function capacity, which can cause high morbidity from respiratory disorders or risk of death.[21] Smoking habits can affect lung function by decreasing it. There are addictive substances in cigarettes that can damage human respiratory organs, especially the lungs, which can cause damage to function and tissue structure in the lungs.[15] Secondhand smoke is smoke from active smokers inhaled unconsciously by passive smokers.[22]

Cigarette smoke contains more than 7,000 chemicals in it. Hundreds of them are toxic chemicals, and about 70 of them can cause cancer. No level of passive smoke is risk-free. Even brief exposure can cause immediate harm.[22] Cigarette smoke can disrupt the diffusion process of decreased O_2 supplies in tissues. It can lead to hypoxia, disruption of metabolic processes, and an increase in CO_2 in the blood, causing a decrease in the vital capacity of the lungs.[23] Based on the study of Bird and Staines-Orozco,[24] it was stated that passive smoking causes an increase in respiratory symptoms and a decrease in a person's functional lung capacity. Smoking causes changes in the function of the human respiratory tract. It disrupts lung function caused by hypertrophic mucosal cells and hyperplastic mucus glands, resulting in mucus buildup that causes inflammatory cells to increase in the lungs and alveoli, inducing damage.[25] The habit of smoking causes the emergence of more and more lung deposits so that the air in and out becomes increasingly narrow.[26]

The statistical results show a p-value of 0.006 (OR = 5; 95% CI = 1.701-14.934), indicating a relationship between age and lung capacity in cafe workers. Based on the results of multivariate analysis, age has a significant (p-value = 0.001) value compared to other variables. Its factors were one of the factors that affected the condition of a person's lungs. As age increases, the function of organs and the human immune system also decreases, especially changes in the lungs, such as changes in the nervous system, tissues, and muscles. Age was one of the crucial factors that could affect the condition of a person's lungs. In older people, the function and performance of the body decreases with age, which results in several changes in the lung organs, such as changes in muscle, bone, and nervous system tissue, as well as changes in the immune system.[27]

Each person's lung capacity will decrease by 20 mL each year. When a person reaches the age of 30, their lung function value will decrease by 3,000 mL to 3,500 ml, while in a person over the age of 50, their lung function value decreases to less than 3,000 mL. Based on the statistical results, the p-value of 0.841 indicates no significant relationship between gender and lung capacity in cafe workers.[28,29] These results were in line with the study of Kandung,[30] who found that gender does not show an effect on lung function disorders because both males and females have the same risk of experiencing pulmonary function disorders. Reduced lung function is caused by a decrease in the elasticity of the tissue in the lungs. As a person ages, the respiratory muscles in the lungs, FEV1 and FVC, vital capacity, and antioxidant fluid of the epithelium decrease.[31]

The lung function volume and capacity in women are 20-25% smaller than in men, and the average lung capacity for adult women and men is different. So, there is no relationship between gender and lung capacity in cafe workers. The results showed that 32.4% of male workers had lung capacity disorders because some of them were active smokers. Active smoking can increase respiratory disorders, such as impaired lung capacity, chronic obstructive pulmonary disease, lung cancer, emphysema, and bronchitis.[32] Working period was found to have no significant relationship with lung function disorders in workers with a p-value = 0.630. This is in line with Yuvaraj, *et al.*,'s study stating that working tenure is not related to pulmonary function disorders in workers because the respondents who work at cafes had a working period of fewer than ten years.[33]

The use of air conditioning systems and lung capacity in cafe workers did not show a significant relationship, with a p-value of 0.150. The air conditioning system used in the cafe where the observation was located used two types; an AC and a fan. The results showed that AC increased impaired lung function capacity by 38.5%. The use of an air conditioning system cannot control the exposure to passive smoke because this system can spread exposure to cigarette smoke throughout the room and cause health problems. Therefore, improving indoor and outdoor air quality is an effort to protect the health and safety of employees and customers.[34] Air circulation is crucial to prevent contamination in the room.[12]

An increased ventilation rate plays an essential role in air distribution to remove disease-causing pollutants.[35] The call for a smoking ban effectively improves both indoor and outdoor air quality. This has been shown to be effective in eliminating the risk of health problems associated with exposure to cigarette smoke indoors.[34]

Providing a smoking area can minimize exposure to cigarette smoke, provided that pollutants originating from cigarette smoke from the smoking area flow out without recirculating to another occupied room.[36] To protect workers from exposure to cigarette smoke, the WHO,[37] recommends a policy regarding the implementation of a smoke-free environment in public spaces; this is considered the most effective way to reduce cigarette smoke exposure to a safer level both outdoors and indoors. Ventilation and designated smoking areas either have separate ventilation from smoke-free areas or do not reduce exposure to a safe level of risk and are not recommended.

The limitation of this study was that it used a cross-sectional approach, so the study may change in the future due to the limited time of the study and only proving the relationship between the variables that occurred during the study. Also, the upcoming changes could not be observed. The sample size was not large, so the study results could not be generalized to a population; the various factors associated with pulmonary disorders cannot be controlled. This study only looked at the relationship between one or several variables with other variables but could not conclude whether there was a causal relationship. The recommendation for future study is to be carried out experimentally by comparing the control and exposed groups. Respondents who meet the inclusion criteria must undergo a medical examination according to the procedure (not only by filling out a form).

Conclusion

There is a relationship between exposure to cigarette smoke and lung capacity in cafe workers and age. Based on the multivariate analysis, there was a relationship between age and lung capacity in cafe workers. Based on this study results, the authors suggest cafe visitors be more positive in obeying the rules of the no-smoking area and for the Department of Health, Department of Trade, and Department and Industry to take preventive measures by making smoking protocols or rules in public rooms monitoring the workplace environment.

Abbreviations

WHO: World Health Organization; PERDA: *Peraturan Daerah*; BMI: Body Mass Index; OR: Odds Ratio, CI: Confidence Interval; O_2: Oxygen, CO_2: Carbon dioxide, AC: Air Conditioner; FEV1: Forced Expiratory Volume in one second; FVC: Forced Vital Capacity.

Ethics Approval and Consent to Participate

This research was conducted in accordance with the Declaration of Helsinki guidelines and approved by the Poltekkes Kemenkes Pontianak (No.195/KEPK-PK.PKP.V/2019). Written consent was obtained from all workers who participated in the study.

Competing Interest

The author declares that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

Data supporting the findings of this study are available upon request from the author. Data are not publicly available due to the ethical constraints of the research.

Authors' Contribution

S takes responsibility for the integrity and accuracy of the data and the drafting of the manuscript and also wrote the primary draft of the manuscript. ZA and FRP are responsible for the design of the study and contributed to the analysis and interpretation of the data.

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