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RESEARCH ARTICLE

Pulmonary Function Test among Asymptomatic Male's Smokers and Non-smokers: A Community Study in Denpasar City, Bali

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Abstract

Background: Smoking chronically affects lung function, The effect and severity changes differ between individuals. It is estimated that six million adults and ~100,000 adolescents died each year from tobacco-related health issues. Active smoking by healthy adults has been reported to cause declines in lung function. These differences between cigarette smokers and non-smokers are in direct proportion to the quantity of smoking. Study-related factor associated with pulmonary function in Indonesia, especially in Bali still limited. Aim: This study aims to examine the factor that may be associated with pulmonary function among smokers and non-smokers in Denpasar. All participants were males. Method: This is an analytical study using a case-control method conducted in Denpasar City represented by 592 male respondents. Data collection is done through interviews with structured questionnaires. Demographic data, occupation, residence, body mass index, smoking habit, spirometry examination were documented. Data were analyzed using SPSS IBM 25.0 with univariate and bivariate analysis. Results: Spirometry examination showed 0.2% respondent had obstructive lung disease, 8.3% had restrictive lung disease, and 0.3% combines. This study found the association between smoking status and impaired lung with *p*-value <0.0001 (3.334 (CI95% 1.898-7.204). Association between pack years above 1.9 also significant with *p*-value <0.05 4.020 (CI95% 2.638-8.558). Conclusion: A significant association was found between the status of smoking and lungfunction parameters. Pack years also affect towards lung function parameter, especially FEV1%.

Keywords: *Smoking status, Packyears, Spirometry, Pulmonary functions.*

Introduction

Cigarette smoking is a health issue that has spread all over the world as an epidemic. It was the second leading risk factor and disability worldwide in 2015 [1]. It carries major health risks with the most cause-specific mortality related to those of respiratory and cardiovascular diseases [2].

WHO estimatedthat 1/3 of the world population who is 15 years old and older are smokers. This number is expected to climb as the world population grows. Every day eighty to one hundred thousands of people across the world are predicted to be addictedto cigarettes [3]. It is estimated that six million adults and ~100,000 adolescents died each year from tobacco-related health issues. More than 80% of those deaths occurred in developing countries [4].

ASEAN countries contributed to 10% of the world's smokers and 46.16% of smokers out of the 10% are Indonesia. The rate of cigarette consumption of Indonesian has increased from 1960 until 2003 by 3.8 times, from 35 billion sticks to 171 billion cigarettes per year. In 2020, smoking-related diseases would be the biggest health problem that causes 8.4 million deaths per year [5].

Smoking affects lung function. The extent and severity of these changes differ between individuals. Spirometry is a test to evaluate the normality of the respiratory function of

the lungs. It may be used to identify the deterioration of respiratory function among adolescents before the appearance of clinical symptoms [6]. It measures lung volume when an individual inhales or exhales air as a function of time, and it is invaluable as a screening test of general respiratory health [6,7]. Also, the respiratory function test can be conducted in a number of ways, such as evidenced by decreased pulmonary function including forced vital capacity (FVC), the accelerated loss of forced expiratory volume in 1 second (FEV1) [8], reductions in forced expiratory volume in 1 second/forced vital capacity ratio (FEV1/FVC) and forced mid-expiratory flow rate at 25-75% (FEF25%–75%) [4,9].

Active smoking by healthy adults has been reported to cause declines in lung function. These differences between cigarette smokers and non-smokers are in direct proportion to the quantity of smoking. It is believed that the airway constriction and decline in pulmonary function tests are irreversible [10]. Therefore, this study was conducted to obtain the prevalence of smokers in Denpasar, and the effect of quantity and duration of smoking on pulmonary function tests and related respiratory symptoms.

Methods

Participants

This study is an analytical study using a case-control method which uses primary data. The research was conducted in Denpasar City, Bali, Indonesia. The time of execution starts from November 2018 and completed the data collection on April 2018.The sample selection was obtained from consecutive sampling, until the number of samples was completed. The number of samples is taken according to the minimum sample requirements. The location chosen as the sampling location is easily accessible by researchers and participants.The inclusion criteria of participants were males who were willing to fill out the questionnaire and were willing to be examined for spirometry test by signing an informed consent and aged over 21 years.

Data Collection

Data collection is done through interviews with structured questionnaires. Coding process of each content of the interview form is carried out including age, occupation, residence, body mass index, smoking habit, spirometry examination (FEV1 absolute, FVC absolute, FEV1%, FVC%). Data entry process is carried out each questionnaire based on the results of coding the contents of each respondent's questionnaire. After all the participants' data are entered, followed by data cleaning process where each data in the variable code in the statistical program is seen whether there are missing or incorrect input data.

Spirometry measurements were carried out with the same Chestgraph HI-101 device (Chest M.L.Inc, Tokyo, Japan) at the beginning and follow-up. Before a spirometry examination, a number of requirements are needed. The patient or subject must be required not to smoke at least one hour before the test. Subjects were also not allowed to do heavy exercise because it can hinder the maneuver. Before the examination, subjects must not eat too full in the last two hours. The clothes worn were also must not too tight because it can inhibit chest and abdominal expansion.

Examination can be done in a standing or sitting position, but what needs to be remembered is that if a serial examination is carried out on the same person, the first examination with the next examination must be in the same position. The use of a nose clip to pinch the nose is recommended for this examination, but is not required. When going to do a maneuver, slightly position the neck and chin. When the mouthpiece is inserted into the mouth, all edges must be tightly closed by the mouth to ensure no leakage [11].

Statistical Method

The analysis included frequency distribution for categorical data such as age group, smoking status, nutritional status, impaired (obstructive, restrictive, and combines), and pack years. Obstructive lung disease can be classified with FEV1% below 70%. Restrictive lung disease classified by FVC% below 80%, and combines lung disease if include of all criteria above. Data were analyzed using SPSS Program. Univariate analysis has been done to show the distribution of demographic characteristic.

Chi-square analysis has been done to prove the association between two-group and show the Prevalence Ratio (PR). Data were showed in tables and narratives.

Table 1:Socio-demographic characteristic of the participants

Socio-Demographic Characteristic		n (%)
Age	< 30 years old	323 (54.6)
	≥ 30 years old	269 (45.4)
Smoking	Yes	296 (50)
	No	296 (50)
Nutritional Status	Underweight	7 (1.2)
	Normal	321 (54.2)
	Overweight	210 (35..5)
	Obese	54 (9.1)
Impaired	Normal	540 (91.2)
	Obstructive	1 (0.2)
	Restrictive	49 (8.3)
	Combines	2 (0.3)

Result

Based on the results of the univariate analysis approved in table 1 related to the sociodemographic characteristics of the participants, the total sample of participants was 592 males. We divide into two groups, 296 males for the smoking group (case), and 296 males for the non-smoking group (control).

From total sample, we found 323 participants (54.6%) less than 30 years old, and 269 (45.4) above 30 years old. The age range between 21-67 years old. Based on nutritional status, we record the respondent who had underweight, ideal, overweight, and obese 1.2%, 54.25%, 35.5%, and 9.1% respectively. Impairing status, we divide into 4 groups (normal, obstructive, restrictive, and combine) and then we merge into two groups, normal and impaired (obstructive, restrictive, and combine). The results of spirometry examination showed 0.2% respondent had obstructive lung disease, 8.3% had restrictive lung disease, and 0.3%.

Table 2 showed the cross-tabulation between socio-demographic and impaired. Cross-tabulation between age group and impaired, we found 9.9% respondent who had age below 30 years old had impaired, only 7.4% participants above or equal to 30 years old who had impaired. Nutritional status showed almost all respondent who had impaired are ideal, only 2.9% who had overweight. Smoking habit hasa role to increase the proportion of impaired lung, we also record 13.5% of smokers have impaired lung when compared with non-smoking group that only 4%.

Table 2: The characteristic of lung function among participants

Socio-Demographic Characteristic		Impaired (%)	
		Yes	No
Age	< 30 years old	32 (61.5)	291 (53.9)
	≥ 30 years old	20 (38.5)	249 (46.1)
Nutritional Status	Underweight	]0 (0)	7 (1.3)
	Normal	46 (88.5)	275 (50.9)
	Overweight	6 (11.5)	204 (37.8)
	Obese	0 (0)	54 (10)
Smoking	Yes	40 (76.9)	256 (47.4)
	No	12 (23.1)	284 (52.6)

Based on chi-square analysis in table 3, our study found an association between smoking status and impaired lung with *p* value <0.001. Prevalence ratio smoking status toward impaired showed 3.334 (CI95% 1.898-7.204), it means smoking is the risk factor for impaired in individual.

Association between pack years and impaired also significant between two groups with *p* value below 0.05. Packyears group divided into two groups using mean category (1.9). Prevalence ratio pack years more than or equal with 1.9 years toward impaired showed

4.020 (CI95% 2.638-8.558), it means pack years group more than or equal with 1.9 is the risk factor for impaired among respondents.

Table 3: Association between lung function and smoking habit among participants

Socio-Demographic Characteristic		Impaired (%)		*p*-value	OR	CI
		Yes	No			
Smoking	Yes	40 (76.9)	256 (47.4)	<0.0001	3.698	1.898-7.204
	No	12 (23.1)	284 (52.6)			
Pack Years	≥ 1.9 years	31 (59.6)	128 (23.7)	<0.0001	4.751	2.638-8.558
	< 1.9 years	21 (40.4)	412 (76.3)			

Discussion

In this study, the relationship between the status of smoking, pack years of smoking and pulmonary function parameters were evaluated. Most of the participants in this study were under 30 years old and had a normal nutritional status. This result was in line with world health organization data. There are 1.2 billion smokers globally, of which more than 50% are young people [11,12].

Some of the factors why young people in developing countries initiate smoking are similar to those in developed countries such as Indonesia are repetitive easy access to cigarettes, weak legislation that restrict access, and lack of restriction at school and in public places. From these results, the government must concern about this public health problem [13].

In addition, a significant correlation was found between the status of smoking and lung function parameters (FVC, FEV1/FVC values). Spirometry is a test to evaluate the normality of the respiratory function of the lungs. As would be expected, current smokers were more likely to have reduction of all values of pulmonary function tests compared to those of non-smoker subjects. The PFT values were significantly lower in smokers than non-smokers. The reduction of PFT values in smokers showed the effect of smoking on respiratory system [14].

In the present study out of total 100 study subjects 77(77.0%) had normal lung functions, whereas 23(23.0%) had impaired lung functions, out of which 21(91.3 %) were smokers and only 2 (8.7%) were non-smokers. The association between smoking and impaired PFT was statistically highly significant. The smokers had 17.3 times more risk of having impaired pulmonary functions as compared to non-smokers [14].

In Rawashdeh dkk, investigation of pulmonary function in adults aged e"40 years with a history of e" 15 years of smoking showed that the pulmonary function values of smokers were decreased compared to the predicted values [15].

Another study in Jaakkola found that both current regular smoking and recent former smoking were related to a significantly reduced FEV1 level. Interestingly, there was no indication of adverse effects among subjects who quit over a year ago, suggesting a recovery from the adverse effects of smoking [16]. Several previous studies also showed reduction of different values of PFTs among smoker compared to normal subjects. Nawafleh et al. showed FVC, FEV1, and PEFR were higher in nonsmoker in each age group [14].

This study also found that association between pack years and impaired also significant between two groups with *p* value below 0.05. Participants who have pack years above 1.9 years have chance 4.761 times higher to have impaired lung. that Result of this study related to a negative correlation between the smoking doses (cigarette packs year) and the pulmonary function parameters. Pearson's r value for FEV1 was 0.281 (p <0.05), FEF25-75% was -0.517 (p<0.001), MVV was -0.405 (p<0.001) and PEFR was -0.361 (p<0.001) [15].

The previous study showed that long-term smoking drastically reduced expiratory muscle strength and slightly increased inspiratory muscle strength; in contrast, inspiratory muscle endurance, was reduced in smokers [17,18]. Smoking causes changes in gradual development of parenchymal destruction and increased compliance, development of bronchoconstriction, inflammation, or mucus production. Internal

reaction due to smoking is oxidative stress. It could lowering smooth muscle cells numbers due to endothelial dysfunction [19]. These effects related to lung function and is clearly implicated in the etiology of anumber of respiratory diseases, particularly chronicbronchitis, emphysema, and bronchial carcinoma [1].

Conclusions

A significant correlation was found between the status of smoking and lungfunction parameters. Participants who have active smoking have chance 3.689 times higher more than non-smoking group. Association between pack years and impaired also significant between two groups. Participants who have pack years above 1.9 years have chance 4.761 times higher to have impaired lung disease more than other groups.

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