

Analysis of diabetes mellitus and environmental tobacco exposure of smoke (ETS) as a lung's tuberculosis risk factor

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Abstract

Indonesia is the country with the second highest pulmonary TB case in the world. Some studies suggest there is a relationship between TB and diabetes. Smoking habits are also associated because it can damage the defense mechanism of the lungs so as to facilitate the entry of TB germs. This study was conducted to analyze diabetes mellitus and environmental exposure to tobacco smoke (ETS) as a risk factor for pulmonary tuberculosis. This research is a quantitative analytical research with Case-Control performed in TB endemic region in Palembang namely Puskesmas Kertapati, health centers and health centers Sei Selincah 23 Ilir February to May 2018. Data were obtained from primary data obtained from questionnaires and examinations physical. The statistical test used is the Chi-square test and Independent T-test. In this study showed a significant relationship between blood sugar levels with tuberculosis status ($p=0.000$). And there is a significant relationship between ETS with tuberculosis status.

Keywords: TB; diabetes mellitus; environmental tobacco smoke (ETS)

INTRODUCTION

Infectious disease is one of the main health problems in the world, even in Indonesia. One of the causes of infectious diseases is the Mycobacterium. Mycobacterium tuberculosis is a facultative intracellular bacteria that causes tuberculosis (TB). Based on WHO data in 2015, in 2014 there were an estimated 9.6 million TB cases worldwide. Indonesia, is the country with the second highest pulmonary TB case in the world.

TB prevalence in Indonesia in 2013 was 297 per 100,000 population. Achievement figures in South Sumatra have 74 per 100,000 population experiencing pulmonary tuberculosis. (Kemenkes, 2015) While the prevalence of cases of Pulmonary Tuberculosis in Palembang City is 83.83 per 100,000 population. This figure shows that the city of Palembang is one of



the cities in South Sumatra that has problems with the transmission of pulmonary tuberculosis. TB patients with diabetes may have more complex and different pathogenesis than TB patients alone (Muaz, 2014) . Diabetic patients have cell-mediated immune disorders, renal failure, micronutrient deficiency and pulmonary microangiopathy, all of which increase their tendency to contract TB (Pertiwi, 2011). Low-income countries, most TB transmission sites, tend to report symptoms of active TB disease and also report having a diagnosis of diabetes.

Factors that influence the occurrence of pulmonary TB include socioeconomic conditions, age, sex, nutritional status and smoking habits. Although smoking is not the main cause of pulmonary TB disease, smoking habits can damage the lung defense mechanism so that it can facilitate the entry of germs such as TB bacteria.

Smoking causes pathophysiology in the respiratory system including the immune system and the cleaning mechanism of inhaled pathogens. The mechanisms that influence TB infection in response to smoking include mucociliary cleansing dysfunction, decreased activity of alveolar macrophages, immunosuppression in pulmonary lymphocytes, inactivation of NK (Natural Killer) cells, and pulmonary dendritic cell dysfunction (Chuang et al ., 2015).

The risk of developing TB will increase 9-fold if there is 1 smoker in one house (Kemenkes RI, 2015). Therefore this study was conducted to analyze tobacco mellitus and environmental exposure to tobacco smoke (ETS) as a risk factor for pulmonary tuberculosis.

METHOD

Material and Procedure

The type of research used is quantitative analytical research with Case-Control. The data collected from this study are primary data obtained from the questionnaire. Retrieval of data through questionnaires is carried out in each sample's residence.

The population is TB patients at Kertapati Health Center, Sei Selincah Health Center and 23 health centers. Sample is the whole People Tuberculosis in the year 2018 which is located in Primary Health Center of Palembang consisting of 16 cases of TB positives of PHC Kertapati, 15 cases of TB positives of PHC Sei Selincah and 6 cases of TB positives of PHC 23 Ilir Palembang by using the following criteria :

Tabel 1. Inclusion criteria and exclusion criteria

	Inclusion Criteria	Exclusion Criteria
Case	Age > 15 years	Patients suffer from Non-Pulmonary TB (Bone TB and TB Gland). Patients who are not active or passive smoking.
Control	Non-TB patients visiting the health center 2. Age > 15 years	Ever suffered from pulmonary TB (or other TB) and declared cured Respiratory Patients

Questions on the questionnaire are submitted to each sample and the answers are recorded. In addition, to asking questions through questionnaires, data retrieval was also carried out through physical examinations. The data of each related variable is obtained through the

answers of each sample. After the data is collected then data was processed and data analysis is carried out. Data is processed descriptively and analytically using the IBM SPSS version 22 program.

$$P = \frac{P1+P2}{2} = \frac{0,46+0,51}{2} = 0,48$$

In this study, sample cases were taken from all TB cases totaling 37 people and wanted a control with a ratio of 1: 2. So that the number of cases 37 with control 74 with a total sample of 111 people.

The analysis in this study uses chi square which is used in ordinal and ordinal scale data to determine whether there is a relationship between two variables, the independent variable and the dependent variable. Calculation of Confidence Interval (CI) is used 95% confidence level. T-test analysis is also used in this study for variables with numerical distribution. Calculation of Confidence Interval (CI) is used 95% confidence level.

RESULTS AND DISCUSSION

Based on the results of research that has been done, it obtained that 111 people who became the sample of the study consisted of 37 pulmonary TB patients and 74 patients who did not suffer from pulmonary TB.

Tabel 2. Distribution of Frequency of Pulmonary TB Patients Based on Age, Gender, Education, and Employment Categories

	TB (+)			TB (-)		
	N	%	95% CI	N	%	95% CI
			Age			
Produktive Age	28	75,7	60.5-88.9	62	83,8	75.4-91.7
Non Produktif Age	9	24,3	11.1-39.5	12	16,2	8.3-24.6
			Gender			
Male	30	81.1	67.6-93.0	56	75.7	65.7-84.9
Female	7	18.9	7.0-32.4	18	24.3	15.1-34.3
			Education			
Elementary	19	51.4	37.1-67.7	13	27.6	9.2-26.8
Middle	5	13.5	3.0-25.6	24	32.4	21.3-42.9
High	13	35.1	20.6-51.1	30	40.5	28.8-52.2
Graduate	0	0	0	7	9.5	3.8-16.4
			Work			
Does not Work	19	51.4	35.6-67.6	13	17.6	9.2-26.6
Work	18	48.6	32.4-64.4	61	82.4	73.4-90.8
Total	37	100%		74	100%	

Based on the division of the occupational group of a total of 37 positive pulmonary TB patients showed that the highest percentage obtained in this study was in patients with non-working status while from a total of 74 negative pulmonary TB patients also showed that the highest percentage obtained in this study was in patients with status work This is in line with the Toyalist study (2010) which states that most pulmonary TB sufferers are not working (59%). For job variables, it was found that the group of subjects who did not work at risk of developing pulmonary TB was 4,953 times with a 95% confidence level (2,055-11,939) compared to the subjects who worked. This number is significant because it obtained P value of 0,000 which means that there is a relationship between work and Lung TB status.

The results of this study are in line with the research conducted by Muaz (2014) which obtained p value = 0,000 which means that there is a significant relationship between work with patients with pulmonary TB + AFB. Besides that, the value of OR = 3,739 (CI = 2,189-6,386), meaning that respondents who do not work, will be at risk of developing pulmonary pulmonary TB + 3.7 times compared to respondents who work. Socio-economy has something to do with the type of work because it relates to income earned. Someone with a lower economy tends to have difficulty getting treatment and lack of nutritional intake, whereas pulmonary TB patients who work and have a good socio-economic will try to immediately seek treatment and good nutrition.

Room Conditions of Family Members Who Smoking

The results of this study indicate that positive pulmonary TB status is more common in subjects who have family members who smoke in a room without an air filter. From the results of statistical analysis obtained the value of OR = 29 . 333 95% CI (1 4186 -2 05, 543). This number is significant because it obtained P value 0. 0 00 which means there is a relationship between the condition of the room of a family member who smokes with a Positive TB status. This is in accordance with Ferdy et al. (2016), when the test was obtained the value of $\rho = 0,000$ ($\rho < 0,05$) resulted in a meaningful result and the hypothesis of the study was accepted, namely in general there was a significant relationship between home ventilation conditions and the incidence of pulmonary TB in the Kelayan Timur Health Center. But there are several studies that are not in line with the results of this study.

Tabel 3. The Relationship between the Number of Cigarettes and the Status of Pulmonary TB

Cigarettes	TB Status [n (%)]		Total	Sig	OR (95%CI)
	+	-			
>10 Sticks	30 (46,9%)	34 (53,1%)	64	0,000	19,412 (2,466-152,804)
< 10 Sticks	1 (4,3%)	22 (95,7%)	23		
Total	31 (100%)	56	87		

Tabel 4. Relationship between room conditions of family members who smoke with Pulmonary TB status

Condition of Space for Family Members of Smoking	TB Status [n (%)]		Total	Sig	OR (95%CI)
	+	-			
No Filter	11 (84.6%)	2 (15.4%)	13	0.000	29.333 (4.186-205.543)
Filter	3 (15.8%)	16 (84.2%)	19		
Total	14	18	32		

Type of Cigarette Family Members

Based on statistical analysis, OR = 3.12 (CI 95% 1,041-21,037) were obtained for family members who smoked non filteredcigarettes compared to other types of filter cigarettes . This number is significant because p = 0. 039 which means there is a relationship between family members who smoke non- filtered cigarettes and pulmonary TB status . Based on the results of statistical analysis, the positive TB status in this study was more in the family members who smoked non-filter types of cigarettes. In line with the results of this study, namely the study by Susanna (2012), states that the nicotine content contained in nonfilter cigarettes is greater than that of filter cigarettes in either mainstream or sideways smoke .

The results of statistical analysis on the relationship table in years of family members who smoked with pulmonary TB status were the most results were > 5 years (37 , 5 %). Based on the results of categorical statistical analysis, p = 0.217 (p>0.05). These results indicate that there is no significant relationship between the length of years of smoking of family members with pulmonary TB status.

Tabel 5. Relationship Types of Cigarettes of Family Members and Status of Pulmonary TB

Types of Cigarettes Family Members Smoking	TB Status [n (%)]		Total	Sig	OR (95% CI)
	+	-			
Non Filter	9 (64.3%)	5 (35.7%)	14	0,039	4.680 (1.041-21.037)
Filter	5 (27.8%)	13 (72.2%)	18		
Total	14	18	32		

Tabel 6. Mann-Whitney Test Test Relation of Smoking Day Long Hours, Long Year of Smoking, Number of Cigarettes with Lung TB Status

TB Status	n	Mean	SD	(Min-Max)	p-values
Lama Jam Perhari Merokok					
Positif	37	65,18	2,291	(0,0-8,00)	0,029
Negatif	74	51,41			
Lama Tahun Merokok					
Positif	37	71.73	8.687	(0.0-30.00)	0,000
Negatif	74	48.14			
Jumlah Batang Rokok					
Positif	35	50,27	7,197	(0,0-24,00)	0,013
Negatif	74	36,95			

Long Smoking (Years)

In this study positive pulmonary tuberculosis was higher in active smokers who smoked > 5 years. Through the Mann-Whitney test for the duration of smoking and the status of pulmonary TB, the results of p = 0.000 were obtained (p <0.05). These results can be interpreted that there is a relationship between the length of years of smoking and the status of pulmonary TB. This study was supported by research conducted in Purwokerto (Sarwani, 2012) with a case control design which reported that smoking duration was > 20 years at both cases and controls.

Then there is a decrease in T cell function which is manifested by a decrease in T cell mitogen proliferation. Polarization of the T cell function from the TH-1 response to TH-2 may also interfere with the host's defense in fighting infection. Tar also has a negative impact on B-lymphocyte function leading to decreased immunoglobulin production. In summary tar can cause changes in the structure and function of the airways and lung tissue and the host's immunological response to infection (Eisner, 2008).

Long smoking (per day)

Through the Mann-Whitney test for long hours of smoking per day with pulmonary TB status, the results of $p = 0,02$ ($p < 0.05$) were obtained for the relationship between the length of hours of smoking per day and pulmonary TB status. These results indicate that statistically there is a relationship between the length of hours of smoking per day and the status of pulmonary TB. This is in line with the research of Purnamasari (2010), that smoking habits can cause damage to the lung defense and damage the mechanism of mucociliary clearance, besides that cigarette smoke will also increase airway resistance and permeability of the lung epithelium and damage cilia motion, macrophages increase elastase synthesis and reduce antiprotease production. The longer a person smokes a cigarette it will be increasingly at risk for pulmonary tuberculosis. The results showed that the p value $< 0,05$ (\square) was rejected, so that there was a significant relationship between the degree of smoking suction and the incidence of pulmonary tuberculosis.

The results of research conducted by Wuaten (2010), in the body of a smoker who has a frequency of smoking every day toxins from cigarette smoke content accumulate faster compared to occasional smokers. Smoking habits also increase the risk of developing pulmonary TB 2, 2 times (Nasution, 2008). Lung than a person who does not smoke, the toxic content that is smoked by cigarettes in suction every day will be buried and the body can not completely eliminate the influence of nicotine in the smallest amount (Wuaten, 2010).

Number of cigarettes

The number of cigarettes consumed by patients per day has a significant relationship with conversion rates in pulmonary tuberculosis patients with $OR = 2,59$. The more number of cigarettes consumed by patients per day, it can aggravate the clinical manifestations of pulmonary tuberculosis and affect the success rate of treatment (Haris, 2013). In this study, it was found that patients with > 10 cigarettes were TB positive patients as many as 30 people. This shows that smoking habits can interfere with health, can not be denied many diseases that occur as a result of smoking habits. From the results of statistical tests found that there is a relationship between the number of cigarettes with pulmonary TB status with a p value of 0.000 ($p < 0.05$). Where the number of cigarettes is at risk of developing pulmonary TB by 19,412 x with a 95% confidence level (2,466-152,804).

Theoretically, the chemicals contained in cigarettes will accumulate more in the body. One day it will reach the point of toxin so that it can be seen that the symptoms are caused so that people who smoke > 10 cigarettes a day will feel the impact caused more quickly than those who smoke (Murfikin et al., 2014).

Diabetes Mellitus

A total of 73.0 % of subjects with tuberculosis had a blood sugar level of > 200 mg / dL while only 27.0 % had blood sugar levels of ≤ 200 mg / dL. The results of the analysis of the

relationship between blood sugar levels while with tuberculosis status using the chi-square hypothesis test with a 95% confidence level to produce a value of $p = 0.000$. This shows that there is a significant relationship between blood sugar levels with tuberculosis status.

Tabel 7. Relationship between blood sugar levels and tuberculosis status

Kadar Gula Darah Sewaktu	Status Tuberkulosis				Total		Nilai p	OR (95% CI)
	Positif		Negatif		n	%		
	n	%	n	%				
>200 mg/dL	27	73,0	24	32,4	51	100	0,000	5,625 (2,348 – 13,476)
≤200 mg/dL	10	27,0	50	67,6	60	100		
Total	37	33,3	74	66,7	111	100		

The results of this study are in line with the research Ruslami (2010) in his study stated that DM disrupts the immunity of patients so that it becomes a free risk factor for infections such as TB. The condition of hyperglycemia in patients with diabetes mellitus will give the effect of low immunity so that it is susceptible to infectious diseases, especially tuberculosis. This is because hyperglycemia will interfere with the work function of neutrophils and monocytes in terms of chemotaxis, attachment, and phagocytosis of these cells. Research by Niazi AK, & Kalra S (2012) stated that uncontrolled diabetes control predisposes to TB (Niazi AK, & Kalra S, 2012).

However, the researcher Astrid (2017) said that there was no relationship between the results of the examination of blood sugar while with pulmonary X-rays in tuberculosis and non-tuberculosis patients ($p = 0.184$). This is also in accordance with Nasution's research which says that there is no relationship between blood sugar levels and pulmonary X-ray images of TB patients (Astrid, 2017). In the study Alladin et.al also said that diabetes mellitus had no significant effect on clinical manifestations in tuberculosis (Alladin et al., 2011).

SIMPULAN

The increase in smoking prevalence is an indicator of an increase in the influence of exposure to cigarette smoke for people with Tuberculosis. Especially exposure to cigarette smoke that occurs in the home environment (direct contact) with patients. The results showed that ETS which included (the number of cigarettes, the condition of family members who smoked cigarettes, the type of cigarette family members, length of smoking (per year) and length of smoking per day) could increase the risk of tuberculosis. In addition, this study also proves that the condition of hyperglycemia in TB patients can also increase the risk of TB.

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