Original article

Subjective Complaints of Respiratory Disorders Due to Silica Dust Exposure to Workers at PT Bumi Saran Beton Kalla Block

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Abstract

Purpose: The aims to analyze the effect of exposure to silica dust and individual characteristics on subjective complaints of workers'

Methods: The study design used a cross sectional approach. This research was conducted at PT. Bumi Sarana Beton Kalla Block, samples in this study were workers in the ballmill, mixing and packing as many as 27 people using the total sampling method. Data analysis using chi-square test and multiple regression test.

Results: the results showed that the effect of age on subjective complaints of respiratory disorders was p 0.904> 0.05, the effect of smoking on subjective complaints of respiratory disorders p 0.485> 0.05, the effect of working tenure on subjective complaints of respiratory disorders p 0.728> 0.05, the effect of The use of respiratory protective equipment against subjective complaints of respiratory disorders p 0.820> 0.05, the effect of work history on subjective complaints of respiratory disorders p 0.647> 0.05, the effect of exposure to silica dust on subjective complaints of respiratory disorders p 0.529> 0.05.

Conclusion: exposure to silica dust and individual characteristic factors such as age, smoking habits, years of service, use of respiratory protective equipment, and work history are not significant to the subjective complaints of respiratory

Keywords: *Silica Dust, Subjective Complaints, Respiratory Disorders.*

Introduction

Health problems can arise due to various factors in the work environment, such as: physical, chemical, biological, physiological, and psychological factors[1]. The work environment is very easily exposed to chemical factors such as dust, vapors and gases. Dust under certain conditions is a chemical agent that can reduce work comfort, visual disturbances, pulmonary function disorders, and can even cause general poisoning. Continuously inhaled dust can cause lung damage and fibrosis. Dust with a smaller size has a greater potential to cause lung function problems because dust with a size of less than 1 μ can enter the alveoli, while dust particles <0.1 μ move in and out of the alveoli and do not settle on the alveoli surface[2]

Data from the ILO suggests that among all occupational diseases, 10% to 30% are lung diseases. It is detected that about 40,000 new cases of pneumoconiasis occur worldwide each year (ILO, 2010). Based on the results of a survey by the Directorate General of PPM & PL in Indonesia, chronic obstructive pulmonary disease ranks first as a contributor to morbidity (35%), followed by bronchial asthma (33%), lung cancer (30%), and 2% others[3,4,5].

One of the health problems caused by the work environment is the disruption of lung function for workers and communities around industrial areas. Various substances can pollute the air such as dust, cement, cotton, asbestos, chemicals, poisonous gases. The effect of dust exposure on labor can cause disturbances, including enjoyment of work, irritation to both the eyes and the respiratory tract and impaired lung function[1,6,7]. The accumulation of dust in the lungs can reduce the ability of the lungs to inhale and exhale air so that the volume of air inhaled in the lungs is reduced[4, 8,9].

One of the products of PT. Bumi Sarana Beton is a lightweight brick, where the materials used in the manufacturing process are silica sand, cement, lime, a little gypsum, water, and aluminum paste as a building material[10,11]. Where these materials are one of the factors causing the disruption of lung function when continuously exposing workers to certain concentrations, one of which is silica.[5,12,13.] According to the International Agency for Research on Cancer (IARC), silica belongs to group 1 substances that are carcinogenic in humans. Silica is usually found in crystalline form and rarely in an amorphous state[5].Inhaled silica crystals cause decreased lung function, acute pneumonia, autoimmune disorders, and even lung cancer[10,14,15]. Silica crystals that settle in the lungs, will oxidize the alveoli walls causing fibrosis. The more silica crystals that settle in the lungs, the fibrosis that occurs in the alveoli will get worse and cause a disease known as pneumoconiosis silicosis.

The result of the preliminary survey that has been conducted is by interviewing at PT. Bumi Sarana Beton Kalla Block, the total workforce in the three parts of the production process is 27 people. There are several workers who are at risk of direct exposure to dust including complaints from some workers who experience shortness of breath, coughing and sneezing. The workers who are dominant work 12 hours mand it is assumed that the majority of workers breathe dust from the grinding and finishing process. Observations that have been made by researchers are in fact most workers still do not realize the importance of using masks while working.

Materials and Methods

This research is a quantitative study using a cross sectional approach. This research was conducted at PT. Bumi Sarana Beton Kalla Block. The population in this study were workers from the ballmill, mixing, and packing sections. The number of samples in this study were 27 people. Data analysis used chi square test and multiple regression test. The sampling technique used total sampling. The instrument used to measure humidity and air temperature is a thermo / hygrometer, while the wind speed and direction is an anemometer.

Result

Table 1. Distribution of Respondents Based on Individual Characteristics Variables

Variabel	Total	
	n (27)	%
Age		
< 40 years	23	82,5
≥ 40 years	4	14,8
Masa Kerja		
< 3 years	5	18,5
≥ 3 years	22	81,5

Cont... **Table 1. Distribution of Respondents Based on Individual Characteristics Variables**

Smoking habit		
Smoking	5	18,5
Never smoking	16	59,3
No smoking	6	22,22
Wearing APP		
Always	5	18,5
Seldom	11	40,7
Never wear	11	40,7
Job experience		
dusty	6	22,2
no dusty	15	55,6
no history	6	22,2

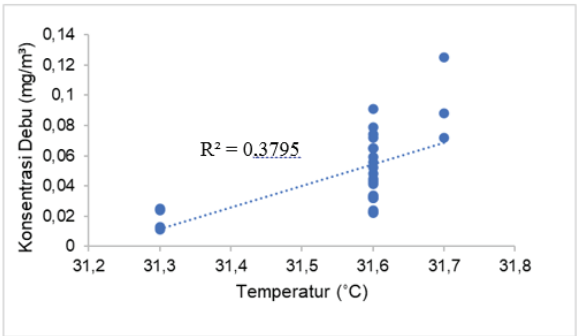
Based on table 1 shows that the majority of workers are <40 years old as many as 23 people (82.5%), the most working tenure is ≥ 3 years as many as 22 people (81.5%), the highest result of the respondents' smoking habit is in the category 16 people (59.3%) have ever smoked, the frequency of using APP by workers in the infrequent and non-using categories respectively has the same number, namely 11 people (40.7%), and the highest result of the respondent's work history lies in a not related to dust a number of 15 people (55.6%).

Table 2. Measurement Results of Environmental Physics Parameters

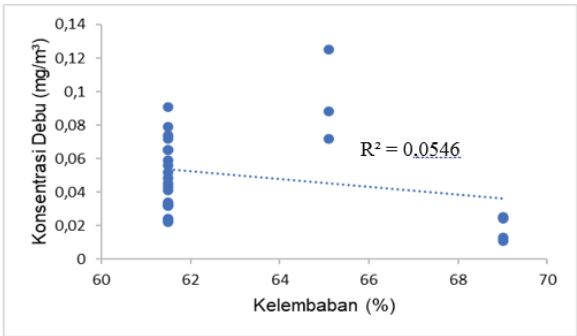
Location	**Result assessment**		
	Ta (°C)	**RH %**	**Wind velocity (m/s)**
Ballmill	31,7	65,1	0,21
Mixing	31,3	69	0,19
Packing	31,6	61,5	0,45

Table 3. Measurement Results of Silica Dust Exposure

Responden	Result assessment
	mg/m³
Packing1	
Packing2	0,041
	0,079
Packing3	0,091
Packing4	0,074
Packing5	0,032
Packing6	0,065
Packing7	0,056
Packing8	0,023
Packing9	0,034
Packing10	0,024
Packing11	0,059
Packing12	0,048
Packing13	0,072
Packing14	0,033
Packing15	0,043
Packing16	0,032
Packing17	0,045
Packing18	0,065
Packing19	0,022
Packing20	0,052
Ballmill21	0,125
Ballmill22	0,088
Ballmill23	0,072
Mixing24	0,013
Mixing25	0,024
Mixing26	0,011
Mixing27	0,025



(a) Temperature – consentration



(b) humidity - consentration

Figure 1. Effect of Work Environment Physical Parameters on Silica Dust Concentration

In Figure 1a, it can be seen that the effect on dust concentration has a fairly high R^2 value of 0.3795, so it can be said that temperature has a sufficient effect on the concentration of silica dust. In Figure 1b, it can be seen that the effect of humidity on concentration has a very small R2 value, namely 0.0546, so it can be said that humidity does not have a major effect on the concentration of silica dust.

Table 4 Analysis of the Effect of Variables on Subjective Complaints of Respiratory Disorders

Variable	Subjective Complaints %		p-value
	Yes	No	
Age			
< 40 years	52,2	47,8	0,904
≥ 40 years	75,0	25,0	
Work period			
< 3 years	40,0	60,0	0,728
≥ 3 years	59,1	40,9	
Smoking habit			
Smoking	80,0	20,0	
Never smoking	50,0	50,0	0,485
No smoking	50,0	50,0	
Wearing APP			
Always	40,0	60,0	
Seldom	72,7	27,3	0,820
Never wear	45,5	54,5	
Job experience			
Dusty	66,7	33,3	
No dusty	52,4	47,6	0,647
No history	50,0	50,0	
Silica expusore			
qualify	53,8	46,2	0,529
not qualify	100,0	0,0	

Based on table 4 it can be concluded that the variables age, years of service, smoking habits, use of APP, work history, and exposure to silica dust have no effect on subjective complaints of respiratory disorders in workers.

Discussion

The older a person, the more susceptible to dust exposure. The elasticity of the lungs does not change at the age of 7-39 years, but there is a tendency to decrease at the age of 25 years, and this decrease is more evident after the age of 30 years, so that breathing power

decreases as a result of which the volume of air during breathing will be less. the age variable is significant with respiratory complaints, an increase in age in workers is followed by an increase in the percentage of workers who experience respiratory complaints[4,8.16,17.]

Smoking habits will accelerate the decline in lung function. The effect of smoke can be greater than the effect of dust which is only one third of the bad effects of smoking. The relationship between smoking and impaired lung function is a dose response relationship. The purpose of the dose response relationship is that the more cigarettes smoked each day and the longer the smoking habit, the risk of developing several respiratory complaints and disease is greater[9,13,18,19.]

Toxins in cigarettes will accumulate in number in the body, especially in the lungs. The presence of this toxin will inhibit the process of exchanging O2 gas with CO2 in the alveoli[17,20,21.] This condition will worsen as the number of cigarettes smoked increases, alveolar damage is also very likely due to smoking. This will certainly reduce the number of functional alveoli that play a role in the respiration process[7,17,20]. As a result, there will be a decrease in the function of the lung organs, causing several complaints about breathing such as coughing, phlegm, shortness of breath, and sputum [8,12,17].

This is because the workers who actively smoke are only 5 people (18.5%), while the others have ever smoked or have quit smoking, and never smoked at all. In addition, based on the results of interviews, respondents said that the company prohibited workers from smoking while in the work environment so that the smoking habit did not affect the complaints of respiratory problems by workers during their work[5,10,22,23.]

Some of the workers also switch to e-cigarettes or what is commonly known as vape, especially younger workers. The use of e-cigarettes does not pose a serious health risk compared to regular cigarettes, which are consumed by burning. vaping does not cause lung problems[10, 22.] This means that vape is considered safe to use[5,8,13]. Even consumers who use e-cigarettes on a daily basis are not affected by their lung health. These findings were obtained from physiological, clinical, or inflammatory effects analysis. This study report was analyzed among e-cigarette users aged 23-35 years. It also targets another group of non-smokers of the same age range6,18,13

But the results of this study contradict previous studies that smoking is a trigger for subjective respiratory complaints. Likewise with the results of the study which states that workers who have a smoking habit have the opportunity to experience complaints and pulmonary function disorders. Workers who smoke and are in a dusty environment are more likely to experience respiratory problems than workers who are in the same environment but do not smoke.

The longer a person works, the more he or she has been exposed to the dangers posed by the work environment. Based on the results of research which states that tenure in a company that contains a lot of dust has a high risk of silicosis. Workers who are in an environment with high dust levels for a long time have a high risk of developing obstructive pulmonary disease. In this process, dust pollution in the air is quite high, especially if it is supported by conditions of low room temperature and humidity, which can increase the dust concentration. Workers in this section have worked ≥ 3 years with a length of work ≥ 8 hours per day and based on the results of measurements of respirable dust, the average worker almost exceeds the threshold value, with one respondent who has exceeded the threshold value with complaints of shortness of breath and coughing at the time do its job.

The onset of respiratory problems in industrial workers can greatly depend on the length of exposure and the dose of exposure received. Long exposure to low levels may not immediately indicate respiratory distress. The relationship between exposure and this effect is highly dependent on three things, namely the level of dust in the air, the cumulative exposure dose (the sum of the levels in the air and the duration of exposure) and the residence time or duration of dust in the lungs. Long-term exposure to low levels causes less severe disease than short-term exposure to high levels[3,7,14.]

Based on the measurement results of respirable dust exposure, it was found that there was only one worker who exceeded the threshold value, namely workers who operated in the ballmill section, the other three people almost exceeded the threshold value. Some of the complaints also came from the ballmil and packing section where the dust came from the manufactured

goods[14,18]. In a day there are approximately 1000 cubic cubic meters of light bricks produced by the company, the dust produced from the lightweight bricks spreads into the air when workers in the ballmill grind the raw materials, namely silica sand and cement and spill it into containers, as well as in the packing department. who organize and move the production.

Conclution

exposure to silica dust and individual characteristics such as age, smoking habits, years of service, use of APP, and work history have no effect on subjective complaints of respiratory disorders for workers

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