TURNITIN_RELATIONSHIP_OF_DEGREE

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RELATIONSHIP OF DEGREE EXPOSURE OF WOOD DUST TO OCCUPATIONAL ASTHMA

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ABSTRACT

Occupational asthma is a kind of occupational disease that poses a risk to workers in the wood industry. Workplace studies concerning exposure to particular substances have shown a incidence of occupational asthma ranging from 3% to 54%. In wood processing activities, workers are at risk of wood dust exposure starting from the sawing process, materialization, production, sanding wood, assembling to finishing wood products. The objective of this study was to prove the effect of the exposure degree to wood dust on the incidence of occupational asthma among wood industry workers in Jepara, Indonesia. The research design was an observational study using a case control approach involving a population of 767 workers. Among those workers, as many as 35 respondents were selected as the sample for the case group and 43 respondents were selected for the control group. Statistical analysis was conducted by applying logistic regression test resulting that there was an increase in the OR value along with the increase of exposure degree to wood dust (p value = 0.044). The OR value in subjects with a heavy degree of wood dust exposure was 4.66 (95% CI = 1.04-20.93), while the OR value of the group with moderate degree of wood dust exposure was 3.14 (95% CI = 0.75-13.04). Current research showed that the higher the degree of wood dust exposure, the more risk the workers obtained occupational asthma in the wood industry. It is important to make efforts to prevent and control risk factors for wood dust in the work environment.

Keywords: degree of exposure; occupational asthma; wood dust

INTRODUCTION

Occupational Asthma is a form of asthma that is caused by a known allergen or irritant that is attached to the work process (International Labour Organization, 2010). Occupational asthma is defined as a disease characterized by limited air flow and / or airway hyperresponsiveness caused by working environmental conditions, not by stimuli outside the workplace. So occupational asthma is only caused by allergens or allergens from the workplace, or certain work environment conditions that cause stimulation , causing asthma attacks (Anies, 2014).

Occupational asthma describes asthma that is caused by exposure to substances, which is precisely defined as being in the work environment. Although the figures vary from one country to another and it is difficult to determine, it is estimated that 5-15% of asthma, newly diagnosed in adults working in caused exposure because of work or temp at work (Anies, 2014). Estimates of the prevalence of occupational asthma have been assessed in previous studies. Workplace studies with exposure to certain substances have reported a prevalence of occupational asthma ranging from 3% to 54%. This has an impact on decreasing work productivity (Tan and Bernstein, 2014).

It is recorded that more than 250 compounds in the workplace are known to contribute to increasing the prevalence of occupational asthma , of which there are a number of patients with occupational asthma who develop permanence after exposure has been stopped . Materials or substances that can cause occupational asthma can be grouped into 2, namely immunological (sensitizer induced asthma) and non-immunological (irritant induced asthma). Occupational asthma through this immunological mechanism is the largest incidence of occupational asthma, which is> 90% of cases. Asthma-causing substances through this immunological mechanism are differentiated into IgE dependent and IgE independent . Furthermore, occupational asthma through non-immunological mechanisms usually occurs without a latency period after exposure to substances that do not induce sensitization. Substances that can cause asthma like this include wood dust, diisocyanates, formaldehyde, sulfur dioxide, hydrofluoric acid, hydrocarbons, fumigating acid, ammonia, acetic acid, cadmium and mercury (Yeung and Malo, 2007).

In wood processing activities, workers are at risk of being exposed to wood dust starting from the sawing process, materialization, production, sanding wood, assembling to finishing wood products. Minister of Manpower Regulation No.5 of 2018 concerning Occupational Safety and Health (OSH) for the Work Environment also states that wood dust has the risk of causing health problems for workers, including: work-related asthma, lung function disorders and upper and lower respiratory tract irritation.(Permenaker RI, 2018) The risk of occupational asthma was based on previous studies that have shown that wood dust associated with the incidence of occupational asthma (Algranti et al., 2005) (Sripaiboonkij, Phanprasit and Jaakkola, 2009) , however research exposure to wood dust have never examined what level of degree levels of wood dust that are at risk of causing occupational asthma . This matter is very important so it is useful for the prevention and control of occupational asthma in the workplace. Based on the above background, there is a need for further research on the relationship between the degree of wood dust exposure and the incidence of occupational asthma .

METHOD

The research design was an observational study with a case control approach, from a population of 767 workers at PT. Kota Jati Furindo Jepara Indonesia, as for the sample with a total of 35 respondents for the case group and 43 respondents for the control group. The study population of the case group in this study were workers who suffered from *occupational asthma* at PT. Jati City Furindo Jepara ; The diagnosis is confirmed by measuring the *Peak Expiratory Flow Rate* (PEFR) 2 times, namely before work and at work, with the difference in the reduction in PEFR ≥ 20% (Hegmann *et al*., 2016). Statistical analysis used a logistic regression test. The purpose of this study is to prove the influence of the degree of wood dust exposure on the incidence of occupational asthma among wood industry workers . This research has received approval to pass an ethical review from the Health Research Ethics Commission of the Faculty of Public Health, Diponegoro University, Indonesia with number 379 / EA / KEPK-FKM / 2019

RESULTS

Characteristics of Research Subjects

The results showed that there was no difference in subject characteristics between the case and control groups (all p-values> 0.05), except for the variable length of work and time of wearing PPE (p-value <0.05). In the case group, the proportion of workers with a length of work ≥ 8 years (58.1%) was higher than that in the control group (41.9%). While the variable

of time to use PPE in the case group, the proportion of time workers wearing PPE ≤ 5 hours (56.5%) was more than the control group (43.5%).

Table 1. Comparison of the Distribution of Characteristics between Case and Control Groups

Characteristics	Case (n=35)	Control (n=43)	P-*value*
Age; Median (Min-Max) (years)[a]	32 (23-40)	30 (21-40)	0,144
Education [b]			0,328
Elementary	5 (14,3%)	2 (4,7%)	
Middle school	6 (17,1%)	11 (25,6%)	
High school	24 (68,6%)	29 (67,4%)	
High Education	0 (0%)	1 (2,3%)	
Length of working; Median (Min-Max) (years)[a]	8 (1-22)	6 (1-12)	0,023*
There is a risk of ≥ 8 years	18 (58,1%)	13 (41,9%)	
No risk <8 years	17(36,2%)	30 (63,8%)	
BMI ; Median (Min-Max) (kg/m^2)[a]	22,9 (16,6-37,1)	21,6 (16,7-31,2)	0,537
The time to use PPE; Median (Min-Max) (hours)[a]	5 (1-6)	6 (2-8)	0,000*
There is a risk of ≤ 5 hours	13 (56,5%)	10 (43,5%)	
- No risk> 5 hours	22 (40,0%)	33 (60,0%)	

Description : [a] *Mann Whitney test* ; [b] *Chi Square test* ; **P-value*<0,05

The Relationship between the Degree of Dose Response of Wood Dust Exposure to the Incidence of Occupational Asthma

To get a description of the relationship between the degree of dose response between wood dust exposure and *occupational asthma* , the variable exposure to wood dust was transformed into the degree of heavy exposure, moderate exposure and light exposure. The degree of exposure to wood dust is "heavy" if the level of respirable wood dust is ≥0,186 mg/m^3 ; "moderate" degree if the level of respirable wood dust is between 0,0575 mg/m^3 – 0,1850 mg/m^3; degree of "mild" if the respirable wood dust content is ≤0,0574 mg/m^3 .

The results of the logistic regression analysis showed an increase in the OR value along with the increasing degree of exposure to wood dust (p value = 0.044). The OR value in subjects with a degree of exposure to heavy wood dust was 4.66 (95% CI = 1.04-20.93), while in the group with moderate degree of wood dust exposure the OR value was 3.14 (95% CI = 0, 75-13.04).

Table 2.
Relationship degree of wood dust exposure with occupational asthma incidence

Variable	Case (n=35)	Control (n=43)	P-value[a]	OR (95% CI)
Degree of Wood Dust Exposure				
- Heavy	18 (51,4%)	21 (48,8%)	0,044	4,66 (1,04 – 20,93)
- Moderate	14 (40,0%)	11 (25,6%)	0,115	3,14 (0,75 – 13,04)
- Mild	3 (8,6 %)	11 (25,6 %)	0,132	

Description : [a] Logistic Regression Test

DISCUSSION

Characteristics of Research Subjects

The length of work is related to the incidence of occupational asthma. The type of work in the wood processing industry affects the risk of exposure to wood dust, especially workers who have a high risk are workers associated with the production process. Length of work is needed to assess the length of exposure to dust, the longer a person is exposed to dust, the greater the risk of pulmonary dysfunction. Workers who are in an environment with high

dust levels for a long time have a high risk of chronic obstructive pulmonary disease. The working period tends to be a risk factor for obstruction in dusty workers for more than 5 years..(Bukhori, 2015).

When using personal protective equipment related to the incidence of occupational asthma. The more obedient workers use personal protective equipment in the work environment, the lower the risk of occupational asthma. Exposure to wood dust particles inhaled in the workplace is one of the causes of occupational asthma . The severity of the disturbance depends on the intensity and duration of exposure to the inhaled material. Besides that, the particle size and the concentration of dust in the air also determine the progression of respiratory distress.(Yeung and Malo, 2007)

The Relationship between the Degree of Dose Response of Wood Dust Exposure to the Incidence of Occupational Asthma

Occupational Asthma As "Limitation of variable air flow and / or airway hyperresponsiveness due to exposure to certain causative agents in a certain work environment and stimuli encountered outside the workplace". (Lummus, Wisnewski and Bernstein, 2011) Occupational Asthma is a chronic disorder. airways involving a complex interaction of airflow obstruction, bronchial hyperresponsiveness , and underlying inflammation (Dykewicz, 2009).

The results of this study corroborate previous research studies which reported that after the labor was divided by the level of wood dust exposure low, medium and high, it can be concluded that the level of wood dust exposure is associated with decreased lung function of labor (Noertjojo *et al*., 1996). Based on Permenakertrans RI No.13 of 2011 concerning the Threshold Value of Physical and Chemical Factors in the Workplace, that the maximum dust content in the workplace is 3 mg/m^3 , and the maximum personal dust level in the workplace is 1 mg/m^3 (Permenakertrans RI, 2011) . The degree of exposure to wood dust in the study is relatively low and in the case group the median value 0,186 mg/m^3 (0,014-1,906 mg/m^3). Despite the relatively low exposure to TLV, an incidence of *occupational asthma was* found with a prevalence of 20.43%. This shows that the current threshold value for personal dust levels set by the Ministry of Manpower and Transmigration of the Republic of Indonesia is too high to prevent and control *occupational asthma* among workers in the wood industry.

CONCLUSION

From the results of research and discussion in the previous chapter, it can be concluded that there is a significant effect of the degree of exposure to wood dust on the incidence of occupational asthma in wood industry workers. It is necessary to do efforts to prevent and control risk factors for wood dust in the work environment.

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PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6