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by Ratna Yuliawati

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Analysis of Factors Related with Lung Disfunction among Coal Mining Workers in Coal Processing Plant

Ratna Yuliawati[1], Risma Arum Lintar[2], Ainur Rachman[3], Marjan Wahyuni[4]

[1,2,4]Department of Environmental Health, Universitas Muhammadiyah Kalimantan Timur; Email: ry190@umkt.ac.id

[3]Department of Public Health, Universitas Muhammadiyah Kalimantan Timur; Email : ar152@umkt.ac.id

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Introduction: East Kalimantan is one of the largest areas of coal mining industry which can cause health problems, such as lung function. The purpose of this research is to find the factors associated with lung disorder among coal mining workers in the Coal Processing Plant at Kutai Kartanegara.

Methods: This research was observational analytic with cross sectional design. There were 20 respondents which participate in this research (total sampling). Data collected by questionnaire and assessing lung function by spirometer. Data analyzed with chi square.

The results: of Bivariate Analysis showed that there was a corelations between smoking habits and lung function (p=0.02), the use of masks and lung function (p=0.038), duration of work and lung function (p=0.04), and dust inhalated with lung function (p=0.04). This research also resulting with no correlation between age and lung function (p=0.77) and exercise habits and lung function impairment (p=0.178).

Conclusions: Based on research results, to maintain health of coal mining worker, the factory should apply smoke prohibition, safety assessment for worker, and manage time of work for the workers.

Introduction

Pulmonary function disorders are pulmonary disorders in the form of inability to develop (elasticity) of the lungs and airway disorders both structural (anatomical) and functional which causes a slowing of air flow respiration. Types of pulmonary function disorders can be Restriction, Obstruction and Mixture. [1]

Exposure to dust in the work environment can cause a variety of occupational lung diseases that cause pulmonary function disorders. Dust factor which includes particle size, form of concentration, solubility and chemical properties are the causes of pulmonary function disorders. Besides the next factors are individual factors including lung defense mechanism, airway anatomy and physiology and immunological factors. Assessment of exposure in humans needs to be considered, among others, sources of exposure/type of plant, length of exposure, exposure from other sources, physical activity and potential accompanying factors such as age, gender, ethnicity, smoking habits, allergen factors. [2, 3]

Looking at epidemiological byssinosis, the prevalence is very high in jobs with high cotton dust. Pain rates can reach 70% of workers who breathe dust and

14% of employees who breathe cotton dust are found to have lung defects. The prevalence of lung disease is very large, it is estimated that more than 80,000 people in the United States die each year from chronic pulmonary disease. More than 5 million suffer from pulmonary function disorders and more than 20 million have lung symptoms. [2]

Pulmonary disease from industrial dust has symptoms and signs that are similar to other lung diseases that are not caused by dust in the work environment. Diagnosis enforcement needs to be done a thorough history including work history and other matters related to workers, because new diseases arise after a long exposure. [3-5] Some researchers have reported the effects of cotton/textile dust on pulmonary function disorders. The measurement of forced expiratory volume during the first second (FEV1) in workers exposed to cotton/textile dust shows signs of pulmonary obstruction. Exposure to the dust causes irritation in the respiratory tract, this irritation subsequently results in pulmonary fibrosis so that eventually lung dysfunction occurs. Lung restriction disorder is characterized by a stiffening of the lungs, stronger inward attraction so that the chest wall shrinks, the ribs narrow and lung volume shrinks. Obstruction is characterized by a problem in the airways that causes a slowdown in the air flow of respiration.

Various studies conducted related to pulmonary function, it was reported that in sand mining and stone breakdown pulmonary abnormalities can occur after exposure to 1-3 years, in the ceramics industry clinical symptoms generally occur after 5 years. in the rice milling industry lung disorders generally occur after 5 years of exposure [6], in wood processing industries pulmonary disorders generally occur after 5-6 years of exposure [7].

Research on the decline in pulmonary function was also reported by Rajsri et al (2013) in India where there was a decrease in lung function in female weavers who worked a minimum of 5 years in which lung function parameters such as FVC, FEV1, FEV1 / FVC, and FEF 25% - 75% significantly reduced in weavers. [8]

This research will conduct an analysis of pulmonary function disorders in coal mining workers, the most potential part of which is contact with coal dust, namely in the Coal Processing Plant (CPP).

Methods

This study is an observational analytic study, with a cross sectional study design or design, where data on dust concentration and pulmonary function disorders were measured together. The sample was chosen by the total sampling method.

Dust levels were taken using Personal Dust Sampler (PDS) lung volume measured using spirometry. Questionnaires were used to collect data on age, years of service, body mass index, mask use, smoking habits.

Data analysis was carried out with univariate, bivariate and multivariate analyzes. Univariate variable analysis is categorized and described by making distribution and frequency, the results are presented in table form.

Table 1. Description of The Frequency of Worker Variables

Variable					
Age (year) mean, median, SD ; min-max	30,7	34	2,57	12	40
Working Period (year) mean, median, SD ; min-max	7,7	12	2,24	1	16
Dust sucked (mg/m^3) mean, median,SD; min-max	0,9	0,7	0,82	0,1	4,4
Body mass index, mean, median, SD; min-max	21,4	20,2	3,26	16,9	26,3
%FEV/FVC.mean,median, SD; min-max	77,9	78,4	12,4	40,0	129,4

Results and Discusion

1. Bivariate Analysis

The results of the bivariate analysis recapitulation as shown in Table 2 shows the variable dust levels associated with lung function disorders.

Tabel 2. The Relationship between The Total Levels of Particles Sucked and Pulmonary Function Disorders

Total Smoked Particles	Lung Function Disorders		P value	PR 95%CI
	Disturbed	Not distrubed		
> 0,2 mg/m^3	0 0%	4 4%	0,04	9,833 (2,154–44,895)
≤ 0,2 mg/m^3	9 33,3%	7 66,7%		

The discussion of bivariate analysis is as follows:

1. Total levels of smoked particles

The total level of sucked particles is an important parameter for assessing the possible negative effects on the lung function of coal miner. Sucked dust levels that exceed 0.2 mg/m^3 are threshold values for unclassified dust in the mining industry. The results of multivariate analysis showed that the risk of workers exposed to dust particles > 0.2 mg/m^3 had a prevalence ratio of 9,833. This means that coal miners who are exposed to sucked particles > 0.2 mg/m^3 per day have a 9 times greater risk of experiencing lung disorders.

Dust that is inhaled during breathing with a certain concentration will endanger human health, can be accompanied by complaints of coughing, sneezing and shortness of breath. Exposure to dust for a certain period of time will cause complaints to workers but it is influenced by the durability of the workforce[3].

Coal particles of more of a dar 5 μm up to 15 μm m who settles on a tract of the breath will cause irritation (bronkhitis gain full recovery of the compulsory or recover .While particles that are sized 0.5 μm to 5 μm will enter alveolus and is generally will be cleaned and removed them again by the bronchi and trakhea macrophages , but exposure to high will result in resistance and intensity of such particles in lung disorder .Generally rarely coal mine workers of experiencing the failure of pulmonary function meaningful because coal dust is dust that have the potential to low fibrogenik .[18]

2. Working Period

The results of the analysis showed that the working period was associated with the occurrence of lung function disorder impairment in coal mining workers, with a prevalence ratio of 21.502 at 95% CI = 9.559-483.655 Workers who have a working period of > 10 years have 21 times the risk of experiencing lung function disorders.

From some of the previous studies, all of them supported the findings of this study, although the length of exposure that resulted from each study was different. This is likely to be influenced by different types or materials of exposure and the presence of other variables that can affect the occurrence of pulmonary function disorders. Working period is related to the duration of labor contact with coal dust, the longer contact with dust will affect lung abnormalities can be in the form of restrictions, obstruction or a mixture of both. Obstruction is a nonspecific disorder of exposure to coal dust but can also occur

due to exposure to the length of contact with other dust[6].

3. Use of masks

The results of multivariate analysis showed that workers who did not always use masks statistically increased the risk for pulmonary function disorders. The prevalence value ratio of 40,965 95% CI is 2,831-68,280. This means that workers who do not always use masks are at risk for lung function impairment 44 times greater than workers who always use masks.

Workers whose work activities are heavily exposed to dust particles need a personal protective device in the form of a mask to reduce the number of particles that are likely to be inhaled. However, it turns out that not all workers who use masks in this study can avoid the risk of pulmonary function disorders. The results showed that 12.5% of workers who used masks also experienced pulmonary function disorders. This is likely due to the quality of the mask used is less qualified.

The use of personal protective equipment in the form of masks has the purpose of preventing the exposure of coal dust so that it can minimize contact with coal miners as much as possible. There are 3 types of respiratory protective devices that can be used including water purifying respirators, supplying respirators, self-contained breathing apparatus. Factors that influence the effectiveness of personal protective equipment are the compatibility between the type of particle with the tool, the method of use and the feasibility of the protective device. The company also expected to monitoring of compliance labor in the use of a mask because the research results show that coal worker use a mask are still indicated by the was suffering lungs disorder.[8]

4. Age

In this study age is a dichotomous variable grouped into two, namely ≥ 35 years and < 35 years. The results of multivariate analysis showed that this variable was considered not to contribute to the occurrence of pulmonary function disorders in the mattress making workers. Not passing the age variable into the final model of multivariate analysis in this study can be explained that other variables that directly affect the occurrence of pulmonary function disorders, namely dust sucked. Furthermore, the dose of inhaled dust can result in impaired pulmonary function after accumulative enough for the occurrence of pulmonary function disorders. Based on this explanation, the absence of a relationship between age and pulmonary function impairment in this study is likely to be the cause of workers aged tahun 35 years not all of them have a long working period. Age is a natural factor that can reduce lung function capacity. The respiratory system will change anatomically and immunologically according to age. As we get older from children to adulthood, around 24 years a person's lung capacity will reach optimum. The average decrease in value of FVC and FEV1 is 20 ml to one years of age.[9]

5. Nutritional Status

The failure to pass the nutritional status variable into the multivariate model in this study is likely due to the percentage of workers whose nutritional status is less and normal is almost comparable, i. e. 12 respondents are not normal and 8 respondents are normal. Low nutritional status will also affect a person's immune system, and the incidence of obesity will also affect lung function capacity. In the case of obesity there will be a buildup of adipose tissue on the chest wall and abdominal cavity that suppresses the chest cavity, abdominal cavity and lung due to decreased compliant power so that it will also reduce the value of FEV1 and decreased lung air capacity.[6]

6. Smoking Habit

In the results stated that smoking habits are a risk factor for lung function disorders. Cigarette smoke is a pollutant that is harmful to the lungs because cigarette smoke inhaled by smoker is greater than the air pollutants in the atmosphere. Pulmonary disorders that occur in labor are influenced by the number of cigarettes for one day and can also be affected by individual vulnerability and how to smoke cigarettes. Smoking can cause mucosal hypertrophy and increase mucous secretion so that it can lead to obstruction which is characterized by a decrease in % FEV_1. Therefore, the action that can be recommended for coal mining workers in the coal processing plant is to able to stop smoking.[11]

The effect of toxicology exposure to dust in work environment could make a synergy with the effects of exposure to cigarette , however workers who work in the vicinity of the dusty and smokers will more susceptible to lungs disorder than workers in the same neighborhood but not smokers.[12]

2. Multivariate Analysis

Based on the results of the bivariate test, it is known that there are 5 variables that can be analyzed by multivariate analysis using logistic regression.

The results of the multivariate test among the 4 variables, namely dust levels, years of service, mask use, smoking habits and age variables must be excluded from the multivariate test.

The results of multivariate analysis showed that the risk of workers exposed to dust particles > 0.2 mg/m^3 had a prevalence ratio of 27.203 with (95% CI = 1.885-39.257). This means that coal miners in the Coal Processing Plant section exposed to sucked particles > 0.2 mg/m^3 per day have a 27 times greater risk of experiencing pulmonary function impairment.

The results showed that the work period was related to pulmonary function impairment in workers, with a prevalence ratio of 21,502 at 95% CI=9.559- 48.365 This means that the working period is a risk factor for pulmonary function impairment

No	Free variable	B	Sig	Exp(B)	95% CI	
					Lower	Upper
1	Total levels of sucked particles (> 0,2 mg/m^3)	3,303	0,04	27,203	1,885	39,257
2	Working period (≥ 10 tahun)	5,371	0,001	21,502	9,559	48,365
3	Use of masks (sometimes)	3,783	0,038	43,965	2,831	68,280
4	Smoking habit	3,317	0,02	27,583	1,955	38,925
	Constan	-9,751	0,001			

Conclusions

There is a significant relationship between levels of particulates sucked and pulmonary function disorders in coal mining workers.

There was no significant relationship between age and pulmonary function disorders in coal mining workers.

There is a significant relationship between working period with pulmonary function disorder in coal mining workers.

There is a significant relationship between the use of PPE (mask) and pulmonary function disorders in coal mining workers.

There is a significant relationship between smoking habits and pulmonary function disorders in coal mining workers.

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REFERENCES

1. Epler.G.R. *Environmental and Occupational Lung Disease*. In : Clinical Overview Of Occupational Lung Diseases. Return To Epler.Com, 2000; 1-9.
2. Word Health Organization (WHO) early detection of occupational disease. 1986
3. Mukono.J. *Pencemaran Udara dan Pengaruhnya Terhadap Gangguan Saluran Pernapasan*. Airlangga University Press. Jakarta,1997.
4. Brom.P.J.A, Jetsen.M, Hidayat.S, van de Burgh.N, Leunissen.P, Kant.I, Houba.R, Soeprapto.H. *Respiratology Symtoms, Lung Function, and nasal cellularity in Indonesian wood workers : a dose-response analysis*. Occupational Environment Medicene, 2002, 59 :338-344
5. Rajsri TR, G.N., Gokulakrishnan K,chandrasekar M. Nikhil Chandrasekar, *A Study on Pulmonary Function Test In Weaver*. International Journal Of Medicine research & Health Sciences,2013.2
6. Anderson.S, Wilson.L.M. *Pathopysiology Clinical Concepts of Desease Processes*(terj Adji Dharma). Bagian 1 edisi 2 cetakan VII. Buku Kedokteran ECG.Jakarta,1989, p:515-521.
7. Guyton.A.C.*Text Book of Medical Physiology*,4th ed,W.B.Sauders Company. Toronto,1995.
8. Amin.M. *Penyakit Paru Obstruksif Kronik*. Laboratorium-SMF Penyakit Paru. Fakultas Kedokteran Universitas Airlangga-RSUD DR. Sutomo,2000.
9. Fishwick, David; Bradshaw, Lisa; Slater, Tania, et al. *Respiratory Symptoms and Lung Function Change in Welders : are they associated with workplaced with workplace exposure?*. The New Zealand Medical Journal. Vol 117 No. 1193. May 2004. 117(1193) : 560 - 566
10. Prabhakara Rao, et al. A *Study of Pulmonary Function Test in Cotton Mill Workers of Guntur Distric*. Bulletin of pharmaceutical and Medical sciences. Vol.1.issue.3.2013
11. Sepuldeva, et al. Acute *lung function response to cotton dust in atopic and non- atopic individual*. British Journal of Industrial Medicine 1984; 41 487 – 491
12. Rajsri RT, et al. *A Study on Pulmonary Function Test in Weavers*. International Journal of Medical Research & health sciences. Vol 2 2319-5886.
13. Sangeeta.Vyas, A *Study of Pulmonary Function Tests in Workers of Different Dust Industries*. International journal of Basic and Applied Medical Sciences. Vol.2 15-21
14. Levy, Stuart A. *Introduction to occupational pulmonary disease*. In : Carl Zens. Occupational Medicine, 3th ed. London : Mosby. 1994: 167 – 170
15. Sepuldeva, et al. Acute *lung function response to cotton dust in atopic and non- atopic individual*. British Journal of Industrial Medicine 1984; 41 487 – 491

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