Disorders of Lung Function in Mattress Making Workers at Wonoyoso Village, Pringapus District, Semarang Regency

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ABSTRACT

Background: *Cotton dust produced from the production process of making mattresses in informal sector businesses based on the temporary measurements using personal dust sampler devices the results are 5.1 mg/m3 and 6.2 mg/m3. The value shows the number above the Threshold Value which is allowed 3 mg/m3. The purpose of this study was to determine the relationship of exposure to inhaled cotton dust with pulmonary function disorders in mattress maker workers.*

Methods: *The type of research used was observational analytic with cross sectional research. The research population is the whole of the research subjects that will be examined as well as sampled, namely workers in the production section. The data were analyzed by univariate and bivariate then statistical tests were performed using the chi-square test.*

Result: *The results of univariate analysis showed that exposure to inhaled cotton dust whose concentration exceeded 3 mg/m3 (56.7%), the use of Personal Protective Equipment (PPE) which included occasional use and did not use PPE at all (43.3%), length of exposure > 8 hours per day (60.0%), working period ≥10 years (46.7%), age> 30 years (73.3%), history of pulmonary disease (23.3%), abnormal nutritional status (60.0%), never exercising (36.7%), smoking habits (36.7%). The results of bivariate analysis showed that there was a significant relationship between exposure to inhaled cotton dust (p=0.001), working period (p=0.000), age (p = 0,034) and smoking habits (0.018) with pulmonary function disorders.*

Conclusion: *The results of examination of lung function capacity of 60.0% of workers experienced pulmonary function disorders. Exposure to inhaled cotton dust, Working period, age and smoking habits are related to lung function disorders.*

Keywords: *cotton dust, pulmonary function, disruption, exposure, fabric waste.*

1. INTRODUCTION

Dust, steam and gas in the work environment can interfere with productivity and health. Dust can cause a reduction in work comfort, visual disturbances, pulmonary function disorders and can even cause workplace accidents (Suma'mur, 1996). The main effects of dust on labor in the form of lung abnormalities both acute and chronic, disruption of physiological functions, eye irritation, sensory irritation and accumulation of harmful substances in the body (Mukono, 2000). Dust is a cause of work-related diseases. Factors that determine the magnitude of health problems due to dust include dust in the air. The higher the level of dust, the faster it causes health problems and pleasure in working. Dust has inert, fibrogenic and carcinogenic properties.

Organic dust is less reactive but can cause irritation. Hot and dry environments encourage dust generation (Soedjajadi, 2005). Among all occupational diseases, 10% to 30% are lung diseases. It is detected that around 40,000 new cases of pneumoconiosis occur worldwide every year (ILO, 2000). In Indonesia the morbidity rate reaches 70% of workers exposed to high dust. Most work-related pulmonary diseases have serious consequences, namely a decrease in lung function, with the main symptom being shortness of breath (Iksan, 2002). Dust exposure in the work environment can cause a variety of occupational lung diseases which result in impaired pulmonary function and disability. Many cases of pulmonary work are severe and can cause disability. There are two factors that make this disease preventable. First is the causal material that can be identified, measured and controlled, secondly, the risky population that is easily visited and monitored regularly and treated (Syahputra, 2015; 135-143).

Lung is a human organ that has a function as an air vent, the disfusion of O2 and CO2 between the alveoli and blood, transportation between O2 and CO2 and ventilation arrangements and other things from breathing (Anonoim, 2003). Pulmonary function can not be maximized because of factors from outside the body or extrinsic factors which include the content of physical components of air, chemical components and factors from the patient's body itself or intrinsic (Amin, 2000). Intrinsic factors from within humans also need to be considered, especially those related to the lung defense system, both anatomically and physiologically, sex, history of the disease that has been suffered, body mass index (BMI) and individual vulnerability (Epler, 2000).

Cotton dust produced from the production process in the textile industry can cause air pollution in the environment that will affect the health status of workers. The dust can enter the body's organs through the nose or mouth and into the lungs so that the

cotton dust will gradually accumulate in the lungs which will affect lung function capacity and eventually can cause lung function disorders in exposed workers. The accumulation and movement of dust in the airways can cause airway inflammation. This inflammation can lead to obstruction of the airway, which can reduce lung capacity (American Thoracic Society, 1995, 225-243.

In the world of industry for developing countries shows that the prevalence of lung disease caused by cotton dust shows an increase. This lung disease induced from cotton dust has become a global health problem. The prevalence of the disease included Turkey 14.2% in 2002; Indonesia: 30% (2002); In Pakistan: 35.6% (2008) and 10.5% (2013) while in Africa, the cotton industry occupies an important place. The prevalence of byssinosis in Africa is as follows: in Sudan 42%; in Ethiopia, 43% (1991) and 44% (1994); in Benin 21.1% (2014) (Hinson, 2016; 895).

The incidence of pulmonary dysfunction cases in the Formal Sector Industry can be detected well. This is due to the existence of clinics in each company that have medical records from their workforce who experience illness so that it is easy to handle. Whereas for the Informal Sector Industry, they have not been able to do it because for the handling of sick workers, their workforce will seek treatment at clinics close to their homes, so that medical records from the workforce cannot be properly integrated.

The mattress industry which is an Informal Sector Industry is usually managed by the community with very simple technology without much touching by legislation, so that all regulations relating to the protection of health and safety for the workforce and surrounding communities receive less attention (Ministry of Health of the Republic of Indonesia, 1994).

In the process of making mattresses in addition to using cotton materials also uses materials from pieces of waste (waste) that are no longer used which come from the production of the textile industry that is in the area around the location of making mattresses. For materials originating from fabric waste, they will be chopped / chopped using a simple tool and then milled in a way that is inserted into the grinding machine so that the ingredients like kapok / cotton will come out but the color is dark. This material is then used as a base for making mattresses.

It is Wonoyoso Village, Pringapus Semarang District, which is a village with informal sector industries making mattresses. There are eight informal sector industries producing this informal sector, but there is one industry that produces the most regularly. In the process of making mattresses in addition to using kapok material also

uses materials from pieces of waste (waste) that are no longer used which come from the production of the textile industry (garment) which is in the area around the location of making mattresses. For materials originating from fabric waste, they will be chopped / chopped and then put into a grinding machine so that the ingredients like kapok / cotton will come out but the color is dark. This material is then used as a base for making mattresses. During the process of crafting, grinding, and inserting material into a cloth that will be formed into a mattress, there is exposure to inhaled cotton dust so that it can have an impact on the health of workers.

From the results of preliminary observations in the scaffolding and grinding room, there is considerable dust with a very small size. In addition there are some workers who do not use personal protective equipment. While the results of the initial inspection using a Personal Dust Sampler (PDS) tool which was paired on two employees who were working on that section obtained one person who worked with the position of the milling tool adjacent to the entrance obtained 5.1 mg / m3 while the one working the room the inside which is not related to the exit is 6.2 mg / m3. Based on the Regulation of the Minister of Manpower and Transmigration of the Republic of Indonesia number PER.13 / MEN / X / 2011 concerning the Threshold Value of Physical and Chemical Factors in the Workplace it is stated that the threshold value for respected particulates is 3 mg / m3. Based on the above description can be submitted as follows:

a. The informal sector industries such as making mattresses in the grinding section produce a lot of cotton dust with dust levels of 5.1 mg / m3 and 6.2 mg / m3.
b. There are some who are involved in work safety. This has the potential for impaired pulmonary function of workers, especially lung function.

Based on the statement, a study of exposure to inhaled cotton dust can be carried out related to lung function disorders in mattress maker workers in Wonoyoso Village, Pringapus District, Semarang.

2. METHOD

This study was an analytic observational study with a cross sectional study design. In this study risk factors and dependence (effects) were assessed simultaneously at one time so that the impact for each subject was measured at the same time (Sastroasmoro, 2011). Population Research is the whole of the research subjects to be studied (Notoadmodjo, 2012). In this study all 30 production workers. Considering the population in this study is relatively small, namely 30 workers who are small populations (<100) then all members of the population are sampled (Riwidikdo). Such sampling techniques are referred to as total sampling / saturated samples, namely the

technique of determining the sample if all members of the population are used (Sugioyo, 2011).

The independent variables were exposure to inhaled cotton dust, use of PPE, length of exposure and length of service while the dependent variable was pulmonary function disorder. Analysis of research data is presented in univariate form to explain or describe the characteristics of each variable. While bivariate analysis was carried out with statistical tests, namely Chi Square test to test the relationship between the levels of inhaled cotton dust with pulmonary function disorders with a significance level of α: 5%, CI: 95%. The results of statistical analysis are seen from the p-value. To interpret the level of risk based on the dependent variable Ratio Prevalence (RP) and Confidence Interval (CI) are used.

3. RESULTS AND DISCUSSION

The informal sector of mattress maker in Wonoyoso Village, Pringapus District, Semarang is a home-based business with cotton raw material used. But over time the cotton materials began to be expensive and difficult to obtain so as to maintain the continuity of production, the substitute materials used were pieces of waste (waste) originating from the production of the textile industry (garment). In the production process the raw material in the form of scraps of leftover cloth is put into the molding machine and then into the milling machine. The material that enters the milling machine is then processed and comes out in the form of a material that looks like cotton / kapok but the color is blackish gray which is often referred to by workers as prin cotton.

The subjects in this study were all 30 production workers. Of this amount is divided into 4 parts, namely the portion of Ornament / Enumeration as many as 2 people (6.7%), the milling section 10 people (33.3%), the filling / inserting material into the fabric mattress / pillow 12 people (40.0 %) and finishing / sewing parts as many as 6 people (20.0%). Measurement of Total Suspended Particulate (TSP) is carried out at two points. The results of TSP measurements in the Parts of Scaffolding and Milling obtained the results of concentrations of 722.26 μg / Nm3 while in the Charging and Suturing Section the concentration was 345.76 μg / Nm3. In accordance with the Government Regulation of the Republic of Indonesia Number.41 of 1999 concerning Air Pollution Control that the national ambient air quality standard for total dust (TSP) in the work environment is 90 μg / Nm3. These results indicate that the TSP in both the Manufacturing and Milling Section and in the Charging and Sewage Section exceeds the quality standard.

To find out the lung function of the workers, an examination was performed using a spirometer. The results of the examination are then included in the formulation to be interpreted in determining the extent to which the level of lung function disorders of the workers. The results of the interpretation found that workers who experienced pulmonary function disorders as many as 18 people (60.0%) were divided into restriction lung function disorders 12 people (66.7%) and a mixture of 6 people (33.3%).

Tabel 1Karakteristik Subyek Penelitian Di Bagian Produksi Pada Industri Pembuat Kasur Di Desa Wonoyoso Kec. Pringapus Tahun 2018

No.	Variable		Frequency (People) (%)	Percentage
1.	Gender	a. Man	14	46,7
		b. Woman	16	53,3
2.	Education	a. no School	5	16,7
		b. Elementary school	16	53,3
		c. Junior High school	6	20,0
		d. High school	3	10,0
3.	Nutritional status	a. Abnormal	18	60,0
		b. Normal	12	40,0
4.	Sports	a. not	11	36,7
		b. Sports	19	63,3
5.	Smoke	a. Yes	11	36,7
		b. Not	19	63,3
6.	History of Lung	a. ever	7	23,3
		b. Never	23	76,7
7.	Inhaled cotton dust exposure	a. Not eligible	17	56,7
		b. Quality	13	43,3
8.	Use of PPE	a. Never	10	33,3
		b. Sometimes	3	10,0
		c. Always use it	17	56,7
9.	Length of exposure	a. > 8 hours per day	18	60,0
		b. ≤8 hours per day	12	40,0
10.	Years of service	a. ≥ 10 years	14	46,7
		b. <10 years	16	53,3
11.	Lung Function Disorders	a. There is disturbace	18	60,0
		b. There is note	12	40,0

Source: primary research data, November 2018

Based on the results of univariate analysis as seen in table 1, it was found that 14 male workers (46.7%) and 16 women (53.3%) with the highest level of education were 16 people (64.0%). The results of the calculation of the Body Mass Index (BMI) obtained the nutritional status of workers with abnormal conditions as many as 18 people (60.0%). Workers who exercise as many as 19 people (63.3%) the most frequent

frequency is sports activities less than 3 times a week. Smoking habits were only carried out by male workers as many as 11 people (36.7%). The number of workers who do not smoke is indeed more because most (more than half) of their workers are women.

The results of interviews with workers both male and female workers who had carried out lung examinations were only 7 people (23.3%). In this interview only limited to having done a lung examination and if associated with the diagnosis of the doctor the workers did not know. Exposure to inhaled cotton dust to workers in the production section based on measurements using Personal Dust Sampler (PDS) equipment showed that 17 people (56.7%) did not meet the requirements and 13 people (43.3%) who met the requirements. Workers in the production department use personal protective equipment (PPE) in the form of masks. Of the 30 workers who always wear masks as many as 17 people (56.7%), workers who sometimes wear masks 3 people (10.0%) and those who never wear masks as many as 10 people (33.3%).

In doing work, the workers get exposure to cotton dust with exposure / exposure time> 8 hours as many as 18 people (60.0%).The working period of workers varies greatly from at least 2 years and for a maximum of 20 years. After grouping it was found that 14 workers (46.7%) worked more than the same as 10 years, while those who worked less than 10 years were 16 people (53.3%).

Table 2 Overall Bivariate Analysis Results of Lung Function Disorders in Matto Maker Workers in Wonoyoso Village, Pringapus in 2018

No	Variable	*p value*	RP	CI (95%)		Description
				LOWER	UPPER	
1	Inhaled Dust Exposure	**0,001**	**25,000**	**3,522**	**177,477**	Significant
2	Use of PPE	0,201	3,750	0,754 -	18,641	Not significant
3	Length of exposure	0,709	0,625	0,137 -	2,852	Not significant
4	Years of service	**0,000**	**4,000**	**1,712**	**9,346**	Significant
5	Age	**0,034**	**8,000**	**1,252**	**51,137**	Significant
6	History of Lung	0,193	5,500	0,568 -	53,215	Not significant
7	Nutritional status	0,709	0,625	0,137 -	2,852	Not significant
8	Sports habits	1,000	1,273	0,276 -	5,873	Not significant

No	Variable	*p value*	RP	CI (95%)		Description
				LOWER	UPPER	
9	Smoking habit	**0,018**	**13,750**	**1,452 -**	**130,239**	Significant

Bivariate Analysis

Inhaled Cotton Dust Exposure to Disorders of Lung Function

Determination of exposure to cotton dust is divided into 2 parts of determination, which is qualified if the particulate particle is below the NAB (3 mg / m3) and does not meet the requirements if above the NAB. The results showed that of the 17 workers exposed to cotton dust with exposure exceeding NAB (3 mg / m3) there were 15 people (88.2%) who had pulmonary function disorders and 2 people (11.8%) who did not experience functional disorders lung.

The results of statistical tests using the chi square test found that p value = 0.001 (table 2) so that exposure to inhaled cotton dust with pulmonary function disorders showed a significant relationship. From the value of Prevalence Ratio (PR) = 25,000 with Confidence Interval between 3,522-177,477, it can be stated that workers with inhaled cotton dust that do not meet the requirements (exceeding NAB) are 25 times more likely to experience pulmonary function disorders than workers who are exposed to inhaled cotton dust fulfill the requirements (under NAV).

This is in line with the results of research conducted by Nugraheni (2004) who stated that dust exceeding the threshold value is related and has an influence on the incidence of pulmonary dysfunction in Bagabs textile industry production workers in Kota Makassar. 18 Similarly, research from Triatmo (2007) who said that exposure to dust is a risk factor that causes pulmonary dysfunction. Exposure to cotton dust in the production section shows that the spread of dust in the air is quite high. In real terms without using a tool, you can see it when you enter the room for the display and grinding section. The results of measurements using HVAS to find out the environmental dust were found in the part of molding and grinding of 722.26 g / Nm3 and 345.76 g / Nm3 in the filling and sewing section. Meanwhile, the results of the measurement of inhaled cotton dust using the Personal Dust Sampler for 30 workers obtained an average yield of 237.51 mg / m3. Even this result also exceeds the predetermined threshold. If cotton dust exposure occurs continuously without any control efforts either in the form of the application of the culture of the correct use of PPE or the management of dust sources by reducing concentration through the application of good ventilation the dust will enter the human body through the nasal cavity and enter the lungs -paru, slowly the cotton dust will be buried in the lungs

which will affect the capacity of lung function and can eventually cause lung function disorders in workers exposed to the American Thoracic Society, 1995; 225 - 243)

Use of Personal Protective Equipment (PPE) Against Disorders of Lung Function

The use of PPE is divided into 2 parts, namely fulfilling the requirements and not fulfilling the requirements. It is said to fulfill the requirements if PPE is always used every time doing work activities while not fulfilling the requirements if you have never used PPE at all or who only occasionally uses PPE. The results showed that the use of personal protective equipment that did not meet the requirements numbered 13 people with workers who had pulmonary function disorders as many as 10 people (76.9%) and those who did not experience lung function disorders as many as 3 people (23.1%). From the results of statistical tests using the chi square test the results showed that p value = 0.201 while the value of α = 0.05 so that there was no significant relationship between the use of PPE against pulmonary function disorders.

From the value of Prevalence Ratio (PR) = 3.750 with Confidence Interval between 0.754-18,641, it can be stated that workers who have never used PPE or sometimes use a risk of 3.750 times greater lung dysfunction compared to workers who always use PPE. This is in line with the research conducted by Robby Aditya Saputra (2016) that there is no relationship between the use of masks and the symptoms of bisinosis. Personal protective equipment used for breathing devices aims to protect respiratory devices against gas, steam, dust or air in contaminated workplaces and toxic or stimulating properties. Use of personal protective equipment in the form of masks will be able to help reduce exposure to dust that enters the lungs through the nasal cavity. Without personal protective equipment, dust will cause a worse effect, especially respirate dust to the emergence of clinical abnormalities.

Length of Exposure to Disorders of Lung Function

The length of time the worker exposes to cotton dust is divided into 2 parts, namely> 8 hours per day and ≤ 8 hours per day. From the results of the study it was found that workers who experienced exposure> 8 hours per day as many as 18 people with details that those who experience pulmonary function disorders as many as 10 people (55.6%) and those who did not experience interference as many as 8 people (44.4%).

From the results of statistical tests using the chi square test the results showed that p value = 0.709 while the value of α = 0.05 (p value> value α) so that the relationship between the duration of exposure to pulmonary function disorders showed no significant relationship. With the value of Prevalence Ratio (PR) = 0.625 with Confidence Interval between 0.137-2.852. In line with the research conducted by

Triatmo (2007) that the length of exposure / exposure is a relationship that is not significant but the likelihood of exposure as a risk factor for pulmonary function disorders can be seen in the results of the study that p = 0.544 with OR = 2.061 with CI = 0.490- 8,665. 19

From the research conducted by Antonius Sardjanto (2012), it was stated that According to Wallaert (1990), there were two main causes of obstructive pulmonary dysfunction in groups of people who were always exposed to dust. The first cause is the long time the dust concentration lasts more than 10 years. While the second cause is the level of dust that exposes a person must exceed the Threshold Value (NAB). The results of this study are indeed declared unrelated. When viewed from the length of exposure there are 18 people who are exposed to> 8 hours, this is indeed a risk of lung function disorders.

Work Period For Disorders of Lung Function

The working period shows the length of time the worker works in that place. The working period can also be interpreted as the length of time a person works, calculated from starting work until now he is still working. The working period is divided into 2 parts, namely the tenure of <10 years and work period ≥ 10 years. Based on the results of the study it was found that workers who worked with a tenure of ≥ 10 years who experienced pulmonary function disorders as many as 14 people (100.0%) and those who did not experience interference as many as 0 people (00.0%). The results of statistical tests using the chi square test indicate that the value of p value = 000 while the value of α = 0.05 (p value <value of α) so that there is a significant relationship between years of work with pulmonary function disorders.

From the value of the Prevalence Ratio (PR) = 4,000 with Confidence Interval between 1,712-9,346 so that it can be said that workers with a tenure of ≥ 10 years are 4 times more likely to experience pulmonary function disorders compared to workers who have a working mass <10 years. This is in line with the research conducted by Mengkidi, Dorce (2006) states that there is a relationship between work period factors with pulmonary function disorders. Supported by the results of his research stating that p value = 0.017 with RP = 1.768 and CI = 1.108-2.2281 (Mengkidi, 2006). A disorder of clinical manifestations of decreased respiratory function will be permanent after exposure to risk factors (dust) approximately 10-20 years of work. The longer a person is at work, the more he has been exposed to the danger posed by the work environment. Chronic disorders occur due to high exposure to dust in the workplace and for long periods of time which are usually annual. Not infrequently the symptoms of pulmonary dysfunction appear after more than 10 years of exposure. The cumulative effect can result in clinical manifestations in future lives (Wahyu, 2004).

The step that must be done is to carry out periodic checks to detect the presence of interference early and use PPE properly and engineer the room so that the dust content is not too thick so that workers avoid lung dysfunction. Because if workers who are in an environment with high dust concentration for a long time (> 10 years), have a high risk of chronic obstructive pulmonary disease. The work period has a tendency as an obstructive risk factor for workers who work in dusty industries starting from having a work period of more than 5 years (Triatmo, 2007)

4. CONCLUSION

1. Respirable cotton dust in the production section both in the parts of molding, milling, filling and finishing (sewing) shows the figure of 56.7% exceeds the threshold value (NAB).
2. The results of examinations of pulmonary function capacity showed that workers with pulmonary function disorders were 18 people (60.0%) with details of workers who had mixed / mixed pulmonary function disorders 6 people (33.3%) and 12 people (66 , 7%).
3. The results of identification of workers who work in the production section found that 56.7% of workers always use PPE, workers who work> 8 hours as much as 60.0%, work period ≥ 10 years as much as 46.67%, with a working frequency of 6 days working in a week.
4. The results of the analysis of the relationship between the use of PPE and pulmonary function disorders showed a non-significant relationship (p value = 0.201), the duration of exposure to pulmonary function disorders showed a non-significant relationship (p value = 0.709), and between years of work with pulmonary function disorders shows a significant relationship (p value = 0,000).

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