

Research Article

The Analysis of Effect of Dust Exposure, Age, and Work Duration through Respiratory Disorder on Fatigue in Worker at PT. Maruki International Indonesia Makassar 2019

Irma B. Hi Lewa^{1*}, Atjo Wahyu² and Amran Razak³

¹Postgraduate Program, Faculty of Public Health, Hasanuddin University, Indonesia

²Departement Occupational Health and Safety, Faculty of Public Health, Hasanuddin University, Indonesia

³Department of Health Policy Administration, Faculty of Public Health, Hasanuddin University, Indonesia

*Corresponding Author

Irma B. Hi Lewa

Abstract: Fatigue is a mechanism to protect the body from further damage so that recovery occurs after resting. Fatigue shows different conditions, but all of that results in a reduction in work capacity and endurance. The profession as a wood craftsman is exposed to various risks due to factors surrounding the work environment. This study aims to analyze the effect of dust exposure, age, work duration, on fatigue through respiratory disorder in workers at PT. Maruki International Indonesia Makassar. This research is quantitative, with a cross sectional study design, as well as a population of all wood craftsmen in the production section and a sample of 99 respondents. Sampling using proportional random sampling. To find out the direct and indirect factors of fatigue, path analysis is used. The results showed that there were 12.1% of respondents experiencing severe fatigue, the analysis test showed that there was a direct effect of work duration on respiratory disorder (p value = 0,000), age to respiratory disorder (p value = 0,000), age to fatigue (p value = 0,000), while working period indirectly affects fatigue through respiratory disorder. However, there is no direct influence on the service life of fatigue, to the company to increase supervision regarding the use of standardized APD.

Keywords: Wood craftsmen, dust exposure, work duration, respiratory disorder, fatigue.

INTRODUCTION

The era of globalization challenges Indonesia to enter free trade so that in the amount that is not small, the growing industrialization sector. One of the most developed types of industry in Indonesia is the wood industry. The development of this industry has had a positive impact on the Indonesian economy by creating considerable employment opportunities, increasing income and people's welfare. However, on the other hand negative impacts occur, such as the emergence of environmental problems, namely the occurrence of environmental pollution caused by dust resulting from wood processing (Kristanto, 2002).

The world body of the International Labor Organization (2017) argues that the causes of deaths caused by work by 34% are cancer, 25% are accidents, 21% are respiratory diseases, 15% are cardiovascular diseases, and 5% are caused by other factors. Occupational lung disease is ranked third in the world

resulting in death in workers. Data on the demands of employment insurance in the United States, recorded only 5% of occupational lung disease, this figure is far from the estimate due to the difficulty of recording the incidence rate. In developed countries such as the United Kingdom and Canada, occupational asthma often occurs, then in China, silicosis is quite dominant (Meredith *et al.*, 1991; Harrianto, 2010).

Not only in general where lung related diseases, such as acute respiratory infections (ARI), are a major health problem, where the prevalence of ARI in Indonesia is 25.5% (range: 17.5% - 41.4%) with The 16 provinces of which have a prevalence above the national rate and pneumonia by 2.1% (range: 0.8% - 5.6%) (Hafsari, 2015). While for lung disease or disorders due to work caused by dust is estimated to be quite a lot (Regina Pradesi, Ari Suwondo, 2018).

Quick Response Code



Journal homepage:

<http://www.easpublisher.com/easmb/>

Article History

Received: 25.06.2019

Accepted: 09.07.2019

Published: 18.07.2019

Copyright © 2019: This is an open-access article distributed under the terms of the Creative Commons Attribution license which permits unrestricted use, distribution, and reproduction in any medium for non commercial use (NonCommercial, or CC-BY-NC) provided the original author and source are credited.

According to Harrianto (2010), lung disease due to work is caused by exposure to chemical substances through inhalation in the work environment where 80% of exposure to hazardous chemicals into the body through the respiratory system in the industrial sector and pollutants can affect the environment and human (Anderson, 1999). Statistical data in various countries varies greatly depending on the type of industry, the level of industrialization and economic development in the country. Every workplace has a variety of potential hazards that can affect the health of the workforce or can cause occupational diseases, dust is a particle which is one of the chemical factors that exist in the workplace (Meita, 2012).

Wood dust is produced from sawing, shredding and sanding processes which can increase the risk to the health of workers. Inhaled wood dust can cause abnormal lung function due to accumulation of dust in the lungs. This dust can also cause allergies and itching on the skin. In addition, if dust enters the eye it can cause allergies or irritation to the eyes, such as conjunctivitis (Ilyas, 2000). Research by Carosso et al (1987) and Neghab (2018) states that exposure to wood dust can cause obstructive pulmonary disease.

Exposure to wood dust for a long time, at least five years is suspected of causing lung function disorders (Soeripto, 2008). At present there are 3300 new cases of lung disease experienced by workers (Septyaningrum, 2014).

Decreased lung function that occurs in workers causes an increase in fatigue, the results of Moghtader et.al (2018) the same research was previously conducted by Small d& Lamb (2000) showed that the prevalence of faigue occurs mostly in patients with respiratory disorders and lung capacity. Jarad et.al (2012) explained that fatigue was reported in respiratory complaints including fibrosis and asthma. Some respiratory complaints cause insomnia and have an impact on fatigue (Sharafkhaneh et.al, 2009).

Products of PT. Maruki International Indonesia is made from wood, the composition of the use of wood materials is 40% local wood and 60% imported wood.

This production process, of course, causes workers to be exposed to wood dust due to production work activities such as cutting, sanding, painting and assembly. Exposure to wood dust has an impact on the high number of complaints of respiratory tracts at PT. Maruki International Indonesia. Almost every month the respiratory tract complaints are ranked first on reports of work-related illnesses at PT. Maruki Indonesia in 2019.

METHODOLOGY

Research Design

This study analyzes dust exposure, work duration, age against work fatigue through respiratory problems. This study uses a path analysis model because there are intervening variables among the exogenous and endogenous variables. This research was conducted at PT. Maruki International Indonesia Makassar. The type of research used is quantitative with observational research design Analytical Cross Sectional approach.

Population and Samples

The population used in this study is all workers in the Production section of PT. Maruki International Indonesia as many as 132 workers and the sampling in this study was carried out using the Proportional Random Sampling method.

Data Collection

Data were obtained from enumerotar who had the ability to give questions to respondents by interviewing and filling in questionnaires, for fatigue measurements using the reaction timer and measurement of dust exposure using high volume air samplers which were measured by a team from the Makassar K3 Hall. and for measuring respiratory complaints using a questionnaire.

Analisis Data

Data were analyzed using SPSS 22 and AMOS applications. Variables measured dust exposure, age, work duration, respiratory problems and work fatigue and described based on the distribution of tables and analysis of the influence of exogenous and intervening variables on endogenous using path analysis.

RESULTS

Table 1. Characteristics of Respondents and Fatigue at PT. Maruki International Indonesia, Makassar

Research variable	Fatigue in worker						Total	
	Light		Moderate		Weight		n	%
	n	%	n	%	N	%		
Age								
Young (≤ 35 yr)	25	54.3	2	32.1	1	8.3	28	100
Old (> 35 yr)	21	45.7	38	43.7	11	91.7	71	100
Work duration								
5-9 years	32	69.5	31	7.5	0	0.0	35	100
10-14 years	4	8.6	1	2.5	1	2.5	6	100
15-19 years	9	19.5	21	52.5	5	13.9	36	100
20-24 years	1	2.4	15	37.5	6	47.5	22	100
BMI								
Normal	21	44.7	14	35.0	4	33.3	60	100
Abnormal	26	55.3	26	65.0	8	66.7	40	100
Dust exposure								
Factory 1 (1.962)	12	56.2	14	68.8	6	18.8	32	100
Factory 2 (1.751)	12	56.2	14	68.8	6	18.8	32	100
	12	54.2	9	37.5	3	12.5	24	100
Factory 3 (1.873)	15	29.2	7	29.2	2	8.3	24	100
Factory 4 (0.342)	8	47.4	10	52.6	1	5.3	19	100
Lung Capacity								
Normal	38	80.9	12	30.0	1	8.3	51	100
Abnormal	9	19.1	28	70.0	11	91.7	48	100
Respiratory disorders								
No	31	65.9	5	41.0	1	8.3	37	100
Yes	16	32.7	35	87.5	11	91.7	62	100

Table 1 shows that the age category of respondents is older than 71 (71.3%) compared to young age as many as 28 (28.7%), for the most working duration of respondents is in vulnerable 15-19 years as many as 36 (36.4%) respondents and the least working duration is with a tenure of 10-14 years, ie only 6 (6.1%) respondents, for dust exposure at PT. The highest Maruki International is found at factory 1 which is 1.962 mg / m³ and the lowest is at factory 4 which is 0.342 mg / m³, while the number of workers who have normal lung capacity is 51 (51.5%) and most workers experience fatigue light work as many as 47 (47.5%) and there are those who experience heavy work fatigue, as many as 12 (12.1%) respondents.

Multivariate Analysis

Table 2. Effects of Coefficients and their Relation to the Direct Effect Research Hypothesis

No	Research variable	Direct Effect		
		Estimate	P value	Conclusion
1	Work duration → Respiratory Disorders	.385	.000	Significant
2	Work duration → Fatigue	-.044	.468	Not significant
3	Dust exposure → Respiratory disorders	-.180	.021	Significant
4	Age → Respiratory disorders	.474	.000	Significant
5	Age → Fatigue	.356	.000	Significant
6	Respiratory disorders → Fatigue	.641	.000	Significant

Table 2 shows that there is a relationship between working duration with respiratory problems (p value = 0.000), exposure to dust with respiratory problems (p value = 0.021), age with respiratory

The results of cross tabulation which are also shown in Table 1 can be seen that older age groups are more likely to experience work fatigue as many as 11 (91.7%) compared to the young age group that is as much as 1 (8.3%). work for 20-24 years is as much as 6 (47.5%), for Body Mass Indeks (BMI) shows that fatigue is more experienced in abnormal BMI as much as 8 (66.7%), for exposure to more factory 1 dust with exposure to dust 1962 mg / m³ which is as many as 6 (50.0%), for more lung capacity in abnormal capacity as many as 11 (91.7%) and many respiratory disorders that experience work fatigue as many as 11 (91.7%).

problems (p value = 0.000), age with fatigue (p value = 0.000) , respiratory problems with fatigue (p value = 0.000) but there was no effect on work duration with fatigue (p value = .468).

Table 3. Effect of Coefficients and Relation to the Indirect Effect Research Hypothesis

Hypothesis (Path)	Indirect Effect	Total Effect
Work duration → Respiratory Disorders → Fatigue	.487	.526
Age → Respiratory Disorders → Fatigue	.148	.504

In table 3, there is an indirect effect of working duration on fatigue through respiratory problems with this value showing that indirect effect > direct effect (-0.44) but there is no indirect effect of age on fatigue through respiratory problems with this value indicating that indirect effect < direct effect (.356).

DISCUSSION

Exposure to wood dust at PT. Maruki International Indonesia especially in the production section (consisting of 4 factories) is around 0.342 - 1.962 mg / m³, where the lowest level of dust exposure is at factory 4, where the highest installation and painting and dust levels are at factory 1 where the sawmill. Both factory 1 with dust levels of 1,962 mg / m³ and factory 4 with 0.342 mg / m³, all of which are still in a safe NAV, which is based on Permenakertrans No. 13 of 2011 for hard wood dust, which is 1 mg / m³ and soft wood dust is 5 mg/m³.

Wood dust levels at PT. Maruki International Indonesia can still be categorized as safe because it is in accordance with the stipulated threshold value (NAV), but that does not mean that workers are free from the risk of health problems related to wood dust in their workplaces. Variable exposure to dust and respiratory problems, it is seen that the most respiratory problems experienced by workers at factory 1 is as much as 41.9% with exposure to dust 1.962 mg/m³ the path analysis test results show that there is an effect of dust exposure on complaints of respiratory problems.

The results of the research by Puspitasari *et al* (2016) states that there is a relationship between the level of inhaled dust and complaints of labor respiratory disruption. Study results Löfstedt *et al* (2017) reported that wood industry workers exposed to wood dust were high enough to experience respiratory problems with symptoms of dry cough and frequency that was quite frequent.

According to Purwana (1992) in (Purnomo, 2015), Health effects on the respiratory tract can be assessed through symptoms of respiratory disease. Symptoms of respiratory diseases are widely used in research on health effects by particulates. Symptoms of respiratory disease are a picture of direct response or short-term effects of the respiratory tract to particulates, in the form of coughing, sore throat, wheezing and shortness of breath.

Regarding exposure to wood dust and respiratory disorders, the results of this study showed that as many as 60.6% of workers at PT. Maruki International Indonesia experienced complaints of

respiratory problems and the results of cross tabulation revealed that complaints of respiratory problems were mostly experienced by workers at factory 1, which amounted to 41.9% with exposure to dust of 1,962 mg / m³. The path analysis test results show that there is an effect of dust exposure on complaints of respiratory problems. Under normal circumstances, age affects respiratory frequency and lung capacity as well as several other physiological abilities of the body, so it is often a variable in research. In this study the youngest age was 24 years old and the oldest was 53 years old, based on the age group there were 71.7% of respondents aged old (> 35 years).

Age affects with health problems in the respiratory system. The results of cross tabulation show that many young workers who experience respiratory disorders are as many as 85.5% who experience respiratory problems are workers with the old age group > 35 Test results of path analysis show there is an influence of age on respiratory disorders, the results of the study Chaiear *et al* (2018) in particular there is a sawmill in Thailand showing the same results where respiratory complaints are more common for workers over the age of 30 years, which is 78.4% with symptoms of dyspnea, chest pain, cough due to work. Wood workers or wood workers are the types of jobs that are at risk of causing respiratory disorders, especially at the age of 50-60 years (Y. Sri Harika, Sadaf Sultana, 2019). In theory, increasing age will reduce the ability to function organs naturally, including the ability of lung function, which is also mentioned in the results of the Puspitasari (2016) points to the existing theory that there is an influence of age on lung capacity. But the differences from various studies are things that can happen, considering the phenomenon of health disorders is indeed influenced by various other factors.

CONCLUSION

Based on the results of the study it can be concluded that there are effects of age, work duration and exposure to dust on respiratory complaints and respiratory complaints against fatigue in respondents, while age has a meaningful influence on fatigue through respiratory complaints. This is because the distribution of dust is still in the threshold value (NAV). Age has a direct influence on fatigue and working duration on fatigue through respiratory complaints. Workers in the PT Maruki International Indonesia Production section need to pay attention to and use standard PPE, while for companies it is necessary to conduct periodic health checks on workers.

REFERENCES

1. Anderson, W.L. (1999). Introduction to the Immune System: Innate and Acquired Immunity. Dalam: Immunology. Madison: Fence Creek Publishing. 7-22.
2. Carosso, A., Ruffino, C., & Bugiani, M. (1987). Respiratory Diseases in Wood Workers', *Br J Ind Med*, 44(1) pp. 53–6.
3. Harrianto, Ridwan. (2010). *Buku Ajar Kesehatan Kerja*. Jakarta: EGC
4. Puspitasari, I. H. S., & dan N. H. (2016). Analisis Kadar Debu Terhirup dan Gangguan Pernafasan pada Tenaga Kerja di Bagian Produksi Suatu Industri Kayu., *Jurnal Kesehatan Masyarakat*, 14(2), 104–108.
5. Jarad, N. A., Sequeiros, I. M., Patel, P., Bristow, K., & Sund, Z. (2012). Fatigue in cystic fibrosis: a novel prospective study investigating subjective and objective factors associated with fatigue. *Chronic respiratory disease*, 9(4), 241-249.
6. Kristanto, P. (2002). *Ekologi Industri*. Yogyakarta; Penerbit Andi.
7. Khumaidah. (2009). *Analisis Faktor-Faktor Yang Berhubungan Dengan Gangguan Fungsi Paru pada Pekerja Mebel PT. Kota Jati Furninda Kab. Jepara* (Tesis). Semarang: Universitas Diponegoro.
8. Lumantow, M. *et al.* (2017). Hubungan Antara Masa Kerja Dengan Kapasitas Vital Paru Pekerja Tempat Penggilingan Padi di Kecamatan Dumoga Timur Kabupaten Bolaang Mongondow, *J. Kesmas Unstrat*, 6 (4), 1-7.
9. Soeripto, M. (2008). *Higiene Industri*. Jakarta: Balai Penerbit FK UI.
10. Meita, A. C. (2012). *Hubungan Paparan Debu dengan Kapasitas Vital Paru Pada Pekerja Penyapu Pasar Johar Kota Semarang* (Tesis). Semarang: Universitas Diponegoro.
11. Neghab, M., Jabari, Z., & Shouroki, F. K. (2018). Functional Disorders Of The Lung & Symptoms Of Respiratory Disease Associated with Occupational Inhalation Exposure To Wood Dust in Iran.
12. Putri, Risa, Yusniar H., & Darundiati, N. A. Y. D. (2017). Hubungan Paparan Debu Kayu Terhirup Dengan Gangguan Fungsi Paru Pada Pekerja Di Industri Mebel Cv. Citra Jepara Furniture Kabupaten Semarang. *Jurnal Kesehatan Masyarakat*, 5 (1): 832–837.
13. Septyaningrum, M. (2014). Hubungan Paparan Debu Kapur dengan Penurunan Fungsi Paru Pada Tenaga Kerja PT. Putri Indah Pertiwi, Desa Pule, Gedong, Pracimantoro, Wonogiri (Tesis), Surakarta: Universitas Muhammadiyah Surakarta.
14. Sharafkhaneh, A., et al. (2009). Sleep Disorders and Their Management in Patients with COPD. *Therapeutic Advance in Respiratory Disease*, 3 (10): 309-18.
15. Ilyas, Sidarta S. R. Y. (2000). *Sari Ilmu Penyakit Mata*. Jakarta: Balai Penerbit FK UI.
16. Wulandari, R., Setiani, O., & YD, N. A. (2015). Hubungan Masa Kerja Terhadap Gangguan Fungsi Paru Pada Petugas Penyapu Jalan di Protokol 3, 4, dan 6 Kota Semarang., *Jurnal Kesehatan Masyarakat*, 3(3) : 797–806.