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Dust and Gender Related With Lung Vital Capacity Dissorders in the Textile Industry Spinning Section

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Abstract - *Many factors affect lung function capacity in textile industry workers. This research aims to determine the factors that affect the vital role of pulmonary spinning workers in the textile industry. This research used an analytic observational research design with a cross-sectional approach. Sampling technique used total sampling and get the sample was 96 people, and measurement of lung vital capacity used spirometry. The Low Volume Sampler was applied to measure dust concentration, and the questionnaire was used to assess the individual characteristics. Bivariate analysis of the variables is the working environment dust, and gender are significant. The result of multivariate analysis of dust is the most significant to the lung vital capacity. dust concentrations is classified above the Threshold Limit Value (TLV), so the company should to control the source of dust exposure, for the workers, they need to have a health examination, and for companies, they should provide N95 type masks as Personal Protective Equipment (PPE).*

Keywords *– Dust and gender, lung vital capacity*

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1. Introduction

Occupational respiratory disease is a major global public health problem that accounts for up to 30% of all occupational diseases. Besides, 10-20% of deaths caused by respiratory problems [1]. Exposure to dust in textile industry workers can be at risk of causing lung function disorders. Health effects in the form of impaired lung function have been documented in workers exposed to dust in both small, medium, and large industries [2,3]. Occupational Lung Disease (OLD) is a pulmonary disease arising from prolonged or repeated exposure that causes toxic effects, both acute and [4]. Occupational diseases are caused by pathological responses from patients to their working environment [5]. There is a growing consensus on the adverse impact of organic dust on the symptoms and respiratory function of industrial workers [6].

ILO data (2013) shows that every year, there are more than 250 million accidents at workplaces, and 160 million workers become sick because of hazards that exist in the workplaces. Also, around 1.2 million workers die due to accidents and occupational diseases. New materials for the production process are distributed annually in the workplaces, and many of them cause lung disease [7]. Indonesia is one of the developing countries that have many companies produce dust from the production process. OLD is a group of occupational diseases in which the target organ of the disease in the lung [8]. The textile industry is one of the many vital sectors in Indonesia, especially in Surakarta Raya region. Workers can be exposed to a variety of different environmental factors, especially from the spinning and weaving processes [9]. Those processes in the textile industry produce large amounts of cotton dust [10]. The dust consists of various sizes and types of particles, such as plant materials, fibers, bacteria, fungi, soil, pesticides, non-cotton materials, and other contaminants [11]. Research on respiratory disturbances and impaired lung function in cotton spinning in Egypt shows a significant relationship in the group exposed to dust [9,12]. The results of the initial survey conducted at 3 points in the production area of the spinning / spinning industry of the textile industry showed the highest levels of work environment dust of 0.24 mg / m3 and the lowest 0.19 mg / m3 with an average of 0.21 mg / m3. This figure is included above the Threshold Value (NAV) of working environment dust with the type of cotton at work that is equal to 0.2 mg / m3. The purpose of this

study is to determine the determinants of the vital capacity of the lung of spinning textile industry workers.

2. Methodology

The study used an analytic observational design and used a Cross sectional study approach. Sampling technique with a total sampling of 96 workers. The independent variables environmental dust and individual characteristics. the dependent variable was lung vital capacity. The measurement of dust levels using a Low Volume Sampler (LVS) tool. Environmental dust measurement procedures based on SNI 16-7058-2004 regarding the measurement of total dust, other variables were assessed by questionnaire. The lung vital capacity is classified are normal, obstructive, restrictive, and mixed. The %FVC and %FEV_1 are measured using a spirometer. A spirometer is a tool used to find out the percentage of Forced Vital Capacity (FVC) and Forced Expiratory Volume that is forced in the first second (FEV_1). Pulmonary function is normal if %FVC ≥80% and %FEV_1 ≥70%, obstructive disorders if %FVC >80% and %FEV_1 <70%, restrictive disorders if %FVC <80% and %FEV_1 ≥70%, mixed disorders if %FVC <80% and % FEV_1 <70%.

The data analysis used univariate analysis to distribute the characteristics of respondents. Bivariate analysis was used to determine the relationship between independent variables with the dependent variable.

3. Result and Discussion

PT X textile industry is located on Jalan Raya Solo-Karanganyar km. 9.5, Surakarta, Central Java. The industry has a spinning production unit that produces yarn as a primary material for making fabrics. Table 1 shows the relationship between respondent characteristics and lung vital capacity. In the age variable, it shows that age >40 years old has obstructive pulmonary function disorder, restrictive, and mixed. In gender variables, lung function disorders experienced mainly by men. The obstructive, restrictive, and mixed pulmonary vital capacity are theoretically incorporated into disorders pulmonary function.

Table 1. Variable Characteristics with Lung vital capacity

Variable	Lung Vital Capacity				Total	r	p-value
	Normal	Restrictive	Obstructive	Mixed			
Dust						-0,390	0,000
Age (year)							
17-40	8	0	0	0	8	-0,110	0,285
>40-60	69	15	2	2	88		
Gender							
Male	30	11	2	2	45	0,319	0,002
Female	47	4	0	0	51		

Measurement of work environment dust at 6 points at PT X Karanganyar, Indonesia Textile Industry obtains an average 0.395 mg/m3. The results of analyses in all aspects are above the Threshold Limit Value (TLV) 0.2 mg/m3 every eight working hours per day for the type of cotton dust based on Permenaker RI No.5, 2018 concerning occupational safety and health work environment appendix 3 TLV Chemical Factors [13]. The workers in the textile industry have the risk of being affected by LFD from exposure to cotton dust so that they can cause the risk of disease. From 96 total samples of workers, 77 workers have normal conditions, and 19 workers experience lung dysfunction (22.86%). Most lung function disorders are the restrictive type, with a total of 15 respondents. The mechanism of dust accumulation in the lung begin by breathing in, then the air containing dust entering the lungs. Dust that is between 5-10 microns will be retained by the upper respiratory tract, while the middle of the respiratory tract will retain the 3-5 microns. Particles with a size between 1 and 3 microns will be placed directly on the surface of the pulmonary alveoli. The particles with a magnitude 0.1 microns do not so quickly settle on the surface of the alveoli. The mass of dust which less than 0.1-micron particles is too small so that it does not end on the surface of the alveoli or lender membrane, because of Brown's movement, it causes such dust to move out of the alveoli. The impaired pulmonary function in the spinning section also caused by inhalation of cotton fibers and dust in the working environment [14].

Suma'mur explains that continuous exposure to cotton dust for years irritates the upper respiratory tract of the bronchus. If the exposure continues, it will happen chronic obstructive pulmonary disease, which can be interpreted that the more extended working period, there will be more cotton dust that settles in the respiratory tract, the more severe the disease suffered byssinosis. Small invisible cotton dust particles enter the alveoli of the lungs through inhalation and accumulate in the lymph cause damage to the alveoli and reduce the capacity to retain oxygen. When cotton dust builds up, workers can suffer from byssinosis [15]. Dust can cause lung disease and fibrosis if inhaled during continuous work. If the alveoli harden, it reduces elasticity in accommodating the volume of air, so that the oxygen binding ability decreases. The

results of the analysis show that the effect of occupational dust exposure significantly to the lung vital capacity with a p-value 0.000. It is in line with research on work environment dust against pulmonary dysfunction [12]. These results are also in line with Qian's, which shows that there is a relationship between dust exposure and lung function disorder [15].

Exposure to dust can reduce lung function. The result of this study shows that there is a significant relationship between dust exposures with reduced lung function. It is followed by research; there is a meaningful relationship between workers exposed to dust with lung function disorders where workers exposed to dust have a higher risk than those who do not [16,17]. Lung function will decrease as people get older. Age is related to the aging process or increasing age where the older a person is, the higher the likelihood of lung function capacity. The age of 20-40 years is the maximum muscle strength in a person and will be reduced by 20% after the age of 40 years. The older a person is, the risk of impaired lung function is also high [18]. The longer a person is at work, the more he has been exposed to the dangers posed by the work environment, including exposure to cotton dust. Chronic disorders occur due to occupational dust exposure which is quite high and for an extended period which is usually annual and not infrequently the symptoms of lung function appear after more than ten years of exposure [9,19]. Gender affects lung function disorders. Several pieces of research in the textile industry show that men have a higher risk of lung function disorders than women [18,20].

4. Conclusion

There is an influence between the level of work environment dust with lung function disorders in the textile industry spinning division of PT X Karanganyar. The average dust measurement results of 0.395 mg/m3 that have exceeded the TLV according to Permenaker Number 5,2018. As the suggestions, for the workers, they need to have a health examination, and for companies, they should provide N95 type masks as Personal Protective Equipment (PPE).

References

[1] Gizaw Z, Yifred B, Tadesse T. Chronic respiratory symptoms and associated factors among cement factory workers in Dejen town, Amhara regional state, Ethiopia, 2015. Multidiscip Respir Med [Internet]. 2016;11(1):1–9. Available from: http://dx.doi.org/10.1186/s40248-016-0043-6

[2] Subbarao P, Mandhane PJ, Sears MR. Asthma: Epidemiology, etiology and risk factors. Cmaj. 2009;181(9).

[3] In R, Surfactant OFA. P Roteins in L Ung F Unction. 2002;347(26):2141–8.

[4] Stobnicka A, Górny RL. Exposure to flour dust in the occupational environment. Int J Occup Saf Ergon. 2015;21(3):241–9.

[5] Qian QZ, Cao XK, Qian QQ, Shen FH, Wang Q, Liu HY, et al. Relationship of cumulative dust exposure dose and cumulative abnormal rate of pulmonary function in coal mixture workers. Kaohsiung J Med Sci [Internet]. 2016;32(1):44–9. Available from: http://dx.doi.org/10.1016/j.kjms.2015.11.003

[6] Khodadadi I, Abdi M, Aliabadi M, Mirmoeini ES. Exposure to respirable flour dust and gliadin in wheat flour mills. J Occup Health. 2011;53(6):417–22.

[7] ILO. Keselamatan dan Kesehatan Kerja Sarana Untuk Produktivitas. Jakarta; 2013. (5).

[8] Sumakmur P.K. Higiene Perusahaan dan Kesehatan Kerja. Jakarta: Sagung Seto; 2014.

[9] Daba Wami S, Chercos DH, Dessie A, Gizaw Z, Getachew A, Hambisa T, et al. Cotton dust exposure and self-reported respiratory symptoms among textile factory workers in Northwest Ethiopia: A comparative cross-sectional study. J Occup Med Toxicol. 2018;13(1):1–7.

[10] Tagiyeva N, Sadhra S, Mohammed N, Fielding S, Devereux G, Teo E, et al. Occupational airborne exposure in relation to Chronic Obstructive Pulmonary Disease (COPD) and lung function in individuals without childhood wheezing illness: A 50-year cohort study. Environ Res [Internet]. 2017;153(December 2016):126–34. Available from: http://dx.doi.org/10.1016/j.envres.2016.11.018

[11] Wu Q, Han L, Xu M, Zhang H, Ding B, Zhu B. Effects of occupational exposure to dust on chest radiograph, pulmonary function, blood pressure and electrocardiogram among coal miners in an eastern province, China. BMC Public Health. 2019;19(1):1229.

[12] Tageldin MA, Gomaa AA, Hegazy EAM. Respiratory symptoms and pulmonary function among cotton textile workers at Misr Company for Spinning and Weaving EL-Mahalla, Egypt. Egypt J Chest Dis Tuberc. 2017;66(2):369–76.

[13] Republic of Indonesia Ministry of Manpower. Keselamatan dan Kesehatan Lingkungan Kerja. 5 Indoneisa; 2018.

[14] Mahmoud T, El-Megeed H. A study of occupational health hazards among Assuit spinning factory workers. … Univ Bull … [Internet]. 2004;7(1):63–76. Available from: http://www.aun.edu.eg.sci-hub.org/arabic/society/aubfer/res8_mar_2004.pdf

[15] Su YM, Su JR, Sheu JY, Loh CH, Lioui SH. Additive effect of smoking and cotton dust exposure on respiratory symptoms and pulmonary function of cotton textile workers. Ind Health. 2003;41(2):109–15.

[16] Khan AW, Moshammer HM, Kundi M. Industrial hygiene, occupational safety and respiratory symptoms in the Pakistani cotton industry. BMJ Open. 2015;5(4):1–8.

[17] Said AM, AbdelFattah EB, Almawardi A-AM. Effects on respiratory system due to exposure to wheat flour. Egypt J Chest Dis Tuberc [Internet]. 2017;66(3):537–

48. Available from: http://dx.doi.org/10.1016/j.ejcdt.2016.11.006
[18] Schachter EN, Zuskin E, Moshier EL, Godbold J, Mustajbegovic J, Pucarin-Cvetkovic J, et al. Gender and respiratory findings in workers occupationally exposed to organic aerosols: A meta analysis of 12 cross-sectional studies. Environ Heal A Glob Access Sci Source. 2009;8(1).
[19] Boschetto P, Quintavalle S, Miotto D, Lo Cascio N, Zeni E, Mapp CE. Chronic obstructive pulmonary disease (COPD) and occupational exposures. J Occup Med Toxicol. 2006;1(1):1–6.
[20] Camp PG, Dimich-Ward H, Kennedy SM. Women and occupational lung disease: Sex differences and gender influences on research and disease outcomes. Clin Chest Med. 2004;25(2):269–79.