

Review Article

Organic Wood Dust Exposure as a Risk Factor for Lung Function Disorders in Workers : Systematic Review

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Abstract

Wood dust is wood particles that result from wood processing and handling. The level of fine dust in the work environment can expose to workers breathing and cause lung function disorders. Obstructive lung function disorders, namely blockages that make it difficult for air to escape from the lungs, resulting in a decrease in airflow velocity. The purpose of this systematic review was to determine wood dust exposure and risk factors for impaired lung function for workers. Article searches carried out through the Portal Garuda Indonesia, PubMed, Scopus, ProQuest, and Google Scholar. There are 9 articles reviewed. Exposure to wood dust was assessed as a significant risk factor for impaired lung function in workers as seen from the statistical analysis results in each study showing that the p-value < 0.05. The risk factors that were stated to have a significant relationship were the concentration of wood dust, gender, work location, use of personal protective equipment (mask), length of work, and smoking habits. Exposure to wood dust increases the risk of impaired lung function in workers, with dust levels ranging from 1.15 mg/m³– 24 mg/m³.

Keywords: wood dust; risk factors; lung function disorders

1. Introduction

The problem of air pollution has become a cause of health problems, especially in industrialized countries that have many factories and motorized vehicles (Summa'mur, 2014). Air pollution has also become a common phenomenon in several countries, especially in developing countries. This is because the existing industry still pays less attention to air pollution control. Air pollution produced from industrial premises is generally in the form of dust from industrial activities. Dust is a solid chemical substance, caused by natural or mechanical forces such as processing, crushing, softening, rapid packing, and blasting of objects, both organic and inorganic (Summa'mur, 2014). Generally, particles that can enter the respiratory tract are particles smaller than 10 µm whereas particles of that size are also called PM₁₀ (Sumantri, 2010).

One of the industries that causes air pollution is the wood industry. Pollutants produced by the wood industry are wood dust particles. Processing in the wood industry includes cutting, stripping, sawing, shaping, sanding, and finishing processes. This mechanical process tends to produce pollutants such as wood dust particles. This is because about 10 to 13% of the sawn wood will be in the form of wood dust, which will fly in the air (Asrini, 2013). Dust from wood processing in the work environment will cause workers to be exposed to wood dust in different concentrations and sizes (Very, 2010).

Environmental conditions in the workplace can affect the health of workers. The dust contained in the work environment, will interfere with productivity and health. Workers who are often exposed to dust are at risk of experiencing health complaints, both in the form of infectious and non-infectious diseases. A potential hazard in the workplace will enter and accumulate in the body, influenced by the length of exposure and the continuity of exposure. The longer the worker is exposed to exposure, one of which is exposure to dust particles, the more dust particles will accumulate in the body. The accumulation of dust in the airways can cause airway inflammation and can result in airway obstruction, thereby reducing lung capacity. The impact of continuous exposure to dust can interfere with lung function in the form of obstruction (Mukono, 2006).

International Labor Organization (ILO) stated that 34% of work-related deaths are from cancer, 25% from accidents, 21% from respiratory disease, 15% from cardiovascular disease, and 5% caused by other factors (International Labor Organization, 2013). According to the WHO, three million people die each year as a result of particulate exposure (World Health Organization, 2012).

Functional disorders in the lungs are divided into two types, there are obstructive and restrictive. Obstructive pulmonary function disorders, namely blockages that make it difficult for air to escape from the lungs, result in a decrease in airflow velocities such as in asthma, chronic bronchitis, emphysema, and chronic obstructive pulmonary disease. Restrictive lung function disorders, namely abnormalities in the parenchyma, pleura, and chest wall that cause inhibition of lung expansion and decreased total lung capacities such as pneumonia, lung abscesses, lung tumors, pulmonary fibrosis, pleural effusion, pleurisy, pneumothorax, rib fractures, scoliosis, and kyphosis. The disease can occur in wood processing workers if they are exposed to certain levels and periods (Bakhtiar, 2016).

In addition to the concentration of wood dust, it is necessary to consider risk factors for human exposure related to impaired lung function, such as the source of exposure, duration of exposure, exposure from other sources, patterns of daily activities, and potential concomitant factors such as age, gender, use of PPE, length of work, and smoking habits. This systematic study aims to determine exposure to wood dust and risk factors in workers with impaired lung function. The purpose of this research is to determine worker exposure to wood dust as well as risk factors for impaired lung function.

2. Methods

This research is a systematic review. Research using the systematic review method is research to identify, evaluate, and interpret all relevant research results related to certain research questions, certain topics, or phenomena of concern (Siswanto, 2010).

The source of this research data comes from national and international journals obtained via the internet in the form of scientific research results from several sources. Data retrieval is carried out through internet searching related to international journal searches carried out through databases; PubMed, Scopus, ProQuest, and Google Scholar, as well as searches for national journals are carried out through the Portal Garuda Indonesia with keywords entered, namely 'paparan debu kayu dan gangguan fungsi paru' and 'faktor risiko gangguan fungsi paru pada pekerja' for Indonesian language journals, while for English-language journals, the keyword 'exposure to wood dust and impaired lung function in workers' is used.

Sorting articles begin by skimming the title, then reviewing the abstracts that are relevant to the research topic. From a total of 196 articles, 16 articles were found to matched. Next, a full-text review was conducted where articles were sorted based on inclusion and exclusion criteria. The inclusion criteria in this study were:

- 1) Articles published in 2011-2021
- 2) Articles with this type of observational research
- 3) The dependent variable in the research article is impaired lung function in workers
- 4) The independent variable in the research article is exposure to wood industry dust

Exclusion criteria were articles that did not clearly describe the method of measuring wood dust exposure and did not impair lung function. After conducting a full-text review, 9 articles that met the criteria were found. The flow chart for sorting articles can be seen in Figure 1. The next step is to conduct a critical study to assess the quality and relevance of the literature found. The guidelines used are Critical Appraisal Tools from the Joanna Briggs Institute (JBI) (Joanna Briggs Institute, 2017). The data/information obtained from the article will be recapitulated and presented in the form of a synthetic matrix table. The analysis is presented in a narrative form.

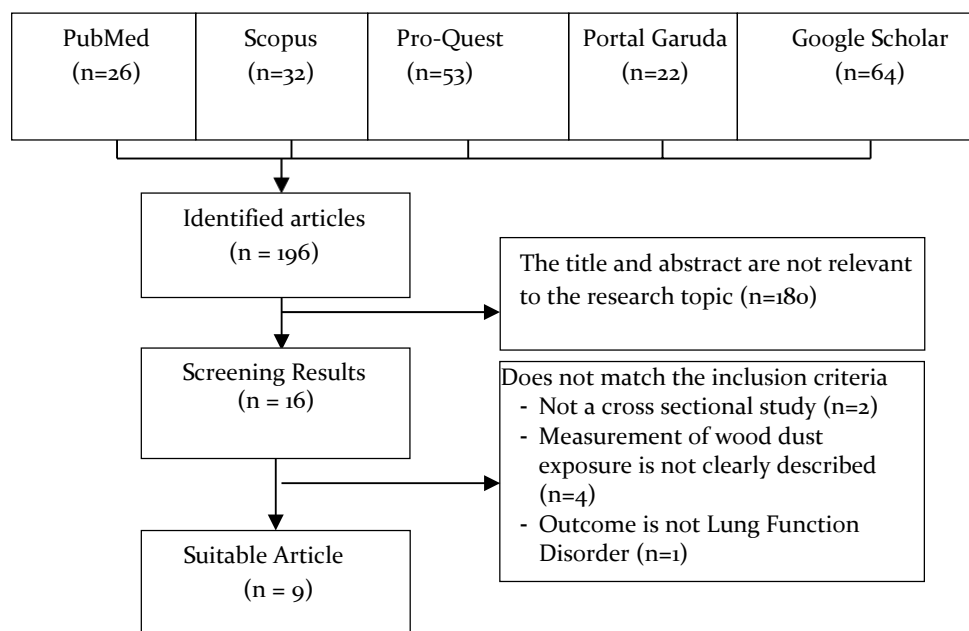


Figure 1. Flow chart screening article

3. Result and Discussion

The research locations of all the articles studied are in several countries. Three studies were conducted in Indonesia, two studies in Nigeria and Iran, and one study was conducted in Thailand, Nepal, and Malaysia. The type of research in the article being studied is observational and the design used is cross-sectional. Based on a review of 9 selected articles, the number of samples in the study varied from 30 to 697. All the research subjects worked in the wood industry and the majority of research subjects were workers in the wood processing division (not offices).

The measuring instrument or instrument used in research related to wood dust exposure with impaired lung function in all articles is a questionnaire. The determination of lung function disorders is based on the level of inhaled dust that exceeds the NAV. Measurement of wood dust exposure using a questionnaire that was assessed based on several variables and measurements of inhaled dust mostly used portable spirometry, but there was one article using a PVC filter, and one article using a personal dust sampler.

Based on the results of a review of 9 selected articles, all articles stated that exposure to wood dust was significantly associated with impaired wood function in workers, as seen from the results of statistical analysis in each study, which showed that the p-value < 0.05, or the OR value and limit below or above the 95% CI value is more than 1. Exposure to wood dust was assessed as a significant risk factor for impaired lung function in workers. The magnitude of the risk of impaired lung function in workers due to exposure to wood dust is indicated by the OR value. The OR values in each of the articles studied varied (Table 1). The variables that were stated to have a significant (significant) relationship were the concentration of wood dust (Thepaksorn et al., 2017; Thetkathuek et al., 2010; Hosseini et al., 2020; Yusof et al., 2019; Neghab et al., 2018; Rachma et al., 2018; Okta et al., 2017; Kartika et al., 2017; Nafisa et al.,

2016), gender (Thepakson., 2017; Yusof et al., 2019), work location (Thepakson et al., 2017; Thetkathuek et al., 2010; Hosseini et al., 2020; Yusof et al., 2019), use of PPE (Thepakson et al., 2017; Okta et al., 2017; Nafisa et al., 2016), Length of Work (Hosseini et al., 2020; Nafisa et al., 2016) and smoking habit (Hosseini et al., 2020; Neghab et al., 2018).

Table 1. Article results

No	Author	Location	Method	Population and Subject	Results
1	Thepakson et al., 2017	Thailand	<ul style="list-style-type: none"> • Cross Sectional • Questionnaire • Measurement of lung function using a portable spirometer • Measurement of total dust and respirable dust using a tared 5-μm PVC filter with closed faced 37-mm Millipore samplers. 	<ul style="list-style-type: none"> • Workers at four Para rubberwood factories in Trang Province, Southern Thailand. • Subjects were 697 sawmill workers. 	<ul style="list-style-type: none"> • The exposed workers received higher respirable wood dust (0.902 mg/m³) than the unexposed group (0.185 mg/m³). • The exposed group had a significantly higher prevalence than the unexposed group for chest tightness (OR=2.79) and shortness of breath (OR=2.27). • Ventilatory function values (VEP₁ and KVP) were lower in the exposed group than in the unexposed group (2.41 vs. 2.55 L/sec and 2.91 vs. 3.01 L/sec, respectively).
2	Nafisa et al., 2020	Nigeria	<ul style="list-style-type: none"> • Cross Sectional • Questionnaire • Measurement of lung function using a Vitalograph Compact II electronic Spirometer. 	<ul style="list-style-type: none"> • All woodworkers in Na'ibawa market Kano, Nigeria • Subjects 370 woodworkers in Kano Wood Market. 	<ul style="list-style-type: none"> • there was a low percentage predicted forced expiratory volume at one minute (PPFEV₁) and percentage predicted ratio of FEV₁ and FVC • A negative correlation was observed between the degree of exposure to the hazards and lung function of the workers ($r = -0.655$, P-Value = 0.0001) • A statistically significant association existed between exposure to wood dust and lung function respiratory symptoms.
3	Hosseini et al., 2020	Iran	<ul style="list-style-type: none"> • Cross Sectional • Questionnaire. • Examination of lung function using spirometry. 	<ul style="list-style-type: none"> • Woodworkers and office workers in the wood industry • Subject 276 workers 	<ul style="list-style-type: none"> • Respiratory symptoms including cough, phlegm, chest tightness, and wheezing were significantly higher in woodworkers than in-office workers. • The duration of exposure of workers over 15 years shows respiratory symptoms • The results of the spirometry test showed that the mean value of the FEP₁ and VEP₁/KVP ratio was significantly lower in the woodworkers compared to the mean value in the control group (smokers). • Obstructive patterns were more common on spirometry tests in

No	Author	Location	Method	Population and Subject	Results
4	Yusof et al., 2019	Malaysia	<ul style="list-style-type: none"> • Cross Sectional • Questionnaire • Pulmonary function test using Spirolab II portable device to measure FVC, FEV₁, and FEV₁/FVC% • Wood dust measurement using Track Aerosol Monitor (Model 8520: USA) 	<ul style="list-style-type: none"> • Woodworkers • 241 woodworker subjects do not smoke 	<p>woodworkers (71.4% obstructive versus restrictive 28.6%).</p> <ul style="list-style-type: none"> • Woodworkers in the Material supply area showed the highest concentration of inhaled dust exposure at 1.1 mg/m³ followed by the machining area at 1.01 mg/m³. Both of these workstation areas exceed the permitted exposure limit of 1 mg/m³. • Other work areas such as: storage, spraying, and sanding are below the permissible exposure limit (PEL) of 1 mg/m³ and in the range of 0.501 to 0.94 mg/m³. • Gender affects the concentration of wood dust exposure with a p-value of 0.001 for males and 0.002 for females. • Length of work among workers exposed to rubberwood dust in furniture factories shows evidence that lung function declines especially for workers who have worked for ten years or more.
5	Neghab et al., 2018	Iran	<ul style="list-style-type: none"> • Cross Sectional • Questionnaire • Measurement of lung function using spirometry • Measurement of worker exposure to wood dust using the NIOSH 0500 method with a personal dust sampler 	<ul style="list-style-type: none"> • All Timber factory workers • Subject of 200 workers 	<ul style="list-style-type: none"> • The concentrations of inhaled and inhaled dust were found to be 2.44 and 6.76 mg/m³ , respectively • Spirometry results showed that the lung function of the exposed group was lower than that of the reference group (smokers). • Wood dust exposure was associated with an increased prevalence of acute (reversible) and chronic (irreversible) respiratory symptoms indicating a decrease in several parameters of lung function.
6	Rachma et al., 2018;	Indonesia	<ul style="list-style-type: none"> • Cross Sectional • Questionnaire • The level of inhaled dust is measured using a Personal Dust Sampler • Sampling of room air using the MVAS 	<ul style="list-style-type: none"> • 42 workers in the furniture industry of PT Marleny Jepara • 30 workers as subjects who meet the inclusion criteria 	<ul style="list-style-type: none"> • Workers exposed to dust > NAV = 82.6% (19 workers) have lung function disorders. Workers exposed to dust < NAV = 28.6% (2 workers) no lung function disorders • As many as 70% of respondents experienced impaired lung function. The type of lung function disorder that most suffered by respondents was a

No	Author	Location	Method	Population and Subject	Results	
					device with the gravimetric method	mild restriction, which was as many as 85.71% of respondents.
7	Okta et al., 2017	Indonesia	<ul style="list-style-type: none"> • Cross Sectional • Questionnaire • Measurement of lung function using Spirometry 	<ul style="list-style-type: none"> • All permanent employees CV. Indo Jati Utama Semarang • 38 Subjects of wood processing workers 	<ul style="list-style-type: none"> • There is a relationship between levels of inhaled dust ($p=0.014$) and impaired lung function in furniture industry workers PT Marleny Jepara • Total dust content > NAV ie 88% $p = 0.040$ and Inhaled dust content > NAV ie 85.7% $p = 0.036$ • 2 respondents (5.3%) experienced impaired lung function consisting of severe restriction, moderate restriction by 10 respondents (26.3%), mild restriction by 15 respondents (39.5%) and mild obstruction by 1 respondent (5.3%) • Variables that have a relationship with impaired lung function are total dust levels, levels of inhaled dust, and the use of PPE. Meanwhile, length of work, length of service, and nutritional status did not have a relationship with impaired lung function 	
8	Kartika et al., 2017	Indonesia	<ul style="list-style-type: none"> • Cross Sectional • Questionnaire • The level of inhaled dust is measured using a Personal Dust Sampler • Air sampling using HVAS with gravimetric method • Measurement of lung function by spirometry 	<ul style="list-style-type: none"> • The population is all workers in the sanding section of The CV. Citra Jepara, Semarang Regency • Subject sample as many as 30 people 	<ul style="list-style-type: none"> • The results of the measurement of exposure to inhaled dust were 19 respondents (63.3%) with exposure to inhaled dust above the NAV and the results of the measurement of lung function were 17 respondents (56.7%) with impaired lung function. • There is a relationship between exposure to inhaled dust and impaired lung function in workers at CV. Citra Jepara Furniture Semarang Regency with a p-value of 0.023 ($p < 0.05$). 	
9	Omole et al., 2018	Nigeria	<ul style="list-style-type: none"> • Cross Sectional • Questionnaire • of lung function using a Spirometer 	<ul style="list-style-type: none"> • The population of all sawmill workers in Ibadan timber markets • Subjects are 204 people 	<ul style="list-style-type: none"> • There was a significant reduction of forced expiratory volume in the first second (FEV₁) and forced vital capacity (FVC) of workers in the sawmill industries when compared with the control group ($p \leq 0.05$). • Sawmill workers exposed to wood dust exceeding 10 years 	

No	Author	Location	Method	Population and Subject	Results
					<p>were found to have a significant decrease in their FEV₁ (F = 10.802, p = 0.001)</p> <ul style="list-style-type: none"> • There was a negative but moderate relationship between FEV₁ and exposure time to wood dust (r = -0.489, p = 0.001)

Table 2. Result synthesis matrix

No	Main Idea	Similarities of Research Findings	Article Source
1	Wood Dust Concentration	High exposure to wood dust affects the decline in lung function, FVC, FEV ₁ , and FEV ₁ /FVC.	Thepaksorn et al., 2017; Nafisa et al., 2020; Hosseini et al., 2020; Yusof et al., 2019; Neghab et al., 2018; Rachma et al., 2018; Okta et al., 2017; Kartika et al., 2017; Omole et al., 2018
2	Gender	The results of the existing research indicate that male workers have risk factors for lung function disorders than female workers.	Thepaksorn et al., 2017; Yusof et al., 2019;
3	Work location	Sawmill workers have a higher risk of lung function disorders such as chest tightness and shortness of breath than office workers in these industries. This is because the dust content in wood processing is higher than the dust content in the office/finishing section.	Thepaksorn et al., 2017; Hosseini et al., 2020
4	Usage Of Personal Protective Equipment (PPE)	The results show that workers who do not comply with the use of PPE such as masks have a higher lung function disorder	Thepaksorn et al., 2017; Okta et al., 2017;
5	Length of Work	Timber workers who work longer hours have higher lung function impairment, FEV ₁ , and FEV ₁ /FVC	Hosseini et al., 2020; Omole et al., 2016
6	Smoking habits	Woodworkers belonging to smokers have significantly impaired lung function than workers who do not smoke	Hosseini et al., 2020; Neghab et al., 2018

The wood industry always produces sawdust particles every processing around the work area, which has the potential to be inhaled by workers. Basically, it is more effective to measure dust than inhalation so that it shows more specific results. The level of wood dust in the workplace, also called total wood dust or wood dust inhaled, affects the performance of lung function. The very small size of dust particles from wood will be very dangerous for individual lung function, because the smaller it is, the easier it is to enter the respiratory tract and end up in the lungs. Wood dust particles measuring 0.1-10 microns are very harmful to exposed individuals (Februar et al., 2016)

The results of the research summary show that more than 50% of workers in the wood industry are affected by the lung function system, while the total amount of wood dust and wood dust inhaled is above the NAV. In this study, the value of dust exposure was significantly associated with the occurrence of pulmonary function disorders. So it can be said that the increased exposure to wood dust levels is proportional to the worker's risk of developing lung function disorders (Thepaksorn et al., 2017; Nafisa et al., 2020; Hosseini et al., 2020; Yusof et al., 2019; Neghab et al., 2018; Rachma et al., 2018; Okta et al., 2017;

Kartika et al., 2017; Omole et al., 2018). The relationship between dust exposure and lung function capacity is that exposure that is inhaled into the respiratory tract will cause non-specific defense mechanisms, namely sneezing or coughing, and for a long period of time will cause impaired lung function (Amerta, 2020). Asri's study (2020) found a significant correlation with FEV₁/FVC, which may suggest that constant exposure to high levels of wood dust can lead to decreased lung function ($p=0.018$). Moreover, this study is in agreement with previous studies conducted on decreased lung function parameters among common workers in the lumber industry (Jacobsen et al., 2013; Redlich et al., 2015).

Most of the workers working in the wood industry are males. This is because, men have greater energy than women when placed in work that is classified as heavy. The results of research by Thepaksorn (2017) and Yusof (2019) explain that male workers have a higher risk of developing lung function disorders due to the workload of male workers in areas with high dust potential. This is in line with Agita's research (2016) where workers in wood processing facilities have abnormal lung function capacity, which is more common in male workers, namely 42.1% with significant results ($p = 0.007$). Furthermore, volume capacity The lungs also have an effect where men have a larger volume of air so that more dust deposits are inhaled in the lungs (Umakaapa et al., 2013).

Wood processing workers have different levels of exposure to wood dust particles depending on the process of their work. The process of sanding and sawing wood produces a lot of wood dust (IARC, 2012). This is in accordance with the research by Thepaksorn (2017), which shows that sawmills have the highest concentration of respirable wood dust exposure, while office workers have a low average exposure to respirable wood dust (Thepaksorn, 2017). Hosseini's research, 2020 also supports the above statement by showing the prevalence of cough symptoms, coughing with phlegm, chest tightness, and wheezing were significantly higher in workers who processed wood compared to office workers. (Hosseini et al., 2020). This is in line with Dahlqvist's research where the lung response to dust in the sawmill shows a greater positive response than office workers (29%) (Dahlqvist et al., 1992). In addition, it is also in line with the research by Thetkathuek, 2010 which states that the highest levels of exposure to wood dust to the lowest levels are sanding, transfer of raw materials, assembly, drilling, and cutting (Thetkathuek, 2010). This is supported by the Malmberg study in which the novel response to lung function testing in sawmill workers was more exposed than workers outside the sawmill (Malmberg et al., 1996). Douwes' research also shows that wood processing workers have 3 times higher dust concentrations compared to workers who only penetrate wood in furniture. In addition, the furniture section also shows 5.4 times higher exposure using circular saws. This is because in the process of using a chainsaw, a lot of fine dust particles are produced, so that it can be easily inhaled by humans (Douwes, 2017).

Masks are one type PPE that can be used when working by workers in the wood processing industry. Masks are able to protect lung health optimally when used in accordance with the type of dust and mask material. Dust has different sizes, so it must match the type of mask used. There are two studies related to the use of PPE on lung function, namely in the study of Thepaksorn, 2017 and Kartika, 2017 where workers who do not comply with the use of PPE have a higher risk of being exposed to wood dust than workers who use PPE when working (Thepaksorn et al., 2017; and Kartika et al., 2017). This study is also in line with the Nafisa research which states that workers who use protective masks at work have a low risk of impaired lung function compared to workers who do not use protective masks ($p=0,049$) (Nafisa et al., 2016). Raynel's research shows that the use of PPE (masks) in workers affects lung function disorders, with the results of the analysis showing $p = 0.002$. This happens because the habit of using PPE in the industrial environment is not continuous (Raynel et al., 2014). According to the theory put forward by Moray and Nadel in Khumaidah (2009) the use of masks by industrial workers whose air contains a lot of dust is an effort to reduce the entry of dust particles into the respiratory tract. By using masks, it is hoped that workers will be protected from the possibility of respiratory problems due to exposure to air with high levels of dust. The habit of wearing masks is a "safe" way for workers who are in a dusty work environment to protect their health (Khumaidah, 2009). Masks are able to prevent the

number of contacts because, in principle, masks do not eliminate the danger but can only reduce it (Kurniawati, 2019). Wood industry workers are at risk for occupational diseases due to wood dust allergens. This action can be carried out by using a mask appropriately according to its function, so that it can explain the exposure of wood dust to the wood industry while working in the workplace (Laili, 2018).

The working period determines the length of a person's exposure to dust that can cause lung function disorders. The longer the exposure (working period), the more likely a person is to get the risk, so one of the potential variables that can cause lung function impairment is the length of time a person is exposed to dust (Umakaapa et al., 2013). In Hosseini's study, 2020 workers who were exposed for 15 years longer experienced a decline in lung function (Hosseini et al., 2002). In the Omole study, sawmill workers with an exposure duration of more than 10 years were more likely to have a significant FEV₁ ($p=0.001$) (Omole et al., 2018). This is in line with Nafisa's research, 2016 where wood processing workers who have worked for 15 years or more have a lower mean parameter value than those who have a service period of fewer than 15 years (Nafisa et al., 2016). Increased values of FEV₁ and FVC were detected in woodworkers with a working period of more than 10 years and in wood dust with concentrations above 4 mg/m³ (Osman et al., 2009). Several studies have shown that the longer a sawmill worker is exposed to sawdust, the greater the concentration level that will be absorbed through the lungs (Meo, 2006; Okwari et al., 2005; and Ennin et al., 2015). According to theory, the time it takes for a person exposed to dust to develop lung function impairment is approximately 10 years (Morgan and McGinley, 2018).

A person's smoking habit affects their lung capacity. Almost all smokers who were observed showed a decrease in their lung function. Smoking habits will not only affect the level of oxygen exchange in the blood, but will also be a potential factor for several lung diseases, including lung cancer. Theoretically, smoking is four times more likely than a non-smoker to alter the structural and functional characteristics of the respiratory system and lung tissue. Therefore, smoking habits can affect lung function disorders (Umakaapa et al., 2013). This is in line with research by Hosseini, 2020 and Neghab, 2018 where non-smoking woodworkers have lower lung function disorders than the control group, namely smokers (Hosseini et al., 2020; Okta et al., 2017). In the Osman Study, there was a decrease in FEV₁, FVC, and FEF for workers compared to non-smokers ($p<0.0001$) (Osman et al., 2009). In Raynel's research, furniture workers have a smoking habit, that is, out of 50 respondents, 37 respondents (74%) have a smoking habit with impaired lung function capacity, and 13 respondents (26%) smoke with normal lung function capacity (Raynel et al., 2014). This is in line with the research of Triatmo, which also stated that there is a relationship between smoking habits and decreased lung function (Triatmo et al., 2007). Then, Suryani's research, stated that there is a relationship between smoking habit and impaired lung function with $p = 0.021$ (Suryani, 2005).

4. Conclusions

Exposure to wood dust can affect the incidence of pulmonary function disorders in workers. Other risk factors that affect workers affected by pulmonary function disorders are dust levels, the male gender of workers, work locations in departments that produce a lot of sawdust, inconsistent use of PPE (masks), working periods of more than 10 years, and smoking activity. Policies or strategies to reduce the risk of wood dust exposure to workers where there are still many industries that do not prioritize the health of their workers, such as installing larger ventilation so that dust does not accumulate in the workspace, providing PPE according to standards, and measuring the health of workers regularly.

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