

Improved Gama Of Interferon (IFN- γ) Serum Levels And Decrease Due To Exposure Pulmonary Endotoxin Lipopolysaccharide (LPS) In Wood Dust Toward Workers Of Wood Processing Factory

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Abstract: *The purpose of this study was to analyze the levels of IFN- γ blood serum and lung function decline due to exposure to endotoxin LPS in the wood dust on workers in the wood processing plant Surabaya, this kind of research is analytic observational prospective Longitudinal design. Population is all of the workers at the saw mill which consists of 30 workers, 11 workers study sample was determined by simple random sampling. Collecting technique is interview; dust and endotoxin measurements individually, blood sampling, and perform spirometry tests. IFN- γ levels and lung function measured at the time before and after work (cross-shift). Personal dust levels were measured using the Personal Dust Sampler (PDS) and endotoxin levels obtained from individual wood dust was measured using ELISA techniques and methods Lymulus Amebocyte Lysat (LAL) and lung function (FVC and FEV) is checked using a spirometer (Spirolab III) and levels IFN γ was assessed using fluorescence immunoassay I Chroma TM 1 Reader. Data analysis was performed using multiple linear regressions. The results showed levels of endotoxin LPS individuals have an effect on increasing blood serum IFN- γ 0.035, and decreased lung function (FVC) 0,040 and (FEV1) 0,028 (multiple regression test, $p < 0.05$). Concluded that wood dust contains endotoxin LPS affects an increase in blood serum IFN- γ and decreased function of the respiratory lung system. Periodic health workers examination should be carried out to detect short-term changes in the respiratory system of workers. Therefore, workers with a high risk of respiratory disease can be treated as soon as possible.*

Keywords: IFN- γ blood serum, Lung Function, endotoxin LPS, Wood dust, Workers.

1. INTRODUCTION

Wood dust inhaled by workers can cause dysfunction or pulmonary capacity. The disorder caused by the destruction of lung tissue that can affect the Productivity and quality of work. Under certain conditions, the dust is a hazard that causes a reduction in working comfort, visual disturbances; impaired pulmonary function may even cause general poisoning (MOH, 2003). LPS exposure Endotokin in wood dust that enters the body through inhalation workers resulted in an imbalance between Th1 cells (IFN- γ) and Th2 cells (IL-4, IL-13). IFN- γ is a Th1 cytokine that aims to activate macrophages, which aims to kill the bacteria, but on the other hand if excessive levels of IFN- γ it can spur inflammation, in terms of the incidence of inflammatory macrophages by IFN- γ activated will produce TGF β and MMP (Matrix metalloproteinase) resulting in lower production of collagen types 1 and 3 are numerous in the lungs. This has resulted in decreased lung function (Elias et al., 1990; Narayanan et al., 1992).

Generally, endotoxin lippolysaccharide (LPS) in the dust timber is one that can trigger inflammation in the respiratory tract, as it is known that endotoxin is the cause of inflation in the exposed tissue, including lung tissue. Lung function disorders involve a variety of inflammatory mediators, including cytokines, including proinflammatory cytokines is TNF, IL-1, IFN- γ that help destroy microorganisms that infect cells. Including anti-inflammatory cytokines was interleukin 1 receptor antagonist (IL-1ra), IL-4, IL-10, which

served to modulate, coordination or repression against excessive response. If there is an imbalance of work proinflammatory cytokines with anti-inflammatory, it causes damage to the body, especially in lung function (Todar, 2014).

Occupational respiratory diseases, according to the results of research The Surveillance of Work Related and Occupational Respiratory Disease (SWORD) conducted in the UK found 3300 new cases of lung disease related to work (Fahmi, 2012). A meta-analysis showed that exposure to wood dust have 1.9 times the risk for the occurrence of pulmonary function impairment moreover, the incidence of pulmonary fibrosis. Research conducted by Asmara Yasa (2012) indicates that there is a significant relationship between exposure to wood dust endotoxin LPS and IFN- γ serum. The correlation coefficient between wood dust exposure with serum levels of IFN- γ is (r) = -0.324; p = 0.011. Wood dust exposure variable is related to the concentration of dust is sucked and duration of exposure are certainly closely associated with the old work.

The rapid development of the wood processing plant in Surabaya have a positive impact on human life in the form of increasing the extent of employment, ease of communication and transportation, and eventually also have an impact on socio-economic improvement of the community. And generate income countries, on the other hand, the industry has the potential to cause contamination of the air in the form of sawdust produced from activated in the workplace and have a direct impact on the health of workers (Asmara, 2012).

While this is still a bit of research on the relationship between exposure to LPS endotoxin in sawdust to increased blood serum levels of IFN- γ and decreased pulmonary function of workers, therefore in this study, aims to determine how much influence the LPS endotoxin in sawdust to increased levels blood serum IFN- γ and decreased pulmonary function of workers, so that the results of the study are expected to be useful as an early prevention of adverse effects of wood dust on the health of the wood processing plant workers so that health workers can be maintained.

2. RESEARCH METHODS

2.1 Research Location

The study was conducted in Margomulyo wood processing plant in Surabaya.

2.2 Research Design and Research Variables

This type of research is an analytic observational research by observing, measuring and sampling in the field, research design used in this study is a Prospective Longitudinal Study namely measurements and observations made before and after work.

The variables of this study consisted of the independent variable, dependent variable and disturbance variable. Independent variables include levels of endotoxin LPS individual, the dependent variable is blood serum IFN- γ and lung function while. Age, length of work and smoking habit as a confounding variable.

2.3 Population and Sample Research

The populations in this study were all workers at the saw mill which consists of 30 workers while the study samples were 11 workers were determined by simple random sampling.

2.4 Data Collection

As data collection techniques, researchers conducted interviews, personal dust measurements, personal endotoxin measurement, take blood samples, and perform spirometry tests. IFN- γ levels and lung function measured at the time before and after work (cross-shift). IFN- γ blood serum and lung function as the dependent variable in this study. Meanwhile, private endotoxin levels as independent variables such as Age, smoking habit, and long work as a confounding variable. Personal dust levels were measured using the Personal Dust Sampler (PDS). Meanwhile, levels of endotoxin obtained from a private wood dust was measured using ELISA techniques and methods Lymulus Amebocyte Lysat (LAL) and lung function (FVC and FEV) Examined by using a spirometer (Spirolab III). IFN γ levels were assessed using fluorescence immunoassay I Chroma TM 1 Reader.

2.5 Data Analysis

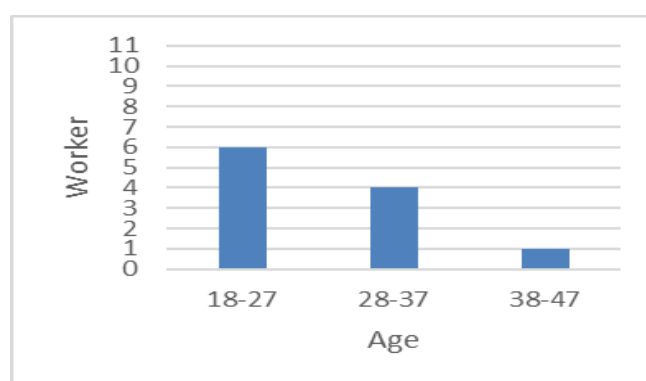
Data have been obtained are presented in the form of descriptive narrative sera tables, which are then analyzed using SPSS statistical tests with significance level of 0.05 ($\alpha = 0.05$). Through the statistical test results had drawn a conclusion that can answer hypothetical. The statistical test

used is double linear regression test.

3. RESULTS AND DISCUSSION

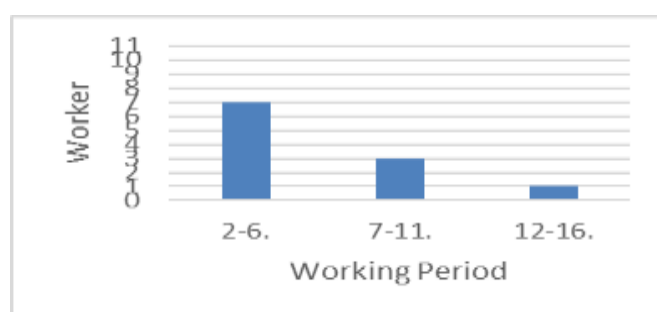
Margomulyo wood processing plant in Surabaya is a private company engaged in the Wood Working and export trade / import domiciled in Surabaya, which was established to cultivate various types of wood which is then utilized further in other factories both inside and outside the country. This study included 11 people as research subjects who are at the sawmill in wood processing factories Margomulyo Surabaya, activities work carried out by the labor came from hours 08:00 to 17:00 pm with a one hour break time is at 12:00 to 13:00 pm during the working day 6 days (Monday-Saturday).

Figure 1 Age Distribution of Workers in Wood Processing Factory Margomulyo Surabaya 2015.



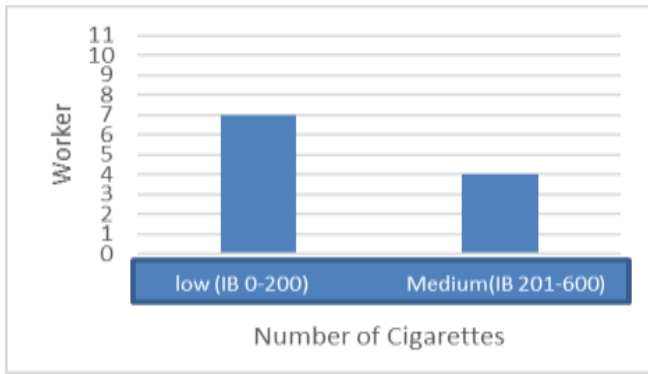
The above chart shows that of the total respondents surveyed, the majority of workers aged 18-27 ranged from as many as six workers presentations 54.5% and the average worker are 27 years old.

Graph 2 Distributions of Work Period Workers in Wood Processing Factory Margomulyo Surabaya 2015



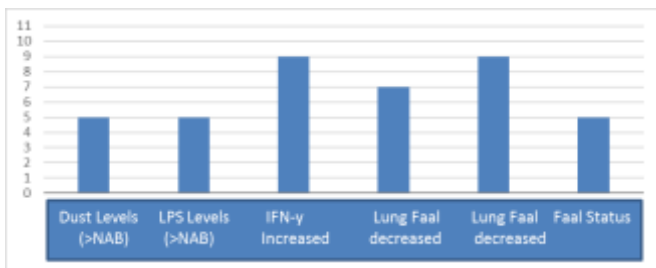
From the graph above shows that workers working period ranging between 2-6 years with the percentage of 63.6% with the average was 5.73 years.

Graph 3 Distribution Index Smoking Habit Workers in the wood processing plant Margomulyo Surabaya 2015



The above chart shows that of the total respondents were 11 people who studied there were 7 people who are light smokers with a proportion of 63.6%, four people as the proportion of smokers was 36.4.

Graph 4 Distribution Index Dust Levels Personal, Personal LPS levels, levels of IFN-γ, Lung Faal Conditions (FVC), Condition Lung Faal (FEV1), and Lung Faal Status



The above chart shows that of the 11 respondents surveyed, there were five workers with 45.5% the proportion of inhaling wood dust above the threshold value (TLV: 3 mg / m³), 5 workers who inhaled LPS endotoxin exceed NAB (NAB: 90 mg / m³) with the presentation of 45.5%, IFN-γ levels were measured in blood serum cross found nine shift workers have elevated levels of the percentage of 81.82%, the condition of pulmonary function (FVC and FEV1) as measured by cross shift is found mostly workers decreased FVC namely 7 workers with a percentage 63.64%, and FEV1 was found nine people with a percentage of 81.82% and the condition of pulmonary function status workers shift cross examined it was found that after working for 8 hours of work there are five workers suffered lung disorder the restriction condition (45.5%)

Effect of Endotoxin Levels between Personal, Age, Work Period, and Δ Against Smoking Habit IFN-γ

Table 1 influence between Levels of Endotoxin Personal, Age, Future Work and Δ Against Smoking Habit Serum IFN-γ Workers.

*p < 0,05

In Table 1 it can be seen that after multiple linear regression test simultaneously on all the variables of the IFN-γ Δ then found that IFN-γ Δ affected by LPS endotoxin levels p = 0.035 (p < 0.05) and smoking habits. p = 0.033 (p < 0.05).

Table 2 influence between Levels of Endotoxin Personal, Age, Future Work and Δ FEV1 against Smoking Habit

Variable	Δ FEV ₁	
	β	p
Endotoxin Levels	-0,941	0,028*
Age	1,264	0,013*
Work Period	0,151	0,692
Smoking Habit	-1,381	0,036*

* p < 0,05

In the table above it can be seen that after multiple linear regression test simultaneously on all of the variables Δ FEV1 then found that FEV1 is influenced by the levels of endotoxin LPS personal variables p = 0.028 (p < 0.05) age p = 0.013 (p < 0.05) and smoking habit workers p = 0.036 (p < 0.05).

Table 3 influence Between Levels of Endotoxin Personal, Age, Future Work and FVC Δ Against Smoking Habit

Endotoxin Levels	Endotoxin Levels	
	Endotoxin Levels	p
Endotoxin Levels	Endotoxin Levels	0,040*
Endotoxin Levels	Endotoxin Levels	0,003*
Endotoxin Levels	Endotoxin Levels	0,475
Endotoxin Levels	Endotoxin Levels	0,031*

* p < 0,05

In the above table it can be seen that after multiple linear regression test simultaneously on all of the variables FVC Δ FVC then obtained that is influenced by the levels of endotoxin personal variables p = 0.040 (p < 0.05), age p = 0.003 (p < 0.05) and smoking habits of workers p = 0.031 (p < 0.05)..

3. DISCUSSION

3.1 Age Respondents

Based on the research results obtained are found most of the workers who work in wood processing plant has a lifespan in the range of 18-27 years, this is because the wood processing plant only recruit workers aged under 40 years with the goal of doing more productive work activity, while the maximum age of the respondents were found to be the figure of 40 years with a mean age of 27.45 (6.44).

Suyono (2001) states that the need for energy substances continue to rise until finally decline after the age of 40 years is due to the reduced power requirements have been declining physical strength. Under normal circumstances, age also affects the respiratory rate and lung capacity. Respiratory rate in adults between 16-18 times per minute, in children about 24 times per minute while the baby is about

Variable	Δ IFN-γ	
	β	p
Endotoxin Levels	-0,925	0,035*
Age	0,563	0,191
Work Period	-0,032	0,936
Smoking Habit	-1,491	0,033*

30 times per minute. Although the adult respiratory rate is smaller than the children and babies, but KVP (Vital Lung Capacity) in adults more than children and infants. In certain circumstances it will change as a result of a disease, for example, can grow fast breathing and vice versa (Syaifudin, 1997).

3.2 Working Period

Results from these studies show that of all respondents who researched mostly found workers with tenure 2-6 years while working for the highest was found in 12 years of employment figures.

As according Suma'mur (2009) states that the period of employment specify a longer exposure to risk factors. The longer service life of a great person is more likely the person has a risk of developing a disease of the job. It is menunjukkan that the longer a person works in a dusty area will eat the longer the time of the exposure to the dust.

3.3 Smoking Habit

based on the results of the study found that the number of cigarettes smoked by workers each year the maximum is 240 cigarettes / year with a mean of 116.27 (99.82). Ansar (2005) state that smoking habits will accelerate the decline in pulmonary function; smoking is a direct cause irritation and damage to the respiratory tract. This process causes irritation and damage to a wide variety of disorders including hard breathing, cough, sputum production, wheezing and respiratory infections such as bronchitis and pneumonia According to Gold et al, (2005) At the moment there is a process of burning smoke tobacco and nikotina tabacum by removing the pollutant particles and gases. Among the dangerous good health for smokers and the people around them are tar (balangin), nicotine, carbon monoxide (CO) or a smoke, nitrogen cyanide, benzopirin, dimethyl nitrosamine, N-nitroso nicotine, catechol, phenol and acrolein. Cigarette smoke stimulates secretion of mucus, while nicotine paralyzes the cilia so that the airway is obstructed cleaning function. The consequence accumulated secretions that cause early symptoms such as coughing, phlegm and shortness of breathe number.

3.4 Dust levels Personal

Wood dust into the worker's body taken by using dust personal sampler tool (PDS), so it can be known wood dust level inhaled by each worker during the respondents perform work activities in wood processing plants, we conclude that that of 11 employees who investigated found 5 with a proportion of 45.5% of workers who inhaled dust above the threshold value with a maximum value of respirable dust of 5.29 with a mean of 2.93 (1.37).

Several mechanisms can be put forward as the cause perch and accumulation of dust in the lungs. One mechanism that is inertia or moist of dust particles moving air that is at a time when veering through breathing that is not a straight road, the dust particles are large enough mass cannot turn to follow the flow of air but keep going straight and finally mashing and mucous membranes alighted there (Suma'mur, 2009).

3.5 LPS Endotoxin Levels Personal

Source of gram-negative bacteria are found from various sources in a good working environment better than solid source (such as dust, garbage, compost, seeds and plants) and

the liquid (wastewater) containing organic material. Endotoxin is spread in the air during the working process that produces aerosol and organic material above including the rice milling. (Madsen 2006 in Duquene et al., 2012).

Similar to the results measured levels of endotoxin LPS personally performed in this study found that there are 5 workers inhaling wood dust containing endotoxin LPS with the proportion of 45.5%, which exceeds the threshold value (≥ 90 mg / m³), which mean that found was 91.00 (11.437) with a maximum value of endotoxin LPS of 108 mg / m³ minimum value is 76 mg / m³.

3.6 Lung Function Workers

Please note that during the examination of the results of measurement using the spirometer tool shows that a decline in pulmonary function during after working with restriction conditions, and statistical tests significant difference from the value of FVC and FEV1 were measured before and after the work (cross shift) , a person is said to have restrictions because of the disruption of lung development as a result of constraints caused lung elasticity dust particles that enter into iber network accumulate on the walls of the alveoli that cannot inflate the alveolar wall perfectly (Alsagaff and Mukty, 2010).

Based on the graph 4 it was found that there is a decrease in pulmonary function conditions of the workers for the FVC Δ are 7 workers with a percentage of 63.64% which decreased pulmonary function of a total of 11 workers, while the mean FVC Δ is -0.230 (0.39) with values The maximum is 0.60 and the minimum value is -0.60. As for the condition of pulmonary function as measured by FEV1 values Δ that there are 9 workers with presentations 81.82% decreased pulmonary function with a mean -0.234 (0.37) with a maximum value of 0.60 and a minimum value of -0.60.

3.7 Serum levels of IFN- γ

IFN is a protein secreted by cells as a result of various stimuli (Petska et al., 2004; Schroder et al., 2004; Plataniias, 2005). Interferon gamma is a pro-inflammatory cytokine secreted by Th1 cells CD-4 direct effect on collagen synthesis, inhibits collagens and inhibit TGF- β so with excessive levels can affect human lung physiology. IFN- γ also has the role of tissue repair and remodeling (Borg & Isenberg, 2007; Bouros & Tzouvelekis, 2009). Interferon- γ serum levels were measured using ELISA method with Hifn- γ ELISA high sensitivity. Figure 4 is found that there are increased levels of IFN- γ serum made with measurements before and after the work (cross shift) ie 9 workers with the proportion of 81.8% of the total of 11 workers with average 7.64 (123.34) with the maximum value -216.00 304.00 and the minimum value).

3.8 Analysis of LPS Endotoxin Levels Effect in Wood Dust against Increased IFN- Γ

This study aims to determine the relationship between the independent variables LPS endotoxin levels in the dust timber and a variable dependent IFN- γ serum. Relations confounding variables such as age, years of service and smoking habits with dependent variable also analyzed the correlation. As a result, where the variables most associated with IFN- γ serum workers in the wood processing industry can be known. Organic dusts usually have a heterogeneous composition of materials from microbial, plant and animal. Organic dust may contain pathogens and non-pathogens or

live bacteria die and mold, high molecular weight allergens, endotoxins the bacteria, pollen, and fiber crops (Douwes et al., 2003; Poole et al., 2010). Endotoxin lipopolysaccharide (LPS) is a component of the outer wall of Gram-negative bacteria are common in various kinds of environments especially working environment and inhalation is estimated to be the main route of exposure and associated (Spaan et al., 2008). Spaan et al., (2008) states that exposure to endotoxins is more homogeneous and more influential than exposure to dust if the levels of endotoxin LPS in overload conditions.

From research conducted found a significant difference between LPS endotoxin exposure with elevated levels of IFN- γ namely with $p = 0.035$ ($p < 0.05$). This is due to endotoxin levels were found in overall worker personally with the maximum value is 108 mg / m³, with a mean of 91.00 (11.437).

Research carried out in line with the Asmara Yasa (2012) indicates that there is a significant relationship between exposure to wood dust endotoxin LPS and IFN- γ serum. The correlation coefficient between wood dust exposure with serum levels of IFN- γ is $(r) = -0.324$; $p = 0.011$. Wood dust exposure variable is related to the concentration of dust is sucked and duration of exposure are certainly closely associated with the old work. Rylander epidemiological studies (1997) stated that the number of levels of endotoxin in the dust affects the health problems if the overload condition, while the details mentioned that endotoxin with levels of 10 ng / m³ cause inflammation of the airways, 100 ng / m³ cause systemic disruptions, and 200 ng / m³ cause toxic pneumonitis (where 1 is equivalent to 10-15 ng endotoxin endotoxin units (EU)).

3.9 Analysis of Effect of LPS endotoxin levels in the Dust Wood Decline Against Lung Faal

Examination of lung function using a spirometer is very useful for finding early occurrence of respiratory disorders. Examination of lung function should involve at least two parameters, namely 1 second forced expiratory volume (FEV1) and forced capacity (FVC) (Alsagaff and mukty, 2010). In this study, the measured parameter is the change in FVC and FEV1 and Edotoksin LPS levels were then compared both by using multiple linear regression statistical tests that can be known effect between the two. Based on LPS endotoxin levels that can be seen in chart 4 that the levels of endotoxin LPS in personal wood dust with an average 91.00 (11,437) with a maximum amount of 108 mg / m³ in caused by alarming condition when exposed continuously to be able to affect workers' lung function. The mean pulmonary physiology with FVC Δ value was -0.230 (0.39) while the mean pulmonary function with a value of Δ FEV1 was -0.234 (0.37). Based on the multiple linear regression test which transactions are carried out by looking at the value of the significance it was found that the levels of endotoxin effect on pulmonary function decline in workers (Δ FVC) with $p = 0.040$ ($p < 0.05$) and the FEV1 Δ $p = 0.028$ ($p < 0, 05$)

4. CONCLUSION

1. Based on the results obtained from this study, it can be concluded as follows: The average concentration of endotoxin LPS in personal wood dust on workers in the

wood processing plant Margomulyo Surabaya exceeding the threshold value (NAV).

2. There is an increase in levels of IFN- γ in the serum of workers were measured before and after work.
3. There is a decrease in pulmonary function of workers in the wood processing plant Margomulyo Surabaya.
4. Levels of endotoxin LPS in the wood dust in a personal effect on elevated levels Gama Interferon (IFN- γ)
5. Levels of endotoxin LPS in the wood dust in a personal effect on decline in lung function.

5. SUGGESTION

1. To reduce the concentration of dust in the air needs to be done by engineering control using local exhaust and ventilation systems in areas that have high concentrations of dust as the sawmill area.
2. Required use of Personal Protective Equipment (PPE) type No power Air Purifying Respirator (NAPR) N Series (No. Resistant to oil) for the protection of wood dust and endotoxins.
3. Required periodic health checks for symptoms of respiratory disorders and lung deed in order to detect short-term respiratory problems that workers who are at risk can be handled immediately.
4. Required for job rotation for employees who have tenure > 10 years.
5. This research can be developed to examine the endotoxin levels greater

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