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# RELATIONSHIP EXPOSURE OF DIESEL EXHAUST PARTICLE AND TENURE WITH LUNG FUNCTION DISORDERS ON THE TRAFFIC POLICE

**Imartha<sup>1</sup>**

<sup>1</sup>Master of Public Health Science Study Program, Faculty of Medicine, Lambung Mangkurat University, South Kalimantan, Indonesia,

**Husaini<sup>2</sup>**

<sup>2</sup>Master of Public Health Science Study Program, Faculty of Medicine, Lambung Mangkurat University, South Kalimantan, Indonesia,

**Syamsul Arifin<sup>3</sup>**

<sup>3</sup>Master of Public Health Science Study Program, Faculty of Medicine, Lambung Mangkurat University, South Kalimantan, Indonesia,

## ABSTRACT

*Air pollution caused by vehicles (Diesel Exhaust Particles) would adverse health effects. People who are continuously exposed it may have impaired lung function, such as the traffic police. The purpose of this study is to find the relationship exposure of CO, SO<sub>2</sub>, total dust, and tenure with lung function disorders on the traffic police. The study was a cross sectional with the subjects were Banjarmasin's Traffic Policeman. The sampling procedure using simple random sampling predefined by inclusion and exclusion criteria with a sample of 45 units traffic police. The study were conducted at the place of work unit Banjarmasin's Traffic Police and Company Hygiene and Occupational Health Office in South Kalimantan. The result shows that there are no relationship between exposure of CO ( $p:0.663 > \alpha$ ), SO<sub>2</sub> ( $p:0.718 > \alpha$ ), total dust ( $p:0.221 > \alpha$ ) and tenure ( $p:0.185 > \alpha$ ) with obstructive pulmonary functions disorders, there are no relationship between exposure of CO ( $p:0.972 > \alpha$ ), SO<sub>2</sub> ( $p:0.565 > \alpha$ ), total dust ( $p:0.929 > \alpha$ ) and tenure ( $p:0.706 > \alpha$ ) with restrictive pulmonary functions disorders. In conclusion, this study showed there is no relationship between the exposure of CO, SO<sub>2</sub>, total dust and tenure with obstructive, restrictive and mixed pulmonary function impairment on traffic policeman.*

**KEY WORDS:** Diesel exhaust particles, lung function disorders, traffic police

## 1. INTRODUCTION

Diesel Exhaust Particle (DEP) is a complex mixture of gaseous compounds and particles produced from incomplete combustion of diesel fuel (Ghio et al ; 2012). DEP contain some harmful substances such as nitrogen oxides, sulfur dioxide, carbon monoxide, carbon dioxide, hydrocarbons, carbon particles burn (soot), and benzene (Arpana et al ; 2014). CO and NO<sub>x</sub> are components of pollutants that may react with air (oxygen), SO<sub>x</sub> is a gas that reacts readily with water vapor in the air while the dust particles as contaminants in solid

form. Estimated percentage of the components of air pollutants from sources of air pollutant transport in Indonesia is (Ward, 2001): CO as much as 70.50%, as much as 8.89% NO<sub>x</sub>, SO<sub>x</sub> as much as 0.88%, HC as much as 18.34% and Particles as much as 1.33%. Based on this as well, the researchers chose DEP components that can represent each reaction is either to react with oxygen (CO), a component that reacts with water (sox) and components for solid DEP (total dust). The three substances including DEP constituent parts

that could endanger human health (Bhide et al ; 2014).

Tenure is a period of time or duration of the labor working in somewhere. Tenure can affect the performance of both positive and negative (Matulus ; 1992). Anhar, et al (2005) states that the longer people work, the greater the risk of disease due to work. Tenure of the traffic police is also a component examined in this research refers to research by Pravati et al (2010), which states that exposure polluting vehicles for several hours a day for years (tenure) causes a decrease in functional capacity of the lungs.

Based on the above researcher conducted a study on exposure of DEP and tenure with lung function disorders on the traffic police.

## 2. MATERIAL AND METHODS

This study was an observational study with cross sectional design. The population is all the police traffic of Banjarmasin. The sample size determined by simple random sampling technique.

Lung function measurements done using a spirometer, measurement of CO using Spectrophotometer-Iodine Pentaoksida, measurements of SO<sub>2</sub> using Spectrophotometer-Pararosinilin and total dust measurements using a gravimetric measuring instrument-LVS. Meanwhile, characteristic data of respondents are age, tenure, smoking habit, long exposure and a history of lung disease through interviews using a structured questionnaire. Data analysis using multiple linear regression and logistic regression.

## 2. DEP Quality (CO, SO<sub>2</sub> and Total Dust)

Table 2. Quality of DEP

Parameters measured	Point 1	Point 2	Point 3	Point 4	Point 5	Treshold value (mg / Nm <sup>3</sup> )
CO	576.33	649.55	346.46	1046.71	10494.56	29000
SO <sub>2</sub>	0.26	0.28	0.56	0.60	0.59	5200
Total dust	783.33	150.00	966.67	316.67	450.00	10000

Diesel exhaust particle (CO, SO<sub>2</sub> and total dust) showed that the highest level of CO, SO<sub>2</sub>, and total dust indicates that the DEP levels remain below the threshold limit values (MoWT ; 2008). The working environment of the traffic police were measured in this research are outdoor working environment so that certainly influenced by the surrounding environment, namely mobility, the weather, velocity, temperature and humidity and traffic. Normally the levels of substances in the air (under TLV) in outdoor work environment of the traffic police Banjarmasin is suspected due to the dynamic nature of the environment are affecting the concentration of pollutants (Rachmawati ; 2013). This is conform with WHO explanation that antagonist substance exposure to two or more chemicals in the air can lead to reduced independent effect of these substances (WHO, 2000). According to Husaini (2014) that the reaction between the gas, especially gas SO<sub>2</sub> will easily react

## 3. RESULTS AND DISCUSSION

### A. Characteristics of Respondents

Table 1. Characteristics of Traffic Police

No.	Item characteristics	N	%
1	Age (years)		
	a. 20-30	8	18
	b. 31-40	28	62
	c. 41-50	9	20
2	Tenure (years)		
	a. 1-5	0	0
	b. 6-10	14	31
	c. 11-15	21	47
	d. 16-20	5	11
	e. 21-25	1	2
	f. 26-30	4	9
3	Length of work every day (hours)		
	a. 6-8	0	0
	b. 8-10	45	100
	c. > 10	0	0
4	Smoking history		
	a. Smoker	0	0
	b. Not a smoker	45	100
5	Lung disease history		
	a. Ever	0	0
	b. Never	45	100
6	Allergic history		
	a. Yes	0	0
	b. No	45	100

in the air or in the body with other gases or with water to form a gas / substance that is new or create secondary pollutants is more corrosive, toxic and synergy or are additive to each other (Husaini, 2014).

So, normally levels of DEP in the working environment of the traffic police Banjarmasin is also suspected due to the levels of DEP that when produced motor vehicle and then released into the air, DEP was immediately react with other substances contained in the air so that the necessary methods and means of measurement in nature cumulatively (Husaini, 2014).

The results of this study conform to a similar study conducted by Ginting (2015), air pollution threshold contained in the free air measured in Central Jakarta still within normal limits. Research conducted Rogan (2014) in East Jakarta also shows the results of SO<sub>2</sub> and CO concentrations at all

monitoring points are still below the quality

standard / below the threshold value.

### 3. Lung Function Measurement Results

**Table 3. Obstructive, Restrictive and Mix Lung Function Measurement Results**

Obstructive			Restrictive			Mix	
FEV1%	n	%	FVC	n	%	n	%
> 75%	45	45	> 80%	45	100	Positives: FVC <79% and 0 FEV1 <75%.	0
60% -74%	0	0	60-79%	0	0		
30% -59%	0	0	30-59%	0	0	Negatives: FVC and FEV1 ≥ 45 80% ≥ 75%	100
<30%	0	0	<30%	0	0		

### 4. Statistical Analysis

**Table 4. Relationship Exposure CO, SO<sub>2</sub>, Total Dust and Tenure with Obstructive and Restrictive Lung Function Impairment on the Traffic Police**

Variable	Obstructive		Restrictive	
	t-value	p-value	t-value	p-value
Tenure	1.349	0.185	0.380	0.706
CO	0.439	0.663	-0.036	0.972
SO <sub>2</sub>	0.364	0.718	0.580	0.565
Total dust	1.242	0.221	0.090	0.929

Statistical analysis show no significant relationship exposure to CO, SO<sub>2</sub>, total dust and tenure with lung function impairment. Obstructive lung function impairment is a respiratory disorder both structural (anatomical) and functional causes of the slowing respiration airflow (Guyton, 1997). The risk factors of obstructive lung function impairment include smoking, both outdoor and indoor pollutants. There are also other risk factors are genetic, gender, age, alcohol consumption and lack of physical activity (Oemiat, 2013). Air pollutants cause lung disorders that cause inflammation of the bronchi and bronchioles and then lead to airway obstruction (Price, 1995). The results showed that the levels of pollution / DEP (CO, SO<sub>2</sub> and total dust) is below the TLV, so according to the analysis in work units of the traffic police on Banjarmasin not cause inflammation of the bronchi and bronchioles and then lead to airway obstruction.

The results showed that the levels of pollution / DEP included total dust is below the TLV and the tenure of traffic police as much as 91% still less than 20 years, so according to the analysis dust particles that enter yet accumulated and yet cause tissue fibrosis in alveolar walls. This is consistent with the opinion of Price (1995) that a particle can cause restrictive disorders are 1-5 µm particle size and required a high degree of beating cilia escalator levels and requires a long exposure (20 years) to be able to cause extensive pulmonary fibrosis. Normal lung function on the Banjarmasin traffic police (FVC, FEV1 and Mix) consistent with the opinion of Penney (2010) that if the CO level is below the TLV tend to be reactive.

Normal lung function of traffic police in Banjarmasin (FVC, FEV1 and Mix) corresponding to the study conducted by Garcia et al (2013) to the traffic police who are exposed to air pollution (PM<sub>10</sub>) with a control group of office workers in

Bogota shows that indeed happened improving the symptoms of upper respiratory tract irritation and rhinitis at the traffic police but there was no difference in lung function between the two groups. This study is also consistent with research Nurjajuli et al (2010) analyze the difference in lung capacity of vendors based on the levels of total dust in Semarang shows the results no significant predictive value % KVP (p = 0.110) and prediction value % VEP1 (p = 0.829) of the vendors based on total ambient dust levels in three National Road Semarang. The absence relations CO, SO<sub>2</sub> and total dust impaired lung function obstructive, restrictive or mix in this study also consistent with research conducted Fahimi (2012) where there is no significant associations between air pollution and lung function (parameter FEV1 / FVC (r = 0.058; p = 0.662) in the traffic police of Surabaya.

The tenure of the traffic police in Banjarmasin obtained the results as much as 1-5 years tenure respondents 0 (0%), length of 6-10 years as many as 14 people (31%), 11-15 year tenure as many as 21 respondents (47%), 16-20 years as many as five respondents (11%), 21-25 year tenure as one respondent (2%) and 26-30 years as many as four respondents (9%). The results of partial hypothesis testing by t-test showed that there is no relationship tenure with obstructive lung function impairment (FEV1) (p: 0.185 > α) and restrictive lung function impairment (FVC) (p: 0.076 > α). This is because there still normal levels of DEP in the work of the traffic police in Banjarmasin, so even though the average tenure of police traffic 14,2 years old, work 8-10 hours / day not cause lung problems in the traffic police. This is consistent with the theory of Price (1995) which states that a particle can cause restrictive lung disorders are 1-5 µm particle size and required a high degree of beating cilia escalator levels and requires a long exposure (20 years) to be able to cause pulmonary fibrosis broad.

Although no relationship tenure with obstructive, restrictive and mix lung function impairment preferably in the traffic police, especially the traffic police with a life of over 20 years of follow-up test to detect lung disease due to exposure to DEP. This is consistent with research Ginting (2015) in which the 97 research subjects with normal lung function turns the thoracic images showing 7 of them showed good abnormalities in the lungs, heart and blood vessels.

This research corresponds with research Lutfi (2014) that respondents had served more than 10 years with impaired lung function were 22 people on the analysis showed no significant relationship between tenure with lung function ( $p = 0.42$ ). These results are also consistent with studies of the traffic police in South Jakarta, North Jakarta, Central Jakarta, Depok and Bogor Regency (Rogan, 2014).

#### 4. CONCLUSION

- There is no relationship exposure CO, SO<sub>2</sub>, total dust and tenure with obstructive lung function impairment at the traffic police in Banjarmasin.
- There is no relationship exposure CO, SO<sub>2</sub>, total dust and tenure with restrictive lung function impairment at the traffic police in Banjarmasin.
- There is no relationship exposure CO, SO<sub>2</sub>, total dust and tenure with mix lung function impairment at the traffic police in Banjarmasin.

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