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Correlation between Work Duration of Gas Station Operators with Mucociliary Transport Time, Hair Pb Level, and Nasal Cytogram

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Abstract- Gas station operators are groups of workers exposed to the risk of dangerous chemical compounds, particularly lead from gasoline and vehicle gas emission that are waiting for a refuelling queue or a vehicle that will depart after completing the refuelling. The research aimed at investigating the correlation between work duration of gas station operators with mucociliary transport time, hair Pb level, and nasal cytogram. The research used the analytic observational method with the cross sectional design, was conducted to the operators of gas station in Tamalanrea and in Gunung Bawakaraeng street from August 2017 until September 2017 with 30 people as total samples. Sample divided into two groups, gas station operator with work duration $<$ 1 year for 15 people and gas station operator with work duration $\geq$ 1 year for 15 people and each sample was underwent mucociliary transport time examination, hair Pb level examination, and nasal mucosa cytogram examination. The research result indicates that the significant correlation between work duration and mucociliary transport time with p value $<$0.05 and OR value=11. There is a significant correlation between work duration and Pb hair level with p value $<$0.05 and OR value = 9.3. There is no significant correlation between work duration and eosinophil and neutrophil count with p value $>$ 0.05.

Keywords: *work duration, mucociciliary transport time, lead (Pb), nasal cytogram.*

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Keywords: work duration, mucocicliary transport time, lead (Pb), nasal cytogram.

I. Introduction

Nose and paranasalis sinus are the organs that play an important role as the front line of the body's defence in the lower air way to the microorganism and hazardous materials [1]. Its effectiveness depends on the integrity of mucociliary system called the mucociliary transport system [2]. It consists of ciliary cells of the respiratory epithelium, mucous – producing glands and mucous membranes produced by goblet cells in epithelial and submucosal seromucinous glands. [3].

According to Waguespack (1995), several conditions which affect mucociliary transport were physiologic factor, air pollution, smoking, congenital disorder, rhinitis allergy, viral infection, bacterial infection, topical drugs, systemic drugs, preservatives, and surgery. [4].

Gas station is one of the places where pollution and discharge of gas or waste from vehicles that contained heavy metals such as lead or Plumbum (Pb) occurs, where Pb is the most dominant pollutant in the gas station [5]. Pb level in the air around the gas station is likely to be sucked thorough the air or even attached to the body tissue especially the skin (hair) [6]. Analysis of lead in hair has more advantages, because hair has longer memory period and even a permanent result. Head hair grows at an average speed of half an inch (1 inch = 2.54 centimeters) per month. Therefore, three inches of human hair can tell the history of the human body for six months [7]. Gas station position which near the highway makes it easier for officers to be exposed to lead pollutants from the smoke of the vehicles on the highway [8].

The Regional Environmental Agency has conducted a study about lead level at several points in Makassar in 2013, and the results found that the highest lead level is on the Ratulangi street with 1.319 $\mu g/Nm^3$ and the lowest is on Monginsidi street with 0,374 $\mu g/Nm^3$[9]. Based on the results of Makassar Centre for Health and Occupational Safety (COHS) study about air quality monitoring in several points of vehicle's traffic, it can be seen that in the last three years, lead is still polluting Makassar even though gasoline without lead has been applied, however the pollution remains occur. In 2012, concentration of lead in the air was 0.528 $\mu g/Nm^3$ and in 2013, concentration of lead in the air became 0.592 $\mu g/Nm^3$ [9].

II. Materials and Method

a) Location and Time

The study was conducted at Tamalanrea gas station and gas station of Gunung Bawakaraeng street in Makassar, South Sulawesi Province, for 1 month from August 2017 until September 2017.

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b) Population Dan Sample

The population is Tamalanrea gas station operators and gas operators of Gunung Bawakaraeng street in Makassar. Samples are the entire affordable population that met the inclusion criteria.

c) Design and Sampling

This is an observational analytic study with cross sectional design. Samples were taken at random, every gas station operators who fulfilled the study requirement, the identity will be recorded and then anamnesis and physical examination will be taken. Each samples will undergo mucociliary transport time examination using saccharin test, hair Pb level examination using Atomic Absorption Spectrometry (AAS), and nasal cytogram examination to assess eosinophil and neutrophil.

d) Data Analysis Technique

The collected data is processed and presented in the form of tables and graphs. Data processing is analysed with statistical test using SPSS 22.0 version with unpaired t test and significance at the $p<0.05$ level.

III. Results

An observational analytic study was conducted with cross sectional study design to determine the correlation between work duration of gas station operators with mucociliary transport time, hair Pb level, eosinophil and neutrophil count in nasal mucosa. This study was conducted in Tamalanrea gas station and in Gunung Bawakaraeng street in Makassar, South Sulawesi Province. For 1 month, from August 2017 until September 2017. Samples number are 30 people, divided into two groups, 15 gas station operators with work duration < 1 year and 15 gas station operators for work duration ≥ 1 year. The highest number of samples at age 15-23 years old are 23 people (76.7%), 18 women (60%) and 12 men (40%), 10 smokers (33.3 %) and 4 people (13.33%) with atopic history. (Table 1)

Table 1: Sample Characteristics

Categories	Frequency (n)	Percentage (%)
Age 15 – 25 years old 26 – 35 years old	 23 7	 76,7 23,3
Gender Men Women	 12 18	 40,0 60,0
Work Duration < 1 year ≥ 1 year	 15 15	 50,0 50,0
Smoking History Yes No	 10 20	 33,3 66,7
Atopic History Yes No	 4 26	 13,33 86,67

Source: Primary Data, 2017

Unpaired t test result showed a significant correlation between mucociliary transport time with work duration < 1 year and ≥ 1 year with p value=0,01 ($p<0.05$). There are 4 people in a group with work duration < 1 year (13.33%) who experienced the disorder, 11 normal people (36.67 %), and mean value 8.48 (SD±4.49). while in the work duration ≥ 1 year group, there are 3 normal people (10%), 12 people (40%) experienced the disorder and mean value 14.68 (SD±3.39). (Table 2)

Table 2: Comparison of Mucociliary Transport Time (MTT) with work duration in gas station operators

Categories	Mucociliary Transport Time (MTT)				Mean±SD	OR	p
	Disorder		Normal				
	n	%	n	%			
Work Duration < 1 Year	4	13,33	11	36,67	8,48±4,49	11**	0,01*
Work Duration ≥ 1 Year	12	40	3	10	14,21±4,07		

** Unpaired t test, ** Chi square test*

Comparison of Pb level analysis in the gas station operators with work duration between < 1 year and ≥ 1 year using unpaired t test demonstrated a significant correlation with p value=0.001 (p<0.05). There is 1 person (3,33%) in work duration < 1 year group with abnormal Pb level, 14 normal people (46.67%) and mean value 6.45 (SD±2.14). In work duration ≥ 1 year group, there are 6 people (20 %) with abnormal Pb level, 9 people (30%) with normal Pb level and mean value 10.92 (SD±1.89). (Table 3)

Table 3: Comparison of Pb Level in Gas Station Operators in Makassar

Categories	Lead Level (Pb)				Mean±SD	OR	p
	Not Normal		Normal				
	n	%	n	%			
Work Duration < 1 Year	1	3,33	14	46,67	6,45±2,14	9**	< 0,001*
Work Duration ≥ 1 Year	6	20	9	30	10,92±1,89		

** Unpaired t test, ** Chi square test*

Comparison of eosinophil count in nasal mucosa analysis in the gas station operators in Makassar with work duration between < 1 year and ≥ 1 year using fisher test shows no significant correlation with p value p=0,29 (p>0,05). There is 1 person (3,33%) in work duration < 1 year group with abnormal eosinophil count and 14 people (46,67%) with normal count. In work duration ≥ 1 year group, there are 3 people (10 %) with abnormal eosinophil count and 12 people (40%) with normal eosinophil count. (Table 4)

Table 4: Comparison of eosinophil and neutrophil count of nasal mucosa in gas station operators

Categories	Eosinophil				p	Neutrophil				p
	Normal		Not Normal			Normal		Not Normal		
	n	%	n	%		n	%	n	%	
Work Duration < 1 Year	14	46,67	1	3,33	0,29*	12	40	3	10	0,21*
Work Duration ≥ 1 Year	12	40	3	10		9	30	6	20	

**Fisher test*

The result of fisher test analysis shows no significant correlation between neutrophil in nasal mucosa of gas station operators in Makassar with p value=0,21 (p>0,05). There are 3 people (10%) in work duration < 1 year with abnormal neutrophil count and 12 normal people (40%). In work duration ≥ 1 year group, there are 6 people (20 %) with abnormal neutrophil count and 9 people (30%) with normal neutrophil count. (Table 4)

IV. Discussion

The major sample characteristics according to age is 15-23 years old with 23 people (76.7%), With the plenty amount of women than men, i.e. 18 people (60%). Munir D, 2010 stated that there was no significant difference in MCT time based on gender [10]. The influence of age and gender on MCT time is still not known clearly. Some researchers say that age and gender have no effect on the speed of mucociliary transport. Prijanto, 2002 suggested that nasal mucociliary transport is related to age, i.e. older age has a slower mucociliary transport rate than younger age. This is due to the possibility that older people are more exposed to air pollution [11].

The result of mucociliary transport time (MTT) comparison analysis between gas station operators with work duration <1 year and ≥ 1 year showed a significant correlation by using unpaired t test with p value = 0.01 (p <0.05) and mean value 8.48 (SD ± 4.49) for work duration <1 year group, and in work duration ≥ 1 year group, the mean value was 14.68 (SD ± 3.39). In work duration <1 year group, there are 4 people (13.33%) who experienced the disorder, this may be caused by the history of smoking and allergies. However, in the work duration ≥ 1 year group there are 3 normal people (10%), this may be caused by the use of maximum protective equipment and immune system of the operators. (Figure 1)

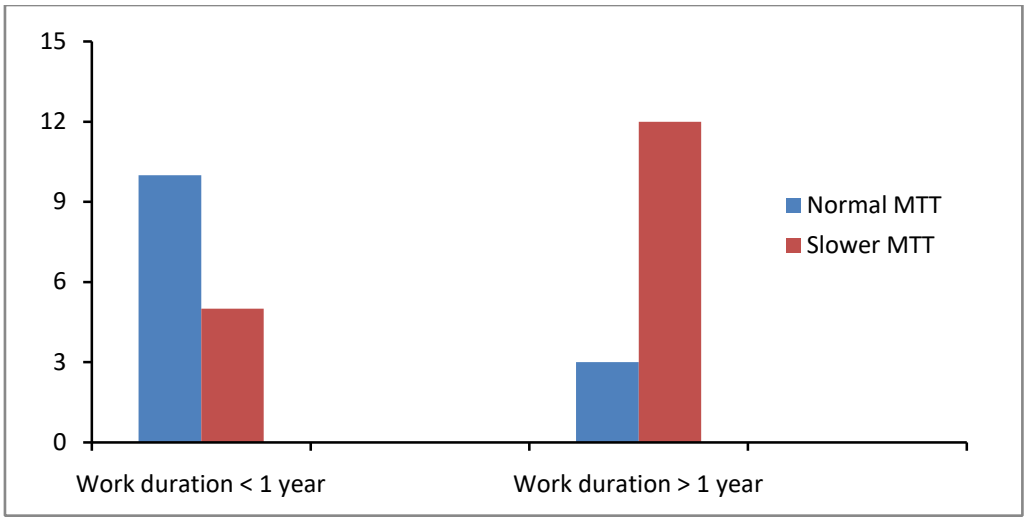

Fig. 1: Comparison of Mucociliary Transport Time (MTT) between gas station operators with work duration < 1 year and ≥ 1 year

Smoking can affect mucociliary transport time. This is due to the ciliostatic effects of tobacco smoke. Prolongation of mucociliary transport time may be caused by a decrease in the amount of cilia or mucus viscoelasticity changes. In addition, increased mucociliary transport time was also associated with an increase in smoking duration where subjects who smoked more than 5 years had a slower mucociliary transport time [12]. In the case of a very long rhinitis allergy, elongation of mucociliary transport time occurs and associated with alternation in nasal mucus flow features [13].

The result analysis of Pb level in gas station operator in Makassar between work duration <1 year and ≥ 1 year shows significant correlation by using unpaired t test with p value = 0.001 (p <0.05) and mean value 6.45 (SD ± 2.14) while mean value 10.92 (SD ± 1.89) for work duration ≥ 1 year group. In work duration <1 year group there is only 1 person (3.33%) with abnormal level of Pb, this may be due to the lack use of protective equipment, food and drinks or other factors. Poisoning caused by Pb metal compounds can occur due to the metal compounds entering the body. The process entry of Pb in the body can be through several routes, such as food and drink, air, permeation or penetration of the membrane or skin layer [6].

In the work duration ≥ 1 year group there are 9 people (30%) with normal Pb level, this may be due to the Threshold Limit Level of Pb at the gas station in Makassar below the mean value and there are 6 people (20%) with abnormal Pb level. Gas station operators who do not use protection equipment such as masks and gloves are susceptible to exposure of lead particles that came out directly from the gas waste-pipes and inhaled gasoline vapour at a higher rate compared to operators using protective equipment [6].

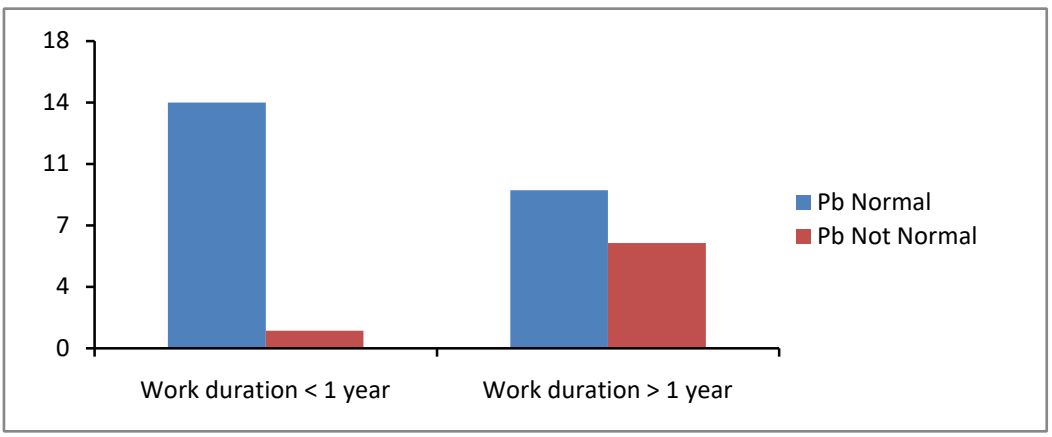

Fig. 2: Comparison of Pb level between gas station operators with work duration < 1 year and ≥ 1 year

The results of fisher test analysis showed no significant correlation of work duration with eosinophil and neutrophil count in nasal mucosa of gas station operators in Makassar, where p=0.29 (p>0,05) for eosinophil and p=0,21 (p>0,05) for neutrophil. Zachariah 2015. suggested that there is no significant correlation between the mass of work with eosinophil and neutrophil. Neutrophils are short-lived cells with a

half-life in the blood between 6-7 hours and lifespan between 1-4 days in connective tissue. Neutrophils form a defence against the invasion of microorganisms, especially bacteria. Neutrophils are active phagocytes against small particles and are called as microphages to differentiate them from macrophages which are larger cells. Eosinophils can survive in the blood circulation for 8-12 hours, and last longer about 8-12 days in the tissue if there is no stimulation. [14]

V. Conclusion

There is a significant correlation between work duration of gas station operators with mucociliary transport time and Pb level. The longer the work duration of gas station operators are the higher risk to have slower mucociliary transport time and risk of lead exposure.

There is no significant correlation between work duration with eosinophil and neutrophil.

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