

An Effect Of Lead Exposure (Pb) On Blood Pressure At Office Of Transportation (Dishub) Medan City

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Abstract: *The officers of Dishub (Department of Transportation) are the workers, who are exposed to lead. Despite the lead reduction in vehicle fuel, the officers of dishub have been chronically exposed. They have 8 working hours with a task that is similar to the police officers i.e. to control traffic and public transportations. The objective of the research was to analyze the influence of lead exposure on the blood pressure of the officers of dishub in Medan. The data were the lead level contained in the blood. The data were taken from taking the officer's blood samples and had them examined in Prodia Laboratory. Bivariate data analysis applied the linear regression testing. This paper described demonstrated that the average lead (Pb) level of the officers was 5.4797, the average age of the officers was 46.5217, the average length of service of the officers was 13.7391, the average systolic blood pressure of the officers was 115.8261, the average of diastolic blood pressure was 79.7826, the average BMI of the officers was 25.8217 and the average PAL was 1.6217. The results of the statistical test in the correlation of Pb level in the blood, systolic blood pressure ($p=0.675$), and diastolic ($p=0.092$) indicated that there was not any correlation between both variables.*

Keywords : *Lead Exposure, Blood Pressure, Department of Transportation.*

1. INTRODUCTION:

Lead is the most abundant heavy metal in the earth's crust, which has been used since prehistoric times and has been widely distributed and mobilized in the environment. (WHO HECA undated). Increased human activities, such as mining and smelting, and their use in petroleum, as well as many other uses in the manufacture of other products, so that the lead content in the biosphere has increased in the last 300 years (NHMRC 2009).

Based on the monitoring of air pollution in cities, transportation emissions are proven to be the highest contributor to air pollution in Indonesia, which is around 85%. This is due to the high growth rate of motor vehicle ownership. Most of these motorized vehicles produce bad exhaust emissions, either as a result of inadequate maintenance or from the use of fuel of poor quality. According to the Environment Project Agency in Dessy Gusnita, about 25% of the heavy metal lead (Pb) remains in the engine and the other 75% will pollute the air through the exhaust. Pb emissions from exhaust gases will still cause air pollution wherever the vehicle is located, the steps are as much as 10% will pollute locations within a radius of less than 100m, 5% will pollute locations within a radius of 20 km, and the other 35% will be carried away by the atmosphere in a considerable distance.

WHO report in 2010, hypertension as the number one cause of death in the world and nearly one billion people suffer from hypertension according to the Joint National Committee VII (JNC-VII) (WHO, 2013; US Department of Health and Human Services, 2003), and according to the American Heart Association (AHA) data for 2015, shows 74.5 million people or one in three over the age of 20 suffer from hypertension, but nearly 90-95% of cases have no known cause.

The factors that play a role in hypertension are age, ethnicity, gender, obesity, stress, diabetes mellitus, alcohol, birth control pills, excessive salt consumption, and harmful metal elements (Pb, thallium, and cadmium) and so on. (Bustan, 2002). The additives added to motor vehicle fuels generally consist of 62% tetraethyl-Pb, 18% methylene chloride, 18% ethylene bromide, and 2% mixtures of other ingredients.

According to Khan in Setiawan (Jatim, 2012), the effect of Pb exposure on blood pressure is more clearly shown by chronic exposure than acute exposure. At relatively low levels of Pb in the blood (5-35 $\mu\text{g} / \text{dl}$) it affects blood pressure. According to Moller and Kristensen, adapted by Hesti Rosyidah, stated that Pb plays a role in the pathophysiology of hypertension. Biochemically, Pb affects calcium (Ca) metabolism in muscle contraction of the vascular blood vessels and the renin-angiotensin system. Diseases that arise due to work relations are diseases caused by work or work environment. by chemical factors, wherein carrying out daily tasks the Department of Transportation regulates traffic and transportation on highways with a very high level of traffic density, especially on congested roads, so it is often in contact with motor vehicle exhaust gases containing lead through breathing and incoming skin. into the body chronically. (Presidential Decree No. 22 of 1993)

The officers of the transportation service (dishub) in the traffic and road transportation division in collaboration with the police carry out their duties in curbing road traffic at road intersections with heavy vehicles, namely from 07.00 to 09.00 WIB and 16.00 - 18.00 WIB. Officers carry out their duties every day including holidays with a total working time of 2 hours, even more than 2 hours due to community activities such as residents grieving their homes on the side of the road, MTQ events, vehicle accidents, and so on. Even though the officers did not carry out their duties for 8 hours at the crossroads, the dishub officers were still on standby at the post (pull), which is located close to the intersection of the dishub officers working, so that the dishub officers were still exposed to the Pb. In carrying out their duties, the dishub officers did not wear masks inside. work, because of various constraints such as mask facilities are not routinely given a budget constraint, officers are not comfortable wearing masks, and there are officers wearing masks that are not up to standard so it is likely that Pb will enter the body through breathing.

A study by Consentina Fega et al (2005) conducted in Italy, conducted a study on workers in a battery storage factory showed that blood lead levels in workers who worked for a relatively long time contributed independently to the increase in blood pressure in workers.

Research by Albalak et al (2003), which was conducted in Jakarta who was acclimated to lead poisoning in Indonesia by Suherni (2010), found that a quarter of school children in Jakarta had a blood lead content of 10-14.9 ug / dL. , which exceeds the limit set by the United States Centers for Disease Control and Prevention of less than 10 ug / dL about the limit for lead classified as non-toxic, but there is a recent study showing the dangers of having blood lead levels below 10 ug / dL (Roberts et al 2009)

In 1997, before the application of lead-free gasoline was used in Indonesia, a study from Heinze in 1998, reported that blood lead levels of children were greater than 10 ug / dl, children living in urban centers had higher levels of lead in the blood. blood from children living in the northern suburbs. Compared to research conducted by Albalak et al (2003), the percentage of lead content in blood among children living in Jakarta in 1997 was higher than that in 2003. The same results were obtained in Semarang. in 1998 (one of the largest cities in Indonesia), with heavy traffic on the main roads (Browne et al 1999).

2. CHARACTERISTICS OF LEAD:

Lead in everyday life is better known as lead or in the scientific language Plumbum (Pb). Lead (timbale, pb) is a heavy metal that is gray in color that melts at 327oC. Lead evaporates at temperatures above 500oC and reacts with air to form lead oxide compounds (Suma'mur, 2010). In the periodic table, chemical elements are included in the group IV -A metal group, having atomic number (NA) 82 with atomic weight or weight (BA) 207.2 (Palar, 2012).

Lead is toxic and can contaminate food, drink, air, water and dust. Lead intoxication can be through the oral route, inhalation, dermal contact, eye contact, and parenteral. Lead or Pb that is in the air system, mainly comes from motor vehicle exhaust. Through the exhaust of the vehicle's engine, the Pb element is released into the air. Some of them will form particulates in free air with other elements, while others will stick to and be absorbed by the leaves of plants along the road (Palar, 2012).

In motor vehicle fuels, scavenger materials are usually added, namely ethylendibromide (C₂H₄Br₂) and ethylendichloride (C₂H₄Cl₂). This compound can bind the Pb residue produced after combustion, so that in the exhaust gas there are Pb compounds with halogens.

Tetramethyl-Pb and tetraethyl-Pb compounds can be absorbed by the skin. This is because these two compounds can dissolve in oil and fat. Meanwhile, in the air layer, tetraethyl-Pb decomposes rapidly due to sunlight. Tetraethyl-Pb will break down to form triethyl-Pb, diethyl-Pb and monoethyl-Pb. All the decomposition compounds of tetraethyl-Pb are difficult to dissolve in oil but all of these derivative compounds can dissolve well in water. Pb compounds in a dry state can be dispersed in the air, so that they are then inhaled while breathing and some will accumulate in the skin and be absorbed by plant leaves (Palar, 2012).

Lead can enter the environment and the human body from various sources such as gasoline (petrol), recycling or disposal of car batteries, toys, paint, pipes, soil, several types of cosmetics and traditional medicine and various other sources (WHO, 2007). In most developing countries, the main source of contact with lead comes from leaded gasoline. Apart from that, various consumer products as mentioned above and food can also contain lead (Meyer, et al 2003).

3. ANALYZE AND RESULTS.:

Transportation Office Medan City is located at Jl. K.L. Yos Sudarso No. 13 P.Brayan Medan, has the task of regulating road transport traffic to the Provincial and Regency / City Regions. Respondents in this study were officers of the Medan City Transportation Office, the Traffic and Road Transportation section, who served in the Pos Simpang, Sisingamangaraja and Pandu areas, setting the officer's working hours from 07.00 WIB to 18.00 WIB. Dishub officers whose daily duties are assigned have almost the same authority and duties as the police in regulating traffic.

Table 1. Average Age, Working Period, BMI, Physical Activity (PAL), Pb and Systolic, Diastolic Blood Pressure, in Medan City Transportation Agency Respondents

Variabel	n	Min	Max	Mean	SD
Ages	23	26,00	57,00	46,5217	9,40440
Period Of Works	23	5,00	26,00	13,7391	4,08119
IMT	23	18,80	31,00	25,8217	4,79061
Pb	23	3,40	9,00	5,4797	1,53066
PAL	23	1,40	1,80	1,6217	0,15654
Sistolik	23	90,00	130,00	115,8261	9,94372
Diastolik	23	70,00	90,00	79,7826	5,32538

The results of the univariate analysis in table 4.1 show that the minimum value of age is 26 years, while the maximum value of age is 57 year. The mean age of the 23 respondents was 46.5217, with a standard deviation of 9.40440. The minimum value of working period is 5 years and the maximum value is 26 years with a mean of 13.7391 and a standard deviation value of 4.08119.

The result of univariate analysis for the BMI variable, the minimum value was 18.8 kg / m², the maximum value of BMI was 42.6 kg / m².

The average BMI of 23 respondents was 25.8217, with a standard deviation of 4.79061. The results of the analysis on the Pb variable showed that the minimum value of Pb was 3.40 µg / dl and the maximum value of Pb was 9.00 µg / dl. The mean Pb of 23 respondents was 5.4957 with a standard deviation of 1.53066.

The results of the analysis on blood pressure variables showed that the minimum value of systolic blood pressure was 90 mmHg, while the maximum value of systolic blood pressure was 130 mmHg. The systolic mean of the 23 respondents was 115.8261, with a standard deviation of 9.94372. The minimum value of diastolic blood pressure is 70 mmHg, while the maximum value of systolic blood pressure is 90 mmHg. The diastolic mean of the 23 respondents was 79.7826, with a standard deviation of 5.32538. The minimum value of physical activity (PAL) was 1.40, while the maximum value of PAL was 1.80. The mean physical activity (PAL) of 23 respondents was 1.6217, with a standard deviation of 0.15654.

Table 2. Relationship between age, duration of work, BMI, PAL and Pb with systolic blood pressure

	<i>P</i>	<i>r</i>
Systolic Blood Pressure		
Ages	0,630 ^a	0,106 ^a
Period Of Work	0,843 ^a	0,044 ^a
IMT	0,868 ^a	0,037 ^a
Pb	0,675 ^a	0,092 ^a
PAL	0,171 ^a	-0,295 ^a
Diastolic Blood Pressure		
Ages	0,709 ^b	-0,082 ^b
Period Of Works	0,876 ^b	0,034 ^b
IMT	0,768 ^b	0,065 ^b
Pb	0,899 ^b	0,028 ^b
PAL	0,597 ^b	0,116 ^b

3.1. Age

The prevalence of hypertension in people aged over 40 years in Indonesia is 37.32%, and the prevalence of hypertension in people aged over 18 years in Indonesia is 32.3%, at the age of 30 the prevalence of hypertension in 1996 was 32.9% an increase of 40, 5% in 2004 (Pikir S. Budi. 2015).

From the results of the analysis, the mean age of the respondents was 46.5217, the bivariate results in table 4.3 showed that age and systolic blood pressure ($p = 0.630$), age and diastolic blood pressure ($p = 0.709$) had no significant relationship.

The results were similar to the study by Angela at all (2016) in Italy, there was no significant relationship between age ($p = 0.51$). Systolic blood pressure increases progressively with age and elderly people with hypertension

are at greater risk for cardiovascular disease. The prevalence of hypertension increases with age. (Thought S Budi. 2015). In the Framingham heart study, in normotensive people at the age of 55 or 65 years, 90% of them will develop hypertension at the age of 75 or 85 years (Vasan, 2002)

3.2.Length of working

The results obtained 23 respondents who worked as a department of transportation in the traffic and road transportation, the average is 13 years. Respondents with the lowest length of work were 5 years. The relationship between length of work and blood pressure based on the results of the analysis did not have a significant relationship between tenure and systolic blood pressure ($p = 0.843 > 0.05$) as well as no significant relationship between length of work and diastolic blood pressure ($p = 0.876 > 0, 05$).

In Setyabudi's (2014) study, there was no relationship between work tenure and systolic and diastolic blood pressure ($p = 0.130$), as well as Malaka Tan's (2011) study which did not have a relationship between work tenure and systolic and diastolic blood pressure ($p = -0.137$)

Working period does not have a significant relationship with systolic and diastolic blood pressure because the workload of the officers is not heavy where the officers only perform tasks during high activity hours, namely 2 hours in the morning and 2 hours in the afternoon, outside these hours the officers are standby at the post.

The results showed 23 dishub officers had a mean BMI of 25.8217. Bivariate analysis showed that the relationship between BMI and systolic blood pressure did not have a strong relationship ($p = 0.868$), the results of the analysis of the relationship between BMI and diastolic blood pressure had no significant relationship ($p = 0.768$).

The results of this analysis are in line with the research with Setyabudi Sus (2014) where the results showed that there was no significant relationship between BMI and blood pressure ($p = 0.491$), as well as the Fenga (2006) study did not have a significant relationship ($p = 0.68$). In contrast to Okky's (2016) research, which has a significant relationship between BMI and blood pressure ($p = 0.000$). Abiola's research (2012) shows that there is a significant relationship between obesity and blood pressure ($p = 0.000$) and there is a female gender who is obese than male.

3.3. PAL

The average physical activity for 23 respondents was 1.6217. The results of the analysis showed that there was no significant relationship between physical activity and blood pressure, it can be seen in table 4.3 that there is no significant relationship between physical activity and systolic blood pressure ($r = -0.295$, $p = 0.171$, $p > 0.05$) and no. there is a significant relationship between physical activity and diastolic blood pressure ($r = 0.597$, $p = 0.116$, $p > 0.05$).

Physical activity has a variable relationship with blood pressure, especially hypertension. In the Conary Artery Risk Development in Young Adults Study (CARDIA) with monitoring over 15 years, it was found that physical activity reduced the risk of hypertension by 17%. Likewise, in the Artherosclerosis Risk in Communities (ARIC) study, high physical activity, especially cycling and walking, reduced 34% risk of developing hypertension in 6 years compared to inactivity, physical activity in the prevention and treatment of hypertension was known, but regular physical activity was difficult and sometimes- sometimes impossible to do in real life. (Thought S Budi. 2015). 30 minutes of physical activity can prevent and control blood pressure (U.S. Department of Health and Human Service. 2006)

3.4. Pb

The results of the analysis of the relationship between Pb and blood pressure, namely when Pb is higher, blood pressure also tends to be high, but based on statistical results it shows that there is no significant relationship between Pb and systolic blood pressure $p = 0.675$ and diastolic where the value of $p = 0.899 > 0, 05$, this figure also shows that the Pb level in the blood of dishub officers is below the threshold set by the Center for Disease Control and Prevention (CDC). The amount of Pb in the blood of dishub officers is below the normal threshold because the officers do not make road arrangements during the set working hours, which is 8 hours, but the officers control the average traffic for 2 hours in the morning, 2 hours in the afternoon, the rest is standby at the post its position adjacent to the protocol road.

Lead exposure is one of the many factors that can lead to the onset and development of hypertension. Although exposure to low to moderate levels of lead ($BLL < 30 \mu\text{g} / \text{dL}$) only shows a low level of association with hypertension, higher exposure (especially seen in occupational regulation) increases the risk of hypertensive heart disease and cerebrovascular disease as a latent effect (National Toxicology Program, 2012; CSEM, 2017)

It shows that there is no significant relationship between the two variables with p value = 0.693 and $r = 0.075$ for systolic blood pressure, p value = 0.327 and $r = 0.185$ for diastolic blood pressure. The results of study stated that the lead concentration in relation to the incidence of hypertension did not show significant results.

the results of the bivariate test analysis using the Mann-Whitney test data on smoking habits showed that there was no significant relationship with systolic blood pressure where the value of $p = 0.077 > 0.05$, as well as the bivariate test using the T-dependent test showed no significant relationship between smoking habit with diastolic blood pressure where the value of $p = 0.237 > 0.05$.

3.5. Smoking habit

This study is in line with Fenga (2006), the results showed that there was no significant relationship between smoking and blood pressure ($p = 0.82$), also in Okky's (2016) study there was no relationship ($p = 0.532$). This result is also in line with Nashetal's (2003) research.

Different results from research by Angela et al (2016); Skerfving and Bergdahl (2015), the results showed that there was a significant relationship between smoking habits and blood pressure ($p = 0.001$), this was due to the stiffness of blood vessels in smokers.

Active smokers usually have different blood pressures, but several studies in various countries show that men who smoke have systolic blood pressure inversely correlated with smoking, whereas systolic blood pressure is reduced by 1.3 mmHg in 1.1% in light smokers, 3.8 mmHg in 3.1% moderate smokers, and 4.6 mmHg in 3.7% heavy smokers compared to nonsmokers (Aurelio, 2015).

3.6. Habit of Drinking Alcohol

The results of bivariate test analysis using the Mann-Whitney test data on drinking habits, there was no significant relationship with systolic blood pressure where the value of $p = 0.148 > 0.05$, as well as the bivariate test using the T-dependent test had no significant relationship between drinking habits. alcohol with diastolic blood pressure where p value = $0.955 > 0.05$.

This result is in line with the research of Setyabudi Sus (2014) that there is no relationship between alcohol consumption and blood pressure ($p = 0.504$), in contrast to the Matthew study (2010) there is a significant relationship between alcohol consumption and systolic blood pressure ($p=0.001$) and there is significant relationship between alcohol consumption and diastolic blood pressure ($p=0.001$).

4. CONCLUSION.:

Based on the results and discussion in this study, it can be concluded that:

- The average age of workers was 46.5217 years, the average working period was 13.7391 years, the mean body mass index was 25.8217 kg / m², the mean physical activity was 1.6217, the mean Pb in blood was 5.4739 µg / dl, the mean systolic blood pressure was 115.8261 mmHg and mean diastolic blood pressure was 79.7826 mmHg.
- The distribution of the frequency of workers who smoke is 13 people (56.5%). The habit of drinking alcohol is 3 people (13%).
- There is no significant relationship between lead in blood and blood pressure in Medan City transportation officers in 2017. Also on age, length of work, BMI, PAL, smoking and drinking alcohol.

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