

Factors Related To the Lead Levels (Pb) On Blood In The Gas Station Operator Tamalanrea Makassar

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Abstract :-Gas Stationare business activities in the field of fuel distribution was operate 24 hours a. Gas station are located at the side of highway, so the operator of gas station could be exposed by the fume from vehicles which in a queue of refueling process. The aims of this research was analyze related factors of lead (Pb) levels in the blood on gas station's operator in Tamalanrea Makassar. This research used analytical survey methode and cross sectional design. There were 51 gas station's operator as a sample. Data was analysis by pearson product moment correlation and linear regression test by the result that there are relations between characteristic respondents, working time and the amount of fuel sold. The age, working period, calcium consumption habit, sistolik blood pressure and diastolic blood pressure are the most associated factors to lead levels in the blood. Lead exposure of workers could be controlled by the company fuel distribution, the supervisor of gas station and the workers. Following the procedures of service operator, using self protective equipments (respirator), doing on health's monitoring and checking periodic, improving the understanding of reducing smoking habit and have a good personal hygiene to the workers could reduce this problem.

Keywords:- lead, gas station's operator, characteristic operated, working time

I. INTRODUCTION

Exhausting emissions from motor vehicles using leaded fuel is one of the greatest air pollution in Indonesia. Gasoline Premium contains lead compounds in the form of tetra ethyl lead (TEL) as much as 0.3 gr/liter and premix as 0.45 gr/liter. Alkyl-Pb contained the fuel is volatile and soluble in fat so easily absorbed by humans through inhalation, ingestion or dermal (Palar, 2012).

Gas station's operator is a group of workers at risk that exposure directly with lead from gasoline and motor vehicle emissions. The measurement results of the air quality in Makassar area, exactly on BPLH Urip Sumohardjo and Perintis Kemerdekaan from 2007-2011 year reported that lead levels in the air of 2.75 $\mu\text{g}/\text{m}^3$.

Distribution of fuel supply to the depot in South Sulawesi are from Balikpapan and Plaju oil refinery that still contain lead levels of 0.30 gr/L. Therefore, the levels of lead in gasoline for the Makassar area was still considered higher than the standards prescribed by 0.013 gr/l according to Kep.Dirjen.Migas No. 3674 K/24/DJM/2006. Perintis Kemerdekaan street was located in Tamalanrea is a dense road traffic around because there are campuses and educational facilities such as schools, office buildings, entertainment facilities and hospitals and this street connecting the Makassar city with another city. This area is the crowded road conditions during weekdays and also on weekends.

II. MATERIALS AND METHODS

This study used a quantitative research survey that is analytical cross-sectional study design to analyze the factors that associated with high levels of lead (Pb) in blood at the gas station's operator in Tamalanrea Makassar. This study was conducted on June-July 2014 by the population of 60 people gas station's operator, using simple random sampling by sample size of 51 people.

The independent variables in this research are characteristics respondent (level of knowledge about lead, age, sex, BMI, respiratory rate, hemoglobin levels, breakfast habits, vitamin C and calcium intake habit, smoking habits and personal hygiene), shift work, working period, the duration of charging fuel into the tank consumers, the number of vehicles charging and the amount of fuel sold.

Data was collecting use interview techniques, questionnaires, observations with the aid of a checklist, and documentation. Analysis bivariate data using the Spearman correlation test and Pearson correlation, Pearson Correlation Test using for ratio data and normal distribution, if data have not normal distribution so use spearman's test. The variables with nominal scale was analyze by contingency coefficient test. The multivariate analyze using simple linear regression.

III. RESULTS

3.1 Bivariate Analysis

Table 1.1 Bivariate analysis between independent variables With Blood Lead Levels In Operators of gas stations in the Tamalanrea Makassar 2014

Independent Variables	Dependent Variables :		Conclusion
	Level of Lead (PB) in Blood		
	Probability Value (P-Value)	Koefisien Value Correlation (r)	
Characteristics of Respondent			
Level of Knowledge about the lead	0.008	0.397	Significant
Age	0.000	0.606	Significant
Gender	0.671	0.124	Un significant
Hb	0.027	0.310	Signifikan
IMT	0.118	0.222	Un significant
<i>Respiratory Rate</i>	0.884	0.21	Un significant
Breakfast habits	0.000	0.475	Signifikan
Vit C.Consumption	0.010	0.390	Signifikan
Calcium Consumption	0.000	0.476	Signifikan
Smoking Habits	0.000	0.490	Signifikan
<i>Personal Hyg.</i>	0.007	0.407	Signifikan
Health Problem			
Systolic Blood Pressure	0.000	0.512	Signifikan
Diastolic Blood Pressure	0.028	0.308	Signifikan
Cough Complaints	0.040	0.335	Signifikan
Shortness of Breath	0.275	0.220	Un significant
History of Asthma	0.037	0.328	Signifikan
History of Hypertension	0.641	0.146	Un significant
Job Characteristic			
<i>Shift Work</i>	0.164	-0.198	Un significant
Work Period	0.000	0.771	Signifikan
Duration of fuel filling	0.005	0.386	Signifikan
The number of Vehicles Serviced	0.023	0.318	Signifikan
The amount of fuel sold	0.003	0.407	Signifikan

Table 1.1 shows the relationship between the characteristics includes knowledge about lead levels, age, sex, Hb, BMI, respiratory rate (RR), breakfast habits, consumption of vitamin C, calcium consumption habits, smoking habits and personal hygiene with blood lead levels.

There were 8 characteristics component have a relationship with blood lead levels. They were: the level of knowledge, age, hemoglobin, breakfast habits, vitamin C consumption habits, calcium intake habits, smoking habits and personal hygiene.

There is relationship between health problems and disorders with high levels of blood lead at the operator of gas station. Systolic blood pressure complaints, diastolic blood pressure, cough and history of asthma was significant influence the blood lead levels. It found that most operators have lead levels over 25 µg/dl. The journal of Lead Poisoning Overview (2010) states explained that health problems can be caused by blood lead levels value of 10-30 µg/dl, this health problems such as systolic blood pressure disorders, anemia, fatigue and central nervous system disorders.

Most of systolic blood pressure in this research was 120 mmHg and diastolic blood pressure of 80 mmHg, suggesting that the higher levels of lead which accumulates in the blood will increasingly higher systolic and diastolic blood pressure values. The crosstabulation shows that most of the workers who complained of cough is a smokers. The conclusion is higher accumulation of lead levels in the blood will impact to the health problems such as cough.

Operator of gas station that have smoking habit, spending more than 15 cigarette/day, will increase the exposure of lead in the body, because in addition to already exposed by motor vehicle exhausted emissions, exposure to lead vapor and added to cigarettes, therefore cigarette smoke contains both lead.

There is a significant relationship between the period of employment, duration charging, the number of vehicles serviced and the amount of fuel sold with lead levels in the blood.

3.2 Multivariate analysis

Table 1.2 The Factors Associated with Levels of Lead (Pb) Blood On Operators of gas stations in Tamalanrea Makassar 2014

Independent Variable	B	t	p-value	Conclusion
Level of Knowledge about the lead	0.05	-0.07	0.461	Un significant
Age	-0.25	-2.55	0.014	Signifikan
Gender	-0.02	-0.32	0.745	Un significant
Hb	-0.11	-1.70	0.096	Un significant
IMT	-0.03	-0.54	0.589	Un significant
Respiratory Rate	-0.01	-0.22	-0.823	Un significant
Breakfast Habits	0.01	0.139	0.890	Un significant
Vitamin C Consumption Habits	-0.12	-1.34	0.187	Un significant
Calcium Consumption Habits	-0.44	-0.65	0.000	Signifikan
Smooking Habits	0.11	1.397	0.170	Un significant
Personal hygiene	-0.05	-0.78	0.436	Un significant
Shift Work	-0.77	-0.26	0.214	Un significant
Work Period	0.680	6.620	0.000	Signifikan
Duration of Fuel Filling	0.07	1.098	0.278	Un significant
The Number of Vehicles Serviced	0.06	0.991	0.327	Un significant
The Amount of Fuel Sold	0.08	1.228	0.226	Un significant
Systolic Blood Pressure	0.49	4.746	0.000	Signifikan
Diastolic Blood Pressure	-0.324	-3.31	0.002	Signifikan
Independent Variable	B	t	p-value	Conclusion
Complaints Cough	0.06	0.974	0.335	Un significant
Shortness of Breath	-0.02	-0.36	0.719	Un significant
History of Asthma	0.02	0.39	0.699	Un significant
History of Hipertensi	0.04	-0.73	0.467	Un significant

Table 1.2 Showed that working period, hemoglobin levels, consumption of calcium, and blood pressure were associate with levels of Lead (Pb) on gas station's operator blood in Tamalanrea Makassar. Variable with ratio

scale of data was analyzed by simple linear regression, the variables with nominal scale was analyzed by dummy regression test.

Table 1.3 Final Results of Simple Linear Regression Analysis

Independent Variable	B	B	t	R	R square	F	p-value
Constanta	-8.399						
Age	-0.209	-0.202	-2.103	0.91	0.83	44.917	0.041
Work Period	0.117	0.599	6.451				0.000
Calcium Consumption	-7.206	-0.456	-6.595				0.000
Systolic Blood Pressure	0.491	0.478	4.495				0.000
Diastolic Blood Pressure	-0.318	-0.312	-3.136				0.003

Table 1.3 showed that there were 5 variables influence blood lead levels, they were age, work periode, calcium consumption, systolic blood pressure and diastolic blood pressure. Value of the correlation coefficient (R-square) test for this regression is 0.833. It is means that variables age, work periode, the consumption of calcium and pressure both systolic and diastolic blood is able to predict the value of the blood lead levels of 83.3% and 16.7% influenced by other factors.

F table value of 44.917 obtained with value probability 0.000, it can be concluded that the form of linear equations $Y = a + bX + cX$ is appropriate and can be used. Furthermore, from the t-test can also see the significance of the variable values < 0.05 . So there are significant effect of age, work period, calcium consumption and blood pressure both systolic and diastolic. The following regression model was:

$$Y = -8.339 - 0.209 (\text{age}) + 0.117 (\text{work period}) - 7.206 (\text{calcium consumption}) + 0.491 (\text{systolic blood pressure}) - 0.318 (\text{diastolic blood pressure})$$

From the equation above can be concluded that for every additional 1 unit of the independent variables of age, work period, systolic blood pressure and diastolic blood pressure it will increase the value of Levels of Lead (Pb) In Blood.

IV. DISCUSSION

4.1 Relationship between Respondents Characteristics with Levels of Lead (Pb) In Blood At the gas station operator in Tamalanrea Makassar.

The blood lead levels of 24 gas station operators have a lead content of more than 25 µg/dl, 20 people have lead levels of 10-25 µg/dl and 7 people have lead levels < 10 mg/dl. The lead content average at 21.4 µg/dl, therefore the normal blood lead levels is < 10 mg / dl, so several respondent has experienced lead poisoning in blood because the measure has exceeded the upper limit of normal.

There were 7 components of characteristics variable had relationship with blood lead levels. They were the level of knowledge, age, hemoglobin level, breakfast habits, consumption of vitamin C habits, consumption of calcium habits, smoking habits and personal hygiene. According to Jain et al in Zarianis (2006) that the higher levels of Pb in the blood will give effect for lower hemoglobin concentration in the blood because Pb inhibits ferokhelatase enzyme activity which functioning as Fe transportation into protoporfirin so the only free protophorfirin (without Fe) accumulated in erythrocytes.

Several factors influence the lead (Pb) absorbed were workers personal higiene, working in a stomach vacant condition or fasting condition because absorption of lead (Pb) from intestine will larger reach of 15-12% (Siswanto, 1991). Calcium deficiency may increase absorption and retention of lead (Ettinger, et al 2006). The blood lead (Pb) levels are influenced too by consumption habits of nutritious foods, for example eating food which contains high protein, vitamin C, iron, and calcium.

Smoking is one of the factors to high levels of lead blood given, cigarettes is one of the components of lead. Smoking and inhaling the smoke are exposed to lead (Pb) at higher levels than not exposed to smoke. However, The passive smokers will exposure to cigarette smoke can also get lead (Pb) exposure approximately 0,017-0.98 µg.

Most of operators have not a good personal hygiene because they have a habit not washing hands before eating. Absorption of lead through the digestive tractus, usually occurs by ingested the lead for along time with smoking, eating and drinking using lead (Pb) contaminated hand, nor when eating food that contaminate the dust in the streets (Darmono, 2006).

4.2 The relationship between Health Problems with Lead (Pb) Levels in Blood

Several gas station Operator's have several health problem, most of operator say that they get cough and blown

disorder by the rate of blood pressure average reach 117.45 mmHg (systolic) and 78.04 mmHg (diastolic). There was relationship between impaired health with levels of lead (Pb) in blood. It found that both blood pressure systolic and diastolic, cough has a relationship with blood lead levels. On hypertension case endothelium have participate to converse angiotensin I become angiotensin II. Further endothelium plays a role controlling vasculer tone and hemostatic process by hormones and neurogen, endothelium is also release compounds causing vasoconstriction, including endotelin which considered in hypertension case (Padmawinata, 2001).

4.3 The Relationship between Job Characteristics with Levels of Lead (Pb) In Blood

The average of operator's work Period more than 4 years (48 months). This suggests that exposure of lead (Pb) on respondents gone on long enough so the accumulation of lead in the body will be higher. This condition will give effect for a slow ekresi of lead (Pb) so will accumulates in the body, both on-exposure occupational and non-occupational. Lead (Pb) has time half-life in blood of approximately 25 days, in soft tissue at 40 days, while in bone 25 years.

According to William (1992) that was known two kinds of shifts that shift permanent and shift rotasi. There is no relationship between a work shift rotation or work schedule for operators. So shift work can not be a decisive factor on levels of lead. The results of this study indicate that there were relationship between the duration of fuel filling, the number of vehicles and the amount of gasoline that was sold with lead (Pb) levels in blood. The duration of fuel filling was the time required to fill where Lead (Pb) entering the body through breathing that comes from steam gasoline during the filling process and exhaust from queuing fill vehicles. The longer duration of fuel filling of consumers serving so more and more vapor and fumes of lead (Pb) inhalation so lead (Pb) will accumulates continuously. The amount of gasoline sold was closely related to the long exposure and the amount of vehicle serviced. They related to levels of lead in blood.

4.4 Multivariate Analysis of Factors Associated with Levels of Lead (Pb) in Blood.

Variable age, work periode, hemoglobin level, systolic and diastolic blood pressure were significant associate with levels of Lead (Pb) in blood. Age also affects the levels of lead (Pb) in the human body. The older age of a person, will get higher concentration of lead (Pb) that accumulated in body tissues because activity of biotransformase enzyme was reduce by increasing of age and endurance of certain organs reduce to lead (Pb) effects (Palar, 2012).

Work periode was associate with the levels of lead (Pb) in operator's blood. Workers which longer work periode will have higher tendency to get exposure by lead (Pb) than the workers with shorter work periode. This result as same as with Fiqi Nurbaya Research (2011).

Dietary factors have been known affecting the dynamics of lead, especially because there was lead (Pb) absorption in the gastrointestinal tractus. Lead (Pb) compete with calcium in the calcium binding sites, further be able to subsequently change protein function and calcium homeostasis (Pearl, 1983).

Several studies on the effects of lead to increased pressure blood, of which Picciotto and Croft (1993), which conclude that an increasing 12-32 $\mu\text{g}/\text{dl}$ was associated with an increasing of approximately 4 mmHg diastolic or 8 mmHg systolic. The relationship between hypertension and elevated levels of black lead (Pb) 30-40 $\mu\text{g}/\text{dl}$ have also been reported. Similarly, the levels of lead in blood was relatively low (5-35 mg/dl) have effects on blood pressure (Nomiya et al., 2002).

V. CONCLUSION

Based on the results and conclusions of the discussion can be obtained as follows:

5.1 Most of the gas station operators have levels of lead (Pb) in the blood exceeding limits ATSDR determined by the more than 25 $\mu\text{g}/\text{dl}$.

5.2 Increasing levels of lead (Pb) in the blood can be influenced by the level of less knowledge, age, hemoglobin levels, eating before work (breakfast) habits, lacking of taking vitamin C and calcium habits, smoking habits and bad personal hygiene.

5.3 Operator's health problem that often feel are cough, systolic blood pressure and diastolic blood pressure increased.

5.4 Increasing levels of Lead Pb) in the blood were not affected by shift work, because the gas station using shift rotation.

5.5 The longer the work period of employment will affect the elevated levels of lead (Pb) in the blood because of the nature of lead (Pb) which is accumulated in the body easily.

5.6 Extending the duration time of gasoline a day, can be affect the increasing of lead (Pb) in the blood.

5.7 The more fuel was sold, will affect levels of lead (Pb) in the blood because the supply of fuel in Makassar region still contains 0.30 gr/l of lead (Pb).

5.8 More and more vehicles serviced, will affect the increasing of lead (Pb) in the blood because the operators get lead (Pb) exposure from vehicle exhaust emissions.

VI. SUGGESTION

There was suggestions that can recommended to the company, readers, and respondents on this study as follows:

- 6.1 PT.Pertamina (Persero) should revisit the operator retail section service procedures to consumers with slogan 3S and disseminate the use of personal protective equipment such as respirators for gas station operators.
- 6.2 Supervisor of gas station should check the condition of workers which have been exposure by lead (Pb) that exceed the threshold for get the treatment.
- 6.3 Supervisor of the filling station should give early examination for the new workers and do the periodic checks to monitor health of workers. The periodic checks are necessary for lead levels in the blood at least once in year.
- 6.4 Supervisor of gas station should provide a place of rest, nutrition repair for the workers by providing food and drink that is feasible, nutritious and safe.
- 6.5 The operator needs to raise awareness to stop smoking habits, increasing personal hygiene such as washing hands before eating, after taking a bath, and replace work clothes before going home.

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