

Analysis of Lead (Pb) Levels in the Blood with the Incidence of Hypertension in Petrol Station Operators

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ABSTRACT

Air quality is influenced by transportation, around 70% of air pollution comes from motorized vehicles. These transportation emissions produce dangerous materials in the heavy metal group lead (Pb). Accumulative lead can be absorbed by the body through the respiratory tract, dermal contact and also the digestive tract. Increased levels of Pb in the blood can cause hypertension. Hypertension raises the risk of stroke, kidney damage and heart failure. This has an impact on gas station operators who are vulnerable to lead exposure from the vehicle refueling process. Due to lack of operator awareness in wearing PPE. This study aims to identify the effect of Pb levels in the blood on hypertension in gas station operators. This type of research is analytical observational with a cross sectional approach. The sample in this study were gas station operators who had worked for more than 2 years whose blood lead levels and blood pressure were measured in August 2023. The results of this study showed an average lead level of 2.28 mg/dL and blood pressure levels. normal is 71.4% and abnormal is 28.6%, so it can be concluded that there is no significant relationship between lead levels and blood pressure values in gas station operators.

INTRODUCTION

Air quality is currently influenced by transportation which has an important role in changing air quality, around 70% of air pollution is currently caused by motor vehicle emissions ⁽¹⁾. This transportation emission produces harmful air pollutants with the type of lead heavy metal (Pb), which can be caused by motor vehicle gas emissions and gasoline vapor during refueling. Cumulative Pb can be absorbed by the body through the respiratory tract, dermal contact, and also the digestive tract. An important route of exposure to Pb entering a person's body through the respiratory tract can cause health problems that are harmful to health for a long period of time ⁽²⁾.

Pb levels accumulated in the body can cause a disease without symptoms and are chronic. This exposure can result in disorders in several body systems, namely the blood system, digestive system, and reproductive system. Usually the effect of increasing Pb levels in the blood can increase the risk of hypertension, reproductive risk ⁽²⁾.

The presence of increased pressure on the diarterial blood system is known as hypertension or high blood pressure. Hypertension can pose a risk of stroke, kidney damage and heart failure. Hypertension can be caused by lifestyle such as lack of exercise, smoking habits, alcohol consumption habits and caused by several other factors such as individual factors such as age, gender and race, genetic factors such as disease history, and environmental factors where one of them is the influence of heavy metals caused by motor vehicle fumes and gas vapors when refueling ⁽³⁾.

Public Fuel Filling Station (SPBU) is a company engaged in refueling that has operators who are at risk of being directly exposed to lead from incoming motor vehicle exhaust emissions, as well as vapors from fuel in the petrol station ⁽⁴⁾. This happens because in general, petrol station operators work without wearing adequate Personal Protective Equipment (PPE) such as gloves, masks, and also *Safety Boots*. There is a relationship between Pb levels in the blood and the incidence of hypertension in petrol station operators, this is shown that if the amount of Pb in the blood is high, there will be a risk of suffering from increased blood pressure in the arteries when compared to petrol station operators who have a low amount of Pb ⁽⁵⁾.

Pb levels in the body are influenced by one of them, namely food and drinks consumed by a person who are sold on the roadside considering that the food and drinks sold have a risk of health problems such as contamination by toxic microbes, the use of food additives that do not have a permit or Pb metal contamination. hours, and longer hours of work than normal, and smoking habit ⁽⁴⁾.

The detection of Pb can be seen in the blood because as much as 90% of the Pb metal absorbed by the body binds to erythrocyte cells which will cause the red blood cells to be destroyed prematurely for regeneration and can cause disturbances in several systems in the body, such as decreased blood hemoglobin levels, blood pressure and reproductive system disorders. Then it can give symptoms such as abdominal cramps, headaches, loss of appetite, changes in blood pressure, fatigue easily ⁽⁶⁾.

There is a correlation between Pb levels in the body and increased hypertension, which is caused by length of working time, service periods, family members who have a history of hypertension, sports activities and also smoking. Officers are at high risk of exposure to Pb due to the presence of pollutants from the large number of vehicles and lack of awareness of the use of PPE ⁽⁷⁾.

Accumulated levels of Pb in the blood in adults have acute and chronic effects on blood pressure. This is shown by the exposure of petrol station operators at work to the risk of poisoning and resulting in health disturbances. Based on the background description above, the researcher is interested in conducting research with the title "Analysis of Lead (Pb) Levels in Blood with the Incidence of Hypertension in Petrol Station Operators"⁽²⁾.

RESEARCH METHOD

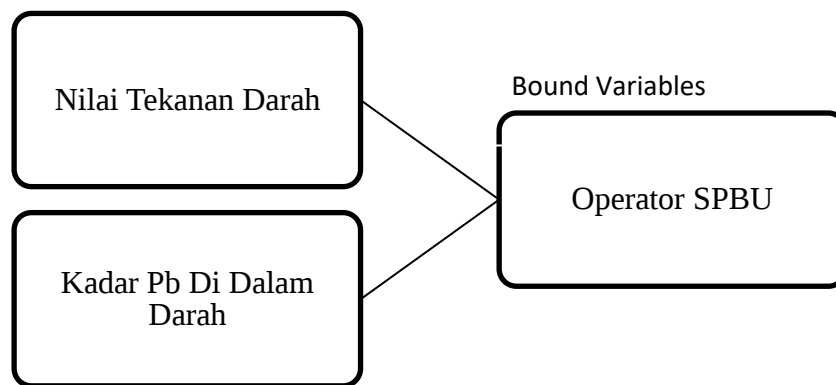


Figure 3.1 Research Concept Framework and Variables

Research Variables

a. Independent/Dependent Variables

In this study, the variables were Pb levels, and blood pressure values at petrol station operators.

b. Bound/Independent Variables

In this study, the independent variable is the petrol station operator.

Operational Definition

An operational definition is a description of the limitations of the variable being studied or about what is measured by the variable in question. Meanwhile, the operational definition of research variables is an explanation of each variable used in the research. The operational design in this study can be seen in table 3.1

Table 3.1 Operational Definitions

Yes	Variable Type	Operational Definition	Measurement	Scale
1	Petrol Station Operators	Workers in charge of filling gasoline on motor vehicles	Gender : Male and Female	Nominal

2	Lead Rate	Heavy metals measured in the blood of petrol station operators In Pekayon the SSA method is used with $\mu\text{g/L}$ units	Nominal : 10-25 $\mu\text{g/L}$ Hazardous : >25 $\mu\text{g/L}$	Ratio
3	Hypertension	The condition of a person's increased blood pressure	Nominal 120/80 mmHg	Ratio

Place and Time of Research

The sampling place is at the Pertamina petrol station located on Jl. Raya Bogor, Pekayon, Pasar Rebo District, East Jakarta. And the blood lead sample examination site was carried out in August 2023 at the Rawasari Health Laboratory, Cempaka Putih, Central Jakarta.

Data Collection Techniques

The data sample collection technique in this study used the venous blood of petrol station operators which was put into 1 tube of 3 ml EDTA anticoagulant using an Atomic Absorption Spectrophotometer, and by measuring blood pressure values using an Omron brand sphygmomanometer.

Data Processing Techniques

The data obtained from this study will be presented using *Microsoft Excel Tables*. Then it is changed to a table shape so that it is easier to read the results of the lead and blood pressure examination. Furthermore, the results of the two tests were compared with their normal values to see whether or not there was an effect of lead levels in the blood on the blood pressure in the sample.

RESEARCH FINDINGS

The implementation of the sampling location was carried out at petrol station 31.137.01 which is located on Jl. Raya Bogor, Blok Swadaya No.14 RT.002 RW.003 Pekayon, Kec. The following can be seen the results of the blood lead level examination in table 4.1:

Blood Lead Levels of Petrol Station Operators

Table 4.1 Results of Blood Lead Level Examination of Petrol Station Operators

Code Sample	Concentration ($\mu\text{g/L}$)	Tenure (Years)	Age (Years)	Normal Value ($\mu\text{g/L}$)
1	2,28	2	22	10 - 25
2	2,28	6	24	10 - 25

3	2,28	13	44	10 - 25
4	2,28	3	22	10 - 25
5	2,28	7	25	10 - 25
6	2,28	10	41	10 - 25
7	2,28	5	36	10 - 25

In Table 4.1, the results of the examination of lead levels in petrol station operators as many as 7 people were obtained that the results of petrol station operators working for a period of 2 years were 2.28 $\mu\text{g/L}$ and for a period of 13 years 2.28 $\mu\text{g/L}$. Based on the Decree of the Minister of Health of the Republic of Indonesia Number 1406/MENKES/IX/2002, the normal value of lead metal in the blood is set to be 10-25 $\mu\text{g/L}$.

Blood Pressure Values in Petrol Station Operators

Table 4.2 Blood Pressure Values in Petrol Station Operators

Hypertension	Frequency (N)	Percentage (%)
No	5	71,4
Yes	2	28,6
Quantity	7	100

Based on Table 4.2, the results of blood pressure measurement at petrol station operators were obtained 2 samples that had high blood pressure values, namely in samples 3 and 6, where samples 3 and 6 were a man who had been working as a petrol station operator for 13 and 10 years who had a smoking habit.

DISCUSSION

Blood lead levels in petrol station operators are used to measure exposure to heavy metals from motor vehicle exhaust gases and fuel vapors. Petrol station operators who have a long working period can be exposed through fuel vapors and also motor vehicle fumes, this can cause health problems where heavy metals can accumulate in the body as toxins and over a long period of time ⁽³⁵⁾.

In Table 4.1, the results of the blood lead level examination in petrol station operators who have worked for 2 years are at the normal threshold of 2.28 and at petrol station operators who have worked for 13 years are still within the normal limit of 2.28. There is no difference in results between petrol station operators who have been working for a long time and petrol station operators who have not worked for a long time, this happens because petrol station operators use complete and adequate PPE and have good personal hygiene such as changing clothes after work so that Pb particles do not absorb into the body through the skin, routinely washing hands either at meals or at the end of their activities ⁽³⁶⁾.

Lead toxicity can have an impact on the growth rate, namely the longer lead exposure lasts and the higher the concentration of lead in the body, it will decrease the growth rate which will affect enzyme activity through the formation of lead compounds with sulfhydryl (S-H) groups. This group can be easily blocked by its working system because it can bind to ions in lead that enter the body, this can cause a reduction in the work of enzymes and even not work at all⁽³⁷⁾. Lead exposure can affect the cardiovascular system, a person who gets lead exposure comes from the workplace. Acute lead poisoning can affect blood pressure values and in chronic poisoning can lead to hypertension ⁽³⁸⁾. The length of work and the relationship between lead levels in the blood and the incidence of hypertension showed no relationship, but it can be seen that people who are exposed to high concentrations of lead over a long period of time may have a higher risk of developing hypertension compared to someone who is exposed to low concentrations of lead pollutants. Lead may play a role in the pathophysiology of hypertension, biochemically lead may exert effects on calcium metabolism on muscle contraction of vascular blood vessels and the renin-angiotensin system ⁽³⁶⁾.

Excessive accumulation of lead in the blood will have an impact on health, especially on the cardiovascular system. Frequent impacts on chronic exposure to hypertension and heart disease. In the circulatory system, lead binds strongly

to several chemical compounds including amino acids, hemoglobin, enzymes so that the metabolic system in the body can be disrupted, as well as other disorders such as blood synthesis, hypertension and also damage to brain tissue ⁽³⁹⁾.

A very important factor in the circulatory system is blood pressure, where homeostasis is greatly influenced by the increase and decrease in blood pressure used to encourage blood flow in the arteries, arterioles, capillaries, and also in the venous system, and can form a steady flow of blood. There are two types of blood pressure disorders, namely hypertension and hypotension ⁽⁴⁰⁾.

Based on Table 4.2, the measurement of blood pressure values that exceeded the normal threshold of 28.6% was obtained, namely in sample codes 3 and 6 which had blood pressure values of 125/80 mmHg and 150/104 mmHg. This blood pressure value is influenced by smoking factors, age, and family history. Hypertension is an increase in blood pressure that gives persistent symptoms to certain organs such as the brain for stroke, heart blood vessels for coronary heart disease. Hypertension control can be done by changing a person's lifestyle and administering antihypertensive drugs with therapy ⁽⁴¹⁾.

Based on Table 4.1 and Table 4.2, it was found that there was no significant relationship between lead levels in the blood and the incidence of hypertension in petrol station operators, this is in line with the research of Ayu Rofiah and Maulida Fitri in 2021. Hypertension is a condition of pressure in the blood vessels that is chronically increased. This condition occurs because the heart works harder to pump blood to meet the body's oxygen and nutrient needs, and if left unchecked, it can interfere with the activity of other organs such as the heart and kidneys ⁽⁴²⁾.

If the pressure in the blood increases, it has an effect on the blood vessels, namely the blood vessels become inelastic, thicken so that it is easy for blockages to occur. These thickened vessels will reduce the supply of blood flow to important parts of the body, namely the heart, brain and kidneys ⁽⁴³⁾. Exposure to lead in the body can be a cause for increased processes *Reactive Oxygen Species (ROS)*, so that stress-triggering compounds that cause inflammation and block the work of Nitric Monoxide which functions in the dilation of blood vessels so that it can provide a stimulating effect for an increase in blood vessels. It is hoped that the public will carry out blood pressure checks early as a form of preventive efforts in cases of hypertension ⁽⁴⁴⁾.

The relationship between obesity and the incidence of hypertension showed that those who had an overweight status (28.57%) were less than those who were normal weight or not obese (71.42%). This shows that there is a relationship between obesity and the incidence of hypertension. Obesity is related to the incidence of hypertension due to irregular diets and lack of physical activity. Being overweight will increase the heart rate and insulin levels in the blood. The heavier the body mass, the more blood is needed to supply oxygen and food to the body's tissues. This means that the volume of blood circulating through the blood vessels becomes increased which puts more pressure on the artery walls.

The relationship between family history and hypertension showed that respondents who had a history of hypertension (14.28%) were less than

respondents who had no history of hypertension (85.71%). In this study, family history was not related to the incidence of hypertension, because fewer respondents had a history of hypertension than their families. With a family history such as father, mother, grandfather, grandmother, siblings, who have hypertension, it is possible for a person to experience hypertension. This is in line with the theory that hypertension tends to be a hereditary disease, if both of our parents have hypertension then there is a 60% chance that we will get the disease

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