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Plumbum Exposure and MCV Value in Silver Human Workers in Semarang

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ABSTRACT

Plumbum enters through various environmental factors such as inhaled air, digestion, urine as much as 75-80%, feces 15%, and others such as sweat, hair, and nails. The impact of exposure to lead can affect erythrocyte index. The erythrocyte index is a limitation of the size and content of erythrocyte hemoglobin, the erythrocyte index examination consists of MCV MCH and MCHC. The purpose of this study was to determine the relationship between exposure to lead in the blood and MCV values in silver human workers. This type of research was analytic. 15 silver workers were taken from Jl. Soekarno Hatta Semarang. 8 ml samples were taken for examination of lead levels and MCV levels, put in a purple tube, then 5 ml of blood was examined for lead levels in the IDD laboratory using the ASS method, while 3 ml of blood was examined MCV levels in the Hematology Laboratory, Universitas Muhammadiyah Semarang using a hematology analyzer. The results showed that the lead levels in the high category was 15 samples at most with a percentage value of 100%, while the MCV had the highest number, namely in the normal category as many as 13 samples with a percentage value of 86.6. Statistical test using Pearson correlation showed p-value of 0.102. It can be concluded that there is no relationship between exposure to lead in the blood and the value of MCV.

Keywords: silver human workers; MCV; plumbum exposure

INTRODUCTION

Background

Semarang is the capital city of Central Java Province which has progress in the fields of development and infrastructure. The increase in the number of poor people has encouraged the emergence of children who have dropped out of school and an increase in homeless children, beggars around the road or red lights⁽¹⁾. Their existence makes crowded places a place to earn money from the compassion of others, one of them being a silver man⁽²⁾. The existence of silver man is clearly a phenomenon that occurs in social life, which is a description of the actions taken by individuals with conditions that lead them to think creatively and be willing to paint their bodies every day and not be afraid of the dangers to health⁽³⁾.

Chairman of the Indonesian Doctors Association (IDI) of Semarang City, Elang Sumambar, said that the paint used will cause an itchy effect on the skin. The use of screen printing paint mixed with oil should be used in textile production, not for human skin⁽⁴⁾.

One of the hazardous chemicals is plumbum (Pb) which is a heavy metal group IV-A with the Periodic System of Chemical Elements, which has an atomic number of 82 with an atomic weight of 207.2 in solid form at room temperature, a melting point of 327.4°C and a melting point of 327.4°C. has a specific gravity of 11.4/1.⁽⁵⁾ Pb is found in molecular compounds such as PbBr₂ and PbCl₂.⁽⁶⁾

Exposure to low levels of lead that lasts continuously for a long time will have health impacts including hypertension, anemia, decreased brain capacity and can inhibit the formation of red blood⁽⁷⁾. Due to the inhibition of haeme synthesis by Pb, it will reduce hemoglobin deficiency which has an effect on the occurrence of anemia.

The decrease in the number of erythrocytes is caused by the process of hematopoiesis and can reduce the level of hematocrit in red blood cells and can affect the value of the erythrocyte index (MCV, MCH and MCHC), associated with lead levels in the blood ⁽⁸⁾.

The effect of plumbum (Pb) haematotoxicity can inhibit most of the enzymes that play a role in heme biosynthesis, including δ -ALAD enzymes and ferrochelatase which are Pb inhibitory enzymes. The erythrocyte index examination consists of the mean cell volume (MCV), the average cell hemoglobin (MCH), and the average cell hemoglobin concentration (MCHC) which is calculated from the hematocrit (PCV), hemoglobin level and red blood cell count. The erythrocyte index is used in classifying anemia and can help diagnose the cause of anemia. Anemia is the most common hematological disorder found both in the clinic and in the field. ⁽⁹⁾

Purpose

The purpose of this study was to determine the relationship between exposure to lead in the blood and MCV values in silver human workers.

METHODS

The research design used was an analytic study with a cross sectional approach. The research location was in the UNDIP GAKI Laboratory and the Unimus Hematology Laboratory. The time of the research was conducted in March 2022. The research population was silver men who worked on Jl. Soekarno Hatta, Central Java. Samples were taken with a total sampling of 15 people. The independent variable in this study was the level of lead (Pb) in the blood of silver human workers and the dependent variable was the level of MCV. Measurement of Pb using atomic absorption spectrophotometry (AAS) and MCV levels using colorimetry and impedance using a hematology analyzer, to determine the relationship between the independent variable and the dependent variable using the Pearson Correlation statistical test.

This research had received ethical approval from the Bioethics Commission of the Faculty of Medicine, Unisula with No. 233/VII/2022/Commission on Bioethics with due observance of the principles contained in the Declaration of Helsinki and the guidelines contained in the National Guidelines for Health Research Ethics (PNEPK) of the Ministry of Health of the Republic of Indonesia in 2004.

RESULTS

From the results of the study, it was found that there was no relationship between lead exposure and the MCV value, namely the results of the examination of plumbum levels.

Table 1. Results of examination of Pb levels in silver human workers

Pb level	Amount	Percent	Minimum	Maximum	Average
Normal	-	-	-	-	-
High	15	100	35.9	47.0	41.9
Low	-	-	-	-	-
Total	15	100	-	-	-

Based on table 1, it can be seen that most of the respondents had high levels of 15 samples with an average value of 41.9.

Table 2. Results of examination of MCV values in silver human workers

Pb level	Amount	Percent	Minimum	Maximum	Average
Normal	13	86.6	77.2	94.7	87.5
High	1	6.7	102.4	102.4	102.4
Low	1	6.7	75.2	75.2	75.2
Total	15	100	-	-	-

Based on table 2, it can be seen that most of the respondents have MCV values in the hypochromic (low) category as many as 1 sample with an average value of 75.2, normochromic (normal) as many as 13 samples with an average value of 87.5 and hyperchromic (high) as many as 1 sample with an average value of 102.4.

Based on table 3, the lead content had a minimum value of 35.9 and a maximum of 47.0, the standard deviation was 3.5898 so that the mean value was 41.913, while the MCV level had a minimum value of 75.2 and a maximum of 102.4, the standard deviation was 6.9980, so that the average value was 87.747.

Table 3. Average levels of lead and MCV of silver human workers

	Mean	Standard deviation	Minimum	Maximum
Pb level	41.913	3.5898	35.9	47.0
MCV level	87.747	6.9980	75.2	102.4

Table 4. Normality test results on Pb and MCV levels data

Variable	p-value
Pb level	0.317
MCV level	0.893

Based on table 4, it is found that the amount of data used in the study was less than 50 samples, so the test used was the Shapiro-Wilk normality test. While the MCV variable obtained a p-value of 0.893 and the Pb variable obtained p-value of 0.317, so the two data are normally distributed. The right test data analysis to use is the Pearson Correlation test.

Based on the hypothesis test using the Pearson Correlation, p-value was 0.102, so it can be stated that there was no relationship between exposure to lead in the blood and the MCV value. Based on the value of the correlation coefficient of -0.439, it shows a sufficient level of relationship and is negative (the higher the Pb level, the lower the MCV level).

DISCUSSION

Based on the results of the study, it was obtained that Pb levels were above the normal value, but there was only 1 MCV level below normal and 1 above normal, most of them were still within normal limits, namely 13 people. Based on these results, it can be explained that changes in hematocrit levels and the number of erythrocytes which are variables for calculating MCV have not changed due to the high levels of Pb.

Hematocrit is the average volume of erythrocytes contained in 100 ml of blood⁽¹⁰⁾. Erythrocyte volume is strongly influenced by hemoglobin levels in erythrocytes and other nutritional ingredients⁽¹¹⁾. Hemoglobin levels can be affected by Pb exposure through inhibition of heme synthesis in δ -ALAD and ferrochelatase enzymes⁽¹²⁾. In this condition, heme synthesis has not experienced interference so that the erythrocyte volume is still normal. Impaired heme synthesis can occur if the accumulation of Pb in large quantities and lasts a long time.

Erythrocyte cells can decrease due to exposure to Pb through the erythrocyte wall⁽¹³⁾. Pb becomes a free radical that can damage the erythrocyte wall⁽¹⁴⁾. The number of erythrocytes in the blood is normally between 4.5 million to 5.5 million. The number of erythrocytes is also influenced by the average age of erythrocytes of 120 days⁽¹⁵⁾. In the condition of Pb exposure in this study, the erythrocyte wall damage was not significant, this could be due to the amount of exposure, duration of exposure, erythrocyte age, and the process of erythropoiesis in the bone marrow.

CONCLUSION

Research in March on Jl. Soekarno Hatta Semarang on silver human workers with 15 respondents as follows:

1. The results of Pb in 15 samples obtained values above the normal limit (>40 g/dl) with a percentage value of 100%.
2. MCV results with a normal value of 76-96 fl in the Normal category were 13 samples with a percentage value of 86.6, 1 sample high with a percentage value of 6.7 and low as many as 1 sample with a percentage value of 6.7. Normal MCV data has the highest number of average values.
3. There is no relationship between MCV variable and Plumbum variable with sufficient category.

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