



Relationship Between Lead Exposure In Blood And Hemoglobin Levels In Women Of Childbearing Age In North Semarang District, Semarang City

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ABSTRACT

The results of transportation activities, humans, and also company activities will lead to lead exposure in the surrounding environment, if for a long time the lead exposure can cause health problems for the community. One of the effects of long-term health problems caused by lead exposure is a decrease in hemoglobin levels. Based on the 2013 Riskesdes data, the anemia rate in women

of childbearing age (WUS) is 32.9%. The prevalence of anemia in Central Java is 57.7%. The purpose of this study was to describe and analyze the relationship between blood lead exposure and hemoglobin levels in women of childbearing age, North Semarang District.

This type of research is analytical observational with a cross sectional study design conducted in the North Semarang district with 50 respondents selected by purposive sampling. Collecting data by interview, observation, measurement of blood lead levels, measurement of hemoglobin levels. Data analysis used chi-square test and correlation.

Based on the results of bivariate analysis, it is known that the value of blood lead levels with $r = 0.461$ and $p = 0.001$ which means the strength of the relationship between blood lead levels and hemoglobin has a moderate relationship strength.

Based on a study of 50 women of childbearing age who were examined for hemoglobin levels in the blood, there were 56% of women of childbearing age who experienced abnormal hemoglobin levels, and 44% of women of childbearing age who experienced normal hemoglobin levels.

Keywords: lead exposure, anemia, hemoglobin levels

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INTRODUCTION

Lead is a toxic metal used in a variety of products and materials, including paint, pipes, lead crystals, plates, pottery coatings, gasoline, food utensils, toys and batteries (Poisoning, 2015). Gasoline and paint are the main sources that pollute the environment (Vijayakumar, 2017).

Industrial development and increasing population growth rates make pollution of natural resources increasing, inadvertently lead pollution can occur through liquid waste from industry, transportation, air and households (Solo, 2014). Usually the most commonly used biomarker for the examination of lead exposure is to measure blood lead levels in units of micrograms (μg) per hundred liters of blood (DI) or /dl (Juliana, 2017).

From 2002 to 2011 it was known that there were around 11,536 adults who had very high blood lead levels, ie 40 / dl. The Middle East, Asia, Eastern Europe and Latin America are some of the countries that have high blood lead exposure rates. This refers to the Analysis of Adult Blood Lead Epidemiology And Surveyance (ABLES) (Juliana, 2017). In adults with occupational and other problems there is about 91% of these very high lead levels⁵. This is in line with data from the World Health Organization (WHO) that there are around 143,000 deaths per year caused by lead exposure with the highest incidence being in developing cities (Maskinah, 2016), and the Institute For Health Metrics And Evaluation (IHME) around 853,000 deaths. caused by the impact of long-term lead exposure and the highest rates are in developing countries (Juliana, 2017).

Heavy metal pollution, one of which is lead, may be caused by not yet maximally processing industrial waste from upstream, making it possible for an impact on the waters of the surrounding area (Juliana, 2017). In this case, North Semarang sub-district, Bandarharjo sub-district and Tanjung Emas sub-district are areas located on the north coast of Semarang city. This is based on the results of examining samples from previous studies, which were taken from dug wells, seawater, and groundwater. Where the results of the lead content in seawater samples were 0.446 mg/L, dug wells were 0.194 mg/L, and ground water was 0.080 mg/L (Putra, 2020). Which of these three results has a value above the average threshold of 0.005 mg/L. If used continuously it can cause health problems.

From the results of the examination of blood lead levels in Wus, all of them have values above the normal limit, namely $\geq 5 \mu g$ /dl, this can have a health impact on Wus. The impact of lead on the body if continuously can cause kidney, nervous, haemapoitic, gastrointestinal, cardiovascular, endocrine, reproductive and carcinogenic triggers which are negative impacts caused by lead to humans. In addition, lead can also affect the life of erythrocytes. The



destruction of erythrocytes can cause the lifespan of erythrocytes to be shorter or commonly known as hemolytic anemia due to the toxicity of lead (Maskinah, 2016).

Based on Basic Health Research (Riskesdas) data in 2007 showed the percentage of anemia in WUS in urban areas was 19.7% and in 2013 it increased by 35.3% (Sudikno, 2016). As for Central Java itself, the prevalence of anemia is 57.7%, it can be said that anemia is still a health problem in Indonesia, especially in Central Java (Ataniyazova, 2003).

METHOD

This study is an analytic observational study with a cross sectional design (cross-sectional). The population of this research is WUS in North Semarang District, Semarang City. The sample in this study was 50 people taken by purposive sampling technique. The reason for choosing research sites and research subjects is because coastal or coastal areas are one of the sources of lead pollution which may come from industrial waste, besides that WUS is also susceptible to lead exposure. Collecting data through interviews, observations, laboratory examinations by taking blood samples to measure hemoglobin levels and blood lead levels. Sampling was carried out by laboratory personnel. Data analysis used the Statistical Package For The Social Sciences (SPSS) version 16. Inferential analysis was carried out to determine whether or not there was significance between the independent variable and the dependent variable. Multivariate analysis was carried out by logistic regression test to see the relationship between the independent variables that had the most influence on the dependent variable.

RESULTS AND DISCUSSION

Table 1. Distribution of respondents based on length of residence, source of drinking water, source of clean water, hemoglobin level

No	Variable	N = 50	%
1	Hemoglobin levels		
	a. Abnormal	28	56
	b. Normal	22	44
2	Lead level		
	a. Abnormal	50	100
	b. Normal	0	0

Based on the results of the study, it is known that the age distribution of respondents ranges from 17-48 years, with the average age of respondents being 33 years. The minimum value is 17 years and the maximum value is 48 years. Most of the respondents' education is high school graduates as many as 30 people (60%). And for the value of lead levels in the blood of WUS, all of them exceeded the normal limit value of 5 µg/dL.



Based on the results of laboratory tests in table 1, it shows that out of a total of 50 WUS respondents, most of them had abnormal hemoglobin levels, as many as 28 people (56%) while those with normal hemoglobin levels were 22 people (44%). And the results of the examination of blood lead levels from 50 respondents showed that all respondents experienced abnormal lead levels.

Variable	Mean	Sd	Min	Max	NAB / Normal Level
Lead level	74,35	1,8	52,70	99,70	5 µg/dL
Hemoglobin	11,63	1,9	7,80	15,50	12-15 gr/dl

Based on table 2, it is known that the average blood lead level is 74.35 g/dL, with a minimum value of 52.70 gr/dL and a maximum value of 99.70 g/dL. Meanwhile, the hemoglobin level has an average value of 11.63 g/dl, with a minimum value of 7.80 g/dl and a maximum value of 15.50 gr/dl.

Relationship Length of Residence With Hemoglobin Level

Of the 14 respondents who lived <20 years, there were 1 (7.1%) respondents who had abnormal hemoglobin, while of the 26 respondents with a length of stay of 20-35 years, there were 22 (84.6%) respondents who had abnormal hemoglobin. normal, and from 10 respondents with length of stay > 35 years, there were 5 (50%) respondents who had abnormal hemoglobin. The results of the chi-square statistical test obtained p value = 0.000 which means that there is a significant relationship between length of residence and impaired hemoglobin levels in North Semarang District, Semarang City.

This is in line with research conducted by Dr.Oral in Kazakhstan that there is an increase in impaired hemoglobin levels (anemia), which is found in almost all groups of women in Karakalpakstan, Kazakhstan. In 87% of adolescents, 91% of women are not pregnant, and in 99% of pregnant women. Anemia is the biggest problem in the region, this is an increasing number that has occurred over the last 20 years, where in the 1980s only 17-20% of women were anemic. This happens because of environmental problems around the Aral Sea which are polluted due to problems from agricultural chemicals, climate change, and agricultural irrigation which have caused poor water quality for the last 30 years.

The Relationship of Clean Water Sources With Hemoglobin Levels

Based on the results of the study showed that of the 21 respondents who used clean water sources from the Drinking Water Company, there were 16 (76.2%) respondents who had abnormal hemoglobin, while of the 28 respondents who used clean water sources from dug wells and there were 11 (39.3%) of respondents had abnormal hemoglobin, and 1 (100%) of



respondents who used artesian water sources had abnormal hemoglobin levels. The results of the chi-square statistical test obtained p value = 0.018, which means that there is a significant relationship between clean water sources and impaired hemoglobin levels in North Semarang District, Semarang City.

This is in line with a study conducted by Saujan Gautam et al, with an OR of 1.93 of 95% CI (1.58-2.37), which said that women who use clean water sources from dug wells are twice as likely to experience anemia as compared to women who use clean water sources. using clean tap water. This is due to the high concentration of arsenic.

Relationship between drinking water sources and hemoglobin levels

Based on the results of the study showed that of the 15 respondents who used drinking water sources from Damiu, there were 13 (86.7%) respondents who had abnormal hemoglobin, while from 27 respondents who used drinking water sources from the PDAM and there were 10 (37.0%)) respondents had abnormal hemoglobin, and of the 8 respondents who used drinking water sources from dug wells, 5 (62.5%) had abnormal hemoglobin levels. The results of the chi-square statistical test obtained p value = 0.005, which means that there is a significant relationship between drinking water sources and impaired hemoglobin levels in North Semarang District, Semarang City.

This is in line with research conducted by conservation education in America in 2016 which said that 12% of drinking water filling outlets in America had lead levels that exceeded the quality standard value (5ppb), where the lead value in refill drinking water there was between 5-15 ppb. This statement is also supported by the Environmental Protection Agency (EPA), which estimates that 20% of drinking water sources can affect lead exposure in humans, this is because the pipes of drinking water sources have materials that contain lead and can dissolve in water, so that the drinking water may contain lead.

Relationship of Lead Levels in Blood With Hemoglobin

In individuals who are exposed to Pb with normal limits, the toxins from Pb will continue to work in the body. However, if it has exceeded the threshold, the individual will show symptoms of Pb poisoning that attacks the body. The results of the correlation test between blood lead levels and hemoglobin levels obtained a value of $r = 0.461$ with $p = 0.001$, which means that the strength of the relationship between blood lead levels and hemoglobin has a moderate strength.

Hemoglobin is a protein-pigment complex containing iron. The complex is red in color and is present in erythrocytes. If the levels of erythrocytes (red blood cells) and hemoglobin levels



are reduced in every cubic millimeter of blood in the human body, this is usually called blood deficiency or in other words anemia. The proportion of subjects with abnormal hemoglobin (which is below the normal limit) with the proportion of lead levels is not normal is 56%. this is higher than the normal lead group of 44%. the data has a correlation between blood lead levels and hemoglobin levels in WUS, i.e. the higher the lead level in the blood, the less hemoglobin in the body.

And from the results of the linear regression test, the sig value (0.001) which means <0.05 , then this linear regression model can be used to see if there is an effect of the independent variable on the dependent variable. From the results of this output also obtained the value of $r = 0.461$ and the value of $R \text{ square} = 0.213$ which means the influence of the independent variable on the dependent variable is 21.3%.

CONCLUSION

From this study it can be concluded that of the 50 respondents who were examined for hemoglobin levels, there were as many as 56% of WUS had abnormal hemoglobin levels, and 44% WUS had normal hemoglobin levels. And from the test results it was found that the drinking water source variable had a strong influence on the occurrence of impaired hemoglobin levels in WUS with a sig of 0.024.

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