



Correlation Between Lead Exposure With Balance Disorders In Women Of Childbearing Age In The North Semarang Coastal Region Indonesia

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ABSTRACT

Women in the South Indian age have an important role related to the function of their production which can interfere with other health impacts as a result of the lead bearing. The purpose of this study was to determine lead exposure with balance disorders in women of childbearing age in the North Semarang Coastal Region and factors related to lead levels such as work, family

clean water sources and seafood consumption.

This research is observational with qualitative research design. A total of 42 enthusiastic women were taken by purposive sampling.

The results of the analysis of this study showed that the weight of lead in the blood was enthusiastically buried 21 people (50%) in the high category and 21 people (50%) in the lowest category. This is related to the source of clean water for the day-to-day and consumption of sea food.

It is recommended that environmental pollution and environmental examination be conducted in a periodic bloodbath.

Keywords: Lead levels in blood, Balance Disorders, Women Of Childbearing Age

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Introduction

Industrial growth can have an impact on environmental pollution. Environmental pollution in recent years is very interesting to note because of the impact it causes. Human activities in meeting their needs can have a variety of negative impacts on human life and the environment. Sources of pollution that can damage the environment usually come from industrial wastes that have a high level of toxicity such as heavy metal pollution. Heavy metal pollution can occur in water, soil and air and the most dangerous to life is pollution that occurs in the waters (Damono 1995).

Lead, is a type of metal that is widely used since prehistoric times and its use at this time has developed very broadly. Lead which is released into the water or into the air can enter the human body then it will settle into the blood. The accumulation of lead in the blood will cause various adverse effects. These impacts include: an increase in the number of adult deaths due to cardiovascular and coronary heart disease, increased cases of hypertension, decreased IQ of children and can cause intestinal disorders, anemia, nephropathy and encephalopathy (Palar, 2014)

Lead is toxic to adult astrocytes and interferes with the formation of myelin, both of which are involved in the formation of blood flow barriers to the brain. When the barrier is disrupted, molecular proteins such as albumin enter the CNS (Central Nervous System) network, so that their output can produce edema, increased intracranial pressure, and encephalopathy. Basically our body makes important adaptive changes when exposed to heavy metals that are reactive to the sulfhydryl group (thiol group). The main heavy metal-induced damage mechanism is the production of free radicals that alter mitochondrial activity and genetic information on DNA. Lead is also a metal that can damage the myelin sheath of axons so that it can cause dysfunction of axon impulse delivery which in turn will cause disruption of the response of postural muscles that cannot work synergistically to maintain body balance (Mason Lisa, 2014)

The normal Pb level in blood according to WHO and CDC is 10 µg / dl of blood, according to NIOSH the limit of normal Pb in blood is 5 µg / dl of blood, whereas according to OSHA the limit of normal Pb level in blood is 40 µg / dl of blood, if the Pb level exceeds this value it will cause a negative impact on health (WHO, 2010, NIOSH, 1994, CDC, 2013)

Various studies have reported the existence of health problems caused by lead pollution (Pb) in coastal areas directly adjacent to the Java sea. The results of the Ismanto Day study conducted in 4 Coastal Districts in Brebes District showed that pregnant women who were the subjects of the study had blood levels of Pb an average of 42.67 µg / dl, with the lowest levels being 3.6 µg / dl and the highest 108, 6 µg / dl. The results of this study are far above the normal



range and high levels of Pb in the blood of pregnant women are influenced by many factors such as location of residence, occupation and the nature of accumulative Pb exposure over time (Ismanto, 2018).

To determine the lead content in the human body is determined in an accurate way in the form of analysis of the concentration of lead in the blood or urine. Lead concentration in the blood is a better indicator than lead concentration in urine. Therefore, lead in the blood is an exposure parameter that is often used in connection with external exposure. Lead levels in the blood can be a direct indication of the amount of lead that actually enters the body (Kemenkes RI, 2001).

The North Semarang coastal area is an area with decreasing surface conditions. This results in sea water being able to intrude into artesian wells in the area where water from artesian wells is used by the local community as drinking and clean water sources. According to research conducted by Supriyadi in 2012, seawater intrusion occurred at several points in the city of Semarang one of which occurred in the Tanjung Mas area (Supriyadi, tt). This certainly poses a risk to the population in the region including women of childbearing age which are the most vulnerable because it is related to reproductive function that can be disrupted, disorders in children or babies they contain and other health effects when compared to other groups.

Preliminary test results in sea water, dug well water and artesian in the North Semarang coastal area found Pb content in sea water samples of 0.446, dug well water samples of 0.194 and artesian water samples of 0.08. These results indicate that the three water samples Pb levels have exceeded the permissible threshold value of 0.05 for sanitary hygiene water. According to research conducted by Harys Tri Laksana in 2013, the high presence of lead heavy metals in waters is influenced by Several factors are industrial waste around the waters, ship waste, oil spills, antifouling paint (deterrent from animals sticking to it) and environmental quality parameters of water (temperature, salinity, current speed, PH, turbulensin and waves) (Laksana, 2013)

This study aims to determine lead exposure with balance disorders in women of childbearing age in the North Semarang Coastal Region and factors related to lead levels such as work, family clean water sources and seafood consumption.

METHODS

The study was conducted in October - November 2019 and located in the North Semarang Coastal Region. This study was an observational study with qualitative research design. The population in this study was women of childbearing age in the North Semarang Coastal Region.



Determination of the number of samples made using the Lemeshow formula obtained a total sample of 42 people. The sampling technique is done by purposive sampling.

Lead levels in the blood are measured by Atomic Absorption Spectrophotometer in units $\mu\text{g} / \text{dl}$, for balance disorders it is measured using aromberg test based on the diagnosis of occupational medical personnel and physiotherapists.

Inclusion criteria in this study were willing to be respondents of the study to take blood samples and be interviewed, included in the category of women of childbearing age, which ranges from age 15-49 years or experiencing menstrual cycles, residing in the study site, not in a pregnant condition, not in the habit smoking and drinking alcohol. Exclusion criteria in determining the sample: not willing to be a research respondent to take a blood sample, not included in the category of women of childbearing age, not residing in the study site, in pregnancy, having smoking and drinking alcohol. Statistical data analysis was done univariately and bivariate. Bivariate analysis using the chi-square test, with a significance level (significance) $p < 0.05$.

RESULTS AND DISCUSSION

From the results of the research, 42 people were found that were in accordance with the criteria of the study respondents 'inclusion, then obtained data on the distribution of respondents' characteristics as in Table 1 and Table 2.

Table 1 Distribution of Characteristics of women of childbearing age on the North Semarang Coast

No	Variable	n	Min	Max	Mean	SD
1.	Age of respondent (years)	42	17	48	31,48	8,788
2.	Length of stay at the study site (years)	42	6	43	23.93	7,928
3.	Lead levels in the blood ($\mu\text{g}/\text{dL}$)	42	54,2	99,7	76,160	13,081

Table 2 Distribution of Characteristics of women of childbearing age Categories on the coast of North Semarang

No.	Variable	Frequency	%
1.	Respondent Jobs		
	Does not work	30	71,4
	Work	12	28,6
2.	Education of Respondents		
	Primary school	1	2,4



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	Junior high school	6	14,3
	Senior High School	27	64,3
	Academy / College	8	19,0
3.	Drinking Water Source		
	PDAM	2	4,8
	Bottled Water	2	4,8
	Artistic	5	11,9
	DAMIU	33	78,6
4.	Clean Water Source		
	PDAM	22	52,4
	Dug Well	6	14,3
	Artistic	14	33,3
5.	Seafood consumption		
	Yes often	25	59.5
	Never / rarely	17	40.5
6.	Lead Category		
	High	21	50
	Low	21	50
7.	Balance disorders		
	Positive	33	78.6
	Negative	9	21,4

In Table 1 it can be seen that the average age of respondents is 31.48 years, with the lowest age of 17 years and the highest of 48 years. Based on the length of stay at the study site, the average respondent stayed at the study site for 23.74 years with the shortest residence time of 6 years and the longest residence time of 43 years. In table 2 based on the results of research on lead levels in blood specimens of women of childbearing age, 21 people (50%) high category and 21 people (50%) low category. This shows that most women of childbearing age have been contaminated by lead due to pollution that occurs in the waters of North Semarang. High levels of lead in the blood of respondents can cause health complaints. Based on interviews with respondents, 34 people (80.9%) experienced health complaints such as insomnia, dizziness, tingling, reduced concentration and decreased memory.

According to Palar lead poisoning can disrupt the nervous system, kidney system, reproductive system, endocrine system and heart. In addition, according to the Ministry of Health (2001) can cause inertia in neurological development of nerves, damage to the male reproductive



system, neurological diseases, changes in thinking and behavior, high blood pressure, and anemia. In cases of chronic lead exposure such as fatigue, lethargy, irritability and gastrointestinal disorders are the first signs of chronic lead intoxication. Continuous exposure to the central nervous system shows symptoms such as insomnia, confusion or frequent forgetfulness (Sabki, 2002).

Table 3. Bivariate Analysis Results of Factors Affecting lead Levels In Blood in women of childbearing age on the North Semarang Coast

No	Research variable	p-value	Information
1.	Job	0,733	Not significant
2.	Clean Water Source	0,035	Significant
3.	Seafood consumption	0,012	Significant

The type of work for women of childbearing age in the North Semarang Coastal Region is divided into 2 parts, namely not working and working. Of the respondents who did not work out of 30 people, 14 people (46.7%) of whom had blood Pb levels included in the high category and 16 people (53.3%) included in the low category. Whereas for respondents who worked out of 12 people, 7 people (58.3%) had blood levels of Pb in the high category and 5 people (41.7%) were in the low category. After a bivariate analysis using the chi-square test, the p-value of 0.733 is greater than α (0.05), so there is no relationship between the type of work and blood levels of Pb in women of childbearing age in the coastal area of North Semarang. The results of this study are in line with research conducted by Sabki in 2002 showing that there is a relationship between work and cadre of the body as measured by levels in urine, but the relationship is not statistically significant (Irfandi, 2013).

Types of family clean water sources for women of childbearing age in the North Semarang Coastal Region are divided into 3 types namely PDAM, dug wells and artesian. For family clean water sources that come from PDAMs, out of 22 people, 7 people (31.8%) have lead levels in the blood which are high and 15 people (68.2%) are low. For family clean water sources originating from dug wells, out of 6 people, 5 people (83.3%) had blood levels of lead in the high category and 1 person (16.7%) was in the low category. For clean water sources from artesian families, out of 14 people, 9 (64.3%) had blood levels of Pb in the high category and 5 people (35.7%) were in the low category. After a bivariate analysis using the chi-square test, the significance value of p value is 0.035 less than α (0.05), so there is a relationship between family clean water



sources and blood levels of Pb in women of childbearing age in the coastal area of North Semarang.

This is in line with the results of research by Ahmad Irfandi, et al. (2013), the results of lead checks on dug well water were examined, 10% contained lead content that was not eligible and caused health problems due to the use of well water for daily activities such as nausea, increased blood pressure dead / less sense and pain or difficulty move. Lead is a dangerous metal and has no benefits for the body. If this metal enters the body it will settle in the blood, target organs of the liver and kidneys, so that in a short time will have an acute effect and in a long time will cause chronic effects that will endanger the health of the population (Suyanto, 2010).

The seafood consumption habits of women of childbearing age in the North Semarang Coastal Region are divided into 2 parts namely Yes often and not often / Rarely. For respondents who answered yes often, out of 25 people, 17 people (68%) had blood levels of Pb in the high category and 8 people (32%) were in the low category. For respondents who answered not often / rarely, out of 17 people, 4 people (23.5%) had Pb levels in the blood included in the high category and 13 people (76.5%) were in the low category. After a bivariate analysis using the chi-square test, the p-value of 0.012 was less than α (0.05), so there was a relationship between the habit of consuming seafood with blood levels of Pb in women of childbearing age in the coastal area of North Semarang.

According to Hari Ismanto in 2019 marine products contaminated with lead metal will increase the risk of lead exposure to humans.8 Reports from Suyanto et al. In 2010 stated that fish from examined samples originating from the sea areas of Tegal, Pati and Semarang regencies contained lead with concentrations <0.1 to 0.14 ppm. Fish and other marine products containing lead are then consumed by humans, then the lead content will move into the human body. If this goes on for a long time, then lead will accumulate in the human body in ever increasing amounts (Roomberg Test. internet.http: //digilib.unila.ac.id/20894/13/BAB%20II.pdf. accessed on 10 August 2019)

Table 4. Results of bivariate analysis of the corellation between lead levels in the blood with impaired body balance.

No	Research variable	Value	95% CI	P-value	Information
1.	Blood lead levels	1,538	1,085–2,181	0,024	Significant



Lead levels in the blood have a significant relationship with impaired body balance. Based on research that has been done (table 3) respondents who have high blood Pb levels have a risk of 1.538 times affected by impaired body balance compared with those who have low blood Pb levels and statistically this relationship is significant.

Lead competes to bind the cerebellum (Cerebellum) to phosphokinase. This process influences the entry of calcium into cells and nerve function, and alters the structure of the mitochondria, causes inhibition of cellular respiration, accelerates the mitochondria to destroy itself through the formation of the perforability of the transplants, and the activation of the cell death process. This causes an increase in spontaneous neurotransmitter release and inhibits the stimulation that should be controlled to be released, so that impulse delivery dysfunction can disturb the balance of the body.

Measurement of body balance disorders in this study using the Romberg test with occupational medical diagnosis and physiotherapy from Telogorejo Hospital, Semarang City. The romberg test is done by means of the patient being instructed to stand up and open the eyes with the feet positioned close to one another and both arms on the sides of the body, then the patient is instructed to close the eyes for 1 minute (the doctor must stand in front of the patient with arms extended on both sides of the patient but does not touch it with the aim of supporting the body of a patient who might fall). Then watch if the patient loses balance (experiences a balance disorder). If the patient closes his eyes then experiences a swing and almost falls, this indicates a weakness in the proprioceptive or vestibular nature so that it can be said that the patient has a positive Romberg test (Roomberg Test. internet.http://digilib.unila.ac.id/20894/13/BAB%20II.pdf. accessed on 10 August 2019)

Results Research conducted in line with research conducted by Avicena Sakufa Marsanti in 2015 about the relationship between levels of lead in blood with impaired body balance Metal Casting Workers CV. Bonjor Jaya, Batur Village, Ceper, Klaten produced a meaningful relationship between Pb levels in the blood with impaired body balance.

Research conducted by Kyoung-Bok Min in 2012 on the relationship between lead and cadmium levels in the blood with impaired bodily and vestibular balance in adults, also produced a significant relationship between Pb levels in the blood with impaired bodily and vestibular balance (Min, 2012).

CONCLUSION

Based on the results of research, analysis and factors - factors related to levels of lead in the blood of women of childbearing age in the north Semarang coastal region, can be concluded as follows:



1. A total of 21 people (50%) of 42 respondents had high levels of lead in the category and 21 people (50%) had a low category. This shows that most women of childbearing age have been contaminated by lead due to pollution that occurs in the waters of North Semarang.
2. There is no relationship between work and blood levels of Pb in women of childbearing age in the northern coast of Semarang ($p = 0.733$).
3. There is a relationship between family clean water sources and blood levels of lead in women of childbearing age in north Semarang coastal areas ($p = 0.035$)
4. There is a relationship between the consumption of seafood with blood levels of lead in women of childbearing age in the north Semarang coastal area ($p = 0.012$)
5. There is a relationship between blood levels of lead in women of childbearing age (wus) with impaired body balance in the north Semarang coastal area ($p = 0.024$)

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