



Proceeding of the 1st International Symposium of Public Health

"Emerging and Re-emerging Diseases"



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Reviewer Board

Ika Yuni Widyawati
Ratna Dwi Wulandari
Sondang Sidabutar
Dewi Kurniasih



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S3 Ilmu Kesehatan
Fakultas Kesehatan Masyarakat
Universitas Airlangga
Kampus C Mulyorejo Surabaya 60115
Telp/Fax. (031) 5990603
Email: s3ikes.fkmua@gmail.com

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THE EFFECT OF LEAD (PB) AND CADMIUM (CD) EXPOSURE IN PERNA VIRIDIS TO DECREASE THE IQ OF SCHOOL-AGE CHILDREN (CASE STUDY IN KEJAWAN REGION)

Dewi Kurniasih

*Engineering Department of Occupational Safety and Health
Politeknik Perkapalan Negeri Surabaya,
Jl. Teknik Kimia Campus ITS - Surabaya Sukolilo
Email: dewi.kurniasih@ppns.ac.id*

ABSTRACT

Sewage is a source of pollution to the environment through water and drainage system which sometimes resulted from human activity. One of pollution in water bodies is the influx of heavy metals which will be followed by an increase in the levels of these substances in aquatic organisms and others marine biota. The lead exposure on aquatic organisms, especially in *Perna viridis* can adversely affect cognitive development and behavior of children in Kejawen Keputih Tambak.

This research aimed to determine the results of Pb and Cd in *Perna viridis* using the AAS (Atomic Absorption Spectrophotometry) procedure with post-test design. The psychological data was measured using in-depth interview.

The AAS results showed that Pb content in *Perna viridis* of 2.049 ppm or mg / kg was far above the threshold quality standards set by the Rules of BPOM Regulation No. HK.00.06.1.52.4011, that the Pb content in foods should not exceed 1.5 ppm or mg / kg. Metals content of Cd in *Perna viridis* was 0.0182 ppm or mg / kg which was still far below the quality standard limits set in the amount of 1 ppm or mg / kg. The results of psychological examination from 15 samples showed that the respondents indicated a level of intelligence were below the average of children at the same age.

In conclusion, there was a relationship between the level of frequency of eating *Perna viridis* contaminated heavy metals of Pb and Cd to the childpsychological outcomes. It showed that the level of intelligence of children eating contaminated *Perna viridis* were below the average intelligence level and cognitive behavior of children at their age.

Keywords: Lead (Pb), Cadmium (Cd), *Perna viridis*, Intelligence, Cognitive Behavior

INTRODUCTION

Sewage is a source of pollution for the environment (air, water and soil) that can cause a decline in the quality of the environment and human health. One of pollution in water bodies is the inclusion of heavy metals. This is in line with human activities on land which are also a source of pollutants. One of the animals exposed to the effects of pollution are *Perna viridis*.

Increased levels of heavy metals in the waters will be followed by an increase in the levels of these substances in aquatic organisms and others marine biota. Heavy metals can also be accumulated by aquatic organisms even in low concentrations in the water column. Utilization of this organism as a food ingredient could be harmful to human health. Kennish (1992) found that marine invertebrates and estuaries, especially Mollusca concentrate or accumulate heavy metals in their bodies.

When humans consume an organism that has been concentrating heavy metals for a long time they could be suffering from disability or death. The greater the consumption of marine fish suspected of being contaminated with heavy metals such as lead, the greater the accumulation of heavy metals of lead in the body. Several studies have shown that exposure to lead can adversely affect cognitive development and behavior of children (Rome-Torres et al., 2007, Apostoli et al., 2005).

Kejawan Keputih Tambak is a village in the subdistrict Mulyorejo, Surabaya, the Province of East Java, where the majority of the community were in the middle-class economy. In the area of Kejawan Tambak, almost 80% of the population in this region work as *Perna viridis* farmers and made *Perna viridis* as daily consumption. The study was conducted because in Kejawan Tambak the children suffered from the decreased IQ levels (Data Puskesmas, 2014) which was suspected as a result of consuming *Perna viridis*.

MATERIAL & METHOD

This was a laboratory experimental research with the posttest only control design. The laboratory analysis method with techniques of two repetitions (Duplo) for sample shells was carried out. The measurements of heavy metals in *Perna viridis*/Shellfish were performed by the AAS (Atomic Absorption Spectrophotometry). Having obtained the results then the sample was compared to a threshold value of Pb and Cd levels that can be tolerated in the body that has been set by BPOM No.HK.00.06.1.52.4011 of Determination Limit of Microbial and chemical contaminants in food (1.5 ppm or mg / kg for Pb and 1 mg / kg for Cd). For psychological measure, in-depth interview and several psychological tests were conducted to 15 samples.

The population of children in Tambak Keputih Kejawan was 30 children, but at the time of the study 10 children were not allowed by their families to be included in the study. Several reasons for the lack of participation including the stigma that sample would shame the family, moving from their rented house, etc. In the end only 14 children were willing to participate in this study.

RESULT AND DISCUSSION

Profile of Kejawan

Kejawan Keputih Tambak is a village in the sub district Mulyorejo - Surabaya, the Province of East Java. After making observations on Kejawan community activities, the majority of them are middle-class economy.



Figure 1. Kejawan Putih Tambak

Human activity such as industrial activities, households, agriculture and mining to boost the economy can be both positive and negative. Disposal of Industrial Wastewater which is still above the water quality standard of lead content stream polluted city of Surabaya, in some studies found their heavy metal content (Pb) in the biota of the river around the area. This is in line with human activities on land are also a source of pollution, especially in foods that come from the sea. One of them happens to marine life that *Perna viridis*.

Kejawan White Pond neighborhood, dominated by ponds and most of the residents were fishermen. Almost 80% of

the population in this region worked as farmers of *Perna viridis* and make *Perna viridis* as daily consumption. The study was conducted because investigators received information that in the area of Kejawan children under five have a decreased IQ levels (data puskesmas, 2014) which suspected as a result of consuming *Perna viridis*/Green mussels. This study aimed to manage *Perna viridis*/Green mussels before consumption so that the value of the existing levels of lead can be minimized before consumption.

Result of Analysis Content Pb and Cd

Heavy metal content *Perna viridis* pre-treatment can be explained as follows. In this study, the weight of sample used was the minimum weight limit authorized namely 15 grams. AAS analysis results showed that Pb metal content of 2,049 ppm or mg/kg and Pb levels was far above the quality standard limits set by Regulation BPOM No. HK.00.06.1.52.4011 of Determination Limit of Microbial and chemical contaminants in food is 1.5 ppm or mg/kg. The metals content of Cd amounting to 0.0182 ppm or mg/kg. The range of Cd levels were still far below the quality standard limits set by Regulation BPOM No. HK.00.06.1.52.4011 of 1 ppm or mg/kg. This low concentration of Cd derived from the availability of metal Cd in the water column. This naturally low concentration was allegedly related to the fact that Cd binded to small minerals that easily lifted the base. Cd metal was also used by fishermen to coat the surface of the hull because of its anti-corrosive property.

Acute exposed from cadmium (Cd) causes symptoms of nausea (nausea), vomiting, diarrhea, cramps, muscle, anemia, dermatitis, slow growth, kidney and liver damage, cardiovascular disorders, emphysema and testicular degeneration (Ragan & Mast, 1990). Estimated acute lethal dose (lethal dose) is about 500 mg/kg for adults and effects will appear if

the absorbed dose of 0.043 mg/kg per day (Ware, 1989).

Mineral toxicity of lead (Pb) can cause changes in the central nervous system, gastrointestinal disorders and impaired synthesis of red blood cells. The main clinical signs of lead poisoning (Pilliang (2002) in Didid (2009)), namely: the microcytic hypochromic anemia, vomiting, diarrhea, abdominal disorders, increased saliva secretion, decreased body weight and miscarriage. Whereas if exposed to acute by cadmium (Cd) causes symptoms of nausea (nausea), vomiting, diarrhea, cramps, muscle, anemia, dermatitis, slow growth, kidney and liver damage, cardiovascular disorders, emphysema and degeneration testicular (Ragan & Mast, 1990, Alfie 2009).

Estimated acute lethal dose (lethal dose) is about 500 mg/kg for adults and effects will appear if the absorbed dose of 0.043 mg/kg per day (Ware, 1989). Heavy metal content in each location will experience the difference womb. This is due to factors place, season, movement of the wind and current speed, and other activities along the river. Increased heavy metal content received by marine life occurs due to the accumulation of concentration and exposure time. The more the heavy metal content is consumed and the longer the exposure or the content of the received then the effects will be caused will be even greater.

Result of Psychological Examination

Economic status of the family's in Kejawan Keputih Tambak was mostly medium, there were always eating a "full" without thinking about the nutrition content. Most parents have low level of education. This resulted in parents being too focused on his children's education problems, and tends to ignore their health or nutritional need. Children who live in Kejawan Keputih Tambak almost drop out from school and the average citizen around only educated up to primary school. This contrasts with the government program

where children in the city of Surabaya had to go to school and get a free education up to senior high school. They were only required to learn the Koran, because many parents there who will be questioned in the Hereafter were a religious issue alone. But despite extensive religious education, they did not apply it in their daily life. Children often showed actions that disturb the public welfare such as stealing, fighting, said harshly, drinking alcohol until free sex.

The results of psychological test conducted by three psychologists showed that 14 children in this area have more or less the same problems. It can be concluded the average child who conducted tests have the IQ level below the average for their age. There was discrepancy between age and psychological development. The problem was getting worse because of the lack of attention from the family. Details can be found in Table 1.

Table 1. Psychological analyze for respondents in each range of age

No	Description	Total Sampel	Status Psychology	Psychological Analyze
1.	Subjects age 7-9 years	4 samples	Subjects cannot be regulated, defiant and said rudely. The subjects are very irritable when their wishes are not fulfilled. Besides age 9 years old when the subject was always wetting nap or sleep at night. unable to restrain urinate	The analysis reveals the behavior of non-compliance with the needs of the subjects in the anal phase (toilet training) at the age of 2-3 years. Subjects tend to behave arbitrarily because it has not been able to see the core of the problem which is right and what is wrong. IQ level is below average.
2.	Subjects age 10-12 years	3 samples	Often failing a grade (already 3 times). Do not want to interact with your friends, loner, do not understand write and read properly, often say rude and often beat and defiant.	Analysis obtained the subject is on the level of mentally defective light, meaning that the 10-12 years old ways of thinking just like children aged 6 years and 4 months.
3.	Subjects age 13-15 years	7 samples	His habit is smoking, which began 5th grade, often beat her, often talking to himself angrily and used to solve the problem with the fighting birds "trend doro" and drinking alcohol (cukrik)	Based on the results of the test subjects demonstrated intellectual capacity is below average when compared to his age.

CONCLUSION

There was a relationship between the frequency of eating *Perna viridis* contaminated with heavy metals of Pb and Cd to the child psychological development. It showed that the level of intelligence of children consuming contaminated *Perna viridis* were below average intelligence level and cognitive behavior of children at their age.

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