

*Hubungan Tingkat Pendidikan dengan Pengetahuan tentang Kontaminasi Arsen (As) pada Kerang Darah (*Anadara granosa*) di Pasar Tradisional Surabaya Utara*

The Relationship between Education Level and Knowledge about Arsenic (As) Contamination in Blood Clam (*Anadara granosa*) at Traditional Market in North Surabaya

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ABSTRAK

Latar Belakang: Arsenik adalah salah satu unsur polutan yang berbahaya. Arsenik yang terakumulasi dalam kerang dan dikonsumsi manusia dengan frekuensi yang cukup sering akan mengakibatkan penumpukan di dalam tubuh.

Tujuan: Tujuan dari penelitian ini adalah untuk menganalisis hubungan antara tingkat pendidikan dan pengetahuan tentang kontaminasi arsenic pada kerang darah yang dijual di pasar tradisional di Surabaya Utara.

Metode: Jenis penelitian ini merupakan penelitian observasional analitik bersifat kuantitatif dengan metode pendekatan cross sectional yang menggunakan data primer dari wawancara langsung dan data sekunder dari studi literatur penelitian sebelumnya. Sampel yang digunakan sebesar 35 penjual kerang darah diambil secara acak dengan simple random sampling. Variabel dependen dalam penelitian ini adalah pengetahuan penjual dan variabel independennya berupa tingkat pendidikan pedagang kerang darah. Data yang didapat dianalisis dengan menggunakan uji chi-square.

Hasil: Uji chi-square menunjukkan bahwa pengetahuan penjual tidak signifikan dengan tingkat pendidikan penjual ($p > 0,001$).

Kesimpulan: Dapat disimpulkan bahwa tidak ada hubungan antara tingkat pendidikan dengan pengetahuan mengenai kontaminasi arsenic pada penjual kerang darah di pasar tradisional di wilayah Surabaya Utara.

Kata kunci: Arsenik, Pengetahuan, Kerang darah, Ketahanan pangan

ABSTRACT

Background: Arsenic is one of the dangerous pollutant elements. Arsenic accumulated in clams and consumed by humans with a fairly frequent frequency will result in the accumulation in the body.

Objectives: The purpose of this study is to analyze the relationship between education level and knowledge about arsenic contamination in blood clams sold in traditional markets at North Surabaya.

Methods: This type of research was a quantitative analytical observational research with a cross sectional approach method that used primary data from direct interviewed and secondary data from previous research literature studies. The sample used was 35 blood clam sellers taken randomly with simple random sampling. The dependent variable in this study is the seller's knowledge and the independent variable is the level of education of blood clam traders. The data obtained were analyzed using the chi-square test.

Results: The chi-square analysis revealed that the seller's knowledge is not significant with the seller's education level ($p > 0,001$).

Conclusion: In conclusion, there are no correlation between education level and knowledge about arsenic contamination in blood clams sellers at traditional markets in North Surabaya.

Keywords: Arsenic, Knowledge, Blood clam, Food security

INTRODUCTION

East Java beach has a length of about $\pm 2,128$ km which is divided into the north coast, east coast, and south coast. Surabaya is a city in East Java that has quite a lot of coastal and industrial areas. The region has a variety of potential resources including fisheries, aquaculture, fish management industry, livestock, and beach tourism. The center of the economy and high population distribution makes the northern and eastern coastal areas have the potential to experience higher pollution in the aquatic environment compared to the southern coastal. Pollution that occurs in aquatic ecosystems such as in the sea is often caused by accumulation of pollutant substances which includes chemical elements, pathogens/bacteria, and chemical properties of water from industrial activities, port activities, oil spills from ships, aquaculture, and household waste.

One source of disease in humans is food intake contaminated with heavy metals. Metals are classified into two categories, heavy metals, and light metals. Heavy metals are metals that weigh 5 grams or more per cubic meter. While light metals are metals that weigh less than 5 grams per cubic meter (Darmono, 1995). Heavy metals can be sourced from contaminated vegetables and fruits. The contamination comes from vegetables and fruits grown in a polluted environment. All heavy metals occur naturally in the environment. However, the release of heavy metals into nature also results from industrial discharges that do not pay attention to environmental safety, especially during the waste disposal process. These metals will then be released into the contaminant environment and absorbed by living things in it. Heavy metals are dissolved in water at certain concentrations and become toxic to aquatic life. Heavy metals become harmful due to the bioaccumulation process. The process of heavy metal accumulation through the food chain, the higher the level of the food chain occupied by the organism, the more heavy metal accumulation in the body of the marine animal (Hananingtyas, 2017). Heavy metals, when entering the human body through food continuously and in the long term, can cause nervous system disorders, paralysis, decreased intelligence levels in children, and premature death (Kusnoputranto, 1995).

Food is a basic human need that plays a direct role in improving health so that humans are able to carry out daily activities. Therefore, food safety is very important so as not to cause health problems

that will hamper human routines. According to Government Regulation of the Republic of Indonesia Number 86 of 2019, food safety is a condition and effort needed to prevent food from possible biological, chemical and other contamination that can interfere with, harm and endanger human health and does not conflict with religion, beliefs and culture of the community so that it is safe for consumption.

Types of heavy metal contamination commonly present in food are arsenic (As), lead (Pb), cadmium (Cd), mercury (Hg), and tin (Sn). Arsenic is one form of heavy metal that is divided into two reduced forms that occur under anaerobic conditions called arsenite and oxidized forms that occur under aerobic conditions called arsenate. Arsenic is mostly found in the form of basic compounds in the form of inorganic substances. Arsenic can be soluble in water or gaseous and exposed to humans. Arsenic compounds are one of the most toxic elements and are found in soil, water, and air. In addition, arsenic is found in groundwater. This is because arsenic is one of the minerals contained in the earth's rock structure. Arsenic is known to be highly toxic and used as a poison and is widely used in the metallurgical industry, production of color materials (pigments), and glass factories. Contamination from arsenic can cause irritation to the intestines and stomach, decreased productivity of red blood cells and white blood cells, lung irritation, and even give cancer a chance to develop faster. Contact with high levels of arsenic can cause infertility and miscarriage in women (Agustina, 2014). Based on the Decree of the Director General of Food and Drug Control No.03725/B/SK/VII/1989 on the maximum limit of metal contamination in food, the maximum limit of arsenic in fish and processed products including shellfish is 1.0 ppm.

Shellfish is a type of marine biota that has the potential to be contaminated with heavy metals. This is due to the main habitat of shellfish, namely coastal waters with muddy sand at a depth of 4-6 meters where there are many substrates rich in organic content. The presence of heavy metal contamination in the waters will gradually descend and settle at the bottom of the waters forming sedimentation with mud so that marine biota organisms such as clams, shrimp and crabs that forage at the bottom of the waters are at high risk of heavy metal exposure. Shellfish also have properties as filter feeders that can accumulate heavy metals and their lives are more sedentary and slower to move from the influence of pollutants making shellfish easily contaminated with

heavy metals which will then accumulate in shellfish and have an impact on the health of humans who eat them.

Blood clams (*Anadara granosa*) belong to the *Lamellibranchiata* class. Blood clams are bilaterally symmetrical, have a cupped shell that has two shells on both sides of the body. Blood clams have separate sexes, dispersing eggs and sperm into the water for fertilization (Ahmad, 2017). Blood clams are one type of clam that is widely consumed in Surabaya. Shellfish is one of the marine biota that can accumulate heavy metals in its body, such as arsenic. Blood clams can be easily found in traditional markets. Food traders have an important role in ensuring the quality of food sold so that it is safe for consumers to consume. This requires basic knowledge from traders regarding metal contamination in blood clams. This study aims to analyze the relationship between education level and traders' knowledge about arsenic contamination in blood clams.

METHODS

This study is a quantitative analytical observational analysis with a cross sectional approach to determine the relationship between education level and knowledge of arsenic heavy metal contamination in blood clams sold in traditional markets in the north Surabaya area. This study has passed the ethic No: 26/EA/KEPK/2021.

The study population was all peeled blood clam traders in 12 traditional markets in the north Surabaya area. Sampling was conducted using simple random sampling technique and the number of samples used was 35 shelled blood clam traders. Researchers collected data on the characteristics of shellfish traders and analyzed the knowledge, attitudes, and actions of traders towards heavy metal arsenic contamination in blood clams using a questionnaire instrument filled in according to the trader's situation. This study uses an informed consent and seller's personal data form. Interviews were conducted on the respondents to ask about their characteristics and level of knowledge. Knowledge data was obtained from multiple choice questions that had 14 questions related to contamination, arsenic, and also the impact of contamination. The questionnaire had been tested for validity and reliability.

The dependent variable in this study is the seller's knowledge and the independent variable is the seller's education level. Data sources in this study are primary and secondary data. Primary data is obtained from direct interviews with respondents regarding identity, knowledge, and also preliminary studies. Secondary data obtained from previous research literature studies. The chi square test was used to see the relationship between education level and traders' knowledge.

RESULTS AND DISCUSSION

This study showed that there was no relationship between the seller's education level and the seller's knowledge about arsenic contamination in blood clams. The characteristics of respondents analyzed in this study are age, gender, education level, and knowledge. Table 1 shows the gender of the respondents 100% female.

The age of traders ranged from 26-75 years. Most of the respondents fall into the early elderly age group with an age range of 46-55 years, namely 42.8% and the remaining small portion falls into the elderly age group with the age of the respondent 75 years as many as 1 respondent. Most respondents had elementary school (51.4%), did not finish elementary school (25.7%), junior high school (25.7%), and bachelor degree (2.9%).

The knowledge score was obtained through filling out a questionnaire with a knowledge level measurement scale divided into 3 categories, namely said to be good if the correct answer is $\geq 75\%$, sufficient if 56-74% of the correct answers, and less if $\leq 56\%$ of the correct answers (Arikunto, 2013). Based on the level of knowledge, most traders did not understand about arsenic heavy metal contamination in shellfish. A total of 91.4% of traders have a poor level of knowledge about contamination. As many as 62.9% of traders did not know what food contamination meant, only 20% of traders correctly answered knowledge questions related to the type of metal hazardous to health, namely arsenic and 20% of traders answered questions correctly related to shellfish is one of the marine biota that has a high risk of being contaminated with heavy metal arsenic.

Table 1. Respondents' Characteristic

| Variable | n | % |
|---------------------------------|----|-------|
| Gender | | |
| Male | 0 | 0 |
| Female | 35 | 100.0 |
| Age | | |
| 26-35 (Early adulthood) | 5 | 14.3 |
| 36-45 (Late adulthood) | 10 | 28.6 |
| 46-55 (Early elderly) | 15 | 42.9 |
| 56-65 (Late elderly) | 4 | 11.4 |
| >65 (Aged) | 1 | 2.9 |
| Education level | | |
| Didn't finish elementary school | 7 | 20.0 |
| Elementary school | 18 | 51.4 |
| Junior high school | 9 | 25.7 |
| Senior high school | 0 | 0.0 |
| Bachelor | 1 | 2.9 |
| Knowledge | | |
| Good | 1 | 2.9 |
| Sufficient | 2 | 5.7 |
| Low | 32 | 91.4 |

Table 2. Relationship between Education Level and Knowledge about Arsenic (As) Contamination in Blood Clams (*Anadara granosa*) that Sold in Traditional Market at North Surabaya

| Knowledge | Education | | | | | | | | <i>p-value</i> |
|------------|--------------------------|------|------------|------|---------------|------|---------------|-----|----------------|
| | Didn't Finish Elementary | | Elementary | | Middle School | | Undergraduate | | |
| | n | % | n | % | n | % | n | % | |
| Good | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 2.9 | 0.075 |
| Enough | 0 | 0.0 | 1 | 2.9 | 1 | 2.9 | 0 | 0.0 | |
| Not Enough | 7 | 20.0 | 17 | 51.4 | 8 | 25.7 | 0 | 0.0 | |

The results in Table 2 shows that there is no significant relationship between education level and knowledge about arsenic contamination in blood clams that are sold in traditional markets at North Surabaya, it gives result $p\text{-value } 0.075 > 0.001$. Food safety issues regarding arsenic heavy metal contamination are rarely discussed, so that not many people know about heavy metal contamination in blood clams.

Food safety is a very crucial aspect in protecting public health. The main objective of food safety is to prevent food or beverages from being contaminated by physical, biological and chemical substances so as to reduce the potential for illness due to food hazards. Unhygienic food will become an intermediary for disease transmission called foodborne disease and food poisoning. Foodborne disease can occur in people who consume unsafe food. The occurrence of these diseases is due to the negligence of food handlers about food safety. Food handlers are people who are directly in contact with food and equipment from the preparation, cleaning, processing, transportation to serving stages (Nurfikrizd & Rustiawan, 2020).

In the process of implementing food safety, all activities or production processes to produce food that is safe for consumption must go through the implementation of food safety requirements. Various efforts are made to achieve food safety. However, there are still foods circulating in the community that do not meet the criteria for safe consumption (Lestari, 2020).

Based on the Table 1, it was found that the blood clams sellers in this study had a predominately elementary school (51,4%). This can be categorized as low because it does not run the government's compulsory education program for 9 years. The level of education is the level of knowledge obtained from the last formal educational institution taken by the respondent (Anggitasari et al., 2014).

Based on the results of research on the age of traders, most traders belong to the early elderly with an age range of 46-55 years (42.8%). The average age of traders is 47 years with the highest age being 75 years and the youngest age being 26 years. The number of traders in the elderly category is influenced by several factors. Some of the statements of traders who were respondents in this study said that becoming a trader at an advanced age was something they chose in order to earn money to

meet their needs. Another reason that becomes a factor for the elderly to become traders in the market is because this business field does not have special requirements so that anyone can do it with a small capital. The level of knowledge possessed by the most of respondents is still lacking.

Based on the results of the study, all traders are female (100%). The large number of women who trade in the market is due to the fact that trading is an easy job for women to do and trading activities require tenacity, subtlety, and accuracy that are identically owned by women.

Most of the traders had primary school education (52,4%), while the highest level of education was a bachelor's degree (2,9%). Some of the other traders had primary level education but did not graduate from primary school (20%) and the rest (25,7%) had a junior high school education. According to some of the respondents, education is not a priority. Economic demands force them to be able to work as early as possible in order to earn money to help the family economy.

Based on Table 2, the results of chi-square test showed that the $p\text{-value}$ was 0,075 ($p > 0,001$). It can be said that there is no relationship between education level and knowledge of sellers about arsenic contamination in blood clams. Study done Kusumawarni (2020) which didn't see the relationship between education level and knowledge about arsenic contamination in blood clams. It was found that in 78 fishermen samples, 33 fishermen had low education because the fishermen didn't finish elementary school. This study is not in line with the research by Alwi, et al. (2019) most of the subjects (93.55%) had good knowledge related to food safety and there were no subjects who had less knowledge.

Arsenic contamination to the environment has become a concern in Bangladesh. So measurements are taken to determine the level of a person in avoiding this contamination. The result showed that a person's knowledge of arsenic contamination was obtained through word of mouth and campaigns (Aziz et al., 2006). The study in Pasaleman sub-district, Cirebon found that every housewife who has a poor level of knowledge has poor food safety behavior, and the respondent's education level has no effect on food safety behavior (Septiyani et al., 2021). The results of this study are in line with the results of research in Bantul Regency

that education level is not related to food safety behavior. This can occur because the education obtained does not focus on food safety, so that handlers with higher education do not necessarily have good behavior towards food safety (Nurfikrizd & Rustiawan, 2020).

Knowledge about contamination is the ability to choose safe food that is free from danger and also healthy. Knowledge is the result of human knowing (Notoatmodjo, 2003). Knowledge can be obtained both internally and externally. Internal knowledge is knowledge that comes from oneself based on life experience. While external knowledge is knowledge obtained from other people.

Indicators that can be used to determine the level of knowledge of the risk of exposure to heavy metal contamination that can be contained in marine biota, one of which is shellfish, can be described as the causes of contamination, the kinds of dangerous heavy metal contaminants, the health risks of heavy metal contamination that accumulates in marine biota that is then consumed, the maximum limit of heavy metal contamination, especially arsenic, which is allowed in food, the source and prevention of heavy metal contamination, and the kinds of marine biota that have a high potential for contamination.

Most of the traders had a low level of knowledge regarding arsenic heavy metal contamination in blood clams. The majority of traders did not know what heavy metal contamination is, heavy metals that are harmful to health, and did not know that blood clams are at risk of arsenic heavy metal contamination.

Factors that affect the level of knowledge include the level of education, sources of information that a person has, culture or habits that are difficult to change, experiences that a person has experienced about something informal, socio-economic level, and age (Sukanto, 2000). Education is a conscious effort to develop the personality and abilities of learners. With education, learners will have various abilities both cognitive, affective, and motoric. Cognitive abilities are related to knowledge and thinking skills. Affective abilities are related to attitudes. While motoric ability is related to action or practice. The higher a person's education, the higher the ability gained. The existence of high abilities allows a person to develop the knowledge, attitudes, and practices they do (Sugiyatmi, 2006).

Education level is not the only factor that determines a person's ability to develop knowledge and attitudes to do something. Past problem-solving experience also determines a person's attitude towards something. A person with low education but getting good information from various media such as television, radio, newspapers, magazines, etc., can also increase one's knowledge (Notoatmodjo, 2003). This is evidenced by research on mixed ice sellers in 11 traditional markets in Padang City in 2017

showing that there is no significant relationship between the seller's education level and food safety behavior (Hidayah et al., 2017).

CONCLUSION

There were no correlation between education level and knowledge about arsenic contamination in blood clams sellers at traditional markets in North Surabaya. For the further researchers it is recommended to be able to add more samples size of sellers, add male respondents, and expand the study area so that the study can measure more blood clams sellers.

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Conflict of Interest and Funding Disclosure

The author declares no conflict of interest in relation to this research study. There are no financial or personal relationships with individuals, organizations, or entities that could potentially bias or influence the research findings. The research is conducted with utmost objectivity and integrity, solely driven by the pursuit of scientific knowledge and the advancement of understanding in the field. Transparency and impartiality are maintained throughout the research process, ensuring the reliability and credibility of the study's outcomes.

Author Contributions

NA: article-writing, formal analysis NH: investigation, writing-original draft, formal analysis TM: conceptualization, investigation, methodology, supervision.

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