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Heavy Metal Contamination in Beef Cattle on Local Community's Health (Study Case: PT. Vale Indonesia, Sorowako Indonesia)

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***Abstract*:** *Beef Cattle farming activity in post-mining site of PT. Vale Indonesia has been contaminated by heavy metals. This was indicated by 60% and 40% of produced beef from cattle farming in post-mining sites supplied to the traditional market. The study is a descriptive quantitative study employing descriptive statistics analysis. This study employed a purposive sampling method on 30 respondents consisting of 10 pregnant women, 10 teenagers (age of 10-17), and 10 adults (age of +17). The results of the study confirmed that there is the presence of potential health risks based on Sytmthoms (1) anemia, (2) headache, (3) fatigue and (4) sore throat in pregnant women for 41,43%; teenagers (age of 10-17) for 21,43% and the adults for 37,14% respectively. Although the authors found the potential health risk from the respondent, we could generalize all the symptoms come from the heavy metal contamination on beef consumed. Therefore, we need to conduct further study about the beef consumption of local communities around the post-mining area PT Vale, Indonesia.*

Keywords : Heavy Metal Contamination, Beef Cattle, Health

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INTRODUCTION

Local communities in post-mining areas have traditionally faced degraded landscapes, environmental degradation, and socio-economic problems. Previously mines were often abandoned after the production phase without considering the potential risks to humans and the environment or social dimension (Sandlos and Keeling, 2016; Kivinen, 2017). The most common post-mining land use objectives include agriculture, livestock farming, forestry, pastures recreation, and conservation (McHaina, 2001; O. E. Kubit, Pluhar, and Graff, 2019). The utilization of post-mining land as livestock farming is very promising. However, post- mining land is the largest area that produces heavy metals. Environmental pollution by heavy metals is a threat and a serious concern nowadays (Ali, Khan, and Ilahi, 2019). Not all post-mining land contains exceeded heavy metals.

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If we indicated that the post-ming area contaminated heavy metals that exceeded food safety standards, the company, government, and local community should perform land rehabilitation and remediation. As an example, Kidston post- Gold Mine.

Beef and livestock products are essential need for human diet because they provide most of the nutrients. Heavy metals are environmental pollutants known for their toxicity, persistence in the environment (Ali, Khan, and Ilahi, 2019), and bioaccumulative properties. Heavy metals from manufactured pollution sources are continuously released into aquatic and terrestrial ecosystems (Ali, Khan, and Sajad, 2013). Contamination with heavy metals becomes serious threat due to toxicity, bioaccumulation, and biomagnification in the food chain (Demirezen and Uruç, 2006). Generally, Beef quality is essential as one factor of beef value. However, a number of farmers cannot fill the quality. Beef can also be hazardous media materials such as bacteria and other microorganisms from pen or feedstuffs. In contrast, Humans need to consume beef should be free of any harmful ingredients. The toxic materials may accumulate in the organs in heavy metals content such as Cu, Zn, Fe, Pb, Cr, Hg, etc. (Pan, Lu, and Lei, 2020; Lu et.al., 2014).

In recent years, much attention has focused on heavy metal levels in fish and other seafood. However, it is only a little attention on heavy metal levels of beef and its products. Related to this phenomenon, the research of heavy metals in beef consumption needs to be evaluated. Therefore, this study focuses on the contamination of heavy metals on beef from cattle that grazed around the area of PT Vale Indonesia and the effect of the contamination on the local community's health.

METODOLOGI

This study was conducted for three months in 2019 and was implemented to 30 respondents by purposive sampling consisting of 10 pregnant women, 10 teenage women (10-17 years), and 10 adults (over 17 years old). The respondent was living and directly consuming the beef from the area of PT. Vale Indonesia. The data were employed according to descriptive qualitative and were measured in Likert scale three tiers. The long-term problem with Likert-type scales and ordinal responses is the appropriate statistical treatment of these data. If the data is ordinal, non-parametric statistics are usually considered the most appropriate choice for analysis (Bishop and Herron, 2015; Djamba and Neuman, 2002).

Furthermore, this study was supported by Focused group discussion (FGD) to get an overview of the variables and indicators. The data were collected by direct interviews of 30 respondents. Tools and analysis used to obtain the research results were statistical descriptive. To complete the data experiment, this study also was analyzed by test validation and data absolute (Sullivan and Artino, 2013).

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RESULTS AND DISCUSSION

Heavy metals contamination on the beef affects the local community's health.

Table 1 showed that heavy metals contamination on beef was interpreted according to variables and indicators. Heavy metals contamination on beef from cattle grazing in PT vale Indonesia potentially affects health risks. About 41.43% affect health's pregnant women, 21.43% affect health's female teenagers (10-17 years of age), and 37.14% affect health's mature age (over age 17 years). The results are presented in Table 1

Table 1. Heavy metals on consumed beef of local community's health

Aspect	Variable	Indicators	Rating Score 1 2 3	Category
Heavy metals contaminatio on the beef	Symptoms	Health risk		2.03 (high)
	anemia,	100 %		
	headache	70 – 99%	19 8 3	1.46
	fatigue	< 70%	8 7 15	2.23
	sore throat		4 10 16	2.40

Source: Research results, 2019

From Table 1, heavy metal on beef from cattle grazed in PT. Vale Indonesia tends to affect the local community's health, as shown by rating score (2.03), and the category is high influence, according to 2 and 3 values. The health variable, i.e. (1) anemia, (2) headache, (3) fatigue, (4) sore throat, the pregnant women respondent experiences the heavy metals on health symptoms. The pregnant women experienced anemia, sore throat repeatedly, and excessive fatigue. Afterward, they feel drowsiness after working 8 hours. Teenagers and adults also experience the symptoms. Although the respondents experienced the same symptoms as heavy metal effect on human health, it remains possible that the respondent symptoms come from other factors such as urban runoff, sewage disposal, insect or disease control agents, and pesticide applied to plants.

The local community at the post-mining site would expect the consumed beef products to have no health risk. In contrast, a study performed by (Purnama et al., 2014) confirmed the potential health risk due to consuming beef products. Heavy metal toxicity has been shown to be a significant threat, and there are several health risks associated with it. Although they have no biological role, the toxic effects of these metals can interfere with metabolic processes over a period of time (Jaishankar, et.al., 2014).

Heavy metals enter the beef through feedlots and water. The content of heavy metals in beef that humans consume cannot be removed by cooking. Therefore, further research is needed to determine the accumulation of heavy metals in beef cattle (Ako *et al*, 2019). The grazing area around the post-mining site showed the content of heavy metals, i.e., Cu of 1.05 mg/kg, Fe 108.34 mg/Kg, Zn 7.11 mg/kg, Cr 125.48 mg/kg, Ni

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0.61 mg/kg, respectively (Baloch, et.al., 2020). Although the Ministry of Health of the Republic of Indonesia (No.03725/B/SK/VII/1989) stated that the content of heavy metals was still below the threshold. Yet, it is indicated that harmful to human health or the community if they consume the Beef, water, and other foodstuffs sourced from the land area of PT Vale Indonesia. The contamination of the local community's health risks also can cause various organ systems disorders such as the blood, nervous system, kidneys, reproductive system and digestive tract headache, dermatitis, allergies, hives, inflammation of the throat, respiratory disorders, anemia, pneumonia, kidney failure.

The higher amounts of heavy metal essential contamination such as Cu and Zn can have severe consequences leading to liver cirrhosis, hepatitis, and/or hemolysis similar to those seen in acute copper poisoning (Yakup et.al., 2018). Non-essential elements such as Pb, Cd, Ni, and Cr are toxic to the human body. Pb exposure, always associated with gastrointestinal irritation and neurotoxicity in children and adults, causes cancer in humans (Karri, Schuhmacher, and V. Kumar, 2016). Heavy metals such as Nickel (Ni) and Chrom (Cr), Cadmium (Cd), and lead (Pb) is essential metal and occur at deficient levels in the environment. Ni is carcinogenic and can cause fibrosis, tumors, pneumonia, and emphysema (Salnikow and Kasprzak, 2005). WHO recommends a tolerable intake of 0.025 ppm/week for Pb and 0.49 ppm/body weight/week for Cd (WHO, 2009), a change from the previously permitted limit of 1.75 ppm/week for adults weighing 70 kg (Pandelova, et.al., 2012). In addition, Ni is important in the body at low levels as an enzyme activator but is a carcinogen at high concentrations (Sreekanth, et.al., 2013). WHO also has set a tolerable daily intake of Ni at 11 ppm/day/bodyweight for humans (WHO, 2009; Pandelova, et.al., 2012). Cr has been associated with urticaria, anemia, and generalized visceral disorders. In a recent study, half of the local population consuming wild boar meat was shown to be exposed to Cr levels >12.5 l ppm/week/person (CI for median = 0.5l ppm/Cr week/person) (Saha et.al., 2011) Furthermore, environmental pollution with sewage and urban agriculture that thrives on it helps spread the bio-accumulation of heavy metals in food. Most estimated metals indicated healthy risk since their values are higher than the permissible tolerable levels cited by internationals health (Kasozi *et al*., 2021).

CONCLUSIONS

Beef from cattle grazed around PT Vale Indonesia may affect the local community's health either on pregnant women, teenagers or adults. Although the authors found the potential health risk from the respondent, we could generalize all the symptoms come from the heavy metal contamination on beef consumed. Therefore, we recommended that (1) the government, researcher, and company should evaluate the rehabilitation and remediation time in PT Vale Indonesia, (2) we need to conduct further study about the beef

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consumption of the local community around the post-mining area PT Vale Indonesia, (3), the government and company provide health service in the local community around PT Vale Indonesia.

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