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Lead detection in blood of the Bali cattle that were slaughtered in the traditional slaughterhouses in Denpasar, Bali

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ABSTRACT

Lead contamination in the body of the cattle was thought initially to be coming from the feed and the environment in which the cattle were maintained. When a human consumes more than 2.0 ppm of lead-contaminated beef, it could cause damage to various organs, and also lower cognitive abilities. This study aims to determine the amount of heavy metal lead in the blood of Bali cattle which were slaughtered in a traditional slaughterhouse in Denpasar. Blood plasma samples from 20 Bali cattle were taken randomly and used for this study. The blood stored in 10ml tubes which were filled with 0.5% Ethylenediaminetetraacetic acid (EDTA) previously. The lead content measurement was conducted by using atomic absorption spectrophotometer (AAS) method. From the measurement result, it was obtained that the average lead content was 7.35±4.33 ppm. There was a blood sample that did not contain any lead. The lead content of this result is higher than in the cattle from Suwung Landfill Denpasar, which was 6.60±1.85 ppm, as the result of our research previously. This result shows that lead contamination does not only originate from the place in which the cattle were raised. However, other risk factors can contribute to it and thus further investigation is needed. Nonetheless, it can be concluded that the level of lead contamination in blood plasma of Bali cattle which were slaughtered in a traditional slaughterhouse is 7.35±4.33 ppm. There is the need to do a further study about the risk factors of lead contamination in the blood of Bali cattle.

Keywords: lead, Bali cattle, blood plasma.
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INTRODUCTION

In order to maintain food safety, examination of hazardous substances in foodstuffs must be routinely done. One of the most common elements is heavy metal, particularly lead (Pb). Lead is hazardous to human health if the amount consumed exceeds the recommended threshold. Lead, like the other heavy metals, tends to accumulate in the body of the consumer. The lead could substitute iron in the hemoglobin and potentially caused anemia.[1] Lead poisoning could also result in various organs failure such as liver,[2] kidney, lungs, spleen,[3] and brain.[4]

Beef is one of the many protein sources that are widely consumed. To obtain a healthy and safe-to-consume beef, one needs to ensure the meat quality thoroughly, and especially to watch out for the lead (Pb) content in it. Lead contamination in Bali cattle could be originated from the food, water, and even the polluted air. The blood of the cattle herded at a landfill in Denpasar was found to be contaminated by lead with an average concentration of 6.595 ± 1.85 ppm.[5] It exceeded the maximum threshold set by SNI 7387-2009, which is 2.00 ppm. Another study had also reported that the mean of lead contamination in the blood of cattle butchered in a slaughterhouse in Nigeria was 5.65±0.70 ppm.[6]

A traditional slaughterhouse is a common place of livestock slaughtering of Bali cattle that possibly came from a farm with poor animal care. The cattle could be herded in an inappropriate and polluted location, such as a landfill. That is why it is necessary to conduct an examination of lead contamination in the blood of Bali cattle which were butchered in a traditional slaughterhouse.

METHOD

Sample

The study used blood samples from 20 cattle that were slaughtered in a traditional slaughterhouse in Denpasar, Bali. The blood was taken using 10 ml syringe from and stored in 10 ml tubes which previously filled with anticoagulant 0.5% Ethylenediaminetetraacetic Acid (EDTA). Examination of lead concentration was conducted in the Analytical Laboratory of Udayana University.

Measurement of Lead Content Level

The analysis of lead content in cattle's the blood samples was done using AAS (Atomic Absorption Spectrophotometric) method. Each of the blood samples was taken from each cattle. Each sample was then split into two parts of 0.5ml each; one for

Table 1 **Lead concentration of the blood samples from twenty Bali cattle that were slaughtered at the traditional slaughterhouse.**

No	Lead contain (ppm)
1	5.957
2	6.492
3	0
4	6.329
5	4.877
6	6.259
7	7.376
8	7,065
9	4.354
10	4.322
11	5.636
12	5.882
13	7.210
14	7.444
15	23.204
16	7.160
17	9.673
18	9.363
19	8.798
20	9.594
Mean	7.350±3.31

positive control, and another as a sample. After that, 0.25ml of 1mg/1 standard solution was added to the sample to create spiked sample or positive control group. The spiked sample was then heated on a hot plate at a temperature up to 100°C until it was dried up. Sample and spiked were put in an ashing furnace, and half of the surface was closed. The temperature was slowly rising by 100°C every 30 minutes up to 450°C and then maintained for 18 hours. The sample and spiked were taken out after and were let cool down to room temperature. After that, 1ml of 65% HNO_3 was added and then shaken carefully until the ashes mixed with the acid before it was put on the hot plate again with 100°C temperature and dried up. And then the ashing process repeated, but this time the temperature only maintained for 3 hours. After the ashes have perfect white color, it was then let cool down, then 5ml of 6M HCl was added to each sample before they are shaken carefully. Then they were put back on the hot plate on 100°C temperature until they were dried up. After that, added 10ml of 0.1M HNO_3 to the sample and were let cool down in room temperature for an hour, before the sample put in a 50ml polypropylene flask and 0.1M HNO_3 was added as a matrix modifier solution, which was poured until it reached the marking. The lead standard solution was then prepared in minimum five concentration point. The standard solution, sample and spiked were read in graphite furnace atomic absorption spectroscopy (GFAAS) on the wavelength of 288.3nm to measure lead concentration. The concentration of lead can be calculated using the formula (SNI 2354.5:2011). The result of lead measurement of the blood samples was analyzed by using quantitative descriptive analysis.

RESULT

Twenty female cattle used as a sample in this study with age ranged between 4 to 6 years old. Clinically, all of the cattle look healthy, and there was no macroscopic pathological finding. The blood was taken when the cattle were slaughtered and collected in 10 ml tube which had previously been filled with anticoagulant 0.5% ethylenediaminetetraacetic acid. Table 1 summarizes our findings.

The result showed that almost all of samples (19 out of 20) were contaminated with lead higher than maximum recommendation level (2.00 ppm; SNI 7387-2009). The lead concentration ranged from 0 ppm to as high as 23.204 ppm with an average concentration of 7.35 ± 4.33 ppm. In contrast to the results of a study conducted on 22 cattle that were herded at a landfill in Denpasar City, where obtained lead contamination rates vary between 0.104 ppm to 10.216 ppm, with an average of 6.595 ± 1.85 ppm.

DISCUSSION

Bali cattle that were slaughtered in traditional slaughterhouses usually come from various farms or cattle markets. The owners of the slaughterhouses often buy the animals directly from the farmer, therefore obtaining it as cheap as possible. Usually, the condition of the farm or the herding methods is not considered by them which results in many unhealthy cattle to be sold in the market. Those cattle could even possibly herded in the landfill which increase the chance of lead contamination. Most of the landfills in Indonesia are open dumping, and therefore had a high risk to contaminate cattle herded there, in particular by the lead.[7] The result of our study is consistent with the results of several studies, in which lead contamination was found in the blood of the animal.[5,8]

The average rate of lead contamination in the blood of Bali cattle that were butchered in traditional slaughterhouses is 7.350±3.31 ppm, which

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exceeds the average of Bali cattle's that were herded at the landfill of 6.595±1.85 ppm.[5] It was surprising that lead contamination rates were higher than those that were herded in an inappropriate location. This phenomenon raises a notion that air pollution could also potentially cause lead contamination. The evidence supporting this idea was that lead contamination in India was caused by residue from the coal burning as well as other materials containing lead.[9]

In addition, numerous plant species naturally contain a certain amount of lead and, thus, could also be the source of lead contamination. The results from a study found the evidence of lead contamination in dairy cows in Egypt, even though the cattle were raised appropriately.[10] Lead contamination was also found in cows and chicken egg in Palestine. [11] This is certainly an issue for consumers of beef, milk and chicken eggs as they could potentially consume foods with high level of lead. Lead contamination could result in lead poisoning which mostly results from oxidative stress which damage cells and tissues, rendering them dysfunction or inducing malignant transformation.[3] Lastly, a study reported that lead contamination was distributed and accumulated in several organs of Bali cattle herded at landfills.[12]

In our study, we found that most of the cattle were contaminated. However, one cattle was found to be free of lead, and the other one was highly contaminated (lead plasma level 23.204 ppm). It appears that the cattle in our samples were originated from unsanitized and polluted farms which probably had contaminated grass or animal food or even polluted water. It also possible that the cattle were raised in garbage dumps which should be avoided because of its various poisonous substances. Our previous study about the lead contamination in cattle raised in city dumps in Denpasar, Bali also showed that lead poisoning was widespread in the cattle.[5] Furthermore, all of our samples were contaminated albeit with various level. Thus, there is a possibility that the cattle slaughtered in the traditional slaughterhouse were raised in this environment. The lead that originates from used batteries, ceramic dye, paints and many other could contaminate the food and water which will subsequently consume by the cattle. Long-term consumption of such substances would result in the magnification of lead concentration in various organs of the cattle, rendering them unhealthy for human consumption.[13]

CONCLUSION

In conclusion, we found a significant lead contamination in the blood of Bali cattle slaughtered in traditional slaughterhouses which were higher than maximum recommended level. The contamination level was also found to be greater than that in the cattle that raised in city garbage dumps. Close monitoring by health department is required to decrease the amount of contaminated meat in the market as well as to socialize the appropriate farming methods to reduce the contamination level of heavy metal in the beef.

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