

Assessment Of Trace Metals Contamination In Cow Hides Singed By The Use Of Rubber Tyre And Boiling Water In Essien Udim, Akwa Ibom State, Nigeria.

Udo, Idongesit I., Etuk, B. A. and Effiong, J.O.

Department of Science Technology, Akwa Ibom State Polytechnic, Ikot Osurua, Ikot Ekpene, Akwa Ibom State

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ABSTRACT

The concentrations of trace metals in singed cow hides and unsinged cow hides using rubber tyre and boiling water was examined using flame atomic absorption spectrophotometer. The results obtained for hides singed with rubber tyre was Cd (0.75 ± 0.001), Pb (18.08 ± 0.005), Ni (0.72 ± 0.001), Cu (13.80 ± 0.001), Zn (3.12 ± 0.001) and Fe (12.14 ± 0.003) while the unsinged hides recorded 0.03 ± 0.001 , 0.05 ± 0.00 , 0.22 ± 0.001 , 4.35 ± 0.00 , 11.22 ± 0.002 and 20.15 ± 0.00 for Cd, Pb, Ni, Cu, Zn and Fe respectively. The concentration of these metals in cow hide singed with rubber tyre was higher than that singed with boiling water. Singeing using rubber tyre and boiling water decreased the level of essential trace elements in the meat and increased the levels of toxic trace elements. The levels of Pb, Ni, Cr, and Cd, in cow hide singed with rubber tyre and the levels of Pb and Cd in cow hide singed with boiling water were higher than the WHO standard. Regular monitoring of our environment and routine surveillance of cow hide processed by the use of different alternative fuel is advocated to ensure the continuous safety of cow hide consumed in Essien Udim, Akwa Ibom State.

Keywords: Heavy Metals, Rubber tyre, Boiling water, Singeing and Cow Hide.

I. INTRODUCTION

Trace metals may be defined as naturally occurring substances present in the environment at low concentrations. These metals find their way into humans by ingestion through food chains, drinking water, inhalation and skin contact. Trace metals are not easily degraded or destroyed and can

be accumulated in certain organs leading to some unwanted adverse health effects. Some trace metals are essential for effective growth include Fe, Cu, Zn and Mn while some are toxic to the body As, Hg, Pb, Ni and Cd etc. The essential trace metals are mainly used in physiological processes in the body while toxic metals do not play any role in the body.

Our water, air and land environment is a sink for trace metals through natural or anthropogenic sources. Most hides are processed by roasting which evokes acceptable flavour and maintains the hides for consumption (FAO, 1985). Roasting and singeing is mostly achieved by using firewood but the relative high cost of firewood as fuel has resulted in the use of alternative energy fuel sources such as plastics, dry palm fronds or scrap tyre. These alternative fuel sources contain potential toxic substances such as dioxin and trace metals, which may be introduced into food through processing methods like singeing.

However, rubber tyres are non-biodegradable; some additives such as zinc, chromium, lead, copper, cadmium and sulphur can breakdown and leached leads to environmental concerns. According to Etuk et al., (2009), singeing of hides with scrap tyre under open and uncontrollable fire leads to air pollution and the emission of black plume of smoke, toxic volatile products such as soots, large amount of green house gases, dioxin, volatile organic compounds and polycyclic aromatic hydrocarbons that may be carcinogenic or mutagenic. Moreover, emissions from scrap tyres contain significant carcinogens like benzene, 1,3-butadiene and benzopyrene (USEPA, 1997). Burning of tyres emit small particles of zinc

oxide which causes inflammation of the lungs (Reisman, 1997).

Obri-Danso, et al., (2008) observed that singeing of meats using scrap tyres introduce contaminants into meat making it unsafe for human consumption. Agency for Toxic Substances and Disease Registry (ASTDR, 1997) has revealed that tyre derived fuel contains several trace metals such as Cu, Cd, Zn and Pb, that may be introduced into the environment through combustion. The soil can also be polluted from leaching of ash and unburned residues following rainfall.

The contaminated soil and water affect man and the aquatic ecosystem. Based on the concentration of exposure, adverse health challenges may be experience by humans. These include, skin, eye and mucous membranes irritation, respiratory effect, cancer and depression of the central nervous system. However, trace metals contamination of food possess great global health concern due to their toxicity, which bio accumulated and biomagnified along the food chain (Underwood, 1997).

Cow hide contamination by rubber tyre results in food borne disease and food contamination that threatens the health of the consumers of such food. Sabir et al. (2003) reported that the outbreak of food-borne diseases was on the increase and this resulted in disputes over food safety and quality requirements by countries in the international food market. Literature on cow hide quality singed by the use of different alternative fuel sources in Essien Udim, Akwa Ibom State is scarce. Thus, this study seeks to examine the quality of cow hide singed with scrap tyre as alternative fuel in Essien Udim, Akwa Ibom State.

II. MATERIALS AND METHODS

Sample Collection and Treatment (AOAC, 1979)

Three live cows were slaughtered and the skin purchased from cow sellers at Obo-Annang

market abattoir in Essien Udim Local Government Area of Akwa Ibom State. The cow hides singed in open fire fuelled with scrap rubber tyre while hairs from the unsinged sample were removed by the use of boiling water.

Deionize water with iron sponge was later used to wash off the burnt surface of hides singed with scrap tyre. The processed cow hides were kept in cleaned polythene and preserved in an ice box and then taken to the laboratory for further analysis.

Approximately 2.0 grams portion of each samples (samples singed with scrap tyre and samples treated with boiling water) were wet digested. 2.0g of the samples were measured into separate beakers and digest using a mixture of HNO₃ and HCl acids in the ratio of 1:2 (v/v) on a hot plate for 5-10 minutes at 110°C until the fumes disappeared. The digest were filtered through whatman filter paper no. 1 into 50ml volumetric flask washed with deionize water and made up to the mark. Working solutions used as standard were prepared from stock metal standard of each metal.

Trace metals Analysis

The concentrations of Cd, Pb, Zn, Fe, Ni and Cu ions in each digests were examined through flame atomic absorption spectrophotometer with blank set as zero and standards used for the calibration of the spectrophotometer. The levels of trace metals were expressed as mean of triplicate determination ± standard deviation. The observed results were compared with standard stipulated by world health organisation, (WHO), for meat meant for human consumption.

III. RESULT AND DISCUSSION

The levels of heavy metals analysis in cow hide singed with rubber tyre, and unsinged cow hides (boiling water) are presented in Table 1 below and Figure 1 is a bar chart showing the levels of the heavy metals in the cow hides

Table 1: levels of trace metals in cow hides singed with scrap tyres and boiling water

Sample id	Cd (mg/kg)	Pb(mg/kg)	Ni(mg/kg)	Cu(mg/kg)	Zn(mg/kg)	Fe(mg/kg)
Singed with rubber Tyre	0.75±0.001	18.08±0.005	0.72±0.001	13.8±0.001	3.13±0.001	12.14±0.003
Unsigned (boiling water)	0.03±0.001	0.50±0.003	0.22±0.001	4.38±0.002	11.22±0.002	20.15±0.002
ECR standard	0.05	0.01	0.05	20	40	30

(Levels of trace metals expressed as mean of triplicate determinations \pm standard deviation, ECR: European Commission Regulation, 2006)

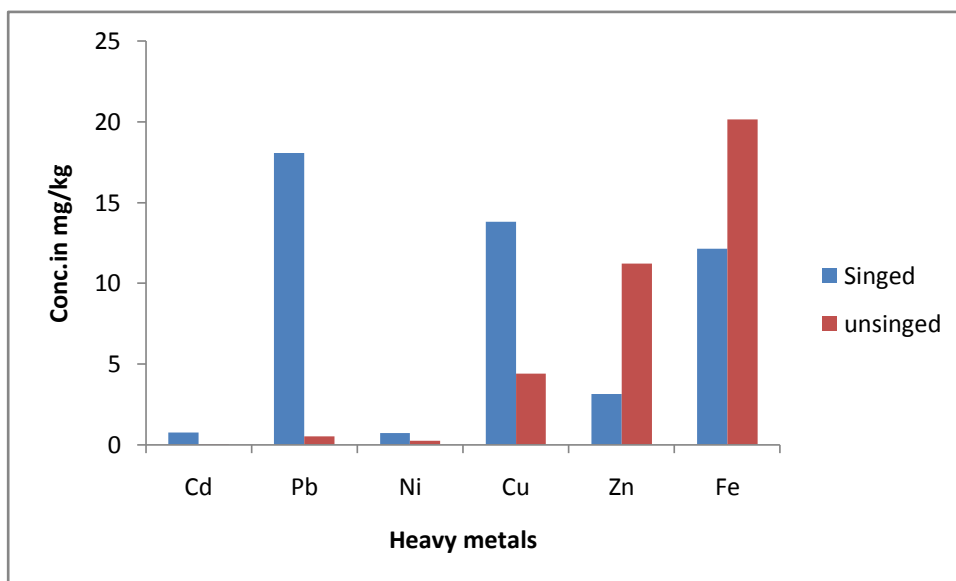


Fig.1: A bar chart showing heavy metal concentrations in cow hides singed with rubber tyre and boiling water. The results in table 1 above shows the concentrations of Pb, Cd, Ni, Fe, Zn and Cu in cow hide singed with rubber tyre and unsinged using boiled water while the trend indicated that $Pb > Cu > Fe > Ni > Cd > Zn$, the trend for cow hides singed with boiling water was $Cu > Ni \geq Zn > Pb > Cd$.

The highest concentration was recorded for lead in cow hide singed with rubber tyre was $18.08 \pm 0.005 \text{ mg/kg}$ while the cow hide singed boiling water (control) was $.05 \pm 0.003$. The trend showed that the Pb^{2+} ion in cow hides singed with rubber tyre is greater than that of control. Etuk, et al.,(2019) reported elevated levels of lead in goat hide singed with rubber tyre when compared with the unsinged goat hide. The observed values indicated that Pb contents in cow hides analyzed was higher than the Food and Agricultural organisation (FAO), world health organisation (WHO) and European Commission Regulation (ECR, 2006) with limits between 0.05 -0.10 mg/kg. Lead is responsible for increase blood pressure, cardiovascular and encephalopathy diseases in adults. Lead also affects nervous and circulatory systems and intelligence quotient in children (Jarup, 2003).

Copper (Cu) recorded the second highest concentration in this study, in cow hide signed with rubber tyre ($13.8 \pm 0.003 \text{ mg/kg}$), while the hides singed with boiling water (control) was $4.38 \pm 0.002 \text{ mg/kg}$. Lethal levels of copper may be toxic but the level of copper in this study was lower than the standard of 30mg/kg stipulated by FAO (1995).

Nickel concentration in this study showed that hides singed with rubber tyre is greater than

control Etuk, et al.,(2019), reported values of 1.63mg/kg for unsinged goat hide and 3.50mg/kg for goat hide singed with rubber tyre which is higher than values obtained in this study. The level of nickel in this research for hides singed with rubber tyre is higher than that stipulated by WHO (0.05mg/kg). Although, nickel is essential for some metabolic processes in the body, elevated levels of nickel be toxic. Nickel toxicity has been linked with cancer of the lungs, nose, bone and skin infection (Jarup,2003).

Levels of iron in singed and unsinged cow hide was 12.14 ± 0.003 and $20.15 \pm 0.002 \text{ mg/k}$. Etuk, et al.,(2019), reported values of 9.67mg/kg for unsinged goat hide and 2.83mg/kg for goat hide singed with rubber tyre. This result suggest that singeing with rubber tyre decreased the level of the essential element and this is i result reported by Etuk, et al.,(2019) Deficiency of iron causes anaemia while too much of iron may leads to gene mutation resulting in haemochromatosis with symptoms such as joint pains, fatigue and weight loss (Etuk et al., 2017). Singeing was found to reduce the level of iron in cow hide

Cadmium levels in this study revealed that singed cow hides contain higher Cd levels than unsinged. Similar trend was reported by Obri-Danso, et al., (2008). Etuk, et al.,(2019), reported values of 0.14mg/kg for singed goat hide which

smaller than observed in this study. The concentration of cadmium observed is higher than 0.05mg/kg stipulated by WHO. However, cadmium is not needed for physiological process in the body, but competes with zinc in the body. It disrupts zinc dependent enzymatic activities because of its chemical similarity and can accumulate in the kidney resulting in kidney toxicity and damage (Amfo-Otu et al., 2014).

Zinc content in singed cow hide was 3.13 ± 0.002 mg/kg while unsinged value was 11.22 ± 0.001 mg/kg. Zinc level in the unsinged cow hide was found to be higher than the singed due to the fact that zinc is an essential trace element required by the body. Zinc is the second most required transition metal in the body. Etuk, et al., (2019), reported higher values of 7.89mg/kg for unsinged goat hide and 2.26mg/kg for goat hide singed with rubber tyre which is lower than values obtained in this study. The level of zinc in this study was lower than the stipulated standard but singeing was found to lower the level of this essential trace metal.

The high levels of the trace metals in the unsinged cow hide may be due to the fact that the animal may be exposed to the metals from the environment during grazing (open grazing), consumption of contaminated animal feed and polluted water from the drains, scavenging in open waste dumps for fodder and exposure to atmospheric deposition especially automobile fumes (Jarup, 2003). Moreover, Qiu et al. (2008), reported a close correlation between contaminated animal feed and rearing of livestock in proximity to polluted environment. However, level of trace metals in animal hides may be due to types of pasture, processing methods, environmental conditions, industrial development and the trace metal content of fuel used in singeing.

IV. CONCLUSION

Trace metals such as Pb, Cd, Ni, Cu, Zn and Fe were found in singed and unsinged cow hides. The concentrations of Pb, Cd, Ni and Cu in cow hide singed with rubber tyre were higher than that for unsinged. However, these levels were found to be higher than the FAO standard. In addition, singeing of cow hide with rubber tyre decreased the amount of essential trace elements in singed cow hide. From this research, singeing of cow hide especially with scrap rubber tyre is a major source of trace metal contamination in cow hide. Continuous consumption of cow hide as meat product in Essien Udim may be a threat to consumers due to the fact that these metals are non biodegradable and can bioaccumulate and biomagnified. Therefore routine monitoring and

assessment of our meat and meat products from Obo-Annang market abattoir in Essien Udim local government area is advocated to ensure continuous safety of meat.

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