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Research Article

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Assessment of Heavy Metals in Processed Cow Skins consumed in Two Area Councils of the FCT-Abuja

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Abstract

The use of spent engine oil, tyres, refuse etc in the singeing of cow skin is a common sight in many local abattoirs in Nigeria. This research work analyzed the heavy metal content in cow skin proceed using different methods from two Area Councils of the FCT. Metals like Mn, Ni, Fe, Cd, Pb and Zn were determined using AAS. From the results obtained, the heavy metal concentrations (mg/kg) in processed cow skins in Gwagwalada and Kuje Area Councils are in the range of Pb (0.1172-0.2656), Cd (BDL), Ni (BDL), Mn (0.8934-0.9526), Fe (13.3735-18.5128) and Zn (3.0142-5.9430) in scrapped (S_c) cow skins, Pb (BDL-1.0973), Cd (BDL) Ni (BDL), Mn (1.3005-1.6724), Fe (21.1975-25.0922) and Zn (2.3903-7.6962) in singed (S_n) cow skins and Pb (BDL-0.1471), Cd (BDL), Ni (BDL), Mn (0.2204-1.4261), Fe (11.2719-24.1805) and Zn (0.8110-7.1082) in singed and then washed (SW) cow skins.

Keywords: *Cow skin; Singeing; Scrapping; Heavy metals; Lead*

Introduction

Heavy metals are metallic chemicals with a relatively high density that are toxic, persistent and hazardous to human health at low concentrations [1]. These include mercury (Hg), lead (Pb), copper (Cu), cadmium (Cd), arsenic (As), chromium (Cr), thallium (TI), manganese (Mn), zinc (Zn), and nickel (Ni) [2]. Some of these metals (Fe, Mn, Cu and Zn) are essential for metabolism in their lower concentrations [3]. As, Cd, Cr, Co, Pb, Ni, and Zn are the most common heavy metals potentially hazardous to human health [4]. However, cadmium and lead have more significant side effects on human health since they are easily accessible through the food chain [5].

The World Health Organization (WHO) has identified food contamination as a problem facing humanity today [6]. This include problem include heavy metal contamination in meat, which is of great concern for both food safety and human health because of the toxic nature of these metals at relatively low concentrations [7]. Consumption of unsafe amount of heavy metals in food may lead to the disruption of biological and biochemical processes in the human body [8] causing various disorders that are characterized by gastrointestinal disorders, stomatitis, tremors, diarrhea, hemoglobinuria, paralysis, vomiting, convulsions, and depression [9]. Similarly, heavy metals have the ability to disrupt metabolic activity and genetic makeup, or to affect embryonic or fetal development [10].

In FCT-Abuja as in most part of Africa singeing with scrap tyre, spent engine oil, polystyrene, refuse and firewood have become a major method of removing the hair on the skin of slaughtered cattles and goats. These disturbing methods are worrying since they can introduce different contaminants into the meat, thereby rendering it unsafe for human consumption [11].

This work is aimed at investigating the possible heavy metals contaminating cow skins processed in Gwagwalada and Kuje Area Councils of Federal Capital Territory.

Experimental Methods

Cow skins from already slaughtered cows were collected from abattoirs in two Area Councils of the Federal Capital Territory.

Seven cows were randomly selected for the sampling in each Area Council; three samples were collected from each cow making a total of 21 samples per Area Council. The three samples collected from each cow were processed using deferent method, viz: scrapped (unsinged), singed and singed and then washed. The processed cow skins were put in the oven at temperature of 105°c to get their moisture content. Singeing of the cow skin was carried out using different materials like fire wood, fuel with refuse, spent engine oil, charcoal, tyre etc while scrapping was done using hot water and razor blade/knife.

Moisture Content

This was done by weighing 5 g of the sample into a crucible, placed in an oven and heated for 5 hours at constant temperature of 105°C. The sample was then removed and put rapidly into a desiccator in order to prevent more moisture uptake from atmosphere. The sample was cooled to constant mass and reweighed. This was done in triplicate. The difference in the mass constitutes the amount of moisture content of the adsorbent in percentage.

$$\frac{(W_2\text{-}W_3)}{(W_2\text{-}W_1)} \qquad 1$$

W_1 = Mass of empty crucible
W_2 = Initial mass of crucible with sample
W_3 = Final mass of crucible with sample

Ash Content

10 grams of the samples were put in a muffle furnace at a temperature of 530°C for four hours thirty minutes; allowed to cool in a desiccator and weighed; the percentage ash was calculated using the formula below

$$\% \text{ ash (wet)} = \frac{\text{weight of crucible and ash-weight of crucible}}{\text{weight of crucible and sample-weight of crucible}} \times 100$$

2

Sample Preparation

The Ash was dissolved in 2cm^3 of HNO_3 and made up to 50 cm^3 with distilled de-ionized water.

Elemental Analysis of the Sample

Pb, Cd, Ni, Mn, Fe and Zn in cow skins processed by different methods were determined using atomic absorption spectrophotometry (AAS).

Standard Working Solution

The Stocks were severally diluted to obtained standard working solution. All solutions were prepared using distilled de-ionized water. All the salts used were of analytical grade.

Statistical Analysis

All data were subjected to two ways analysis of variance (ANOVA) without replicate.

Result

Metals	Conc. of unspiked samples (mg/kg)	Amount of standards added (mg/l)	Conc. of spiked samples (mg/kg)	% Recovered
Pb	BDL	0.2	0.2059	103
Cd	BDL	0.2	0.2139	107
Ni	BDL	0.2	0.2252	113
Mn	0.2203	5.0	5.5176	105
Fe	11.2716	5.0	16.1925	98
Zn	0.8110	5.0	4.9145	82

Table 1: *Percentage recovery of heavy metals in cow skin.*

Discussions

From the results obtained, it is evident that the singed samples contain more heavy metals. This may be due to the technique of singeing where spent engine oil, refuse, tyres etc are used as the singeing agent where there is high possibility of direct contact between the skin and metal stripes in the tyres. This may be the reason for higher metal concentrations in singed samples.

Gwagwalada Area Council

	Moisture content (%)	Ash content (%)	Pb	Cd	Ni	Mn	Fe	Zn
Gwagwalada Area Council								
S_n	55.00 ± 0.592	4.80 ± 0.050	BDL	BDL	BDL	1.3005 ± 0.0004	21.1975 ± 0.0005	2.4624 ± 0.0003
S_W	59.00 ± 0.015	1.93 ± 0.030	BDL	BDL	BDL	0.2204 ± 0.0005	11.2719 ± 0.0003	0.8110 ± 0.0005
Sc	69.00 ± 0.015	2.87 ± 0.0366	0.2656 ± 0.0003	BDL	BDL	0.9526 ± 0.0002	18.5128 ± 0.0002	3.0142 ± 0.0002
Kuje Area Council								
S_n	54.00 ± 0.017	5.27 ± 0.0436	1.0973 ± 0.0005	BDL	BDL	1.6724 ± 0.0005	25.0922 ± 0.0002	7.6962 ± 0.0006
S_W	63.00 ± 0.020	4.40 ± 0.0361	0.1471 ± 0.0000	BDL	BDL	1.4261 ± 0.0001	24.1805 ± 0.0003	7.1082 ± 0.0001
S_c	70.00 ± 0.020	1.67 ± 0.0200	0.1172 ± 0.0005	BDL	BDL	0.8937 ± 0.0003	13.3735 ± 0.0006	5.9430 ± 0.0001

S_n= singed, S_W=singed and washed, S_c=scrapped, BDL= below detection limit

Table 2: *Heavy metals concentration (mg/kg) in differently processed cow skin.*

Table 2 revealed that the higher the ash content, the higher the heavy metal concentration in the samples. The highest concentration of lead was observed in cow skins singed in Kuje Area Council (1.0973mg/kg), which is far above permissible limit. This might be due to the substances (tyre, spent engine oil, polystyrene, refuse etc) used in singeing off the hair from the cow skins.

In Kuje Area Council for example lead content in the singed sample is 1.0973 mg/kg and 0.1471 mg/kg for the singed and washed sample indicating a massive 87% drop in lead concentration when the singed skin was washed.

Lead would become toxic if it is consumed in the amount which exceed threshold and can cause acute and chronic poisoning. It causes about 10% of intellectual disability of otherwise unknown cause and can result in behavioral problems. Some effects are permanent [12]. Lead is known to induce reduced cognitive development and intellectual performance in children and increases blood pressure and cardiovascular disease in adult. It is also evident that the singeing did not introduce lead into the sample from Gwagwalada. The scrapped sample from Gwagwalada contain the highest lead dose, this amount may have been introduced into the sample through other sources while the scrapped sample in Kuje contain the least lead dose as expected. Apart from the S_n and S_W samples from Gwagwalada, The levels of lead far exceeded the maximum permissible level (MPL) of 0.01 mg/kg [13]. Cadmium and nickel concentrations in all the samples are below detection limit (BDL) in both Area Councils.

Nickel and Cadmium in all the samples are below detection limit. Manganese is an important element for human health, essential for development, metabolism and antioxidant system. Nevertheless, excessive exposure or intake may lead to a condition known as manganism, a neurodegenerative disorder that causes dopaminergic neuronal, death and symptoms similar to Parkinson's diseases [14]. The highest manganese in the sample was found in singed sample in Kuje Area Council which is within the permissible limit for age 9 and above.

Zinc is an essential trace metal with very low toxicity in human [15-16]. Symptoms of high doses of zinc are nausea, vomiting, pains, crams and diarrhea. Even though iron is an essential metal, excess of it can pose a health risk, human body has no regulated physiological means of excreting iron. Only small amount of iron are lost daily due to mucosal and skin epithelial cell sloughing. So controlled iron level is primarily accomplished by regulating uptake [17]. The highest concentration of iron in the sample is 25.0922mg/kg.

Finally, in singed animal skin, it is believed that heavy metals accumulate both on surface and in the skin in way that washing can remove the surface metals making washing an important operation in animal skin treatment

Conclusion

Mean results of processed cow skins in the area councils of Federal Capital Territory revealed that the contaminants were in the range Fe > Zn > Mn > Pb. Anova analysis also revealed ($p>0.05$) meaning that there was significant difference between the heavy metal

concentration in the processed cow skins in the two Area Councils. Conclusively, the singed washed skin in Gwagwalada was safer for consumption than that of Kuje because of the absence of Pb, Ni and Cd. It is therefore recommended that government should ensure safe methods of processing the skin at the abattoir in all Area Councils as this will reduce bioaccumulation of the toxic metals in the animal skin.

References

1. K. Sobha, A. Poornima, P. Harini, K. Veeraiah. (2007). A study on biochemical changes in the fresh water fish, Catla catla (Hamilton) exposed to the heavy metal toxicant cadmium chloride, Kathmandu University Journal of Science Engineering and Technology, 3(2): 1.
2. M. Tadesse, D. Tsegaye, G. Girma, (2018). Assessment of the level of some physico-chemical parameters and heavy metals of Rebu river in oromia region, Ethiopia. MOJ Biol Med, 3(4): 99–118.
3. A. Ikem, N.O. Egiebor. (2005). Assessment of trace elements in canned fishes (mackerel, tuna, salmon, sardines and herrings) marketed in Georgia and Alabama (United States of America), Journal of Food Compos Anal, 18(8): 771–87.
4. M. Lambert, B.A. Leven, R.M. Green R.M. (2000). New methods of cleaning up heavy metal in soils and water. Environment science and technology briefs for citizens. Manhattan: Kansas State University.
5. M. Hashemi, T. Salehi, M. Aminzare, M. Raeisi, A. Afshari. (2017). Contamination of toxic heavy metals in various foods in Iran: a review, Journal of Pharmaceutical Science Resources, 9(10): 1692–7.
6. M.A. Hussain. (2016). Food contamination: major challenges of the future. Foods, 5(2): 21.
7. D. Santhi, V. Balakrishnan, A. Kalaikannan, K.T. Radhakrishnan. (2008). Presence of heavy metals in pork products in Chennai (India). Am. J. Food Technol. 3(3): 192-199.
8. P.C. Prabu. (2009). Impact of heavy metal contamination of Akaki River of Ethiopia on soil and metal toxicity on cultivated vegetable crops. Electron J Environ Agric Food Chem, 8(9): 819–20.
9. M. Jaishankar, T. Tseten, N. Anbalagan, B.B. Mathew, K.N. Beeregowda. (2014). Toxicity, mechanism and health effects of some heavy metals. Interdiscip Toxicol. 7(2): 60–72.
10. H. Ali, E. Khan, M.A. Sajad, (2013). Phytoremediation of heavy metals—concepts and applications. Chemosphere, 91(7): 869–81.
11. A.O. Richard, B.A. Joseph, A. Samuel. (2014). Meat contamination through singeing with scrap tyres in akropong-akuapem abattoir, Ghana.Applied Research Journal, 1(1): 12–19.
12. J. Meija et al. (2016). Atomic weights of the elements 2013 (IUPAC Technical Report), Pure and Applied Chemistry. 88(3): 265-91.
13. European Commission Regulation (2006). No 1881/2006, Setting maximum levels for certain contaminants in foodstuff. Official J. of the European Union, L 364: 5-24.
14. A.D. Silva, P. Luiz, A.M. Robson, (2013). Manganese in Health and Disease, Metal Ions in Life Sciences, 13 199-227.
15. D. Ciubotariu, C.M. Ghiciuc, C.E. Lupusoru, (2015). Zinc involvement in opioid addiction and analgesia-should zinc supplementation be recommended for opioid-treated persons, Subst Abuse Treat Prev Policy, 10(1): 29.
16. G.J. Fosmire, (1990). Zinc toxicity American of Journal of Clinical Nutrition, 51 (2) 225-7.
17. S.C. Ramzi, K. Vinay, C. Tucker, L.R. (1999). Stanley, Robbins Pathologic basis of disease. Saunders.