ResearchGate

See discussions, stats, and author profiles for this publication at: https://www.researchgate.net/publication/259895273

Assessment of Heavy Metal Residues in Hides of Goats Singed with Tyres, and the Effect of Boiling on the Heavy Metal Concentrations in the Hides

Data · May 2013

CITATIONS
0

READS
284

1 author:

Moses Teye
University of Cape Coast
21 PUBLICATIONS **39** CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:

Investigating the potential of harvest by-products, in formulating feed for rabbits. View project

Promoting Non-Traditional livestock species as alternative sources of livelihood among small scale farmers in Ghana View project

All content following this page was uploaded by Moses Teye on 28 January 2014.

The user has requested enhancement of the downloaded file.

JOURNAL OF VETERINARY ADVANCES

Assessment of Heavy Metal Residues in Hides of Goats Singed with Tyres, and the Effect of Boiling on the Heavy Metal Concentrations in the Hides

Adam I., Okyere D. and Teye M.

J Vet Adv 2013, 3(5): 165-169

DOI: 10.5455/jva.20130531104440

Online version is available on: www.grjournals.com

Original Article

Assessment of Heavy Metal Residues in Hides of Goats Singed with Tyres, and the Effect of Boiling on the Heavy Metal Concentrations in the Hides

Adam I., Okyere D. and *Teye M.

Department of Animal Science, School of Agriculture, University of Cape Coast, Ghana.

Abstract

Tyres are reported to contain toxic materials which could pose health threats to humans. However, some butchers in Ghana singe carcasses of small ruminants with scrap car tyres. This study was therefore conducted to determine the heavy metal concentrations of carcasses singed with scrap tyres, and the effect of boiling on the heavy metal concentrations in the hides. Samples of singed goat carcasses were taken from the Cape Coast slaughter house and analyzed for the concentrations of Cu, Pb, Fe, Zn, Ni and Cd. In addition, the scraped soot from the singed carcasses was collected to determine the levels of heavy metals in it. The Cu, Zn and Pb concentrations in the tyre-singed carcasses far exceeded the Maximum Permissible Levels (MPL), rendering them unwholesome for consumption. Boiling of the carcasses marginally reduced the heavy metal concentrations, but the heavy metal residues after boiling were still higher than the MPL, indicating that boiling cannot render tyre-singed carcasses wholesome for consumption. The scraped soot from the singed animals had very high levels of heavy metal residues and therefore poses threats to soil and water bodies. Laws should be enforced in Ghana to stop local butchers from using tyres as singeing materials. Scraped soot should also be disposed appropriately in order to reduce the risk of polluting soils and water bodies.

Keywords*:* Singeing, tyres, heavy metal contamination, soil pollution.

* Corresponding author: Department of Animal Science, School of Agriculture, University of Cape Coast, Ghana.
Received on: 03 May 2013
Revised on: 18 May 2013
Accepted on: 20 May 2013
Online Published on: 28 May 2013

Introduction

In Ghana and in several other African countries, singeing in an open fire is the major process by which hair on the skin of slaughtered goats is removed (Obiri-Danso *et al.,* 2008). This is because singeing maintains the carcass hide for consumption and also evokes flavours in the meat which are acceptable to the consumer (FAO, 1985). Singeing is done mainly by the use of firewood as fuel, but the relative scarcity of firewood in recent times has resulted in local butchers using scrap car tyres in place of firewood (Obiri-Danso *et al.*, 2008). The use of scrap tyres, according to the local butchers is cheaper and more efficient, as it produces more flame with less heat hence it is able to selectively burn off the fur from the animal without cracking the hide (personal communication, January 20, 2012).

Meanwhile, the use of car tyres as fuel for singeing carcasses is reported to impart some toxic heavy metals to the singed skin which could diffuse into the meat, thus rendering them unsafe for consumption, as it poses several health threats to the consumer (USFA, 1999; Okiel *et al*., 2009; Costa, 2000; Jayasekara *et al.,* 1992; Leita *et al.,* 1991). A study conducted by the Agency for Toxic Substances and Disease Registry of the United States of America revealed that 'tyre derived fuel' (TDF) contains several heavy metals including lead (Pb), zinc (Zn), copper (Cu) that could be carcinogenic when exposed to consumers continuously over a long period. Obiri-Danso *et al*. (2008) reported high levels of heavy metal residues in goat and cattle hides singed with scrap tyres, which made them unsafe for consumption.

This study was conducted to determine the concentrations of some heavy metals in the carcasses of goats singed with tyres at the Cape Coast slaughterhouse, and to determine the effect of boiling in water, on the heavy metal concentrations in the carcass.

Materials and Methods

The study was conducted in the Cape Coast Metropolis of the Central Region of Ghana. The singed chevon were obtained from the Cape Coast slaughter house, while chemical analyses of the samples were conducted at the Laboratories of the School of Agriculture, University of Cape Coast, Ghana.

Carcass Samples

Samples from a total of 70 freshly singed goats were obtained from the Cape Coast slaughter house for the study. Out of this number, 35 were goats singed with firewood, while the remaining 35 were those singed with tyres. Samples of the hides of the un-singed carcasses were taken before the carcasses were singed, to be used as control. The singed hides were isolated from the muscles, and were packed in moisture proof polythene bags, placed in ice-boxes containing ice cubes and then transported to the laboratory for chemical analyses. Portions of the hides were boiled to an internal temperature of 70°C, before the analyses were conducted, while the other portions were analyzed in the uncooked form.

Laboratory Analyses of Meat Samples

The total Lead (Pb), Zinc (Zn), Iron (Fe), Copper (Cu), Manganese (Mn) and Cadmium (Cd) residues in the singed hides were determined according to the methods of the Association of Official Analytical Chemists (AOAC, 1990).

Statistical Analysis

The data obtained were analyzed using the GenStat Discovery Edition 3 software. Concentrations of heavy metal residues were expressed as mean ± SEM (standard error of mean). Means of heavy metal concentrations were compared with the European Commission's Standards for Maximum Permissible Levels (MPLs) (ECR, 2006).

Results and Discussion

The heavy metal residues in the uncooked hides of the singed carcasses are presented in Table 1. From the studies, Manganese (Mn) and Cadmium (Cd) residues were not detected in the samples. The results however, indicated that singeing of the carcasses increased their heavy metal contents, but those singed with firewood had lower concentrations of heavy metals than those singed

with tyres. This observation contradicts the findings of Eremong *et al.* (2011) who reported decreasing levels of heavy metal residues in singed cattle hides. This was said to be due to losses through the scrapings (Okiel *et al*., 2009). Obiri-Danso *et al.* (2008) however, reported increased levels of some heavy metals, when goats and cattle hides were singed with tyres. The authors reported that the concentrations increased further when the singed carcasses were washed with water. These reports are indications that the mode of processing and the source of water for washing singed carcasses have direct effects on the heavy metal concentrations of the carcasses.

Table 1: Concentrations of heavy metals (mg/kg) in uncooked hides.

Heavy metals	Un-singed	Firewood	Tyre	MPL (mg/kg)	SEM(+/-)
Cu	10.24	15.89	22.21*	20.00	0.015
Zn	19.01	29.21	75.22**	50.00	0.012
Cd	ND	ND	ND	0.05	-
Fe	9.67	18	36.12	50.00	0.012
Mn	ND	ND	ND	-	-
Pb	0.04	0.9	0.47**	0.10	0.015

**= (P<0.01); *= (P<0.05); SEM = Standard Error of Mean. MPL = European Commission's Maximum Permissible Limit of product acceptability, ND = Not detected.

The concentrations of Cu, Zn and Pb in the carcasses were higher than the recommended Maximum Permissible Levels (MPLs) of the European Commission Regulations (USDA, 2006; ECR, 2006). These results are in agreement with the findings of Essumang *et al*. (2007) and Obiri-Danso *et al.* (2008) who reported high levels of heavy metal residues in the hides of goats and cattle singed with tyres. Research reports indicate that singeing is not the only means by which animals could pick up heavy metal residues, but also, the soil, feed and drinking water are potential avenues from which these heavy metal residues could be picked up by the animals (Qui *et al.*, 2008). This therefore explains why there were heavy metal residues in the hides of the unsigned carcasses (Table 1).

According to Gautam and Irfan (2011), Zinc (Zn) is an important micro-nutrient in the body, but higher doses could result in a type of dermatitis known as "Zinc Pox", and also in irritation of the digestive tract causing nausea and vomiting (WHO, 1996). Cupper (Cu) is reported to accumulate in the liver and brain, with higher levels resulting in Wilson's disease (Gautam and Irfan, 2011). Excessive dose of Lead (Pb) in the body is reported to result in "Lead poisoning" (WHO, 1996). These indicate that continuous consumption of these products over a long period of time could pose toxicological threats to consumers.

Table 2: Concentrations of heavy metals (mg/kg) in cooked hides.

Heavy metals	Un-singed	Firewood	Tyre	MPL (mg/kg)	SEM(+/-)
Cu	8.89	13.44	21.02*	20.00	0.006
Zn	14.12	24.17	69.75**	50.00	0. 21
Cd	ND	ND	ND	0.05	-
Fe	7.21	16.27	31.33	50.00	0.034
Mn	ND	ND	ND	-	-
Pb	0.02	0.07	0.43*	0.10	0.005

**= (P<0.01); *= (P<0.05); SEM = Standard Error of Mean. MPL= European Commission's Maximum Permissible Limit of product acceptability, ND= Not detected.

Boiling of the samples marginally reduced the concentrations of Fe, Zn, Cu and Pb in both the tyre-singed and firewood-singed carcasses (Table 2). The concentrations of Cu, Zn and Pb in the cooked tyre-singed carcasses were still beyond the Maximum Permissible Levels of the European Commission Regulations. Obiri-Danso *et al*. (2008) reported that tyre-singed carcasses were

unwholesome for human consumption due to heavy metal concentrations in them. It was speculated that boiling could aid in reducing the heavy metal contents of these meats. The studies however, indicated that the effect of boiling tyre-singed carcasses in water on their heavy metal concentrations is very minimal. Meanwhile, Santhi *et al*. (2008) reported that heavy metals are not destroyed by heat, and therefore cooking might reduce the heavy metal contents of food products, but these would be deposited in the resulting broth.

Table 3: Concentration of heavy metals in soot scraped from singed carcasses.

Heavy metal	Concentration(mg/kg)	SEM(+/-)	MPL (mg/kg)
Pb	5.40**	0.010	0.10
Zn	96.10**	0.012	50.00
Cu	38.03**	0.015	20.00
Fe	61.00**	0.006	50.00
Mn	ND	-	-
Cd	ND	-	0.05

**= (P<0.01); MPL = European Commission's Maximum Permissible Level of product acceptability, SEM = Standard Error of Means, ND=Not detected.

The soot scraped from the singed carcasses were collected and analysed in a similar way as the carcass samples, and the results are presented in Table 3. It can be realized that the concentrations of Cu, Fe, Zn and Pb were significantly (P<0.01) higher than the respective Maximum Permissible Limits (USDA, 2006). This soot is normally washed into drains, and when it rains, they are conveyed into various water bodies. This could be one of the sources of heavy metals in soils, water and in plants, as reported by Qui *et al*. (2008). Heavy metals dissolve in water and are taken up by plants during photosynthesis (Leita *et al*., 1991). When animals graze these plants over a long period of time, the heavy metals accumulate in them, hence the heavy metals detected in the hides of the un-singed carcasses. Some butchers fetch water from nearby streams and other water bodies for washing the singed carcasses (Personal communication, January 20, 2012). This therefore explains why washing singed carcasses with water resulted in an increased heavy metal concentrations as reported by Obiri-Danso *et al.* (2008).

Conclusions

Singeing of goat carcasses with tyres, increases the heavy metal concentrations in the hides of the carcasses beyond acceptable limits. Boiling of these carcasses marginally reduces the heavy metal contents, but not below the safe limits. The scrapings of singed carcasses have very high heavy metal concentrations, and are potential sources of heavy metals in soils, surface water and in plants.

Consumption of carcasses singed with tyres could pose health threats to consumers. Regulatory agencies should therefore regularize the activities of local butchers it Ghana, to ensure they stop the use of tyres as singeing materials. The scrapings from singed carcasses should be disposed appropriately in order to minimize the pollution of soils and water bodies with heavy metals.

References

AOAC (1990). Association of Official Analytical Chemists, Official Methods of Analyses, 15th ed. AOAC, Arlington, Virginia, USA.

Costa M (2000). Trace elements: aluminum, arsenic, cadmium, and nickel. In Morton Lippmann (ed.) Environmental Toxicants: Human Exposures and Their Health Effects, 2nd Edition. John Wiley and Sons, Inc. pp. 811-850.

Eremong DC, Akwetey WY, Donkoh A (2011). Chemical composition of cattle hide processed using four different procedures. *Proceedings of the Seventeenth Biennial Conference of the Ghana Society of Animal Production*, Pp 69-73.

Essumang DK, Dodoo DK, Adokoh KC, Koka V, Nkrumah BN, Nuer ACD (2007). Heavy metal levels in singed cattle hide (*wele*) and its human health implications. Proceedings – *The First International Conference on Environmental Research, Technology and Policy*, ERTEP 2007, Accra, Ghana. Book of Abstracts, p.19.

European Commission Regulation(ECR) (2006). No 1881/2006, Setting maximum levels for certain contaminants in foodstuff. *Official J. of the European Union*, L 364: 5-24

FAO (1985) Animal by-products: Processing and utilization. FAO Animal production and health series. No.9, FAO

Agricultural Development Paper No.75, FAO, Rome.

Gautam P, Irfan A (2011). Heavy metals contamination assesment of Kanhargaon Dam water near Chhindwara city. *Acta Chim. Pharm. Indica*: 1(1), 2011, 7-9

Leita L, Enne G, De Nobili M, Baldini M, Sequi P (1991). Heavy metal bioaccumulation in lamb and sheep bred in smelting and mining areas of S. W. Sardinia, Italy. *Food Sci. Technol*. 24: 125-127.

Obiri-Danso K, Hogarh JN, Antwi-Agyei P (2008). Assessment of contamination of singed hides from cattle and goats by heavy metals in Ghana. *African Journal of Environmental Science and Technology* 2 (8), 217-221

Okiel W, Ogunlesi M, Alabi F, Osiughwu B, Sojinrin A (2009). Determination of toxic metal concentrations in flame treated meat products. African Journal of Biochemistry Research 3(10) 332-339.

Jayasekara S, Samarajeewa U, Jayakody AN (1992). Trace metals in foods of animal origin in Srilanka. *ASEAN Food J.* 7: 105-107

USDA (2006). Foreign Agric Services GAIN report, Global GAIN Report No. CH 6064, Chinese people'sRepublic of FAIRS products. Specific maximum levels of contaminants in foods, JIM Butterworth and WU Bugang

United States Fire Administration (USFA), (1999). Report on tyre-fires submitted to Committee on Commerce, Science and Transportation, United States Senate and Committee on Science, United States. House of Representative, pp 12-14.

Qiu CAI, Long M, Liu J, Zhu M, Zhou Q-zhen, Deng Y-de, Li Y, Tain YJ (2008). Correlation between heavy metals concentration in cattle tissues and rearing environment. *Chinese J. of Ecol.* 27(2): 202-207

Santhi D, Balakrishnan V, Kalaikannan A, Radhakrishnan KT (2008). Presence of heavy metals in pork products in Chennai (India). *Am. J. Food Technol*. 3(3): 192-199.

World Health Organization (WHO) (1996). International Standards of Drinking Water, Geneva.

View publication stats