LEAD CONCENTRATION IN CATTLE AND GOAT BLOOD AT TWO ABBATOIRS IN ZARIA METROPOLIS NIGERIA

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Abstract
Heavy metals are among the most dangerous pollutants that have a tendency to accumulate in different organs and tissues of exposed animals and disrupt different physiological function. Pollution has become a global problem and the results are implied in high levels of contaminations reported for soil, water, air, plants and animals. Blood being a major assessment medium for these metals in ruminant tissues, while goat source of meat, cow being a major source of milk and meat in several countries. Hence, blood levels of lead in cattle and goats at two Abattoirs in Zaria Metropolis in Nigeria were assessed in this investigation. The analysed blood samples showed mean concentrations (PPM) range of 1.900-4.8250 for Pb in cattle and goats respectively. When compared with the maximum tolerant limits set by World Health Organization (W.H.O) for animal blood, the samples are heavily contaminated with lead.

Key words: Heavy Metals; Lead; Ruminants; Zaria; Abattoirs.

Introduction

Heavy metals are among the most dangerous pollutants that have a tendency to accumulate in different organs and tissues of exposed animals and disrupt different physiological function (Najar-Nezhad *et al.*, 2008). Lead poisoning is the most common metal toxicosis in domestic animals; the domestic species most commonly affected is cattle (Mavangira *et al.*, 2008). Lead poisoning in cattle and goat usually occurs on pasture due to their indiscriminate eating habits and natural curiosity. However, Pb can also contaminate batches of feed and cause toxicosis in confined cattle (Miranda *et al.*, 2006). Lead paint and Pb-acid automotive batteries are the most common sources of Pb for ruminants, with short term exposure and rapid onset of clinical signs likely and leading to either death or culling or appropriate diagnostics and treatment (Sharpe and Livesey, 2006).

Lead has no beneficial biological roles despite its poisoning is common in farm ruminants which are considered most susceptible to its toxic effect (Swarup *et al.*, 2005; Thompson, 2007). It is well known that most of the metal is accumulated in the blood and have many deleterious effects related to its circulating concerntration (Swarup *et al.*, 2007). The main target organs of lead are hemopoietic, nervous and renal systems (Ahmed *et al.*, 2010). Also it has impairment effects on the reproductive and immune systems (Swarup *et al.*, 2005). Neurological symptoms like muscle weakness, paraesthesia, headache, fatigue, gastrointestinal problems such as constipation, weight loss, anaemia have been reported (Amitai, 2005). The lead in these materials settles in the stomach of cattle, where stomach acids gradually change the lead into poisonous salt (Audit *et al.*, 2013). It can lead to sterility, miscarriage and fatal death. Calves are the most vulnerable as they are more likely to be contaminated if the blood of the mother and lactating milk is contaminated with lead (Derakhshesh and Rahimi, 2012).

Livestock can be a source of Pb contamination for the human food chain, although clinical Pb Poisoning from ingestion of contaminated animal products is unlikely. Subclinical Pb exposure in children is associated with intellectual and cognitive deficits, aggressive behavior, renal impairment, hypertension, and cataracts (Pokras and Kneeland, 2008). Miscarriages, stillbirths, and other fertility problems are also associated with human subclinical Pb poisoning (Pokras and Kneeland, 2008).

Milk and dairy products are important components in the human food web (Swarup *et al.*, 2005), lead accumulating in milk of animals constitute public health concern (Emam and El-Nabrawy, 2008). Lead is able to cross the blood brain barrier, particularly in infants and young animals. This leads to the observed neurotoxic effects (Bradbury and Deane, 1993). Following binding to metallothionein, lead accumulates in the liver and

in the kidney (particularly in the cortical zone). During long-term exposure, lead accumulates also in the bones by co-precipitation with calcium. Lead crosses the placental barrier and can accumulate in the fetal liver exerting toxic effects on the foetus. The presence of lead in the food chain is the result of environmental pollution and its concentration has to be controlled on a regular basis. There has been no regulation amended to the best of my knowledge for blood lead level in cattle and goat in Nigeria.

Material And Methods

Sample Collection

Blood samples from four randomly picked cattle (A_1, A_2, A_3 and A_4) and goats (B_1, B_2, B_3 and B_4) were taken from the Zango and Samaru Abattoir Zaria, Kaduna State respectively.

Sample Preparation and Dilution

The collected samples were centrifuged at 1500rpm for 15 minutes. The sera were decanted into clean sample bottles and properly labeled. 2ml of Strontium dichloride hexahydrate ($SrCl_26HO_2$) solution was added to each of the 25ml volumetric flask containing 1ml of sera samples and distilled water was added to give a 25 times dilution.

Preparation of Lead standards

0.160g of lead (i) trioxonitrate (v) [$Pb(NO_3)_2$] was accurately weighed and dissolved in 100cm^3 volumetric flask and made to the mark with dissolved water to give 1000ppm of lead standards.

Mode of Operation

Most currently available ETAAS are fully controlled from a personal computer that has windows compatible software. Aqueous sample should be acidified typically with nitric acid (HNO3) to a pH of 2.0 or less. Discolouration in a sample may indicate that metals are present in the sample. A good rule to follow is to analyze clear (relatively dilute) samples first, and then analyze coloured (relatively concentrated) samples. It may be necessary to dilute highly coloured samples before they are analyzed after the instrument has warmed up and been calibrated, a small aliquot is placed, either manually or through an automated sample, into the opening in the graphite tube. The sample is vaporized in the heated graphite tube; the amount of light energy absorbed in the vapour is proportional to atomic concentrations. Analysis place from 1 to 5 minutes, and the result for a sample is the average of triplicate analysis.

Result And Discussion

The result of the atomic absorption spectrometric analysis (determination) of ruminant blood samples generated from the Zango and Samaru abattoir in Zaria Nigeria showed the presence of lead (Pb).

Table 1: Mean concentration of lead in blood samples

CONCERNTRATION OF LEAD (PPM) SAMPLE	Pb
A_1	4.8250
A_2	2.9500
A_3	3.2750
A_4	2.3250
B_1	2.2000
B_2	2.8750
B_3	1.9000
B_4	2.7250
W.H.O	1.0000

Sample $A_1 - A_4$ are the blood sample of cattle
Sample $B_1 - B_4$ are the blood sample of goats
W.H.O represents World Health Organization tolerant level of the blood of ruminant animals.

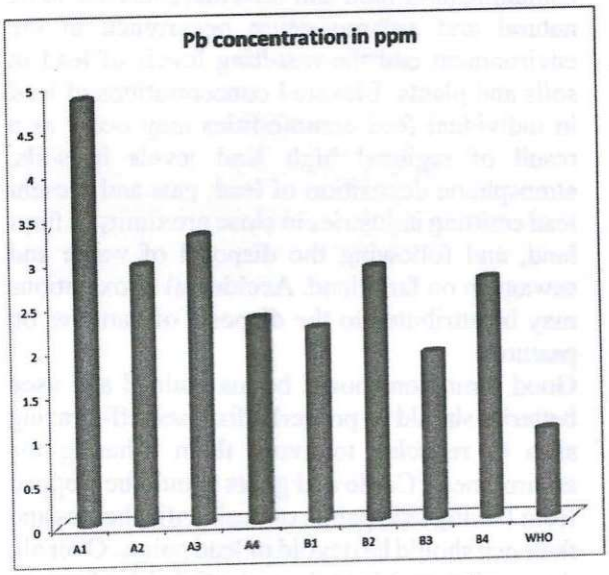

Fig. 1: Lead level in the blood samples

Discussion

As shown in table 1, the blood level of Pb range from 1.9000-4.825mgkg^{-1}, blood lead level in cattle and goats from different environment to establish the level of the heavy metals accumulations shows that blood Pb were at higher risk state compare to W.H.O tolerant level. Also, as production animals, Pb contamination of either beef or dairy cattle is associated with risk to the human consumer (Sharpe and Livesey, 2006). Lead accumulates to some extent in kidney and liver tissue as well as in bones, resulting in

measurable residues. Muscle tissue contains very low residual amounts of lead and carry over into milk is normally limited, but may increase in diseased animals.

Conclusion

The elevated level of Pb in the analyzed samples showed that there is heavy metals contamination at the ruminants grazing sites. This could be attributed to continuous grazing of the animals around the industries where there are some chemicals wasted disposed around the grazing sites and also suggesting the environments at the risk of high disease outbreak which also pose danger to human that consume the animal both directly or indirectly.

Contamination of food with lead is of public health concern as recent data indicate that within the human population exposure of the foetus and young children may result in mental retardation and cognitive deficits even at low levels previously considered safe. Lead is a common contaminant of food and feed materials due to its natural and anthropogenic occurrence in the environment and the resulting levels of lead in soils and plants. Elevated concentrations of lead in individual feed commodities may occur as a result of regional high lead levels in soils, atmospheric deposition of lead, past and present lead emitting industries in close proximity to farm land, and following the disposal of waste and sewage in on farm land. Accidental intoxications may be attributed to the disposal of batteries on pastures.

Good sanitation should be maintained and used batteries should be properly disposed off- grazing sites or recycled to avoid them lithering the environment. Cattle and goats should be stopped from licking lead paints on residential homes and their pen should be devoid of lead paints. Over all, the grazing area is at the potential risk of secure heavy metal pollution requiring immediate actions by appropriate authorities.

Three things are crucial in achieving more healthy ruminants for slaughter which will be consumed by the populace firstly; environmental consideration must be incorporated into all aspect of planning for the sitting of grazing zone for the farmers. Secondly, techniques must be developed with more easily and flexible control pollution with in a legal framework which provides strong incentives particularly economic incentives to minimize the occurrence of pollutant and the production of wastes and which places greater emphasize on the polluter pay-principle. Thirdly should be an appropriate control to eliminate or reduce pollution arising from the industries around the ruminant grazing sites for the good of the ruminant and also the entire populace that feed on the product of the ruminants.

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