Sjournals
Scientific Journals
Scientific Journal of Veterinary Advances (2012) 1(2) 47-51

Contents lists available at Sjournals
Scientific Journal of Veterinary advances
Journal homepage: www.Sjournals.com


Original article

# Measurement of chromium (Cr) residue in kidney and liver of slaughtered cattle in Sokoto central abattoir, Sokoto state, Nigeria

**A. Bala[a], A.U. Junaidu[b], M.D. Salihu[b], K.I. Onifade[b], A.A. Magaji[b], O.O. Faleke[b], M.A. Saulawa[b], L.U. Muhammad[a], P.K. Dachin[a], S.A. Anzak[c], N. Lawal[b]**

[a]National Veterinary Research Institute, Vom, Plateau State, Nigeria
[b]Faculty of Veterinary Medicine, UsmanuDanfodiyo, University Sokoto, Nigeria
[c]Federal Livestock Department (FLD), Abuja, Nigeria

[*]Corresponding author; National Veterinary Research Institute, Vom, Plateau State, Nigeria; Tel: +2348039731300

A R T I C L E I N F O

*Article history:*
Received 10 August 2012
Accepted 25 August 2012
Available online 28 August 2012

*Keywords:*
Abattoir
Chromium
Kidney
Liver
Nigeria
Slaughter
Sokoto

A B S T R A C T

The prevalence of Chromium (Cr) residue in liver and kidney samples of cattle was determined at cattle slaughter section of Sokoto Central abattoir Sokoto State Nigeria. A total of one hundred of each of the liver and kidney samples were collected and processed for the detection of Chromium using Atomic Absorption Spectrophotometer. All the samples (liver and kidney) were 100% positive for Chromium. The highest and lowest concentration of Chromium in liver and kidney were found to be among the age groups of ≥9 years and those at 0-2 years respectively. There was no significant difference (P>0.05) in the concentration of Chromium in liver and kidney samples of the different age groups of the slaughtered cattle. The concentration of Chromium in all the samples are within the permissible level recommended by Food and Agricultural Organisation (FAO) and World Health Organisation(WHO).It is therefore obvious that the liver and kidney of cattle slaughtered at Sokoto abattoir contain Chromium residue. This study was carried out to determine the level of Chromium residue in liver and kidneys of beef consumed from Sokoto Central abattoir Sokoto State, Nigeria.

## 1. Introduction

Heavy metals are chemical elements with specific atomic weight between 63.546 to 200.590g (Kennish, 1992). Examples of heavy metals commonly found in the environment include Lead, Cadmium, Chromium, Mercury, Zinc, Arsenic, Bismuth, Selenium, Copper, etc. These metals are particularly dangerous, because they tend to bio-accumulate in the body tissues and organs (Luckey*et al*., 1975*;* Babalola*et al*., 2005).

Proper tissue formation, growth, and repair required animal protein. The common animal protein sources in Nigeria includes: beef, fish, fowl, mutton, pork, snail, and other sources. The habitat of these animals are continually been polluted with heavy metals, as a result of indiscriminate dumping of waste materials on the land and water bodies, illegal mining of ores (Kamala and Kumar, 1998; Dioka*et al*., 2004), some of these waste materials may contain some of these heavy metals that are dangerous to human and animal health. Cattle and other ruminants graze freely on such environment and drink water from ponds, streams, rivers and other possible contaminated water sources. Contamination of animal and human food with heavy metals is a serious threat, because of their toxicity, bioaccumulation, and bio-magnifications in the food chain (Demirezen and Uruc, 2006). Toxic effects of heavy metals have been described in animals under relatively low levels of metal exposure (Kostial, 1986); one of the earliest effects is the disruption of trace element metabolism (Goyer, 1997; Lo'pez -Alonso *et al.,* 2002). When large amount of heavy metal like Chromium, Cadmium and Lead are ingested, can cause reduced litter size and weight, liver and kidney damage [Blowes., 2002]. Cadmium can also accumulate in kidney where it damages filtering and causes excretion of essential proteins and sugar from the body [Blowes., 2002].

Chromium (Cr) was discovered by Vaquelin in 1798 (Baruthio, 1992; Barceloux, (1999). It is one of the abundant mineral in earth crust and found in combination with iron and oxygen in the form of chromite ore. It is a hard, steel grey metal. Chromium exists in three valence states which are Cr (0), Cr (III), and Cr (VI) (Barnhart, 1997). It is very dangerous to human and animal health and it is partially related to the valence state, as chromium (VI) is most toxic and carcinogenic than other form of chromium (Jadhav and Turel, 1994). Chromium is used in chemical, metallurgical, and refractory (heat-resistant applications) industries. It is also used in the production of stainless steel, metal alloys, formation of joint prostheses, chrome plating, wood treatments, leather tanning, water treatments, safety matches, photocopy machine toner, corrosion inhibitors, photographic chemicals, magnetic tapes and drilling mud and manufacturing of paint pigments such as orange, red, yellow, and green (ATSDR, 2006).

Academy of Science has established a safe and ample daily intake for chromium in adults to be50 mg/kg/ day. The daily dietary intake of chromium for an American adult is approximately 50 mg/kg/ day.

## 2. Material and methods

### 2.1. Study area

The study area is Sokoto Central abattoir, which is located in Sokoto North local government area of Sokoto State, Nigeria. Sokoto State is geographically located at the North Western part of Nigeria, between longitudes 4o8'E and 6o54' E and latitudes 12o N and 13o58'N. The State share boundaries with Niger Republic to the North, Kebbi State to the West and Zamfara State to the East. Sokoto State covers a total land area of about 32,000 square Kilometres with an estimated human population of 3,696,999 (NPC, 2006). The State rank second in the Nigerian livestock population with an estimated 3 million cattle, 3 million sheep, 5 million goats, 4,600 camels, 52,000 donkeys and host of other species of local and exotic poultry species (MOCIT, 2002; Mamman, 2005).

### 2.2. Source of samples

The samples consist of two different parts of Cattle (liver and kidney) which were sampled at Sokoto Central abattoir

### 2.3. Samples collection and preservation

A total of 100 fresh samples each of liver and kidney of slaughtered cattle at Sokoto Central abattoir were collected between the month of March and April, 2011, the animals were selected randomly, the age of the slaughtered cattle were determined using teeth eruption and wearing. About 100g of liver and a whole kidney of each selected animal were packed in a sterile polythene bags, properly labelled with permanent marker, and transported to Veterinary Public Health and Preventive Medicine laboratory of Usmanu Danfodiyo University Sokoto, Sokoto State, Nigeria where it was frozen and stored in a freezer. The frozen samples were then transported in a cold chain to Chemical Research Institute Zaria, Kaduna State, Nigeria for further processing and analysis

### 2.4. Processing of samples

#### 2.4.1. Digestion of samples (dry digestion)

Liver and kidney samples were dried at $45^0$ C using oven, after drying, individual samples were crushed into fine powder using mortar and pestle, and 1.0g of the fine powdered sample were weighed into porcelain crucible. The crucible and the fine powdered samples were ignited in a muffle furnace at $500^0$C for six to eight hours. The samples were then removed from the furnace and allowed to cool in desiccators, and weighed again. The difference between the weight of the crucible and ash and the weight of the crucible alone were used to calculate the percentage ash content of the sample. 5$cm^3$ of 1M trioxonitrate (v) acid (HNO3) solution was added to the left-over ash and evaporated to dryness on a hot plate and returned to the furnace for heating again at $400^0$C for 15-20 minutes until perfect grayish-white ash was obtained. The samples were then allowed to cool in desiccators. 15$cm^3$ of hydrochloric acid (HCl) was then added to the ash to dissolve it and the solution was filtered into 100 $cm^3$ volumetric flask. The volume was made to 100 $cm^3$ with distilled water.

#### 2.4.2. Spectrophotometry techniques for chromium (cr) detection

In the prepared liver and kidney samples, Chromium (Cr) residue was determined under specified condition according to the manufacturer (AA-6800, Shimadzu Atomic Absorption Spectrophotometer) (Szkoda and Żmudzki, 2005).

### 2.5. Statistical analysis

Data from the study were presented in tables and percentages**;** ANOVA (Analysis of Variance) was used to compare the mean concentration of Chromium in liver and kidney in different age groups. The results were analyzed using Graph pad Instate 3.10, 32 bit for window.

## 3. Results and discussion

### 3.1. Percentage of chromium (Cr) positive liver and kidney sample

All the samples (100%) tested positive for Chromium (Table 1). The mean Chromium concentration in liver (Table 2) is higher among the age group ≥9 years with the concentration of 0.121±0.052 mg/kg, and it is lower among the age group of 0-2 years with the concentration of 0.110±0.045 mg/kg. While in the kidney, the mean Chromium concentrations was also higher among the age group of ≥9 years with the concentration of 0.089± 0.04854 mg/kg and lower mean Chromium concentration was found among the age group of 0-2 years with the concentration of 0.036±0.045 mg/kg.

**Table 1**
Percentage of chromium (cr) positive liver and kidney sample

| Organ | No. Sample Tested | Positive Samples | Prevalence (%) |
|---|---|---|---|
| Liver | 100 | 100 | 100 |
| Kidney | 100 | 100 | 100 |

% =Percentage

**Table 2**
Mean and standard deviation (mean ± SD) of chromium (Cr) concentration (mg/kg) in kidney and liver samples

| Age range (years) | Mean and SD of Cr conc. in liver (mg/kg) | Mean and SD of Cr conc. in kidney (mg/kg) |
|---|---|---|
| 0-2 | 0.110±0.045 | 0.036±0.045 |
| 3-5 | 0.112±0.043 | 0.044±0.011 |
| 6-8 | 0.117±0.059 | 0.040±0.028 |
| ≥9 | 0.121±0.052 | 0.089±0.04854 |

Generally, the mean Chromium concentration in liver was higher than in kidney in all age groups, this result is similar to that of Akan *et al,* (2010) who also recorded high concentration of chromium in liver than in the kidney. But this is contrarily to the findings of Nwude *et al,* (2011) who recorded higher concentration of chromium in the kidney than in the liver.

The mean concentration of Chromium from this finding is generally low compared to that of Akan *et al*., (2010) and Nwude *et al*., (2011), who recorded 0.43 mg/kg and 1.51/kg in the liver, 0.32mg/kg and 1.71mg/kg in the kidney respectively as their highest mean concentration of Chromium.

According to the results of this study, there was no significant difference in the concentration of Chromium in liver and kidney in the different age groups $P \geq 0.05$, and there was increase in the concentration of Cr with increase in age of the animal.

Cr is an essential element helping the body to use sugar, protein and fat, at the same time it is carcinogenic (Institute of Medicine, 2002). Excessive amounts of Cr may cause adverse health effects on both animals and human (ATSDR, 2004).

**4. Conclusion**

Chromium residue was detected in all the liver and kidney samples collected from the slaughtered bovine carcasses at Sokoto Central abattoir. It shows that these animals were exposed to Cr either in their feed (pasture), water, or inhalation. The liver and kidney of slaughtered cattle at Sokoto Central abattoir Sokoto State, Nigeria, seem to be safe for consumption considering the low level of chromium concentration in these organs.

**References**

Akan, J.C., Abdulrahman, F.I., Sodipo, O.A., Chiroma, Y.A., 2010. Distribution of Heavy Metals in the Liver, Kidney and Meat of Beef, Mutton, Caprine and Chicken from KasuwanShanu Market in Maiduguri Metropolis, Borno State, Nigeria. Res. J. Appl. Sci. Eng. Technol., 2(8), 743-748, ISSN, 2040-7467.

Agency for Toxic Substances and Disease Registry, Division of Toxicology (ATSDR), 2004. CliftonRoad, NE, Atlanta, GA. Retrieved from, http://www.atsdr.cdc.gov/toxprofiles/

Agency for Toxic Substances and Disease Registry (ATSDR), 2006. Chromium toxicity: Case Studies in Environmental Medicine.U.S. Department ofHuman and Health Services.

Babalola, O.O., Ojo, L.O., Aderemi, M.O., 2005. Lead levels in some biological samples of automechanics in Abeokuta, Nigeria. Indian J. Bioch. Biophy. 42, 401-403.

Barceloux, D.G., 1999. Chromium. Clinical.Toxicol. 37, 173–194

Barnhart, J., 1997. Occurrences, Uses, and Properties of Chromium. Regular. Toxicol. Pharm. 26(1), 3-7.

Baruthio, F., 1992. Toxic effects of Chromium and its compounds. Biological Trace Element. Resource. 32, 145-153**.**

Blowes, D., 2002. Tracking hexavalent chromium in groundwater. Science. 295, 2024-2025

Demirezen, D., Uruç, K., 2006. Comparative study of trace elements in certain fish, meat and meat products. Meat. Sci. 74, 255-260

Dioka, C.E., Orisakwe, I.E., Adeniyi, F.A.A., Meludu, S.C., 2004. Liver and Renal function tests in Artisans occupationally exposed to Lead in Mechanic village in Nnewi, Nigeria. Inter. J. Environ. Res. Pub. Health. 1, 21-25.

FAO/WHO, 2000. Report of the 32nd Session of the codex committee of the food additives Contaminants. Beijing People's Republic of China, 20-24 March

Goyer, R.A., 1997. Toxic and essential metal interactions. Annu. Rev. Nutr. 17, 37- 50.

Institute of Medicine, 2002. Dietary Reference Intakes forVitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc. Institute of Medicine of the National Academies. The National Academy Press. Washington D.C. USA.

Jadhav, S.D., Turel, Z.R., 1994. Determination of chromium in aquatic environment by substoichiometric thermal neutron activation analysis. J. Radioana. Nucl. Chem. 177(1), 185-191.

Kamala, K., Kumar, B.D., 1998. Lead toxicity. Indian Paediat. 35, 209-216.

Kennish, M.J., 1992. Ecology of Estuaries Anthropogenic Effects. CRC Press, Boca Raton. pp. 494.

Kostial, K., 1986, Trace elements in human and animals nutrition, Volume 2, 5th edition. Academic Press New-York 7592.

Lopez Alonso, M., Benedito, J.L., Mirada, M., Castillo, C., Herandez, J., Shore, R.F., 2002. Cotribution of cattle products to dietary intake and toxic elements in Galicia, Spain. Food Addit. Contam. 19, 533-541

Luckey, T.D., Venugopal, B., Hutchson, D., 1975. Heavy metal toxicity, safety and homology. Qual. Suf. Thieme Stuttgart, Supplement, 1,120-121

Mamman, A.B., 2005. Transport aspect of livestock marketing at Achida and Sokoto Kara Markets. Paper prepared on a network supported by UK Department of International Development (DFID) Sokoto.

MOCIT, 2002. Guide to Sokoto State economy potential, Commerce Department, Ministry of Commerce, Industry and Tourism, Sokoto State. Pp 4-18.

National Population Commission (NPC). Census data 2006.

Nwude, D.O., Babayemi, J.O., Abhulimen, I.O., 2011. Metal quantification in cattle, A case of cattle atslaughter at Ota Abattoir, Nigeria. J. Toxicol. Environ. Heal. Sci. 3(9), pp. 271-274. ISSN 2006-9820 ©2011 Academic Journals

Szkoda, J., Żmudzki, J., 2005. Determination of Lead and Cadmium in biological material by Graphite Furnace Atomic Absorption Spectrometry Method.Bulletin Vet. Institute, Pulawy. 49, 89-92.