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# DETERMINATION OF THE LEVEL OF TRACE ELEMENT IN SHEEP INTERNAL ORGANS IN MUBI ABATTOIR

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## ABSTRACT
The level of trace element residual concentrations of Cd, Zn, Cr, Pb, and Cu in the in Heart, Kidney and Liver (organs) using Atomic Absorption Spectroscopy (AAS) have been determined in sheep, each consisted of five sample. The results of concentration of trace elements were showed that Cadmium, was not detected in all the organs sampled of heart and kidney only has a minute

## Introduction

Consumption of both crops and livestock products is inevitably important for good human health and as such, the intake of safe product, must be ensured. To this, the federal government of Nigeria, nowadays through the Directorate of National Agency for Food and Drug Administration and Control (NAFDAC) has been very serious and moving a checkpoint on taking food, drugs etc that are not certified and there is the need for certification or proof of safety of food or drug before advocating their consumption to the public (Izah *et al.*, 2017). However, the place of beef as a protein source cannot be over looked and the consumption of some organs in cow as food to be examined to be sure of the safety, while taking into consideration those needed in small or large quantities

Trace metals are metals in very small quantities almost at the molecular level that reside in or are present in animal and plant cells and tissues. Some are necessary part of good nutrition. They include Iron, Zinc, Copper, Chromium, Cobalt, Molybdenum, Manganese, Selenium and others. These trace metals are depleted through the

quantity in liver 0.0023±0.01 mg/kg. The highest concentration (2.950±0.01 mg/kg) of zinc was found in liver and (1.760±0.01 mg/kg) of Zinc was found in the kidney while the lowest which was detected (0.34±0.01mg/kg) in the heart , which is below the permissible limit of 0.50 mg/kg, as recorded by USDA, (2006). Chromium Cr was not detected in different organs of all samples of 0.00 ± 0.00 mg/kg. Copper, was detected in all the organs sampled and varied in the range of 0.45 ± 0.22 mg/kg, 0.33 ± 0.01 mg/kg. and 0.19 ± 0.01 mg/kg). The most values of trace element residues have been found higher: in Liver than in Kidney. Drastic measures are suggested to detoxicate and treat both the industrial and domestic effluents which are intended to be used for health purposes.

**Key word**: AAS, Organs Sample, Digestion apparatus and nitric Acid.

expenditure of energy by living organisms. They are also replenished in animals by eating plants which gets them through uptake of minerals from the soil (Francis, 1990). Human vitamin pills and plant fertilizers both contains trace metals and as addition source for trace metals. Human Soft tissue contains 0.13-0.50 ppm lead in brain and from 1.3-1.7 ppm lead (wet weight) in the liver (Kotferova *et al.,* 1999). lead is a constituent of vitamin B12, an essential nutrient for man in prevention of pernicious anemia (EI-Salam *et al.,* 2013). The special concentrations of cadmium in the liver and kidneys, particularly the kidney cortex is apparent from many studies with several species. Mean value for adult kidney is 13.9±0.7, liver 4.3±1.0, brain 0.3±0.04 and muscle 0.03±0.01 ug/g wet weight (Harlia, *et al.,* 2010). Cadmium reduces the toxicity of $Hg^{2+}$ ions and possibly that of other divalent metals (Lucas and Coleman, 1978). A healthy adult body has been found to contain 80 mg of total copper (Chinma *et al.,* 2007), the distribution of total copper among the tissue varies with the species, age and copper status of the animal. (Harlia, *et al.,* 2010), found the following mean concentration in adult human, liver 14.7±3.9, brain 5.6±0.2, kidney 2.1±0.4 µg/g wet weight. Copper helps in well functioning of erythrocytes in the body (Chinma *et al.,* 2007). Absorbed chromium is stores in the liver, spleen, soft tissue and bone, body chromium content may be reduced under several conditions. Diets high in simple sugars can increase chromium excretion in the urine.

Chromium deficiency is a disorder that results from an insufficient dietary intake of chromium. It occurs rarely in developed nations. In valent chromium is an essential trace metal and required for proper metabolism of sugar in humans. Deficiency affects potency of insulin in regulatory sugar balance. Unlike other essential trace metals, chromium has not been found in a metalloproteinase with biological activity. Therefore the functional basis for chromium requirement in the diet remains unexplained. Chromium picolmate is the most commonly used synthetic supplement to correct imbalance in glucose metabolism due to chromium deficiency.

The aim of this research work is to determine the effect of trace element (Zn,Cu, Cd, Cr, and Pb) in some organs (Liver, kidney and Heart) obtained in Mubi abattoir.

## MATERIAL AND METHOD

### Sample Collection

The samples were consist of three internal organs (heart, liver and kidney) which was collected at abattoir in Mubi North Local Government Area of Adamawa State. The collected samples were stored in 10% formaldehyde to the laboratory for safe storage and subsequent analysis to determine the trace elements presents in the selected organs.

### Sample preparation

The collected samples were prepared for digestion. The samples were grinded using a blender. 1g of each blended sample was introduced into the digestion flask together with 25ml of water and 6ml of 0.1M nitric acid. The mixture was heated in a fume cupboard to dried.

### Digestion:

The samples were dried in the oven for three days at temperature 105°C. After which they was grinded in a mortar into fine powder. 2g of the well-grounded samples was weighed into 1000cm$^3$ Kjeldahl flask. 20 cm$^3$ of deionized water was added followed by 20cm$^3$ of concentrated $HNO_3$. The mixtures was boiled at about 100 °C for 60 minutes until they form. When the samples pass into colloidal solution, which will be then cooled and 10 cm$^3$ of conc $H_2SO_4$ will be added. The mixture will be heated again and continued at a temperature of 140°C, for 20 minutes when a dense white fume of the conc $H_2SO_4$ was noticed. The solution was allowed to cool and transferred quantitatively into 100 $cm^3$ volumetric flasks and made up to the mark. The solutions were finally transferred into sample bottles (already labeled), and were analyzed for the presence and concentrations of Chromium (Cr), and lead (Pb) using Atomic Absorption Spectrophotometer AAS (AOAC, 1995)

**Determination of trace Element**

Lead nitrate (1.00 g) was dissolved in 50 mL of 2 M nitric acid. The solution was then made up to mark in 1 L volumetric flask with deionized water. Cadmium nitrate (1.0 g) was dissolved in 20 mL of 5M hydrochloric acid and 2 drops of concentrated Nitric acid was added. The resulting solution was made up to mark in 1L volumetric flask with deionized water. Chromium nitrate (Cr (NO3)3).9H2O) (7.696 g) was dissolved in 250 mL of deionized water. The solution was then made up to mark in 1L volumetric flask with deionized water. Zinc sulphate (1.0 g) was dissolved in 30 mL of 5M HCl. The resulting solution was then made up to mark in a 1L volumetric flask with deionized water. Copper sulphate (1.0 g) was dissolved in 50 mL of 5M nitric acid. The solution was then made up to mark in a 1L volumetric flask with deionized water.

**RESULT AND DISCUSSION**

**Results**

The results of concentration of trace elements were given in table 1, the results showed that Cadmium, was not detected in all the organs sampled of heart and kidney only has a minute quantity in liver in the range of 0.0023±0.01 mg/kg. The highest concentration (2.950±0.01 mg/kg) of zinc was found in liver and (1.760±0.01 mg/kg) of Zinc was found in the kidney while the lowest which was detected (0.34±0.01mg/kg) in the heart , which is below the permissible limit of 0.50 mg/kg, as recorded by USDA, (2006).

Chromium Cr was not detected in different organs of all samples of 0.00 ± 0.00 mg/kg. Copper, was detected in all the organs sampled and varied in the range of 0.45 ± 0.22 mg/kg, 0.33 ± 0.01 mg/kg. and 0.19 ± 0.01 mg/kg. The highest concentration of Copper was found in the liver (0.45 ± 0.22 mg/kg) while the lowest in the kidney (0.33 ± 0.01 mg/kg) which were below the permissible limit of 0.50 mg/kg, as recorded by USDA, (2006).

Lead , was detected in all the organs sampled of 0.012 ± 0.22 mg/kg, 0.00 ± 0.00 mg/kg. and 0.0 ± 0.00 mg/kg. The highest concentration of Lead was found in the liver (0.012 ± 0.22 mg/kg) while the lowest concentration (0.00± 0.00mg/kg) which were below the permissible limit of 0.30 mg/kg, as recorded by USDA, (2006).

**Table. 1**: Concentration of trace elements detected in selected Organs of Heart

| S/N | Organs | Cd (mg/kg) | Zn (mg/kg) | Cr (mg/kg) | Pb (mg/kg) | Cu (mg/kg) |
|---|---|---|---|---|---|---|
| **1** | Heart | ND | 0.346± 0.01 | ND | ND | 0.133±0.02 |
| **WHO** | Organs | 0.5 | 0.2 | 1.00 | 0.30 | 0.1- 0.50 |

Note; ND = Not detected. The values in the table are presented in mean ± standard deviation [M±SD]. $p<0.05$

**Table. 2**: Concentration of trace elements detected in selected Organs of Kidney

| S/N | Organs | Cd (mg/kg) | Zn (mg/kg) | Cr (mg/kg) | Pb (mg/kg) | Cu (mg/kg) |
|---|---|---|---|---|---|---|
| **2** | Kidney | ND | 1.763± 0.01 | ND | ND | 0.336± 0.01 |
| **WHO** | Organs | 0.5 | 0.2 | 1.00 | 0.30 | 0.1- 0.50 |

Note; ND = Not detected. The values in the table are presented in mean ± standard deviation [M±SD]. $p<0.05$

**Table. 3**: Concentration of trace elements detected in selected Organs of Liver

| S/N | Organs | Cd (mg/kg) | Zn (mg/kg) | Cr (mg/kg) | Pb (mg/kg) | Cu (mg/kg) |
|---|---|---|---|---|---|---|
| **3** | Liver | 0.0023± 0.01 | 2.953± 0.01 | ND | 0.0012± 0.22 | 0.4530 ± 0.01 |
| **WHO** | Organs | 0.5 | 0.2 | 1.00 | 0.30 | 0.1- 0.50 |

Note; ND = Not detected. The values in the table are presented in mean ± standard deviation [M±SD]. $p<0.05$

## DISCUSSION

Trace elements were detected in the selected organs and they are highly toxic even at trace concentration. In biodiversity, Trace elements are being broadly utilized as a group name for metals and metalloids that have been associated with contamination and potential toxicity or eco-toxicity. Trace elements in general are not - biodegradable, have long biological half-life and the potential for accumulation in the different organs of sheep Leading to unwanted side effects. From this study, the levels of Trace elements determined in different organs were above the permissible limit set by FAO standards, only Cadmium in kidney was found to be within the normal range.

Different studies have shown Cadmium concentrations were lower in the liver and not detected in heart and kidneys (Hetcht *et al.,* 2000). The lowest concentration of Cadmium in the organs is due to the undetoxification where these metals are not accumulated (Aranha, 1994; Stokey *et al.,* 1995). Exposure of animals to heavy metals could Lead to accumulation in their heart, livers and kidney as their free protein-thiol content Leading to a strong fixation of heavy metals. Despite the excretory mechanism for such metals, which is based on low molecular compounds with -SH groups, vertebrates could not develop these mechanisms during the period of evaluation.

Zinc concentration were detected in all the organs, the highest concentration was detected in the liver and the lowest concentration was detected in heart, the concentration in kidney have a related similar concentration. Zinc substantially accumulates in the heart, liver and then kidney. It acts to diminish the toxicity, Zinc may be a modifier of the carcinogenic response; excessive levels of Zinc may enhance susceptibility to carcinogens, in few instances of acute Zinc poisoning are manifestations include nausea, vomiting, diarrhea, fever, and lethargy. Zinc is an essential trace metal it occurs in most foodstuffs and beverages, the main Zinc intake is in meats, especially organ meats, whole grain cereals and milk product including cheese. Zinc is essential component of many metal enzymes (Vallee and Auld, 1990).

Chromium concentration was not detected in kidney, liver and heart which are below the permissible limits set by the standards. Chromium is an essential element which assists the body to use sugar, protein and fat, and is internationally recognized as one of the most carcinogenic metals (Xia *et al*., 2019). In humans the oral route exposure to Cr is due to contamination of foodstuffs. Certain effects have been reported like mouth ulcers, indigestion, acute tubular necrosis, vomiting, abdominal pain, kidney failure and even death. It has been studied that

Cr (III) has an essential role in protein and lipid metabolism but there are studies which has reported that Cr(III) cause oral toxicity in humans.

Lead was detected in the liver, but not detected in the heart and kidney. The concentration of Lead was lowest in all the study and was detected in liver. Lead is a toxic metal, which has effect on organisms. Lead is regarded as a potent occupational toxin and its toxicological manifestations are well known. The non-biodegradable nature of Lead is the major reason for its prolonged persistence in the environment. Human exposure to Lead occurs via various sources such as bearings, soil, foods stuffs etc. Lead toxicity is a particularly insidious hazard with the potential of causing irreversible health effects. It is known to interfere with a number of body functions and it is primarily affecting the central nervous, hematopoietic, hepatic and renal system producing serious disorders. Lead toxicity is characterized by persistent vomiting, encephalopathy, lethargy, delirium, convulsions and coma, which occurs mainly through the respiratory and gastrointestinal (GI) tracts. About 30-40 percent of inhaled Lead is absorbed into the bloodstream, the amount absorbed in the gastrointestinal tract (GI) varies depending on nutritional status and age. Increased dietary intakes of magnesium, phosphate, and dietary fat have also been shown to decrease Lead absorption in gastrointestinal tract.

Copper is naturally present in most foodstuffs in the form of the Copper ions or Copper salts. The main sources are meat organs, offal, fish, pecans, milk, chocolate, and green vegetables. Copper is an essential metal which is involved in activities as diverse as hemoglobin synthesis, bone and elastic tissue development, and the normal function of the central nervous system. Acute toxicity is due to ingestion of high quantities of Copper salts is characterized by vomiting, lethargy, acute hemolytic anemia, renal and liver damage, neurotoxicity, increased blood pressure and respiratory rates. In some cases, it Leads to coma and death. ( Adebayo, *et al.,* 2009)

## CONCLUSION

The study confirmed the presence of trace elements in the samples analyzed. The trace elements present in different organs were found to be below the permissible limits set by WHO and FAO. This points out that trace elements bioaccumulation could arise due to consumption of organs from sheep that most especially graze in contaminated areas. Therefore, there is serious need of monitoring the presence of trace elements in sheep's organs in order to advice the government and populace against the dangers associated with the sheep organs consumption.

## RECOMMENDATIONS

i. The use of organs (Heart, Kidney and Liver) of Sheep needs policy attentions particularly in urban and industrial areas
ii. Drastic measures are suggested to detoxicate and treat both the industrial and domestic effluents which are intended to be used in order to safeguard our populace.

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