



## Determination of Heavy Metals in Ready to Eat Entrails

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### Abstract

*The present study provides information on the concentrations of metals in liver, stomach, intestine, colon and kidney of animals. These entrails of cow, sheep and goat are delicacies in this part of the world. Many Nigerians (men and women) in their 40s, prefer these delicacies( internal organs of the animals) whenever they visit local restaurants or purchase beef (meat) for consumption at home. They are becoming exposed to these toxic metals. The heavy metals determined in this work are Pb, Cr, Cd, Cu and Co. Pb was consistently higher in all the samples analyzed. In all the samples analyzed, the ranged from 6.116 to 15.110 mg/kg in the goat, 8.018mg/kg to 11.617mg/kg in the cow and 9.969mg/kg to 21.614mg/kg in the stomach of sheep, Co has the lowest concentration ranging from 0.960mg/kg to 8.169mg/kg in all the samples analyzed. All the animals (cow, goat and sheep) samples contained heavy metals, exceeding the WHO guidelines for permissible tolerable weekly intake (PTWI).*

**Key words:** Liver, stomach, kidney, colon, heavy metals.

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### Introduction

Toxic heavy metals in air, soil, and water are global problems that are a growing threat to humanity. There are hundreds of sources of heavy metal pollution, including the coal, natural gas, paper, and chlor-alkali industries (1,2). In response to the growing problems, Federal and state governments have instituted environmental regulations to protect the atmosphere, land surface and ground water from heavy metal pollutants, such as Cd, Cu, Pb, Hg, Cr, and Fe (3)

Grazing animals depend ultimately upon the soil for their supply of all mineral elements (4). The soil plant animal relationship in human nutrition is completed by the supply of great variety of food which comprise modern human dietaries and by the increasing amount of processing to which they are subjected.

The former provides mineral abnormalities of food grown in another area under different environmental condition. The latter provides the opportunity for contamination especially with trace elements from metals and chemical used in processing and preservation.

Cadmium is a heavy metal that occurs in the environment, generated by volcanic emissions and the degradation of rocks, as well as industry and agriculture. It collects in the soil, from where it is taken up by plants and animals, eaten by humans. High amount of Cd, a carcinogen, can cause kidney damage and bone demineralisation (5)

### Aim and Objective of This Research Work

Pollution of the environment with heavy metals is a serious problem, and of great concern to the government and other stake holders. The environments where these animals feeds are becoming polluted by discharge from industries, run off from agricultural land use, domestic waste discharge and effluent and spillage from oil industries.

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These metals accumulate in the liver, kidney and other internal parts of the animals. This part of the animals is preferred to the beef because they are richer in proteins and minerals and taste better if well prepared.

The objective of the research is to assess the level of heavy metals in the internal parts of these animals, as the result will help to focus on the evaluation of environmental quality and the consumer safety.

TABLE: 1.  
THE SAMPLE CODE, ANIMAL TYPE AND THE INTERNAL ORGANS.

SERIAL NO	SAMPLE CODE	ANIMAL	INTERNAL ORGANS	REMARKS
1.	SAMPLE A	COW	LIVER	
2.	SAMPLE B	GOAT	INTESTINE	
3.	SAMPLE C	SHEEP	COLON	
4.	SAMPLE D	COW	STOMACH	
5.	SAMPLE O	GOAT	LIVER	
6.	SAMPLE P	SHEEP	INTESTINE	
7.	SAMPLE Q	COW	COLON	
8.	SAMPLE R	GOAT	STOMACH	
9.	SAMPLE S	SHEEP	LIVER	
10.	SAMPLE T	COW	INTESTINE	
11.	SAMPLE U	GOAT	COLON	
12.	SAMPLE V	SHEEP	STOMACH	
13.	SAMPLE X	COW	KIDNEY	
14.	SAMPLE Y	GOAT	KIDNEY	
15.	SAMPLE Z	SHEEP	KIDNEY	

### Material and Methods

REAGENTS:- Analytical reagent grade chemicals of the highest purity, and double-distilled deionised water were used for the preparation of all the solutions

SAMPLING:-

The meat samples were purchased from four different markets ( Ajegunle, Agege, Ojo and Oyingbo ), along with the restaurants operators within the Lagos metropolis.

Lagos is a densely populated Metropolitan city with more than 14 million people. These four (4) markets from which the samples were purchased were chosen based on the population density, coupled with the facts that they are the depot for these animals as they are brought into Lagos.

DIGESTION:-

The samples were digested using the wet digestion (11), a mixture of nitric acid and hydrogen peroxide at ratio 1:2.

INSTRUMENTATION:-

Metals determination in the digested meat samples was carried out by means of Bulk Scientific 200A Atomic Absorption Spectrophotometer. Hollow Cathode Lamps have been used as excitation sources. Lamp intensity and band passed were used according to the manufacturer's recommendation. Acetylene and air flow rate for all elements were 2-4L/mm respectively.

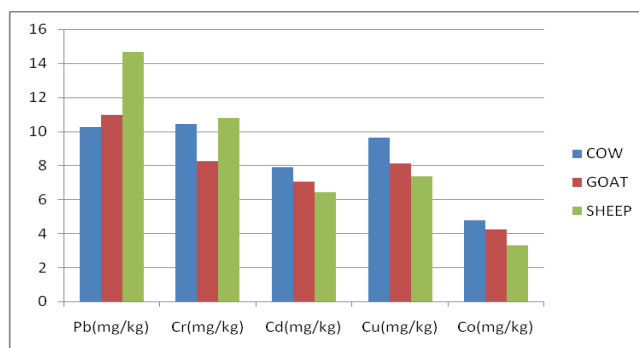
### Results and Discussion

TABLE 2:-  
HEAVY METAL CONCENTRATION IN VARIOUS PART OF ANIMAL.

	SAMPLE	COW	Pb(mg/kg)	Cr(mg/kg)	Cd(mg/kg)	Cu(mg/kg)	Co(mg/kg)
1.	A	LIVER	9.345	14.618	0.764	19.361	3.614
2.	D	STOMACH	11.418	5.314	9.642	3.178	4.740
3.	Q	COLON	10.816	13.610	7.618	10.116	4.819
4.	T	INTESTINE	11.617	13.514	16.114	8.177	0.960
5.	X	KIDNEY	8.018	5.117	5.346	7.364	9.710
		GOAT					
6.	O	LIVER	15.110	10.158	5.433	7.664	6.432
7.	R	STOMACH	6.116	9.418	8.550	4.086	1.760
8.	U	COLON	11.183	3.648	9.118	11.458	6.118
9.	B	INTESTINE	12.841	9.330	7.168	9.761	2.700
10.	Y	KIDNEY	13.640	8.644	4.960	7.694	4.161
		SHEEP					
11.	S	LIVER	12.455	8.618	5.168	3.458	2.771
12.	V	STOMACH	12.231	10.342	9.451	5.783	2.573
13.	C	COLON	9.969	6.007	3.503	6.140	1.945
14.	P	INTESTINE	21.614	17.618	11.418	9.230	8.168
15.	Z	KIDNEY	17.071	11.341	2.610	12.191	0.964

### Discussion

The result obtained from the analysis of these meat samples showed Pb to have the highest concentration. Of the three (3) animals under investigation, the sheep showed the highest lead concentration of 9.969mg/kg in the colon, 12.231mg/kg in the stomach, 12.455mg/kg of the liver, while kidney and intestine showed 17.071mg/kg and 21.614mg/kg respectively.

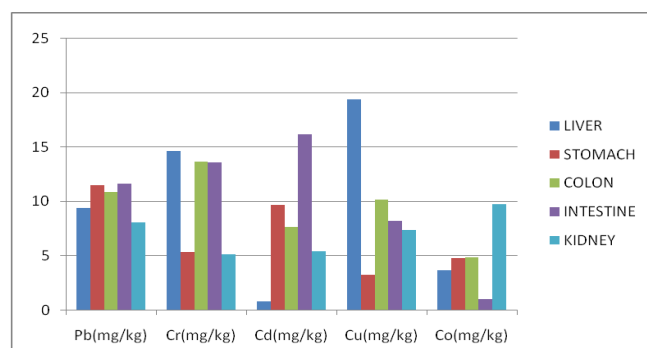


Mean Value of the Metals Present

**This observation was followed by** the lead concentration in the goat samples. It range from 6.116mg/kg in the stomach, 11.183mg/kg in the colon, 12.841mg/kg in the intestine, to 13.640mg/kg in the kidney and 15.110mg/kg in the liver. The cow samples have the lowest lead concentration, which range between 8.018mg/kg for the kidney, 9.345mg/kg for the liver, 10.816mg/kg for the colon to 11.418mg/kg, 11.617mg/kg for the stomach and intestine respectively.

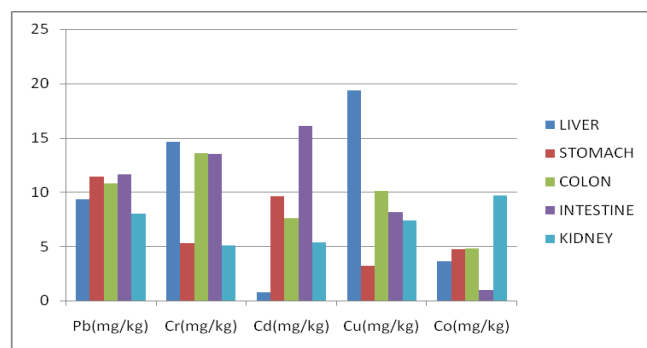
Also high in concentration, next to lead among the metals investigated is the Cr. The highest value of 17.618mg/kg still occurred in the intestine of the sheep. 11.341mg/kg in the kidney, 10.342mg/kg in the stomach, 8.618mg/kg in the liver and 6.007mg/kg in the colon..

Cd. gave the highest value of 16.114mg/kg which was detected in the intestine of the cow, the next higher value was found in the intestine of the sheep, while the colon of the goat have the value of 9.118mg/kg.

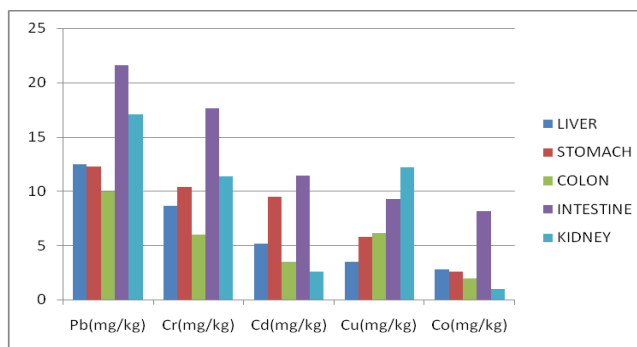


Metals Present in the Goat Sample

The cow samples was next to the sheep in term of Cr concentration. The value range from 5.117mg/kg in the kidney, 5.314mg/kg in the stomach, 13.514mg/kg in the intestine, 13.610mg/kg in the colon and 14.618mg/kg in liver of the cow sample. Goat sample have the lowest Cr. Concentration with the value ranging from 3.648mg/kg in the colon to the highest value of 10.518mg/kg in the liver. Cu have the highest value of 19.361mg/kg in the liver sample of the cow. The next higher value of 12.191mg/kg occurred in the kidney sample of the sheep, while the colon of the goat sample showed the value of 11.458mg/kg.



Metals Present in the Cow Sample



Metals Present in the Sheep Sample

Of all the metals detected in the three animals, Co showed the least concentrations. The highest value of Co detected (8.161mg/kg) still occurred in the intestine of the sheep sample .The liver showed 2.771mg/kg, stomach showed 2.573mg/kg, colon 1.945mg/kg and the kidney 0.964mg/kg. The value of 7.710mg/kg of Co occurred in the kidney of the cow. 4.819mg/kg and 4.740mg/kg in the colon and stomach respectively. While the least value of Co (0.960mg/kg ) was detected in the intestine of the cow.

## Conclusion

Pollution of the environment with heavy metals is a serious problem, which is recognized in most countries of the world. This work has shown the concentration of some heavy metals in the internal organs of some of these animals. Metals accumulate in the liver, kidney and other parts of the animals.

The internal organs of these animals are good sources of proteins and some minerals for humans, coupled with the facts that they (internal organs) are more desirable and taste better if well prepared.

This work has been able to show that Pb pollution among others is imminent in our environment. And, of the three animals investigated, sheep contained the highest heavy metals concentration when compared with others, value higher than the permissible tolerable weekly intake (PTWI), value set by WHO/FAQ.

This is an indication of heavy metal pollution in the environments where these animals feeds.

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