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DETERMINATION OF ASERNIC, LEAD, CADMIUM, ZINC AND IODINE IN SOME SALT SAMPLES SOLD IN SOUTH-EAST NIGERIA AND EFFECT OF THESE METALS ON PROTEIN AND HAEMOGLOBIN CONTENT OF ALBINO RATS

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ABSTRACT
Arsenic, lead, cadmium, zinc and iodine levels in royal salt, dangote salt, Uncle palm salt and Uburu salt sold in South East Nigeria were determined using atomic absorption spectrometry. The effects of the salt samples on protein and haemoglobin levels in albino rats were examined. The levels of the elements, arsenic, lead, zinc, cadmium and iodine were 0.0001, 0.0200, 0.0020, 0.0050 (mg/kg) respectively in all samples. while iodine values vary from 254, 508, 1269 and 0.010 (mg/kg) respectively. The values of arsenic, lead and zinc were lower than WHO limit of 0.05, 0.50 and 0.50 (mg/kg) respectively, while that of cadmium was slightly above its WHO's limit of 0.001(mg/kg). During the administration of the salt samples to albino rats, there was a decrease in their body weight. The protein concentration in all the group of the rats showed no significant difference ($P<0.05$). The result showed that haemoglobin concentration in the control group was insignificantly higher ($p<0.05$) than those of the treated group. Iodine values in the result indicate that all the salts are good source of iodine except Uburu salt, which has little iodine value and therefore its consumption should not be encouraged.

KEYWORDS: Arsenic, lead, cadmium, zinc, iodine, haemoglobin, protein, albino rats.

INTRODUCTION

Salt is a compound made up of sodium and chloride (NaCl). It contains grains of rice, which provide physical agitation and prevent the salt from caking. These two components of salt are necessary for the survival of all living creatures, including human, but they need not to be consumed as salt where they are found together in very concentrated form (Ben, 1995). Salt cravings may be caused by trace mineral deficiencies as well as by a deficiency of sodium chloride. Over consumption of salt can increase the risk of health problem, including high blood pressure. In food preparation, salt is used as a preservative as well as seasoning (Ben, 1995).

Heavy metals are among the elements found in the body. They are called trace elements because they are at least five times denser than water and as such are stable element and cannot be metabolized by the body (Robert and Robert, 2000). Heavy metals are present in drinking water, in the air, in medication and via direct skin contact. Detection of heavy metals is not easy as they lodge deep within tissues and organs. Serum test is helpful at times but not in chronic exposures. Tissues test such as hair mineral analysis are more helpful. Hair is a meaningful and representative tissue for monitoring, arsenic, cadmium and lead. The body has need for approximately 70 friendly trace elements. Heavy metals found in the body are also called trace elements since they act in low concentration (Schroeder, 1975). Some of those trace elements are poisonous, interfering with the normal functioning of enzymes and metabolism in the body (Anderson and Jensen, 1993). Despite food supplements or procedures to the natural healing functions of the body, metals naturally found in the body are said to be essential to human health. Zinc for example is a cofactor in over 100 enzyme reactions. Magnesium and copper are metals needed in minute quantity but necessary for proper metabolism to occur (Robert and Robert, 2000).

MATERIALS AND METHOD

Sample collection

The salts used in this work are: royal salt, dangote salt, uncle palm salt and Uburu salt. These salts were brought from four different states in south east Nigeria. Royal salt from Agbor, Delta State, Dangote salt from Ontisha Anambra State, Uncle Palm salt from Enugu, Enugu State and Uburu salt from Uburu, Ebonyi State.

Collection of animals

Albino rats were used in this work and were bought from zoology department, university of Nigeria Nsukka, Enugu State.

Preparation of the animals

One week after the collection was used to acclimatize the rats. The rats were fed with poultry feed without administration of salt solution.

Preparation of salt solution

The salt solutions administered to the rats were prepared by dissolving 10 grams of salt in 100mls of distilled water.

Grouping of rats

The rats were grouped into five places. Each group is made up of four rats. The groups are A, B, C, D, and E. Different salt solution were administered to each of the group according to their body weight. 100mg/kg body weight of the salts was administered to each rat. Group A was administered with solution of Uncle palm salt, group B royal salt, group C Uburu salt and group D dangote salt.

Group E was set as the control group and was given distilled water

Collection of blood samples from the rats

5ml of blood sample was collected from each of the rat after decapitation. The blood sample of each rat was kept into two specimen contained bottled. One of the bottles containing anticoagulant and the other once did not.

Determination of protein level

The determination of protein level was performed according to lowry *et al*., (1951). In the procedure, 0.4 ml of serum was added to 0.4ml of 2xLowry concentrate, mixed well and was incubated for 10 minutes at room temperature. Further, 0.2ml of Folin reagent was added and incubated for another 30minutes. The absorbance was read at 750nm. Protein concentrations were obtained from a standard curve.

Determination of hemoglobin level

Haemoglobin concentrations were determined using Baker and Sliverton method (1980). 0.2ml of blood sample was added to 5ml of drabkins solution. The blood and drabkins solution was mixed and allow to stand for 10minutes. The absorbance was read at 540nm and haemoglobin concentration obtained from a standard curve.

Determination of Heavy metals

Lead, Arsenic, Cadmium and Zinc levels in each of the salt was determine using atomic absorption spectrometer model 939. The analysis was according to American public Health Association (1998). The metals are analyzed by dissolving certain amount of salt in concentrated nitric V acid (conc. HNO_3) and specific cathode hollow lamp was used for each of the metals and at different wavelengths.

Arsenic: 0.100g of salt sample was dissolved in 4mls conc. HNO_3, 7.0 m/s of conc. HNO_3 was added and diluted to 100 ml with water. The analysis involves the use of arsenic hollow cathode lamp and at wavelength of 193.7nm.

Lead: 0.1598g of 1 + 1 HNO_3, 10ml added and diluted to 1000ml with water. Lead hollow cathode lamp and wavelength of 217.0nm.

Cadmium: 0.100g of salt sample was dissolved in 4mls of conc. HNO_3, 8.0mls of conc. HNO_3 was added and diluted to 1000ml with water. Cadmium hollow cathode lamp was used and wavelength of 228.8nm.

Zinc: 0.100g salt sample was dissolved with 20mls of HCL and diluted to 100mls with water. Zinc hollow cathode lamp was used and at wavelength of 213/3nm.

Determination of iodine

The level of iodine in the salt samples was determined by grinding 2g of salt to a fine powder, 50ml of hot water (60^oC) was added. The samples were allowed to cool down to room temperature and were made up to 100 ml with distill water. The solution was mixed and filtered through filter. The levels of iodine in each salt were read colourimetrically (American Public Health Association, 1998).

RESULTS

TABLE 1: The results of the mean concentration of arsenic, lead, cadmium zinc and iodine in the analyses.

Heavy metals	Royal salt (mg/kg)	Uncle palm (mg/kg)	Dangote salt (mg/kg)	Uburu salt (mg/kg)	WHO Limit 1997 (mg/kg)
Arsenic (AS)	0.0001	0.0001	0.0001	0.0001	0.050
Lead(Pb)	0.0200	0.0200	0.0200	0.0200	0.500
Cadmium (Cd)	0.0020	0.0020	0.0020	0.0020	0.001
Zinc (Zn)	0.0050	0.0050	0.0050	0.0050	0.500
Iodine(I)	254	508	1,269	0.0100	6,000

The table showed that there is little iodine level in Uburu salt.

TABLE 2: mean concentrations of haemoglobein (g/dl) and Proteins (g/dl) ± standard deviation

Groups	Haemoglobin	Proteins
Group A	9.50±0.62	1.72±0.01
Group B	9.25±0.96	1.89±0.00
Group C	8.08±0.50	1.60±0.04
Group D	10.88±0.00	1.53±0.00
Group E	11.63±0.00	1.70±0.00

DISCUSSION

Comparing the results with WHO limit (1997) in table 1, arsenic in the sample is below the limit. Lead in the result of the analyses, has values less than that of the WHO limit. High level of lead has being noted to cause damages in humuan. Damaging effect of lead include disruption of the biosynthesis of haeamoglobin and anemia, rise in blood pressure, kidney damage and brain damage.

Cadmium from the results was noted to have values little above WHO limit. It is therefore advice that carefulness should be applied when consuming the salts. Cadmium overload can damage renal nerves, obstruction in the lungs, irritation of the stomach, genetic disorder and it is a known human carcinogen that harms DNA molecules directly and disturbs its repair system that helps to prevent cancer (Ames *et al., 2002).* Zinc from the analysis is less than WHO limit. Iodine from the analysis is less than that of WHO limit. Table 1 shows with WHO limit, royal salt, uncle palm salt and dangote salt are good source of iodine. Uburu salt has a very low content of iodine and as a result people in Uburu who are consuming it may be exposed to iodine deficiency and its consequence.

Table 2 is the result of protein and haemoglobin mean concentration ± standard deviation of the concentration in the albino rats administered with different salt sample to check the effects of heavy metals in the salt on the rats protein and haemoglobin level and compared with a different group set as control. The result showed that

protein concentration for all the groups have no significant differences. The haemoglobin content in group D and E have a slight increase than that of A, B and C. in all, the differences were not significant. The poison of arsenic and lead on haemoglobin synthesis with these results might not occur when consuming the salts.

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