HEAVY METAL CONCENTRATION IN SOME FISHES FROM LAKE CHAD REGION IN NIGERIA

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ABSTRACT

The primary aim of this study was to experiment the levels of concentration of heavy metals in some fishes in the Lake Chad. Three samples of fishes were bought from the fish market and dried to constant weight then acid digested and analysed using Atomic Absorption Spectrophotometer (model Perkin Elmer 3110) for Zinc (Zn), Lead (Pd), Iron (Fe), Mercury (Hg), Nickel (Ni) and Copper (Cu). The levels of these ions were found to be satisfactory for human consumption with highest levels for the ions zinc, lead, iron mercury nickel and copper of 121.15 in molusca, 7.28 in Mackerel, 132.02 in molusca, 0.08 in mulusca, 1.86 in molusca and 1.78 in Mackerel respectively while the lowest values were 98.23 in tilapia, 5.78 in Molusca, 110.00 in tilapia, 0.06 in tilapia, 0.43 in tilapia and 1.05 in tilapia respectively. Though the study revealed the health implication of high levels of various elements such as Cu, Pd and Hg in humans as a breakdown in the nervous system, yet consumers of fishes from this lake are not at risk since the levels are low.

Keywords: *Heavy metals, fishes, Lake Chad*

INTRODUCTION

Heavy metals in water bodies may affect fish and other aquatic organisms, which may endanger public health through consumption of contaminated fish (Odoemelam, Iwuozor and Ozuo, 1999. Heavy metals are commonly found in natural waters. Though some are essential to living organisms, yet they may become highly toxic when present in high concentration (Oni, 1987). Aquatic animals, including fishes bioaccumulate trace metals in considerable amounts (Ibok, Udosen and Udoidiong, 1989; Kemdrium, 1997; Smock, 1983). Hence they are finally transferred to other animals including humans through the food chain (Etuk and Mbonu, 1999). Elevated levels of heavy metals in soils may lead to uptake by native and agronomic plants and leaching to ground and surface waters. Movement of plants or ground water is dependent on chemicals from metals in contaminated soils. The associated problems caused by sewage sludge application such as the increase to harmful levels of the heavy metal contamination in edible crops were well documented (USEPA, 1976). Fish absorbs

heavy metals through ingestion of water or contaminated food. Lake Chad receives its water from various rivers in Nigeria, Chad, Cameroon and Niger Republic. The rivers, generally, carry materials ranging from elements washed from the earth to effluents from domestic activities and industries located along these rivers. The fishes in these water definitely takes part of the heavy metals and consequently transfer to human beings who use them as food. Hence, this study aimed at experimenting Heavy Metal Concentration in some Fishes in Lake Chad.

MATERIALS AND METHODS

Three samples of fishes were bought from the fish market and dried to constant weight then acid digested and analysed using Atomic Absorption Spectrophotometer (model Perkin Elmer 3110) for Zinc (Zn), Lead (Pb), Iron (Fe), Mercury (Hg), Nickel (Ni) and Copper (Cu). A total of 40 fishes consisting of four species were bought in the fish market in Maiduguri, Borno State of Nigeria. These were further dried for 2 days to constant weight at 50ºC and ground to powder in Kenwood blender model BL315 PK 100/AD (Kenwood England). The powder were digested following the method of Poldoski (1980). In brief it involves digesting 1.0g portion of the ground fish sample with mixture of $10cm^3$ HNO_3 and $2cm^3$ $HClO_4$. After complete digestion the residue was dissolved and diluted with 0.2% v/v HNO_3 to $20cm^3$. The digests were then analyzed using Atomic Absorption Spectrophotometer model Perkin Elmer 3110. The results of the concentration of metals and ions in the fish samples were presented on table and chart respectively.

RESULTS AND DISCUSSION

Table 1: Concentration of the metals present in the samples

	Zn	Pb	Fe	Hg	Ni	Cu
Tilapia	98.23 ± 0.453	6.90 ± 0.483	110.0 ± 0.317	0.06 ± 0.015	0.43 ± 0.864	1.05 ± 0.742
Mackerel	112.03 ± 0.547	7.28 ± 0.063	120.23 ± 0.532	0.07 ± 0.006	1.43 ± 0.375	1.78 ± 0.649
Molusca	121.15 ± 1.563	5.78 ± 0.593	132.02 ± 0.563	0.08 ± 0.043	1.86 ± 0.639	1.45 ± 0.234

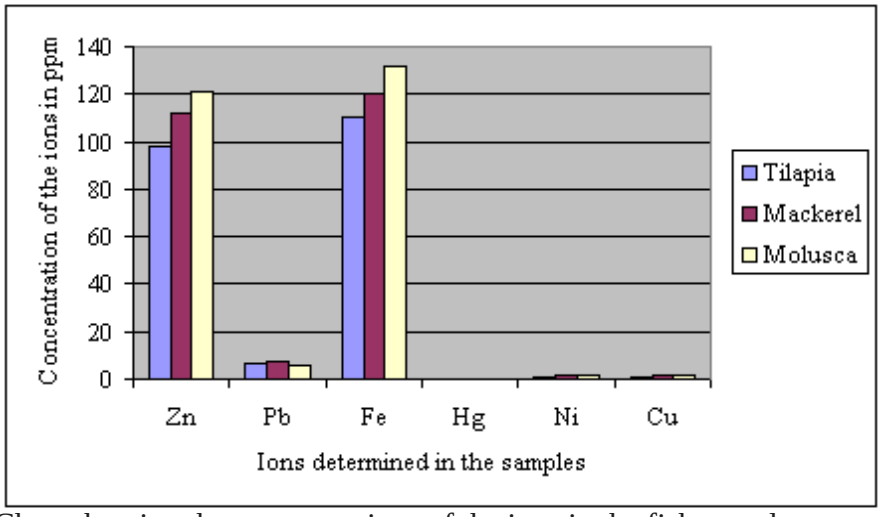

Fig. 1: Chart showing the concentrations of the ions in the fish samples

Zinc is a component of more than 200 enzymes most of which are involved in protein and Dioxonutric Acid (DNA) synthesis in humans (Judith, 1990). It deficiency has been reported to cause retarded growth, poor appetite and delayed puberty among adolescent males also susceptibility to infection and impaired development of sex organs (Prasad, 1985). From the findings above with a level of between 98.23 to 121.15mg per 100.0g of each fish it implies that consumers are getting a good amount for proper functioning of the body. On the other hand, overdose in pregnancy leads to pre-term delivery (Worthington-Roberts, 1985). It may also be involved in the pathogenesis of certain hitherto idiopathic conditions, which may include Menke's disease and Danbolt's disease (*Acrodermatitis enteropathica*) (Danks et al, 1972). However, the levels determined in the fish samples are within the recommended limit. Copper is directly involved in reactions that incorporate iron into the structure of haemoglobin. Pyke (1979) notes that copper is essential for normal development of the nervous system and a part in maintaining the myelin sheath, which forms a kind of insulating layer around each nerve. Even though the amount found in the fishes (1.05 - 1.75mg) are low, consumers are not at risk as they are also available from other sources. Klevay, Reck and Barcome (1979) note that its deficiency causes anaemia, reduced growth and contributes to increase in blood cholesterol level. This is why people are recommended to eat fish more especially when one is getting older so as to avoid diseases associated with high blood cholesterol levels like hypertension. The fishes of this lake are a good source of this supply.

Iron is essential to enzyme structure, function, growth and cellular immunity (Lonnerdal et al, 1976 and Lot and Sinnathury, 1971). Its deficiency may produce a wide range of ailments such as fatigue, impaired immune functions, decrease athletic performance, precognitive defects in children (Murray M., Murray A. and Murray N., 1978; Calada et al, 1982, Franson et al, 1985 and Zavaleta, Nombera and Rojas, 1995, Peng, Wenjian and Zhenji, 1997). This implies that eating fish consistently increases general growth and productivity of both adult and children. Thus in the study, the amounts found even if there are no other sources, consumers may not have iron deficiency. Mercury alters enzymatic and metabolic processes in organisms and interferes with functions of the brain, kidney and liver (Nwaedozie, 1998). Mercury poisoning attracted global attention following the catastrophe in Japan in which severe mercury intoxication resulting from the ingestion of fish and shellfish led to the death of many people (Kakulu, 2000).

Several authors have reported large-scale death of fish from mercury poisoning and subsequently death of humans through consumption of fish contaminated by methyl mercury (FEPA, 1991). The levels of mercury are very low to cause concern for the consumers of fishes from the lake. Lead and cadmium are found in all foods, in widely varying amounts (Reilly, 1980). Lead is a well-known toxicant that has several deleterious effects even at low concentrations. The amount of lead obtained in each species may not be regarded as high as other studies obtained by other researchers from other Nigerian Lakes and rivers. Studies by Nwaedozie (1998) in

River Kaduna, Ibok, Udosen and Udoidiong (1989) in Streams in Ikot Ekpene and Odoemelam (2005) in Oguta Lake reveal higher levels of lead. Elemental nickel is not a potent toxicant but nickel carbonyl is acutely toxic and has been implicated in cancer of the respiratory system (Doll, Morgan and Spiezon, 1970). The results reveals that molusca accumulate more ions than the other species studied.

CONCLUSION

This experiment was conducted to examine Heavy Metal Concentration in Some Fishes from Lake Chad region in Nigeria. The study reveals that eating fish obtained from Lake Chad is not dangerous. That no serious pollutants are thrown into the lake by the contributing lakes therefore fishing activities in the lake should be encouraged to supplement our protein diet. Hence, it is concluded that though the study revealed the health implication of high levels of various elements such as Cu, Pd and Hg in humans as a breakdown in the nervous system, yet consumers of fishes from this lake are not at risk since the levels are low. Thus, further research needs to be conducted to study the mechanism of molusca ability to absorb more ions than others.

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