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Determination of Some Trace Elements Cu, Fe, Pb And Zn In The Gills, Muscle and Tissues of *Claria gariepinus* and *Oreochromis niloticus* Found Along River Yobe

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ABSTRACT

River Yobe supports many activities leading to its extensive contamination and accumulation of heavy metals. These can cause environmental and public health hazards. To ascertain the quality of the water in the river. The study was carried out to determine some of trace element copper, iron, lead and zinc, concentration in gills, tissues and muscle of *Claria gariepinus and Oreochromis niloticus* being the most dominant fish species in river in year 2015. Two samples each of *C. gariepinus* and *O. niloticus* were collected from the river, and the concentration of the (Cu, Fe, Pb, and Zn) were determined. Using Atomic Absorption Spectrometry (AAS 210 RAP BUCK). The study revealed the concentration of iron in the gills, tissue and muscle of both fish: *O. niloticus* 2.74±1.54, 1.17±0.73, and 0.46±0.46 mgkg^{-1}. For gills, tissue and muscle of *C. gariepinus* 3.58 ±1.69, 2.34±1.9 and 2.03±1.21 mgkg^{-1}, respectively. The metal concentrations occur in order Fe, Zn, Cu and Pb. In general, accumulation of the essential element Zn, Fe, Cu, were higher than the non essential element Pb. There is a high concentration of Fe at a significant level (P<0.05) in the study fishes when compared with other elements, followed by the Zn; Pb and Cu appeared at the bottom ladder. However, there is no significant variation (P>0.05) observed among the Zinc, lead and Copper accumulate in the gills of both species.

Key words: Diffusion, food chain, Half life, Heavy metals, Hydrophobic, River Yobe and Toxicity.

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INTRODUCTION

Metals such as Cu, Fe, Pb and Zn are regarded as essential trace metal given their valuable roles for metabolic activities in human (Oluwusi-Peters et al., 2014). Other metals like Cd, Ni, and Hg exhibit extreme toxicity even at trace level (Merian,1991; Olaifa et al., 2004). However, it is of interest to note that essential metal is toxic when supplied in concentration more than the optimum levels (FEPA,1991). Tam and Wong (1995) stated that heavy metals contamination of the aquatic environment is a critical concern due to the toxicity of metals and their accumulation in an aquatic habitat. River Yobe is one of prominent water body in Yobe state, Nigeria.

The main uses of the river in it catchment include domestic use, swimming, transportation and fishing. In addition, domestic, industrial and agriculture waste are dumped into the river as such causing contamination and accumulation in the aquatic biota. Among the aquatic fauna, fish is the most susceptible to heavy metal toxicant (Nwaedozie, 1998). They are more sensitive to metal contamination than any other aquatic fauna. As a result, fishes are considered as a better specimen for investigation of pollutant loads than water sample because of the significant level of metal they bioaccumulate (Atuma and Egborge, 1986). It is significantly important to determine and monitor heavy metal level in foodstuffs, particularly sea and freshwater food. Heavy metal ion can easily accumulate in such food compared to other foodstuffs that can course harmful effect on human health (Allen-Gill and Marynor, 1995). Discharge of industrial water or wastewater without a pre-treatment into the lake, rivers, stream, and sea, primarily

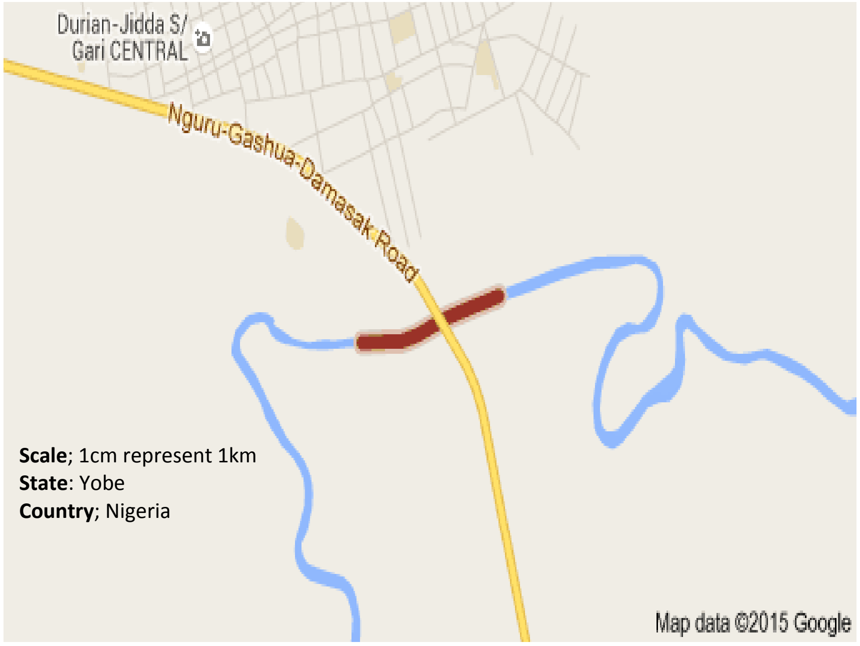

Figure 1. Map of River Yobe.

courses an increase in the heavy metals in those water bodies. Moreover, such water is speedily polluted by chemical substances, paint, pesticide, petroleum products, industrial, domestic and modern agriculture waste (FEPA, 1991).

Metal pollutants in the form of particles metal ions and organic and inorganic compounds in water also toxify the associated ecosystem (Uzairu and Harrison, 2009). Potential of heavy metal ions to accumulate in food, including fish living in water polluted with heavy metals, is rather high. Heavy metals, which especially accumulate in organs of fish; kidneys, and spleen, can be transmitted to and accumulated in various organs of the human body by their consumptions (Marian, 1991). Therefore, the introduction of heavy metals into food chain threatens human health. On the other hand, fish is one of the most important food to be eaten for a healthy life because it has a high protein quality and nutritional value (Edem, 2010). Likewise, it is suggested word wide that fish and seafood are consumed more to prevent cardiovascular diseases. Fish is especially recommended for infants, elderly, cardiac patients, those who had a brain hemorrhage, and those experiencing digestion problems because it has high mineral content and low energy level (Dural, 2007). Consumption of fish and seafood is useful for nutrition and human health. It may cause toxic effects by transmission of heavy metal ions into the human body as a result of a pollutant that may be present in water and cause a risk to human health (Wyse, 2003).

Data provided by Agada (1994) and Olowu et al. (2010) show the evidence of the selected heavy metal contamination of *C. gariepinus* and *O. niloticus*, respectively. Also, Sani (2012) examined the concentration of heavy metal in the tissues of Tilapia and catfish. These fishes are of great commercial importance because they are more consumed freshwater fish in Nigeria and the most dominate species in the River (Olaifa et al., 2004). It is, therefore, a right choice to study their susceptibility to environmental contamination. Particularly the heavy metal so that the result can provide baseline data on the current pollution status of this and predict the safety of consumption on the environment. This study was undertaken to determine the concentration and bioaccumulation of some heavy metal (Cu, Fe, Pb and Zn) in gills tissues and muscle of *C. gariepinus* and *O. niloticus* along River Yobe.

MATERIALS AND METHODS

Study Area

River Yobe is one of the rivers of West Africa located in Yobe State Nigeria. Its coordinates are 13^{0} 42’0” N and13^{0}19’60” E, a tributary of Lake Chad formed by the union of the Hadaija and Komadugu Gana Rivers. It situated between Nigeria and Niger. It forms the border between the two countries for some 95 miles (150 km) and flows a total of 200 miles (320 km) to empty into the Western end of Lake Chad Figure 1.

Sample Collection, Processing and Preservation

Random of fish samples (Cat Fish *C. gariepinus* and Tilapia Fish *O. nilotieus*) were collected from a fisherman

Table 1. Shows the concentration of trace element in *C. gariepinus* /Catfish (mgkg^{-1}).

Trace elements	Gills	Tissues	Muscles
Iron	3.58±1.69	2.34±1.9	2.03±1.21
Zinc	1.2±0.8	0.28±0.005	2.14±0.7
Lead	0.6±0.3	0.92±0.59	1.18±0.22
Copper	0.61±0.49	0.6±0.4	0.58±0.35

Values are expressed as the means ± standard error mean (SEM). p = 0.37.

Table 2. Shows the concentration of trace element in *O. niloticus* /Tilapia fish (mgkg^{-1}).

Trace elements	Gills	Tissues	Muscles
Iron	2.74±1.54	1.17±0.73	0.46±0.46
Zinc	1.4±1.05	0.34±0.06	1.99±0.84
Lead	0.68±0.58	0.92±0.59	0.61±0.35
Copper	0.52±0.01	0.7±0.51	0.74±0.09

Values are expressed as the means ± standard error mean (SEM). p = 0.37.

fishing along River Yobe at a precise location; in Gashua and Geidam towns. The fishermen using gill net that were set overnight. The fish were kept in air tight glass jar containing ice. The fish samples Catfish and Tilapia fish were collected in June/July 2015 in some area of River Yobe and transferred to the freezer for preservation. Sample fishes were removed from the freezer with the aid of a plastic knife and defrosted for two hours before proceeding for elemental analysis.

Method

Catfish *C. gariepinus* and Tilapia *O. niloticus* were dissected to remove organs (that is, gills, tissues, and muscle) according to a method of Dybem (1983).

Analytical

The fish parts were dried at 80^{0}C for 2 h in Gallenkamp hotbox oven and then blended in an electric blender. 0.5 g of each's sample was weighed and ashed at 550^{0}C for 24 h in an electric muffle furnace. The ash was diluted with 4.5 ml concentrated hydrochloric acid (HCl) and concentrated nitric acid ($HN0_3$) mixed at ratio 3:1 the diluent is left for some minutes for proper digestion in a beaker. 50 ml of distilled H_20 was added to the diluents to make up to 100 ml in a volumetric flask. The levels of heavy meat such as iron (Fe), copper (Cu), lead (Pb) and Zinc (Zn) were determined using AA210RAP BUCK Atomic Absorption Spectrometer flame emission spectrometer filter GLA-4B Graphite furnace (East Norwalk USA), according to AOAC (1995) and the result were given in milligram per litter (mgkg^{-1}).

Statistical Analysis

All samples result were calculated from the triplicate assay and expressed as the means ± standard error means (SEM). Statistical analysis was carried out on the non-parametric data using Kruskal-Walis at (α=0.05). Theere was no significance different for iron (Fe), copper (Cu), lead (Pb) and Zinc (Zn) in *C.gariepinus* and *O. niloticus* (α =0.37).

RESULTS AND DISCUSSION

The result collected for this work are present in Tables 1 and 2. The result in Table 1 shows the concentration of trace element Cu, Fe, Pb and Zn in the Tilapia Fish *O. niloticus* and Table 2 displays the concentration of trace element in the catfish *C. gariepinus*. The result obtained for the determination of the concentration of heavy metals in gills and tissue of *O. niloticlus* and *C. gariepinus* in the River Yobe, as Present in Tables 1 and 2, respectively. It shows that the concentration pattern of trace elements in *C. gariepinus* and *O. niloticus* following the order of Fe > Zn > Pb > Cu. The result shows that iron has the highest concentration in gills, tissues, and muscle of *O. niloticus*; 2.74±1.54, 1.17±0.73 and 0.46±0.46 mgkg^{-1}. For gills, tissues and muscles of *C. gariepinus*; 3.58 ±1.69, 2.34±1.9 and 2.03±1.21 mgkg^{-1}, respectively. Although the concentration of iron was more in the gills than the tissues, an indication of bioaccumulation of iron in the flesh of the species under consideration.

In this study of heavy metals concentration in some organ of *C. gariepinus* and *O. niloticus*. Iron was naturally abundant among all metal considered. These could be because these essential elements are naturally abundant in Nigeria soil. Also, the result showed that the bioaccumulation of Zinc was; gills, tissues, and muscles 1.2±0.8, 0.28±0.005 and 2.14±0.7 mgkg^{-1} of *C. gariepinus* and 1.4 *±1.05,0.34 ±0.06 and 1.99±0.84* mgkg^{-1} in the gills, tissues and muscle *O. niloticus*, respectively. Thus, heavy metals when discharged into the river indiscriminately enter the food chain and accumulated in the fish body waiting for the potential harvesters. Lead on the other hand in *C. gariepinus* gills 0.6±0.3 mgkg^{-1}, tissue 0.92±0.59 mgkg^{-1} and muscle 1.18±0.22 mgkg^{-1} is very minimal when compare to other elements. *O. niloticus* contains 0.68±0.58 mgkg^{-1} in gills, 0.92±0.59 mgkg^{-1} in tissue and 0.61±0.35 mgkg^{-1} in muscle. Copper have the least of the heavy metals analyzed. In *C. gariepinus* gills, tissues and muscles 0.61±0.49, 0.6±0.4 and 0.58±0.35 mgkg^{-1}were detected. For *O. niloticus,* it was discovered that 0.52±0.01, 0.7±0.51 and 0.74±0.09 mgkg^{-1} representing gills, tissues and muscles, respectively.

RECCOMMENDATIONS

The finding of trace elements at a tolerable concentration in the fishes species, we therefore recommend the fishes for consumption to supply the protein needs and other minerals require for normal metabolism of human. Further research is therefore suggested to determine the concentration of heavy metal from another part of River Yobe and the study should be expanded by improving samples collection such as collection of sediment, water, and fish from a different location along the river to obtain extensive data to determine the appropriate element in the various samples in the river.

CONCLUSION

Metal concentration was found to be lower than the limit value. It could be concluded that there is no risk in consumption of fishes collected from River Yobe. Further research is therefore suggested to determine the concentration of heavy metal from another part of River Yobe.

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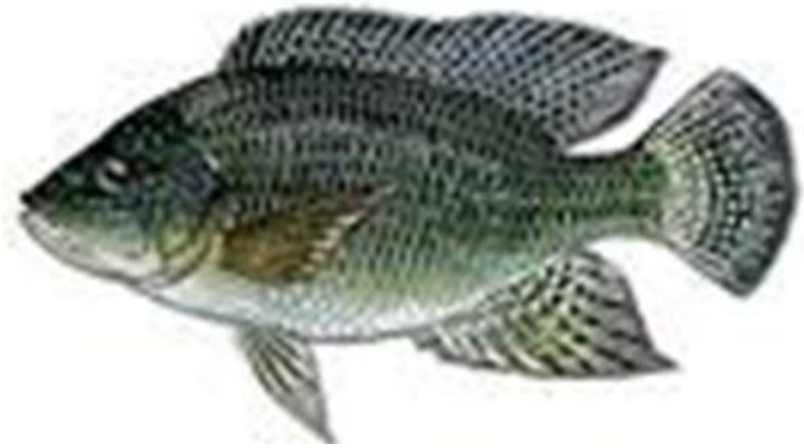
APPENDIX I

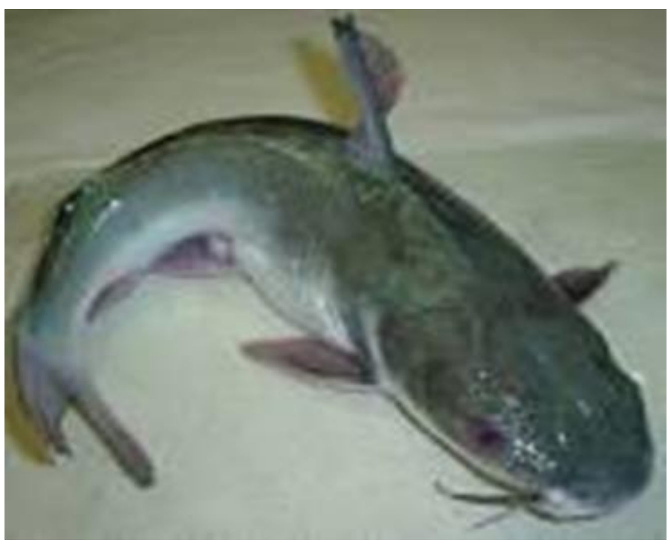


Tilapia fish (*O. niloticus*).

Tilapia fish (*O. niloticus*).

APPENDIX II

Catfish (*C. gariepinus*).



Catfish (*C. gariepinus*).