STUDIES ON TRACE ELEMENTS IN *Clarias gariepinus* OF RIVER GONGOLA, GOMBE STATE, NIGERIA

Auwalu Jalo[1*], A. J Nayaya [2], A. G Ezra[2] and Zaharaddeen Hassan Yusuf [1]
[1] Biology Department, Federal College of Education Katsina
[2] Abubakar Tafawa Balewa University Bauchi, Biological Science Department
*Corresponding Author: email;auwalujalo@gmail.com Phone; +234 813 3036 001

ABSTRACT
Investigation of trace element (Cu,Zn,Pb and Cd) contamination in the muscles of *Clarias gariepinus* from River Gongola, Gombe State was carried out between April and September 2019 in six sampling sites. The Concentrations were determined using Atomic Absorption Spectrophotometer.The data obtained was analyzed using one way analysis of variance and significant differences accepted at $p \leq 0.05$. Post hoc Duncan test was used to separate means.The mean metal levels (mg Kg^{-1}) in *Clarias gariepinus* muscles, were Cu (0.388 – 0.759), Zn (0.020 – 0.082), Pb and Cd were Below Detectable Limit. Cu exhibited significance difference between the sites (p= 0.00) while for Zn there was no significance difference in the sites. The concentrations for all metals in African catfish muscles did not exceed the WHO recommended limit for consumption.
Keywords: HeavyMetals, Atomic Absorption Spectrophotometer, African catfish, River Gongola.

INTRODUCTION
In Nigeria, heavy metals have been implicated in the upsurge of liver and kidney diseases and believed to be responsible for a high proportion of mortality caused by kidney and liver morbidity (Ndiokwere, 2004). The acute neurological effects of cadmium toxicity manifests itself in the form of nausea, abdominal cramps, bloody diarrhoea, vomiting, dizziness and chest pain. Also Rheumatic arthritis, muscular pain and osteomalacia in the elderly are evidence of chronic cadmium exposure (Kobingi, *et al.*, 2009).
Regular monitoring of water bodies is an effective method of protecting aquatic life as well as humans from the toxic effects of heavy metals. However, several rivers in Nigeria have not been adequately assessed for heavy metals concentration. Hence, this study assessed the concentration of heavy metals in African catfish muscles from River Gongola; a recipient of sewage effluent, agricultural waste as well as other anthropogenic inputs and a provider of water as well as fish consumed by People of Gombe State of Nigeria.

MATERIALS AND METHODS
Study Area
River Gongola transverses Gombe State through Gombe North senatorial district at latitude 10.817 N and longitude 10.767 E. Soils in this area are shallow to the deep loamy, sandy clay, loam and vertisols with cracking clays that have weathered from shale.

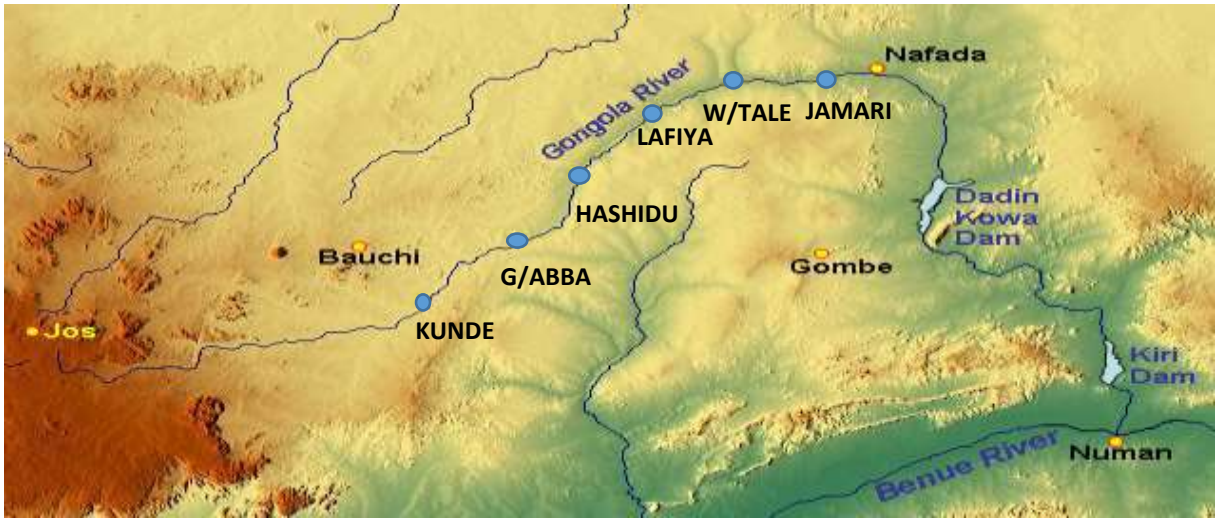

Figure 1: Google Map of River Gongola, Gombe State, Nigeria Showing the Sampling sites

Table 1 Sampling Sites and their Geographical Coordinates of River Gongola, Gombe State.

Sampling Sites	Latitude ^{o}N	Longitude ^{o}E
Kunde	10.695054	10.497167
Gombe Abba	10.815250	10.583070
Hashidu	10.906380	10.665124
Lafiya	10.942264	10.698010
Wuro Tale	10.915633	10.671575
Jamari	11.072901	11.006636

Source: Google Map

Sampling and Digestion of Fish Samples for Metal Analysis

A total of 108 and 11-12cm size of *Clarias garipeinus* samples were collected with fishing net by local fishermen from the sampling sites as described by Osman and Kloas (2010). Sampling was carried out once a month for six months (April 2019 – September 2019) in all the sampling sites in the river.

Digestion of fish samples was carried out in triplicates using concentrated nitric acid (Analytical Grade) according to method described by Zhang (2007). All the digested samples were filtered using Whatman 0.42µm filter paper into a 50 ml volumetric flask and top up to the mark with distilled water. Heavy metal analysis was done using Atomic Absorption Spectrometer at the ATBU Bauchi Public Health Research Laboratory.

Statistical Data Analysis

Data analysis was carried out using computerize statistical Programme (MINITAB 7.0). The data were subjected to one way analysis of variance (ANOVA) and Duncan Multiple Test Range (DMTR) was used to determine critical values for comparisons between means at a significant level of $p \leq 0.05$.

RESULTS

Heavy Metal Concentrations in *Clarias gariepinus* (African catfish) Muscles

Mean Cu levels recorded in *Clarias gariepinus* (African catfish) during the study are shown in Table 3. The levels ranged from 0.388 $\pm$ 0.082 mg Kg^{-1} (Lafiya) to 0.759 $\pm$ 0.413 mg Kg^{-1} (Jamari). The other mean Cu levels recorded were 0.460 $\pm$0.143 mg Kg^{-1} (G/Abba),0.566 $\pm$ 0.255 mg Kg^{-1} (Kunde), 0.603 $\pm$ 0.229 mg Kg^{-1} (W/Tale) and 0.529 $\pm$ 0.146 mg Kg^{-1} (Hashidu). The results varied significantly ($p = 0.00$; $df = 107$) in Cu levels recorded at different sampling sites. The mean Zn concentration levels in African catfish muscles varied (Table 2) with the highest levels observed at Lafiya (0.082 $\pm$ 0.010 mg Kg^{-1}) and the lowest at G/Abba (0.019 $\pm$ 0.012 mg Kg^{-1}). Jamari,W/Tale, Hashidu had mean Zn concentrations of 0.020 $\pm$ 0.010 mg Kg^{-1}, 0.022 $\pm$ 0.009 mg Kg^{-}

[1] and 0.021 ± 0.012 mg Kg^{-1} respectively. Kunde recorded a mean Zn level of 0.024 ± 0.015 mg Kg^{-1}. One way ANOVA revealed no significant difference ($p = 0.869$; $df = 55$) among the sampling sites. However, the African catfish muscles samples of river Gongola showed that Pb and Cd were below detectable Limit (Table 2)

Table 2 Mean ± standard deviation for heavy metal concentration in *Clarias gariepinus* Muscles Recorded from April-September in River Gongola, Gombe State, Nigeria

ELEMENT /SITE	KUNDE	G/ABBA	HASHIDU	LAFIYA	W/TALE	JAMARI	WHO STANDARD LIMIT
Cu (mg Kg^{-1})	0.566 ± 0.255[b]	0.460 ± 0.143[ab]	0.529 ± 0.146 [ab]	0.388 ± 0.082[bc]	0.603 ± 0.229[bc]	0.759 ± 0.413[c]	3.00
Zn (mg Kg^{-1})	0.024 ± 0.015 [a]	0.019 ± 0.012 [a]	0.021 ± 0.012 [a]	0.082 ± 0.010 [a]	0.022 ± 0.009 [a]	0.020 ± 0.010 [a]	60.00
Pb (mg Kg^{-1})	BDL	BDL	BDL	BDL	BDL	BDL	0.30
Cd (mg Kg^{-1})	BDL	BDL	BDL	BDL	BDL	BDL	0.03

DISSCUSION

The uptake of heavy metals by fish occurs from water, food and sediment. Heavy metal concentrations in the tissue of fresh water fish varies due to differences in metal concentrations and chemical characteristics of water from which fish are sampled, their ecological needs; metabolism and feeding habits (Yilmaz, 2009). In this study, the mean Cu levels recorded at river Gongola varied with sites. The variations in Cu levels could be attributed to differences in the anthropogenic activities, the use of agrochemicals in the sites.

Therefore, the source of Zn in the study area could be attributed to use of inorganic fertilizers within River Gongola. Also, Zn could be from sewage sludge from the towns distributed within the catchment such as Kunde, Gombe Abba, Hashidu, Lafiya, Wuro Tale and Jamari to mention a few. The mean Zn concentration levels recorded in the African catfish muscles showed modest variations in all the sampling. The levels of Zn in the present study were lower than the permissible limit of 60.00 mg Kg^{-1} recommended by FAO/WHO (1999).

Its observed that Pb is below detectable limits (BDL) for fish samples from all the sampling sites of river Gongola indicating the absence or the minimum level of the metal. This study compares well with that reported by Shabanda and Itodo (2012) of BDL and 0.015 mg Kg^{-1} respectively. Other study by Oyakhilome *et al*., (2013) however, was greater than the present study and ranged between 0.15 to 0.19 mg Kg^{-1} and 0.07 to 2.39 mg Kg^{-1}in Owena Multi-Purpose Dam, Ondo State, Southern Nigeria and Mediterranean Sea (Libyan coastline), respectively. Therefore, the concentration of Pb from the present study falls within WHO (2008) permissible limit of 0.30 mg Kg^{-1} for fish and edible foods

Concentrations for Cd in *Clarias gariepinus* samples indicates that cadmium concentration was below detectable limits (BDL). Ozturk *et al*.,(2009) obtained concentration ranging from 0.17±0.01 to 0.79±0.33 mg Kg^{-1} from Avsdar Dam Lake in Turkey which is higher than African catfish samples collected from river Gongola. However, the concentrations of Cd from the present study were within WHO (2008) permissible limit of 0.03 mg Kg^{-1} for fish and edible foods.

CONCLUSION

The investigated trace elements (Cu, Zn, Pb and Cd) had lower levels than WHO recommended limit for fish consumption. Therefore, it was concluded that the *Clarias gariepinus* in River Gongola is fit for human consumption.

REFERENCES

FAO/WHO (1999). List of maximum levels recommended for contaminants by the joint FAO/WHO Codex Alimentarius Commission, 3:1-8

Kobingi, N., Raburu, P.O., Masese, F. O and Gichuki, J (2009).Assessement of pollution impacts on the ecological integrity of the Kisian and Kisat rivers in Lake Victoria drainage basin, Kenya. *African Journal of Environmental Science and Technology*. 3(4):097 – 107.

Ndiokwere, C.L. 2004: Chemistry and Environment. University of Benin, Inaugural Lecture Series 73

Osman A.G.M and Kloas W. (2010). Water quality and heavy metal monitoring in water, sediments and tissues of the African Catfish Clarias gariepinus (Burchell, 1822) from the River Nile, Egypt. *Journal of Environmental Protection*, 2010, 1: 389 – 400.

Öztürk, M., Özözen, G., Minareci, O., & Minareci, E. (2009).Determination of heavy metals in fish, water and sediments of Avsar Dam Lake in Turkey. *Journal of Environmental Health Science and Engineering*, 6(2): 73-80.

Oyakhilome, G. I., Aiyesanmi, A. F., Adefemi, S. O.,and Asaolu, S. S. (2013). Heavy metals concentration in sediment and fish samples from Owena multi-purpose dam, Ondo State, Southern Nigeria. *Current Journal of Applied Science and Technology*,4: 65-76.

Shabanda, I. S., and Itodo, A. U. (2012).Toxins in gills and flesh of *Synodontissorex* and *Bagrus filamentosus Int. J. Ecosys*, 2(6): 150-153.

WHO (2008). Guidelines for drinking water quality, World Health Organization, Geneva, 2008

Yilmaz, F (2009). The Comparison of heavy metal concentrations (Cd, Cu,Mn and Zn) in tissues of three economically important fish (Anguilla Anguilla, Mugil cephalus and Oreochromis niloticus) inhabiting Koycegic Lake –Mugla (Turkey). *Turkish Journal of Science and Technology* 4: 715

Zhang, C. (2007). Fundamentals of environmental sampling and analysis. John Wiles and Sons : p. 109