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Short Communication

Safety of fish (*Chrysicthys nigroditatus*) from Northeast of Lagos Lagoon complex, Nigeria

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Abstract

The levels of some heavy metals (Fe, Cu, Pb, Cd, Zn, Cr and Mn) in the edible muscle tissues of Bagridae (Chrysicthys nigroditatus) from the north east axis of Lagos Lagoon Complex were studied. Samples were collected from the designated stations in the Lagoon from February to June, 2009 and analyzed by Atomic Absorption Spectrophotometer (AAS). The mean concentration of metals accumulated in C. nigroditatus varied as follows: Fe 26.3-57.5µg/g, Cu 3.89-12.76 µg/g, Pb 0.563-4.03 µg/g, Cd 0-4.38 µg/g, Zn 6.38-18.03 µg/g, Cr 0.138-2.90 µg/g and Mn 0.563-2.63 µg/g. The concentrations of the heavy metals in the muscle tissue of the fish decreased in the following order Fe>Zn> Cu> Pb>Mn>Cr>Cd. The results indicated that the concentrations of these heavy metals fall within their respective acceptable permissible limits recommended by the FAO/WHO. Therefore, the consumption of this fish species may not pose any threat to human health. However periodic monitoring of these metals in the fish is highly essential to public health.

Keywords: Heavy metal; *Chrysicthys nigroditatus*; Fish; Muscle tissue; Lagos; Lagoon

Introduction

Aquatic environment is an important ecosystem (Osibanjo, 1994; Hart, 2007), a factor in development of various civilizations (Benjamin *et al*., 1996), an abode of some organisms, water supply, a recreation centre, means of transportation, and fishing pot for both the fishing trawlers and artisanal fishermen. In developing countries, increase in population, industries, agricultural practices and indiscriminate waste disposal have resulted in contamination (Canpolat *et al*., 2003; Tijani *et*

al., 1999), loss of aesthetic and economic value, and can become a threat to human health and aquatic life. For these reasons, there has been growing interest in determining the level of heavy metals in the aquatic environment particularly the contamination levels in fish (Kalay *et al*., 1999); as fishes are good bio-indicator of the degree of pollution in the aquatic environment due to their propensity to bio-accumulate toxic metals and other contaminants in their internal organs, most especially their edible muscle tissues. These could reach toxic concentration which could lead to serious health hazards.

The aim of this study is to determine the concentration of Pb, Fe, Zn, Cd, Cu, Mn and Cr in edible muscle tissues of *Chrysichthys nigrodigitatus* fish from the northeastern axis of Lagos Lagoon.

Materials and Methods

Study area

The study area characterized in this study was Northern axis of Lagos Lagoon water front which comprises of Ikorodu, Ibeshe, Oreta, Ofin, Ijede and Igbin. The water body receives effluent from industries, agricultural practices, domestic waste, urban run-off and emission from vehicular and engine boat transportation.

Three sampling points were chosen to represent the entire study area (Fig.1). Site 1- Ikorodu and Ibeshe, [N $06^0$32'.116" E $003^0$29'.534"], Site 2- Ofin and Oreta [N $06^0$32'.309" E $003^0$30'.003"] and Site 3- Ijede and Igbin [N$06^0$33'.267" E$003^0$36'.326"].

Sample collection

Fish samples were collected with the aid of cast nets from the three sampling stations along the northern axis of Lagos lagoon. Samples were collected once in a month for five consecutive months, from February – June 2009, representing the late dry season and early raining season in the three sampling stations. The fish samples were kept in the ice pack from sampling station and later stored in the refrigerator (4°C) before analysis.

Metal analysis

The fish samples were allowed to defrost. Then 2 g of each of the fish samples tissue were digested separately using 25 ml of ratio 1:1 concentrated Nitric acid (HNO_3) and Hydrogen peroxide (H_2O_2) at 105°C respectively, in a fume cupboard. The digested samples were diluted to 50 ml with distilled water and analyzed by Atomic Absorption Spectrophotometer (AAS) (Buck scientific 200A) (FAO/SIDA, 1983). The heavy metal concentration in the edible muscle tissues of

C. nigrodigitatus is presented in μg/g of the wet weight.

Statistical analysis of the results was carried out by one way ANOVA at 5% (p<0.05) significance level.

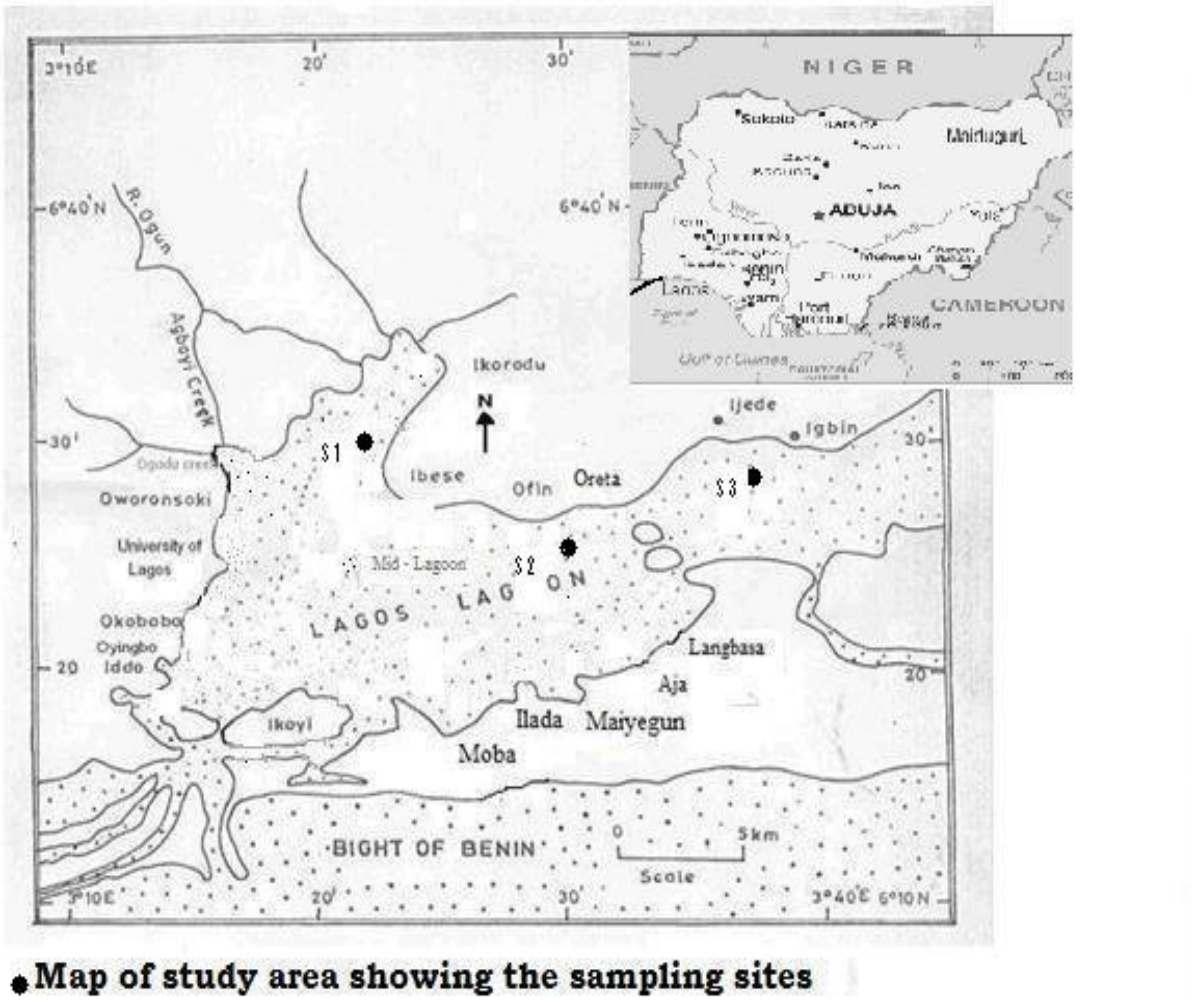

Figure 1: Map showing Lagos Lagoon and sampling locations denoted by •

Results and discussion

Table 1 presents the mean concentration of heavy metals (Fe, Cu, Pb, Cd, Zn, Cr, and Mn) in the edible muscle tissues of Bagridae (*C. nigroditatus*) from three sites in the north east axis of Lagos lagoon Complex. The sampling sites in the north east axis of Lagos Lagoon are indicated in the Fig. 1.

Iron concentrations ranged from 26.3- 110.5 µg/g. No significance difference (p>0.05) in the concentration of metals in the muscle tissues of *C. nigrodigitatus* among the sites. The highest concentration (43.13 µg/g) was observed at sites 1 and 3. The levels of iron observed in this study were higher than those reported by Karakus and Gey (2006) in the muscle tissues of the (10.56 µg/g) µg/g barb in the Kars Creek, Turkey; Ekbo and Ibok (1999) in fish from the River Calabar, Nigeria; Unyimadu *et al*. (2008) in the fish from Badagry (17.88 µg/g), Nun River (5.58 µg/g) and Sombreiro River (12.43 µg/g), Nigeria. However, the mean iron levels in Bagridae were lower than those reported by Unyimadu *et al*. (2008) in the fish from Cross River, Nigeria (46.45µg/g); Ajmal *et al*. (1988) from River Kali Nadi U. P. India; Winger *et al*. (1990) from Lower Savannah River, Georgia and south Carolina; Canpolat and Calta (2001) in fish from Lake Hazar, Turkey, and by Mendil *et al*. (2005) from lakes in Tokat, Turkey.

Table 1: The mean concentration (µg/g) of heavy metals in fish (*Chrysichthys nigrodigitatus*) muscle tissue of northeast axis of Lagos Lagoon at three sampling stations.

Metals	Site 1	Site 2	Site 3	AMCS	WHO Limits
Fe	43.13±9.53b	41.63±8.41a	43.13±12.04c	42.625	42.625
	(29.50-110.50)	(29.38-51.25)	(26.25-57.50)		
Cu	8.050±3.137c	5.975±1.962b	10.663±1.391a	8.229	30.00
	(3.888-11.050)	(3.900-8.713)	(8.925-12.760)		
Pb	2.225±0.463a	1.558±0.613b	2.113±1.353c	1.967	2.00
	(1.563-2.763)	(1.125-2.625)	(0.563-4.025)		
Cd	ND	1.375±1.76a	ND	<0.010	2.00
		(0.25-4.38)			
Zn	9.988±1.326a	8.350±1.606b	15.713±1.886c	11.338	1000.00
	(8.350-11.760)	(6.375-10.730)	(13.090-16.910)		
Cr	1.225±0.339a	1.100±0.916b	1.663±1.146c	1.329	150.00
	(0.638-1.500)	(0.263-2.550)	(0.138-2.513)		
Mn	1.663±6.89c	1.730±0.518b	1.225±0.440a	1.513	_
	(0.813-1.888)	(1.350-2.625)	(0.563-1.688)		

(n=5). Range values in parentheses. ND = Not detected

AMCS- Average means concentration of the sampling stations

Means with the same superscript in each row are not significantly different (p<0.05).

Concentration of Copper (Cu) in the studied muscle tissues of Bagridae (*C. nigroditatus*) ranged between 3.89 and12.76µg/g (Table 1). Cu concentration varied significantly ($p<0.05$) from site to site in the muscle tissue samples. The highest concentration (10.663µg/g) was found at Site 3. The values of Cu observed in this study are much higher than those reported by the Olaifa *et al*. (2004) (0.07 µg/g), Karakus and Gey (2006) (0.0056 µg/g) and Unyimadu *et al*. (2008) in fish from Cross River (4.80 µg/g), Badagry (2.62 µg/g), Nun River (2.69 µg/g) and Sombreiro River (3.20 µg/g).

Lead (Pb) concentrations varied from 0.563 – 4.025 µg/g. The maximum value of Pb 2.225 µg/g occurred at site 1. Pb concentrations in the muscle tissues was not significantly different among the sites ($p>0.05$), (Table 1). The levels observed in this study were higher than those reported by Sabo *et al*. (2008) in *Clarias gariepinus* from River Gongola, Nigeria (1.823 µg/g), Unyimadu *et al*. (2008) in fish samples from Badagry , Nigeria (1.56 µg/g) and Aderinola *et al*. (2009) in periwinkle from Ijora axis of Lagos lagoon, (0.0675 mg/kg) . However, the mean Pb levels in the muscle tissues of Bagridae (*C. nigrodigitatus*) were lower than those reported by Unyimadu *et al*. (2008) in the fish from Cross River (5.17 µg/g), Nun River (3.17 µg/g), Sombreriro River in Nigeria (3.91 µg/g).

Cadmium concentrations ranged from 0-1.375 µg/g (Table 1). The highest Cd concentration was detected at site 2. Meanwhile, the values observed in this study were much lower than those reported by Sabo *et al*. (2008) (1.667 µg/g) and Unyimadu *et al*. (2008) (2.59 µg/g).

Zinc (Zn) concentrations in the muscle tissues ranged from 6.38 – 18.03 µg/g. The highest zinc concentration 15.713 µg/g was detected at site 3. The levels of Zn observed in the muscle tissues varied significantly ($p<0.05$) among the sites (Table 1). The Zinc concentrations in the muscle tissue of Bagridae (*C. nigroditatus*) were higher than those reported by Olaifa *et al*. (2004) (0.58 µg/g), Karakus and Gey (2006) (0.664 µg/g) and Unyimadu *et al*. (2008) in the fish from Sombreiro River location, Nigeria, but much lower than those reported by Sabo *et al.* (2008) in *Cl. gariepinus* from River Gongola, Nigeria and Unyimadu *et al*. (2008) in the fish from Cross River location, Nun River and Badagry location in Nigeria.

Chromium (Cr) concentrations in the muscle tissue of Bagridae (*C. nigroditatus*) ranged from 0.138 – 2.550 µg/g (Table 1). The highest mean concentration of Chromium was found in the muscle tissues from site 3. There is no significant difference ($p>0.05$) in the levels of Cr observed in the muscle tissues among the sites. The concentrations of chromium in this

study are much lower than that of the fish from Badagry, Nun River and Sombreiro River reported by Unyimadu *et al*. (2008), but much higher than those reported by Olaifa *et al*. (2004), in the edible fish from Ibadan and Aderinola *et al*. (2009) in periwinkle from Ijora axis of Lagos lagoon, Nigeria.

Manganese (Mn) concentrations ranged from 0.563- 2.625 µg/g. The highest mean concentration of Mn was detected at site 2. The observed values of Mn in the muscle tissues were not significant different among the sites. Meanwhile, the mean concentrations in this study were higher than those reported by Aderinola *et al*. (2009) and Unyimadu *et al*. (2008).

Moreover, the order of these metals in the muscle tissues determined were as follows: Fe>Zn>Cu>Pb>Mn>Cr>Cd. A similar order has also been found in the muscle of Capoeta *Capoeta* from Kars Creek, Turkey (Karakus and Gey, 2006) and fish and periwinkles of Lagos lagoon (Aderinola *et al*. 2009). Meanwhile, the concentration of metals in the edible muscle tissue is very important in the assessment of trace metals entering the human by food chain enrichment (Forstner and Wittman, 1981). The concentration of heavy metals observed in the muscles of *C. nigrodigitatus* were higher than those of previous studies reported on the fish from Lagos lagoon (Aderinola *et al*., 2009) but lower than the maximum permitted concentrations proposed by the FAO/WHO (FAO, 1983; WHO, 1982, 1983 and 1989). Therefore, consumption of *C. nigrodigitatus* caught from the northeast axis of Lagos lagoon (Nigeria) poses no risk to public health.

Conclusion

This study was carried out to provide necessary information on the heavy metal concentrations in the muscle tissues of *C. nigrodigitatus* from the northeast axis of Lagos lagoon not only because of the health of the aquatic ecosystem, but also public health as a result bioaccumulation in the food chain. Therefore, the concentrations of the metals detected in the edible muscle tissues of *C. nigrodigitatus* in this study were well below the FAO/WHO maximum permissible limits, there is no risk to public health on consumption of the *C. nigrodigitatus* from northeast axis of Lagos lagoon presently but the levels of metals accumulated in the fish requires regular and methodical monitoring. Since there is signification increase in heavy metals concentrations observed in this present study compared to the values reported by other previous investigators on the fish from Lagos Lagoon complex.

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