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Assessment of Levels of Cd, Pb and Zn in Catfish (*Clarias Gariepinus*) within Kano Markets

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Abstract
This study is aimed at assessing the concentration of Pb,Cd and Zn in Catfish (Clarias Gariepinus) collected in four markets in Kano Metropolis. The concentrations of these metals were determined using Atomic Absorption Spectrophotometer. The results revealed that Cd, Pb and Zn have the values ranges from of 0.20±0.006 to 0.34±0.06 (µg/g), 0.21± 0.01 to 0.64± 0.04(µg/g) and 15.14±0.51 to 21.70± 0.14(µg/g) respectively which were within FAO/WHO (1983)threshold limits in fish samples except in two samples for Pb. The statistical analysis using Instat statistical software shows that there is no correlations in metal concentrations within the samples at P < 0.05.

Keywords: Atomic Absorption Spectrophotometer, Clarias gariepinus, FAO, Heavy metals, WHO

INTRODUCTION
Heavy metals are trace metals that are denser than water five times or with density greater than 5g/cm^3, which means they are stable and cannot be breakdown or metabolized by body system, hence bio-accumulated (Ekpo *et al.,* 2008). The bioaccumulation and biomagnification of heavy metals in living organism explain the process and pathway in which the pollutants move from one trophical level to another (Svobodova *et al*., 2004)Metals bioaccumulation in organism also depends on strength and ability to digest the metals, amount of the metals in the environment and pattern of the feeding of the animals (Eneji *et al*., 2011). Metals like nickel, arsenic and platinum have no importance to humans and could be harmful (Fergosson,1990).While heavy metals such as magnesium, chromium ,copper and zinc are importance to body system but at higher amount they may be harmful to the body(Malik and Zeb,2009).

Fish such as catfish are widely consumed because of high content of omega-3polyunsaturated fatty acid i.e Eicosapentanoic acid, doccosahexanoicacid (Clarkson, 2002). Levels of heavy metals present in any fish are an indication of previous exposure of the fish to the pollutants. Heavy metals have been known to cause damages to the body system through the production of free radicals in key parts of the body organ such as heart, kidney, liver brain etc which caused oxidative stress which is the basis of many ailment (Castro-Gonzalez and Mendez-

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armenta,2008). The present study is aim at determining the level of metals such as Cadmium, Lead and Zinc in catfish sold at selected market in Kano markets, Kano State.

MATERIALS AND METHODS

Study Area.

Kano State is known for its commercial activities. Itis made up of 44 local governments. It is on latitude130^{0}N in the North and 110^0 N in the South and longitude 80^0 W in the West and 100^0 E in the East (www.nigeriagalleria.com). Kano city lies on latitude12.00^{0}N and longitude 8.300^{0}E. It comprises of six local governments which are: Gwale, TarauniDala, Nassarawa, Municipal and Fagge (www.nigeriagalleria.com). The main occupation is trading and farming.

Sampling and Sample Treatment.

Samples of dried catfish were obtained from four different markets in Kano city namely Yankura, Janguza, Rimiand Kabuga markets and were stored in polythene container and transferred to the laboratory for further treatment. Samples were dried in an oven at 105^{0c} for five hours. The samples were then grounded into powder with mortar and pestle and stored in polythene container.

Ashing and Heavy Metal Analysis

5.0g of each sample was weighed and transferred into crucible and placed in a muffle furnace and heated at 450^{0c} for four hours. After cooling the samples were each dissolved in 10ml 6M HNO_3 and diluted with little distilled water. Each of the samples was filtered into 100cm^3 polythene container and filled to the mark using distilled water (Abbruzzini *et al.*, 2014).The digested samples were subjected Atomic Absorption Spectrophotometer ALPHA 4 model for metal concentration. The following metals were determined for Zn, Cd and Pb.

Result Analysis

All the results obtained were analyzed statically using Instat 3.0, a statistic software package.

Result and Discussion

Cadmium

Table (1) is the concentrations of cadmium in the fish samples, the concentrations range from 0.20±0.006 to 0.34± 0.06. JANG and RIMI had the highest cadmium concentrations (0.34±0.06) while YANK had the least concentration of 0.20±0.006. The concentration of cadmium in all the samples was within FAO (FAO,(1983). The statistical comparison of cadmium concentration in each samples were shown in Table (II), there is significant difference between JANG and KABU, JANG and RIMI, JANG and YANK at $P < 0.01$ and YANK and RIMI, KABU and YANK at $P < 0.001$ but no significant difference between RIMI and YANK at $P > 0.005$. JANG had the highest variation of 5.06 while YANG had the least variation of 2.50 (Table III). The result obtained for cadmium concentration was lower than that of (Adewumi *et al.*, 2017)and (Edet *et al,* 2014). Cadmium metal is known for damages of joints; bone softened, body shrinkage and finally death (Ademoroti,1996).

Table 1: The concentration of metals in the fish Samples (µg/g)

Sites	Zn	Pb	Cd
JANGUZA (JANG)	18.18±0.91	0.64±0.04	0.34±0.06
KABUGA (KABU)	15.14±0.51	0.21±0.01	0.33±0.01
RIMI (RIMI)	21.70±0.14	0.43±0.02	0.34±0.03
YANKURA (YANK)	21.21± 0.52	0.23±0.02	0.20±0.006
FAO(1983) (µg/g)	50	0.40	1.0

Table II: Comparison of Cadmium Concentration in fish samples using Tukey-Kramer Multiple Comparison test.

Samples	q	p-value
JANG vs KABU	1.200	ns P>0.05
JANG vs RIMI	0.800	ns P>0.05
JANG vs YANK	16.800	P< 0.001
KABU vs RIMI	0.400	ns P>0.05
KABU vs YANK	15.60	P < 0.001
RIMI vs YANK	16.00	P < 0.001

Note: P < 0.0001 extremely significant. And q >4.529 ; P value is less than 0.05.

Table III: Mean result, Standard error and Coefficient of variation for cadmium concentration

Samples	Mean±SD	SEM	CV
JANG	0.34± 0.006	0.0033	1.76
KABU	0.33± 0.011	0.0067	3.33
RIMI	0.34±0.02	0.014	5.88
YANK	0.203±0.006	0.003	2.96

Lead

The lead concentrations in the present studies ranges from 0.21± 0.01 to 0.64±0.04from Table I. Sample JANG had the highest lead concentration of 0.64±0.04 while KABU had the least value of 0.21± 0.01. The concentrations in two samples (KABU and YANK) were within maximum permissible limits by FAO (FAO,1983) but higher than the limits in JANG and RIMI samples. The statistical comparison of lead concentration in each samples were shown in Table (IV). The results shows that there is significant difference between samples JANG and KABU, JANG and YANK, KABU and RIMI, RIMI and YANK at P< 0.001 but no significant difference samples KABU and YANK at P>0.05. Sample KABU had the highest lead variation of 6.61 among all the samples while RIMI had the least lead variation of 2.61. The results obtained were lower than values obtained by (Adewumi, 2017) in the same sample species and (Ekpo *et al.,* 2008). Accumulation of lead in fish may be attributed to effluents discharged into rivers as well as waste from lead mining areas (Moriber, 1974).

Table IV: Comparison of Lead Concentration in fish samples using Tukey-Kramer Multiple Comparison test.

Samples	q	p-values
JANG vs KABU	30.52	P<0.001
JANG vs RIMI	16.002	P<0.001
JANG vs YANK	30.53	P<0.001
KABU vs RIMI	14.53	P<0.001
KABU vs YANK	0.00	ns P >0.05
RIMI vs YANK	14.53	P<0.001

P<0.001 extremely significant. q >4.529 the P value is less than 0.05. ns = not significant.

Table V: The Mean concentration of the Lead, Mean Error and Coefficient of variation.

Samples	Mean ±SD	SEM	CV
JANG	0.64±0.04	0.023	6.25
KABU	0.23± 0.012	0.009	6.61
RIMI	0.42±0.011	0.007	2.61
YANK	0.23± 0.015	0.008	6.60

Zinc

Zinc concentrations in the present studies were shown in (Table I). The concentrations range from 15.14 ± 0.51 to 21.70 ± 0.14. RIMI sample had the highest concentration of 21.70 ± 0.14 while JANG sample had the least concentration of 15.14 ± 0.51. The statistical comparison of zinc concentration in each sample were shown in Table (VI), the results revealed there is significant difference between samples JANG and KABU, JANG and RIMI, JANG and YANK, at P < 0.001. JANG had the highest zinc variation in all the samples while YANG had the

least zinc variation values. The values of zinc in the present studies were within FAO (1983) maximum permissible limits. Zinc is very essential trace minerals for metabolic activities of the body's enzymes, which important for cell division and synthesis of DNA as well as protein (Jayant *et al.,* 2012). Consumption of excess zinc can result to degeneration of nervous system and fatigue. An intake of 150-450mg per day of zinc is associated with low immune function (Jayant *et al.,* 2012).

Table VI: Comparison of Zinc Concentration in fish samples using Tukey-Kramer Multiple Comparison test.

Samples	q	p-value
JANG vs KABU	7.098	P< 0.01
JANG vs RIMI	8.50	P< 0.01
JANG vs YANK	7.09	P< 0.01
KABU vs RIMI	15.61	P<0.001
KABU vs YANK	14.19	P<0.001
RIMI vs YANK	1.42	ns P>0.05

P < 0.0001 extremely significant. And q> 4.529, then p is less than 0.05. ns = not significant.

Table VII: The Mean concentration of the Zinc, Standard error and Coefficient of variation

Sample	Mean ±SD	SEM	CV
JANG	18.18±0.91	0.525	5.06
KABU	15.14±0.51	0.297	3.39
RIMI	21.70±0.14	0.525	4.17
YANK	21.21± 0.52	0.303	2.50

Table VIII: FAO/ WHO (1983) Maximum permissible limits (µg/g)

Metal	WHO/FAO
Cd	1.0
Pb	0.40
Zn	50

CONCLUSION

The concentrations of Cd and Zn in the present studies were within the FAO limits while the concentration of Pb was above limits in two samples (JANG and RIMI). Therefore, because of high concentration of lead in JANG and RIMI samples, fish collected in these areas should be taken with caution. But base on concentrations of Zn and Cd in all the samples the fish collected in these areas are good for consumption.

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