ASSESSMENT OF HEAVY METALS CONCENTRATION IN SMOKED FISH SPECIES FOUND IN RIVER KOMADUGU YOBE, YOBE STATE, NIGERIA

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ABSTRACT
Heavy metal contamination of aquatic ecosystem constitutes a major public health problem especially fishes from contaminated river and Komadugu Yobe river source from industrialized town (Kano and Jos plateau) that may be contaminated with heavy metals and when consumed by human and other aquatic life may cause health challenge due to their toxicological substance. This study was carried out to analyzed heavy metals (AS, Cd, Cr, Hg and Pb) using Atomic Adsorption Spectrophotometry in three species of smoked fish (Tilapia, African lung fish and Catfish). Ten (10) samples each totaling thirty (30) were purchased from fishermen along komadugu Yobe river. The results revealed significantly ($p<0.05$) higher concentration of Pb with significantly ($p>0.05$) lower Cd in African lung fish while non-significant ($p<0.05$) differences were observed across the treatments in AS, Cr and Hg but the concentrations of heavy metals in this study were higher than the maximum acceptable limits except Hg. This implies that they may pose health threat to humans when consumed, Thus, constant monitoring and sustainable management of the Komadugu-Yobe River at Gashua is required to reduce the amount of contaminant entering the river.
Keywords: **Aquatic pollution, Health risk, Heavy metals**

INTRODUCTION

The consumption of fish has shown an upward growth trend with an annual consumption of about 3.2 million metric tons, of which 2.1 million metric tons are imported each year (Vanguard, 2023). Fish is currently the cheapest form of protein for the average Nigerian. (Vanguard, 2023). It is estimated that the demand of fish in Yobe state along is about 1,500 tons while fish supply was about 100 tons in 2008 (Luna, 2008). Fish is one of the main sources of easily digestible protein rich in essential amino acids, fats, macro- and trace elements, and fat-soluble vitamins. Fish is food rich in valuable long chain polyunsaturated omega-3 fatty acids (Wall, et al, 2010). However, fish also have the ability to accumulate trace elements, heavy metals, pesticide residues and persistent organic pollutants in their tissues. Therefore, the study was determined the Heavy metals concentration of three (3) smoked fish species collected from River Kumadugu Yobe, Yobe state Nigeria.

Over the years the researcher observed that, human and animal activities such as defecation, bathing, washing, fishing and mining contribute greatly in accumulation of heavy metals in the river which directly or indirectly consume by fish through food and water which consequently consume by human. Therefore, this study was carryout to determine the concentration of heavy metals such as Lead (Pb), Cadmium (Cd), Chromium (Cr), Mercury (Hg) and Arsenic (Ar). in smoked fish collected from River Kumadugu, Yobe state, Nigeria.

The objectives of the study were to determine; The concentration of heavy metals in the smoke fish species of Catfish (*Clarias gariepinus)*, Tilapia (*Oreochromis niloticus*) and African Lung Fish (*protopterus annectans*) havested from River Kumadugu, Yobe state, Nigeria.

MATERIALS AND METHODS

Study area

Kamodugu Yobe-River is one of the most significant rivers in Yobe State, located in (longitud12º52´N and latitude 10º58´E) Gashua area of Bade LGA. The river was formed from the tributaries of Hadejia and Jama' are rivers that meet at the Hadejia Nguru Wetlands, flows through Gashua and drains to Lake Chad (KYBP, 2006). The average annual temperature of the town ranges from 38^0 C to 40^0 C with a mean maximum temperature of 39.8°C between March to April and mean minimum temperatures of 28.1°C between June to September. Gashua falls within the vegetation zone of Sudan Savannah usually dominated by shrubs and short tress with a yearly rainfall of 500 to 1000mm that lasts for about 120 days (Wakawa et al 2017).

Sample Collection

Precisely three samples Catfish (*Clarias gariepinus)*, Tilapia (*Oreochromis niloticus*) and African Lung Fish (Protopterus *annectans*) were collected from the Gashua traders of smoked fish.

Sample Processing
The smoked fish were oven-dried at 105^0C temperature for 10h, The samples were then ground and kept in air tight containers before the extraction process (Olabemiwo, 2011).

Determination of Heavy Metals in Smoked Fish.
The heavy metals in smoked fish's samples which were analyzed included Cadmium (Cd), Chromium (Cr), Mercury (Hg), Lead (Pb) and Arsenic (Ar). The concentrations of heavy metals in the collected samples were determined (after nitric acid digestion) by means of an atomic absorption spectrophotometer (Buck Scientific Model 210 VGP)

Statistical Analysis
Data obtained was tabulated using Microsoft Excel 2010 and simple descriptive statistical tools, and Pearson Product moment correlation Coefficient.

RESULTS AND DISCUSSION
The value recorded in this study ranged between 0.82 - 1.40 mg/kg, 0.49 - 0.70 mg/Kg, 0.65 - 0.80 mg/Kg and 0,69 - 0.95 mg/Kg for Pb, Cd, Cr and As respectively while the value of Hg was below detectable value (Table 1). The range value recorded in this study were lower than 0.14 - 0,48mg/Kg, 0.001 - 0.062mg/Kg, 0.001- 0.004mg/Kg, 0.001- 0.008mg/Kg, 0.001 - 0.006mg/Kg and 0.092-0.278mg/Kg in fish muscle found in Kumadugu river, Yobe' European lake, Spain, Atlantic bluefin tuna steak Portugal, Atlantic blue tuna canned, Thailand, Patagonian squid, Spain and Blue mussel, Spain (L,ami et al., 2022).

Table 1: Heavy metals concentration in three (3) species of fish caught in Kumadugu Yobe River

Sample	Catfish	African L Fish	Tilapia	SEM
Lead (Pb)	0.82^b	1.40^a	1.33^a	0.94
Cadmium (Cd)	0.69^{ab}	0.49^b	0.70^a	0.63
Chromium (Cr)	0.65	0.80	0.73	0.16
Mercury (Hg)	ND	ND	ND	0.00
Arsenic (As)	0.69	0.95	0.71	0.28

ND = Not detected

Lead (Pb)
The results revealed significantly ($p<0.05$) higher concentration of Pb in African lung fish and tilapia fish with 1.40mg/kg and 1.33 mg/Kg respectively when compared to the values recorded in catfish (0.82mg/Kg). This value were higher than 0.38, 0.45 and 0.41mg/Kg recorded in O. niloticu, C. gariepinus and S. schall muscle respectively in the same river (Lami et al 2022) but lower than 3.0, 3.8, and 10.00mg/Kg for C.nigrodigitatus, E, fimbriata and P. elongatus in the Cross-river system (Asuquo *et al*; 2004). The values were above maximum limit stated by international bodies 1.0, 0.5, 0.3, 0.5, and 0.3 mg/Kg (NAFDAC, 2012) but lower than 2.0 mg/Kg (WHO/FAO, 2015) hence there is a potential risk of Pb poisoning or toxicity when these species are consumed. Lead (Pb) toxicity results in decrease of haemoglobin production, disorder in the working of kidney, reproductive system joints and cardiovascular systems and causes long lasting injury to the central and peripheral nervous systems (Nolan, 2003).

Cadmium (Cd)
From the results of this study, it shows that, the concentration of Cd in the three samples were range from 0.49 - 0.70mg/Kg which were above the range of 0.002- 0.060mg/Kg, 0.049-0.073mg/Kg, 0.013-0.017 and 0.015-0.027mg/Kg found in the muscle of fish in Kumadugu river Yobe, Blue mussel Spain, Black tiger shrimp China and Indian white prawn India respectively (Lami et al., 2022). The value recorded in African lung fish (0.049mg/Kg) was significantly ($p<0.05$) lower than 0.69mg/Kg and 0.70mg/Kg recorded in catfish and tilapia fish respectively, all the values were higher than 0.1,0.05 and 0.1mg/Kg set as the maximum limit (MHPRC 2013 respectively) and also 0.05mg/Kg, 0.19, 0.03mg/Kg, 0.03mg/Kg, 0.42mg/Kg and 0.024mg/Kg in fish muscle found in Kumadugu Yobe, Nigeria, Warri river Nigeria, Okumeshi river, Nigeria, Fresh water Lake India and Red Volter river, Ghana respectively (Lami et al 2022). This implies that smoking may have attributed to the

increase in the concentration of Cd on the smoked fish.

Chromium (Cr)
The chromium values recorded in this study were range from 0.65 - 0.80mg/Kg found to be similar ($p<0.05$) with each other though slightly higher values were recorded in African lung fish and lower values were recorded in catfish and also found to be below the permissible limit of 3.0mg/kg and 2.0mg/kg (NAFDAF, 2019) respectively but higher than maximum tolerance range of 0.1 - 1.0mg/Kg set by FAO (FAO, 1983). This observation might be due to farmers' activities such as fertilizer, pesticide, insecticide and herbicide application could increase environmental levels of heavy metals.

Arsenic (As)
The results recorded in this study were range from 0.69 - 0.95mg/Kg though insignificant ($p<0.05$) different were observed among all species slightly higher value was found in African lung fish and lower value was found in catfish and all values were higher than 0.03 - 0.24mg/Kg in fish gills and 0.20 - 0.38mg/Kg in fish muscle (Lami et al., 2022) as well as 0.10mg/Kg, 0.2mg/Kg and 0.50mg/Kg set as upper limit (WHO/FAO, 2015) but lower than 2.0mg/Kg set as upper limit and also lower than 3.15mg/Kg and 4.27mg/Kg recorded in fishes found in Cika-Koshi reservoir Nigeria and Bangshi river Dhaka Bangadash respectively. Ingestion from contaminated.

Mercury (Hg)
Hg was not detected in all three fish samples, this agreed with work of Shamshad *et al* (2009) who reported that the average Hg content in fish species in Bangladash was lower beyond the quantification limit for the analytical methods (0.03mg/Kg) and also Enkeleda *et al.* (2011) did not detect Hg in *S. aurata* and *O. mykiss* species. These are contrary to the work of Jasmina *et al.* (2020) who recorded a range of 0.114 - 0.309mg/Kg in Atlantic bluefin tuna steak species, and a range of 0.12 - 0.16mg/Kg in D. labrax species byEnkeleda *et al*. (2011).

CONCLUSION
This study concluded that there was higher concentration of heavy metal especially Pb, Cd, Cr and As in the smoked fish muscle. Therefore, prolong consumption of smoked fish species from river Kumadugu Yobe may subject human to high risk of heavy metal accumulation that have negative effects on their health status.

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