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Original Research Article

Evaluation of Heavy Metals in Catfish and Tilipia Fish from Bayelsa River Nigeria

Ezomoh O. Olubunmi[1*], Ebizimor B. Tamarapreye[1], Fredrick A. Kelvin[1], Ebizimor Wodu[1]

[1]Department of Biochemistry, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria

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Abstract: The volume of heavy metals in two different fish samples were examined in this report, dry ashing was adopted to digest the samples and the determination of the heavy metals were evaluated using atomic absorption spectrophotometer. from the analyzed sample the concentration of cadimium in all the samples analyzed were below WHO permissible limits which is 0.2 mg/kg, From the different analyzed samples the concentration of lead was below the WHO's allowable limits which is 0.05 mg/kg, however, catfish and tilapia fish samples gotten from Amasomma have the highest concentration of lead 0.0042 ±0.0021 and 0.0030 ±0.001 respectively. The concentration of cadmium, Aluminium and Manganese are below WHO permissible limits for these heavy metals.

Keyword: Catfish and Tilipia Fish, atomic absorption spectrophotometer, cadimium.

INTRODUCTION

The Aquatic ecosystems are among the top sources of pollution sinks. Water contamination is a consequence of social undertakings such as urbanization, industrialization, and agricultural practices. Fertilizers, pesticides, and sewage originating from household and commercial sources ultimately infiltrate aquatic ecosystems as a result of improper handling and application practices. Environmental contamination is one of the biggest problems facing modern society (Ali *et al*., 2019). The prevalence of environmental pollution is increasing due to rapidly expanding businesses, rising energy needs, and thoughtless loss of natural resources over the past few decades (Gautam *et al*., 2016). The soil and aquatic ecology are continually being exposed to a variety of harmful organic and inorganic chemicals from several anthropogenic and natural sources. Briffa *et al*., (2020) asserted that amongst these, heavy metals present the most significant ecological hazard owing to their toxic properties and knack to amass in the food chain. Heavy metals released into the environment from sources such as households, farms, factories, power plants, mines, and wastewater treatment facilities have the greatest impact on natural habitats. A study on this topic was recently published (Gheorghe *et al*., 2017).

Heavy metals are those that have a higher density than water according to Fergusson (1990). If there is a correlation between mass and toxicity, then metalloids like arsenic, that can be deadly even at low doses, would also be considered heavy metals (Duffus, 2002).

Recently, significant ecological and global public health concerns have been connected to environmental poisoning by these metals. Human exposure has also expanded dramatically because of the meteoric rise in their use across a wide variety of sectors and end uses, including manufacturing, agriculture, home goods, and technology (Bradl, 2002). Heavy metals have been found in the environment from a range of geological, industrial, atmospheric, agricultural, medicinal and household sources (He *et al*., 2005). Mines, foundries, smelters, and other industrial activities involving metals are major contributors to environmental contamination (He *et al*., 2005; Bradl, 2002; Fergusson, 1990).

Aquatic life is particularly vulnerable to heavy metals since they can be ingested directly from the water or the soil. Fishes are primarily impacted because they are the main consumers of the aquatic ecosystem (Youssef & Tayel, 2004). According to Luo *et al*., (2014), heavy metal toxicity can occasionally harm fish

***Corresponding Author:** Ezomoh O. Olubunmi
Department of Biochemistry, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria

neurological systems, which affects how well fish interact with their surroundings. Humans are omnivores, and varied foods including fish, vegetables, and cereals can expose them to hazardous heavy metals. Because of this, the existence of heavy metals in aquatic species or plants can biomagnify, remain in the food chain, and transfer to humans (Baatrup, 1991). Consumers of fish are now facing a serious global threat from heavy metal toxicity (Has-Schön *et al*., 2006).

MATERIALS AND METHODS

Sample Area

Amassoma river which is located at Southern Ijaw LGA, Bayelsa state and Swali river which is located at Yenagoa LGA were the site of sample collection.

Sample collection

The sample for this study is Tilipia fish and catfish, these samples were gotten from two different rivers in Bayelsa state, Nigeria. The samples were gotten straight from the rivers and preserved at room temperature.

Washing

For precise heavy metal analysis, all glassware was washed with detergent and tap water multiple times, then soaked in a solution of HNO3 (5%) for about 24 hours, then rinsed with deionized water, and dried at 80 °C for 48 hours before use.

Preparation of Solution

Diluent preparation (nitric acid solution)

Dilute 69.75ml of Nitric acid (65%) into 800ml od deionized water and mix well by shaking. Wait and allow to cool the solution to room temperature, then add enough deionized water to make the final 1000ml volume.

Dry Ashing

Sample Incineration

5g of each of the Fish sample was taken and placed in a crucible labelled accordingly. The samples were placed them in crucibles and heated on a hot plate set to 150 degrees until the crucibles stopped smoking. The crucibles were then moved to a muffle furnace to ash the samples at 550 degree for 12 hours to completely digest samples. After incineration samples were taken out of the muffle furnace.

Sample dilution

Nitric acid was used to wash all the volumetric flask, glass rods and funnels used for sample dilution. About 30ml nitric acid was added to the crucibles containing the samples and mixed thoroughly with glass rod and was filtered into the volumetric flask using filter papers.

AAS principle

The heavy metals, Al, Mn, Fe, Cu, Pb, Hg and Cd, samples were determined using atomic absorption spectrophotometer (AAS model Pye Unicam SP9). This method is founded on the premises of Beer-Lambert's law, which states that the absorption rate of a chemical is exactly proportionate to its concentration. Therefore, the utilization of absorption spectrometry is employed for the purpose of assessing the concentrations of the analyte inside a given sample. This method necessitates the inclusion of standards possessing predetermined analyte concentrations. The light source utilized in this experiment is a lamp equipped with a cathode composed of the same element under investigation. This choice is made due to the fact that each element possesses a distinct wavelength that can be easily absorbed, allowing for accurate determination. An AAS comprises an atomizer burner that converts the constituent element in the solution into free atoms within an acetylene flame. In addition to that, it has a monochromator, which filters and isolates the light that is emitted, as well as a photomultiplier, which detects and amplifies the light that is allowed to pass through the monochromator and separates it into its component wavelengths. The photomultiplier is used just for the purpose of determining the particular resonance wavelength as well as the amount of light absorbed by the sample. After the lamp that corresponds to the element being tested has been introduced, the measurement of the light's intensity is carried out by allowing the element to travel through the flame without any obstructions. After that, the sample is introduced to the flame, and the amount of increase in light intensity that occurs as a result of the introduction of the sample is used to determine the relative concentration of the elements that are present in the sample.

RESULTS

Table 1: Mean ± SD for Concentration of Heavy Metal (Zn, Pb, Fe, Cd, Hg, Mn, Cu, Al) (ppm) in different brands of fishes

Metals	Zn	Pb	Fe	Cd	Hg	Mn	Cu	Al
Amassoma river (TF)	0.742 ±0.01	0.0030 ±0.001	2.1051 ±0.001	0.0001 ±0	0.0001 ±0	0.0001 ±0	0.0678 ±0.0011	0.003 ±0.0005
Amassoma river (CF)	0.303 ±0.0011	0.0042 ±0.0021	3.1490 ±0.099	0.0001 ±0	0.0001 ±0	0.0001 ±0	0.0001 ±0	0.00083 ±0.0004
Swali river	0.563	0.0022	4.2361	0.0002	0.0001	0.0023	0.0034	0.0001 ±0

Metals	Zn	Pb	Fe	Cd	Hg	Mn	Cu	Al
(TF)	±0.032	±0.0008	±0.056	±0.0001	±0	±0.0001	±0.0007	
Swali river (CF)	0.376 ±0.62	0.0015 ±0.003	4.1879 ±0.54	0.0002 ±0.0001	0.0001 ±0	0.0017 ±0.0005	0.0028 ±0.0001	0.0007 ±0.0002

Analyzing the degrees of the 8-priority heavy metal in catfish and tilapia from the Amassoma and Swali rivers, showed that the swali river's heavy metal concentration was higher than the amassoma river's heavy metal concentration. When compared to other metals, iron has the highest concentration of all the metals examined. Copper, manganese, aluminum, and cadmium concentrations are all low.

Table 2: Pearson correlation of Heavy Metals in different brands of Fishes

	Zn	Pb	Fe	Cd	Hg	Mn	Cu	Al
Zn	1							
Pb	-0.117	1						
Fe	-0.517	-0.639	1					
Cd	-0.155	-0.890	0.906	1				
Hg	0.000	0.000	0.000	0.000	1			
Mn	-0.067	-0.815	0.889	0.976	0.000	1		
Cu	0.851	0.161	-0.846	-0.542	0.000	-0.527	1	
Al	0.237	0.408	-0.853	-0.762	0.000	-0.861	0.711	1

The interrelationship between heavy metals in the fish samples were appraised using Pearson correlation coefficient of those values with negative are moderately negative correlations exist between Zn and Fe (r = -0.51703), Pb and Fe (r = -0.63948), Cd and Cu (r = -0.54168), Mn and Cu (r= -0.52704). Meanwhile Pb and Cd (r= -0.89004), Pb and Mn (r = -0.81531), Fe and Cu (r = -0.84567), Fe and Al (r= -0.85275), Cd and Al (r =-0.762), Mn and Al (r= -0.86111) were those values which are also high negatively correlated. Those that have high correlation are Zn and Cu (r = 0.851095), Fe and Cd (r = 0.906286), Fe and Mn (r = 0.88875), Cd and Mn (r = 0.975964).

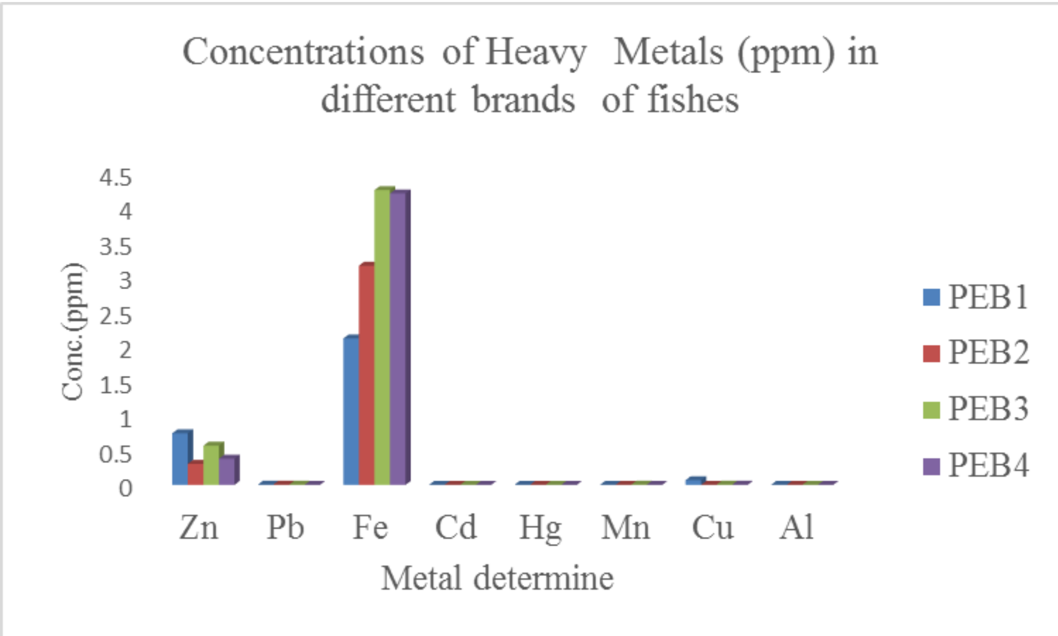

Figure 1: An histogram showing heavy metal concentration in fish

From the histogram interpretation of the analyzed samples, iron is high concentration than any other heavy metal present followed by zinc. The concentration of other heavy metals are low compared to iron and Zinc. However, the concentration of copper in Tilipia fish gotten from Amassoma is higher than any other fish samples.

DISCUSSION AND CONCLUSION

Because of the harm that cadmium does to humans, animals, and plants, it is much more of a problem. The debilitating condition referred to as Itai-itai disease, characterized by joint destruction, bone weakening, bodily atrophy, and a distressing fatality, has been attributed to the toxic heavy metal cadmium.

According to Table 1's results, all of the samples examined had mean cadimium values below the 0.2 mg/kg WHO acceptable level.

Lead is believed to be the causative agent of the medical condition commonly referred to as plumbism. Aquatic biomass contains concentrations of lead that go up the food chain to reach human consumers. Lead is also known to harm the reproductive system, kidneys, liver, brain, central nervous system, and other organs (Ademoroti, 1996). The levels of lead in the various examined samples were all below the 0.05 mg/kg permitted limit set by the WHO, although the catfish and tilapia fish samples from amasomma had the highest levels at 0.0042 and 0.0021 mg/kg, respectively.

Cadmium, aluminum, and manganese concentrations are within WHO-permitted limits for these heavy metals. The levels of heavy metals found in this study's samples were marginally lower than those seen in other publications for several fish species. The concentration of cadmium in Synodontis clarias and Cithrinus citharus obtained from the Amassoma River ranged from 0.014 to 0.015 mg/kg and 0.005 to 0.007 mg/kg, respectively, in the muscles and 0.017 to 0.020 mg/kg and 0.015 to 0.019 mg/kg, respectively, in the bones, according to a previous report by Ogamba *et al*., 2015.

The levels of heavy metals that were discovered in the samples of this investigation were somewhat lower compared to those that were documented in previous research for a few different species of fish. Wokoma 2014 discovered that the tissue lead concentrations of Psuedotolithus elongatus, Mugil cephalus, along with Chrisichthyes nigrodigitatus from the Sombreiro River in Rivers State were 0.23 mg/kg, 0.17 mg/kg, and 0.21 mg/kg, respectively. The lead concentrations in the meat of Oreochromics niloticus taken from Ibrahim Adamu Lake in Jigawa State, Nigeria were found to be 0.27 mg/kg and 0.81 mg/l, respectively, according to Sambo *et al.,*

There is a slight disparity between the findings of this study and those of earlier reports, which may be due to differences in the types of human activities that took place along the rivers that constituted the subject of this investigation, the types of wastes that were dumped into the surface water, or the types of wastes that were washed into the aquatic ecosystem as a result of soil erosion. In addition, the bioaccumulation capacities and levels of tolerance of the many different species of fish could be important variables. Due to the low levels of these non-essential metals in the fish species under study, there may be little to no health risk associated with consuming them due to cadmium, lead, and mercury pollution.

CONCLUSIOIN

In Bayelsa state, central Niger Delta, fishing is a significant occupation, perhaps as a result of the existence of water bodies such rivers, creeks, and creeklets. Numerous fish species, are providers of animal protein, can be found in these aquatic habitats. Municipal trash is disposed of in Amassoma's waterways the locals. Low metals were discovered in the studied fish species, according to the study. Therefore, it's possible that eating these fish species won't endanger the health of their customers.

RECOMMENDATION

Controlling the discharge of industrial waste is necessary in order to decrease the volume of heavy metals released into the aquatic system.

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