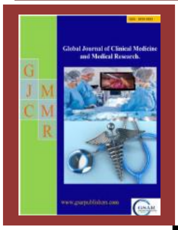

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ASSESMENT OF BIOACCUMULATION OF LEAD IN FISHES IN IBI RIVER, TARABA STATE, NIGERIA

By

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Abstract

The assessment of fish for the presence of lead is very important for the public health of individuals and the conservation of the aquatic ecosystem. Lead has deleterious effects on human beings with children being more vulnerable once they exceed their safety limits in the body. The study was conducted to determine the Lead levels in fishes in Ibi River in Taraba State Nigeria. A total of 36 fish samples were collected weekly for 4 weeks in Ibi River and transported to the Agronomy Laboratory in University of Ibadan for analysis using the Atomic Absorption Spectrophotometer. The results showed that there was no lead present at the detection limit of 0.08 of the Spectrophotometer from all the samples collected. The study concluded that fishes obtained from the river are free from Lead bioaccumulation. That this could be due to the fact that they are natural water bodies and no industrial company is close to the rivers. More extensive studies should be carried out to give a broader picture of the water bodies and the fish at different seasons of the year. Periodic assessment, collection of data and reporting of the results should be given to the relevant authorities and laws encouraging the preservation of the environment should be enacted.

Keywords; *Bioaccumulation, Lead, Fish, Water bodies, River*

INTRODUCTION

Heavy metals presence in aquatic ecosystem in excess of natural loads is a matter of concern in recent times. The sources of toxic heavy metal in water bodies could be both natural and physical coming from anthropogenic activities that have taken place. The natural water bodies may be contaminated with various heavy metals such as lead from draining of sewage, industrial wastes and other activities of man as these effluents are indiscriminately released into the aquatic ecosystem. Heavy metal poisoning is a growing problem as it increases day by day (Taslima *et al.,* 2022)

Given its vast ecology and the variety of impacts that heavy metal poisoning has on water bodies, the aquatic environment is a major area for the observation of these species to develop, reproduce, and maintain general health may be negatively affected by long-term exposure to high concentrations of hazardous metal such as lead. Additionally, as metals move up in the food chain, they can accumulate in the tissues of aquatic organisms, increasing the risk of poisoning. Major sources of heavy metals released into the environment include household and farm waste, industrial waste, fossil fuel combustion, mining, and wastewater treatment plants (Garai *et al.,* 2021).

The sources of lead toxicity in the environment can be linked to both natural and some physical changes that have taken place in the aquatic ecosystem affecting the aquatic habitat. Heavy metals can be magnified through food chain, thereby posing health risk to humans, who consume these fishes from contaminated sources (Suchana *et al.,* 2021).

Bioaccumulation refers to the aggregation of heavy metals in living organisms as an offshoot of its increased presence in the aquatic environment over a period of time. Microbes, plants and animals all depend on water for their existence. Water is needed for fish production. Heavy metal is important in the field of aquaculture production and other related disciplines. There is an interaction between water and the environment consequently the aquatic life. The increasing rate of disease associated with exposure to heavy metals makes it imperative to measure the accumulation of heavy metals

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particularly in this case lead which poses a health hazard to humans (Hussain *et al.,* 2023).

The contamination of the aquatic ecosystem in Nigeria is growing in an alarming proportion. This might be due to the increase in indigenous industries such as the cement industry, the persistent rise in population and the lack of policy as regards decontamination and methods of effluents disposal. Lead is a cumulative toxicant that affects body systems in humans. Fish can absorb lead pollutants through their skin, gills, food particles and oral drinking water. Lead contaminants are transported via the bloodstream to the liver for processing or, after absorption, to a different storage location of the body (Muneer *et al.,* 2022).

High percentage of deaths has been recorded particularly in developing countries especially in Nigeria, (Taslima *et al.*, 2022). hence the need for the study. Taraba has at least three large fish markets from which people come to buy. Lead can accumulate in the organs and systems of this fish to concentrations higher than that of the water. This is known as bioaccumulation. Aquatic organisms like fish can accumulate metals in their organs to many times higher than that of the water. Chronic infections in humans could be due to bioaccumulation of lead from the consumption of toxic fishes

METHODOLOGY

Study location

The study was conducted in Ibi river in Taraba state North-East Nigeria within Latitudes 8· 1825-8.1921 North and longitude 9· 7275- 9.7493 East. The total land area; 2,404 km^2

Figure 1; Map of Taraba State showing River Ibi

Source- Danladi *et al.*, 2023

RESULT

The results of the concentration of lead in all the fish organs (liver, gills, kidney and flesh) sampled in Ibi river 0.000 mg/g. This is lower than the recommended WHO Standard of 0.2mg/g (Murtala *et al.*, 2012). The result revealed that lead was non detected in the fish samples submitted for analysis.

Table 1: Concentration of Lead (Pb) in mg/g in different fish parts collected from fishes in Ibi river, Taraba State, Nigeria

FISH PART/ORGAN	LEAD(Pb) in mg/g
Liver	0.000±0.000
Gills	0.000±0.000
Kidney	0.000±0.000
Flesh	0.000±0.000

Results are presented as Mean ± SD.

DISCUSSION

The present study assessed the bioaccumulation of lead (Pb) in fish samples collected from Ibi River, Taraba State, Nigeria. The finding that lead was not detected in any of the analyzed samples represents a significant and encouraging outcome with important implications for environmental health, aquatic ecosystem integrity, and public health in the study area.

The complete absence of lead in the fish samples from Ibi River stands in contrast to several reports from other Nigerian water bodies. Studies conducted in various parts of Nigeria have documented varying levels of lead contamination in rivers, lakes, and streams. For instance, research on lead levels in fish species from the Lower Benue River in Makurdi, Nigeria, by Ekpo *et al.,* 2021 revealed lead concentrations ranging from 0.34 to 0.61 mg/kg in different fish species. Similarly, studies on heavy metal bioaccumulation in Tilapia zillii from the Challawa River in Kano State by Adeyemi *et al.*, 2020 reported lead levels above WHO permissible limits. The detection of lead in other Nigerian water bodies has been largely attributed to anthropogenic activities, including artisanal mining, agricultural runoff, industrial effluents, and domestic waste disposal.

The absence of lead contamination in Ibi River may be attributed to several factors. Firstly, the geographical location and prevailing land use patterns in the Ibi River catchment area may limit the introduction of lead into the aquatic system. The Ibi area of Taraba State is predominantly characterized by agricultural activities, with limited industrial operations that could serve as point sources of lead contamination. Unlike regions with intensive mining activities—such as the Zamfara, Ebonyi, and Plateau states where lead poisoning has been well-documented—the Ibi region lacks significant mining operations. This absence of industrial and mining activities substantially reduces the potential for lead introduction into the aquatic environment through industrial effluents and mine tailings.

Secondly, the hydrological characteristics of Ibi River may contribute to the low lead levels observed. Rivers with high flow rates and good flushing capacity tend to have lower concentrations of heavy metals due to dilution effects and reduced residence time of contaminants. The seasonal flood patterns characteristic of rivers in Taraba State may facilitate the periodic flushing of sediments, preventing the accumulation of heavy metals in the riverbed. The sandy and coarse nature of sediments in some river sections may also limit the binding of heavy metals, as finer sediments with higher organic matter content typically exhibit greater metal-binding capacity. The absence of lead in Ibi River fish indicates that communities depending on the river for their fish supply are not exposed to lead-related health risks through this pathway.

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CONCLUSION

The present study has successfully assessed the bioaccumulation of lead in fish samples from Ibi River, Taraba State. The finding that lead was not detected in any of the samples represents a significant and encouraging outcome. This indicates that Ibi River is currently free from lead contamination, and communities depending on the river for their water supply are not exposed to lead-related health risks through this pathway. The findings establish baseline data for lead levels in Ibi River, which will be valuable for future monitoring and environmental management efforts. This study contributes to the growing body of knowledge on heavy metal contamination in Nigerian water bodies and highlights the importance of preserving the environmental integrity of relatively pristine aquatic ecosystems.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are made:

1. Continuous Monitoring: Regular monitoring of Ibi River should be established and maintained to detect any future changes in heavy metal concentrations. Periodic sampling should be conducted across different seasons to account for seasonal variations in contaminant levels. Baseline data established in this study should be used as a reference for detecting trends and emerging threats to water quality.
2. Expansion of Study: Future studies should assess a broader range of heavy metals, including cadmium, mercury, arsenic, chromium, and copper, to provide a comprehensive profile of the river's water quality. Comprehensive studies investigating the presence of other heavy metals, like cadmium, mercury, and arsenic, would be very relevant given that their bioaccumulation can be highly toxic to aquatic life and the food chain.
3. Risk Assessment: Comprehensive health risk assessments should be conducted to evaluate potential exposure risks to other contaminants, even in the absence of lead. This should include the assessment of other water quality parameters, microbial contaminants, and the potential impact of agricultural practices on water quality.
4. Community Education: Local communities should be educated on the importance of protecting the river from pollution and the potential health risks associated with heavy metal contamination. This should include information on sustainable land use practices, proper waste disposal, and the dangers of applying metal-rich pesticides or fertilizers near the river.
5. Policy Development: Environmental protection authorities should develop and implement policies to prevent the introduction of lead and other heavy metals into Ibi River. This includes regulation of agricultural activities, control of waste disposal practices, and enforcement of existing environmental standards and regulations.
6. Preservation of Pristine Ecosystems: Efforts should be made to preserve the environmental integrity of Ibi River and prevent activities that could lead to future contamination. This includes the establishment of buffer zones along the river, regulation of land use in the catchment area, and promotion of sustainable agricultural practices.
7. Research on Other Bioindicators: Studies on macroinvertebrates and aquatic plants as bioindicators should be conducted to provide a more comprehensive assessment of the river's ecosystem health and contamination status.

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CONFLICT OF INTEREST

None

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