Direct RESEARCH JOURNALS

Direct Research Journal of Agriculture and Food Science
Vol.8 (5), pp. 136-138, May 2020
ISSN 2354-4147
DOI: https://doi.org/10.26765/DRJAFS6803551297
Article Number: DRJAFS6803551297

https://directresearchpublisher.org/drjafs/

*Full Length Research Paper*

# Comparative Evaluation of Heavy Metal Contents in Tilapia and Catfish Collected from Saki dam, Oyo State, Nigeria

***Lawal, I. A., Azeez, G.O., Imran, M.O., and Adepoju, R. A.**

Department of Science Laboratory Technology, The Oke Ogun Polytechnic, Saki, P. M. B. 021, Saki, Oyo State, Nigeria.
*Corresponding Author E-mail: lassmark520@yahoo.com / lassmark2002@gmail.com

Received 15 April 2020; Accepted 19 May, 2020

The present study was conducted to evaluate the anti-nutrients, proximate and mineral composition in catfish and tilapia fish collected from Saki dam. The gills, body and head parts of each fish sample were separately digested by using aqua regina and another set was dried and then ground separately before taken for laboratory analysis. For tilapia fish, Cd concentration was the same at each part of the fish (0.28±0.00 mg/kg), the Pb, Zn, Fe, and Cr concentrations ranged from 0.50±2.17 to 5.22±1.51 mg/Kg, 0.86±0.19 to 2.86±0.45 mg/Kg, 0.74±0.03 to 1.93±0.01mg/Kg and 0.95±0.20 to 1.59±0.19 mg/Kg respectively. Pb had the highest concentration and was found at the head of the fish. In catfish, the Cd was not detected in the gill but its highest concentration (0.04±0.01 mg/Kg) was found in the head. Pb, Zn, Fe and Cr concentration ranged from 0.12±1.13 to 2.99±0.65 mg/Kg, 1.24±0.31 to 6.13±0.75 mg/Kg, 0.95±0.02 to 1.26±0.10 mg/Kg and 0.41±0.10 to 0.56±0.26 mg/Kg respectively. The results showed that all the parts tested contain trace amounts of the elements analyzed. Zn was found as the element with the highest concentration and was detected in the body part. Cd and Zn concentrations were generally low in all the samples when compared to the permissible limits stated by WHO while Pb and Fe concentrations were higher than the permissible limit in almost all parts of the samples. It can be concluded that the contamination of Pb and Fe in the fish samples may pose a threat to human health. Advise is hereby given that fishes should be handled carefully and neatly to prevent the accumulation of heavy metals.

**Keywords**: Concentration, human health, aquatic environment, heavy metals

## INTRODUCTION

Fish is the earliest organism which belongs to phylum chordate and class Pisces; they are mainly from aquatic habitat (Salihu *et al*., 2013). They are divided according to the types of skeleton they have either as cartilaginous or bony fishes, most of fish spices are cold blood animal (Lynne, 2019). Fish is an excellent source of most of the minerals which the body needs to develop properly and perform its functions (Elżbieta *et al*., 2015). All living organisms are composed of organic and inorganic compounds, which are equally important for growth and development. The quantitative and qualitative proportions of those compounds depend on a fish species, fish biology and environmental conditions. The principal component of fish muscle (water, fat, and protein) must be preserved with little or no change. The protein level of 20% is present in the muscles of fishes. These muscles are of two types i.e. the light and dark which are mostly separated when cooking. Fat varies from species to species and from season to season, with ranges in content of fat soluble vitamins A, D, E and K. Water is the main component as much as 80% in lean fish and 70% in fatty fishes, the iodine in fish prevents goitre or enlargement of thyroid glands. The hormone thyroxin regulates some body's processes (Salihu *et al.,* 2013).

Fish meal is important constituents of human diet which is the mineral components of many enzymes metabolism and contribute to the growth of human body, the heat of the sun and air cause the fish to dry by reducing moisture content to 75% or less depending on its oil level. Fish is known to posed great ability to accumulate heavy metals in their muscles and since the same is very essential in human diet (Ofudje *et al.,* 2014).

Heavy metals are generally defined as metals with relatively high densities, atomic weights, or atomic numbers. They are relatively uncommon in the earth's crust but are present in many aspects of modern life. Some are either essential for human health (such as iron, cobalt, and zinc) but can be toxic in larger amounts or certain forms. Other heavy metals, such as cadmium, mercury, lead, and arsenic are highly poisonous. Aquatic environments have been grossly polluted by heavy metals in recent times. Thus heavy metal contamination of aquatic environments has become a problem of great concern to man (Ibrahim *et al*., 2018).

Heavy metals are the causes of most deadly diseases, cadmium can cause bone demineralization, and it is toxic to the kidney when present in high concentration in the body. Lead toxicity is an important disease and its effects on human body are devastating. The concentration in the fish can be altered due to the environments which the pond or lakes is located. Zinc is plays a role in cell division, cell growth and wound healing. Zinc might cause nausea, vomiting, diarrhea metallic taste, and kidney and stomach damage in the body (Singh *and* Kalamdhad, *2011)*. Iron can cause stomach and intestinal effect such as nausea and vomiting. On the basis of the mentioned threats of the heavy metals to human health, this study was aimed to determine heavy metal contents in various parts of fishes from a dam.

## MATERIAL AND METHODS

### Sample collections

Two different fish samples were collected from the local fisherman using net from Saki dam located at Saki West Local Government. The fish was killed the gills, body and the heads were separated and parked into a polythene bag which is obtained for the market and iced to prevent the tissues from decaying.

### Experimental design

1g of each of the parts of the fishes (gills, head, and the body) was weighed and digested with aqua regina for three hours. The solutions turn clear and allowed to cool for few minutes. These were then transferred into the EDTA bottles that had been cleaned and soaked in 1M nitric acid (Ibrahim *et al.,* 2018) and the samples were taken to the laboratory for analysis.

### Sample analysis

The sample solutions were analyzed by atomic absorption spectrophotometer to reveal the heavy metal concentrations in the samples.

## RESULTS AND DISCUSSION

### Cadmium

Cd concentration was generally low in all samples when compare to the permissible limit of W.H.O\FAO (Ibrahim et al., 2018; Sivakumar *and* Xiaoyu, 2018). Different parts of Tilapia fish had a uniform concentration of (0.28±0.01), while in catfish, it was seen that no cadmium concentration was found in the gills, but in the body and head of cat fish small amounts recorded as 0.03±0.00 and 0.04±0.01 respectively (Table 1). From the results recorded for cadmium, it can be concluded that tilapia fish accumulated high level of cadmium when compare to cat fish, this indicates that the consumption of tilapia fish from the dam for a long period of time can lead to accumulation of cadmium in the body (Singh and Kalamdhad, 2011).

### Lead

The highest concentrations of Pb was recorded in Tilapia head (5.22±1.51) which was followed by its gills (4.93±1.77) and tilapia body had lowest concentration (0.50±2.17) but the concentrations were revealed to be lower in all parts, gills, body, and head had 2.99±0.65, 0.12±1.13, 1.79±0.71mg/Kg respectively. These values were higher than the permissible limit (0.3mg/kg) (Ibrahim et al., 2018; Sivakumar *and* Xiaoyu, 2018).

### Zinc

Zn highest concentration was recorded in catfish's body (6.3±0.75), gills had (5.23±0.46) and head possessed (1.24±0.31mg/Kg). The concentration of Zn in tilapia fish were low in the gills (0.86±0.19mg/Kg) and body (0.98±1.08mg/Kg) but was in large quantity in the head (2.86±0.46mg/Kg), the tilapia head had a higher concentration than that of the catfish. The maximum permissible Zn level for human consumption in fishes is 100mg/Kg (WHO, 1989). In this present study, Zn levels in the fish species were found to be lower than the permissible limit (Singh and Kalamdhad, 2011).

### Iron

Fe concentration was high in tilapia's gill (1.93±0.01mg/Kg),

**Table 1.** Means of heavy metals concentration (mg/Kg) in fish sample from Saki dam.

| SAMPLES | Cd | Pb | Zn | Fe | Cr |
|---|---|---|---|---|---|
| $OE_1$ | 0.28±0.00 | 4.93±1.77 | 0.86±0.19 | 1.93±0.01 | 0.95±0.20 |
| $OE_2$ | 0.28±0.01 | 0.50±2.17 | 0.98±1.08 | 1.46±0.03 | 1.42±0.26 |
| $OE_3$ | 0.28±0.00 | 5.22±1.51 | 2.86±0.45 | 0.74±0.03 | 1.59±0.19 |
| $OF_1$ | N.D | 2.99±0.65 | 5.23±0.46 | 1.26±0.10 | 0.56±0.13 |
| $OF_2$ | 0.03±0.00 | 0.12±1.13 | 6.13±0.75 | 0.99±0.05 | 0.41±0.10 |
| $OF_3$ | 0.04±0.01 | 1.79±0.71 | 1.24±0.31 | 0.95±0.02 | 0.56±0.26 |

*N.D: Not Detected
KEYS
$OE_1$- TILAPIA FISH GILLS, $OE_2$- TILAPIA FISH BODY and $OE_3$- TILAPIA FISH HEAD,$F_1$- CATFISH GILLS, $OF_2$- CATFISH BODY and $OF_3$- CATFISH HEAD

the recorded concentrationin the body and head was 1.46±0.03mg/Kg and 0.74±0.03mg/Kg respectively. In both samples the gills had the highest concentration of Fe, the concentrations of catfish in the gills, body, and head was 1.26±0.10, 0.99±0.05 and 0.95±0.02mg/Kg respectively. These values were below the maximum permissible limit of Fe in Fish 100mg/kg (WHO, 1989). The concentration in Fe was higher than the permissible limit in fish. Therefore, these fishes is not advisable for consuming (Singh and Kalamdhad, 2011; Ibrahim *et al*., 2018).

## Chromium

Catfish gill and head had a concentration of Cr 0.56±0.26 and 0.56±0.13mg/Kg respectively and the catfish body had a concentration of 0.41±0.10mg/Kg. While in tilapia fish gills, body, and head possessed Cr as 0.95±0.20, 1.42±0.26 and 1.59±0.19mg/Kg respectively (Table 1). It is reported that chromium is a trace metal require in minute quantity for glucose metabolism (Singh *and* Kalamdhad, 2011; Sivakumar *and* Xiaoyu, 2018).

## Conclusion

This study was carried out to provide information on metal concentrations (Cd, Pb, Zn, Fe and Cr) in various parts of tilapia and catfish from Saki dam. The results obtained in this study, revealed that Saki dam is contaminated to varying levels by toxic heavy metals. Zinc and lead had the highest levels of bioaccumulation in the gills and the head of sampled fishes. The results also indicated low concentrations of cadmium in all the two fish species. Hence, it is important to control the discharge of pollutants into the water body and this can only be achieved through the public enlightenment, enactment of laws by the government, continuous monitoring exercise should be put in place and proper waste management should be developed.

## REFERENCES


Elżbieta TM, Joanna P, Andrzej KS (2015). Water As A Source Of Macronutrients And Micronutrients For Fish, With Special Emphasis On The Nutritional Requirements Of Two Fish Species: The Common Carp (Cyprinus Carpio) And The Rainbow Trout (OncorhynchusMykiss) Issn 1644-2296.

Ibrahim D, Ibrahim AS, Paul ED, Umar M, Zannah UAS (2018). Determination of Some Heavy Metal Content in Tilapia and Cat Fish Species in Lake Njuwa, Adamawa State, *NigeriaJ. Appl. Sci. Environ. Manage*. Vol. 22 (8) 1159 –1165 2018.

Lynne US (2019). Evolution of nociception and pain: evidencefrom fish models, Philosophical Transitions of the Royal Society B. *Biolgical Sciences, vol 10, Pp. 290- 295.*

Ofudje EA, Akiode KO, Okon UE, Oduleye OS, Williams DO (2014). Proximate and Elemental Analysis of Catfish Reared in River and Pond Systems in Ogun State, Nigeria. *actaSATECH* 5(2): 20 - 2 6.

Salihu-Lasisi M, Akpabio CJ, Ogunsola MO (2013). Comparative nutritional studies on fresh and smoked Clarasgenepinus (Catfish) and Tilapia nilotica (Tilapia) fishes *European Journal of Experimental Biology, 2013, 3(5):183-185*.

Singh J, Kalamdhad AS (2011). Effect of heavy metals on soil, plants, human health and aquatic life : International Journal of Research in Chemistry and Environment, Vol.1, 15-21.

Sivakumar R, Xiaoyu L (2018). Bioaccumulation of heavy metals in fish species from the Meiliang Bay, Taihu Lake, China. Toxicology Reports. Vol 5, 288-295.

WHO (1989). *Heavy Metals- Environmental aspect-Environment Health Criteria*, No 85, Geneva, Switzerland.