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

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Abstract

The present study was conducted to evaluate the anti-nutrients, proximate and mineral composition in cat-fish and tilapia fish collected from a dam located in Saki. However, the gills, body and head each of a set of the sampled fish was subjected to digestion and another set were dried and then ground separately before taken for laboratory analysis. The results showed that all the parts tested contain trace amounts of the elements analysed. For tilapia fish, Cd concentration was the same at each part of the fish (0.28±0.00mg/kg), the Pb, Zn, Fe, and Cr concentrations ranged from 0.50±2.17 to 5.22±1.51mg/Kg, 0.86±0.19 to 2.86±0.45mg/Kg, 0.74±0.03 to 1.93±0.01mg/Kg and 0.95±0.20 to 1.59±0.19mg/Kg respectively. Pb was the metal with highest concentration of the metal determined and it was found at the head of the fish. In cat fish, the Cd was not detected in the gill but its highest concentration (0.04±0.01mg/Kg) was found in the head. Pb , Zn,Fe and Cr concentration ranged from 0.12±1.13 to 2.99±0.65mg/Kg, 1.24±0.31 to 6.13±0.75mg/Kg, 0.95±0.02 to 1.26±0.10mg/Kg and 0.41±0.10 to 0.56±0.26mg/Kg respectively. Zn was found as the element with highest concentration and was detected at body. Cd concentrations were

generally low in all the samples when compare to the permissible limit of WHO. Pb concentrations were higher than the permissible limit in almost all parts of the samples , the concentrations of Zn were lower than permissible limit given by WHO, the iron levels were below permissible limit stated by WHO. It can be concluded that the contamination of P b in the fish samples may pose threat to human health.

Introduction

Fish is the earliest organism which belongs to phylum chordate and class Pisces; they are mainly from aquatic habitat (Saliu *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 *et al*., 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 in 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.

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, kidney and stomach damage in the body. Iron can cause stomach and intestinal effect such as nausea and vomiting. On the basis of the mentioned threats of the heavy metal 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 decay.

Sample Digestion

The parts of the fishes (gills, head, and the body) were oven dried for 8 hours and were later ground with the mortal and pestle to become powder. 1 g of each of the samples was weighed and digested with the mixture of 5ml of 75% HCl and 10ml of 25% HNO_3, the samples were then heated for three (3) hours. The solutions turn yellowish and allowed to cool for few minutes and then filtered into EDTA bottles that had been cleaned with de-ionized water

(Ibrahim *et al.*, 2012) and the samples were taken to the laboratory for analysis.

RESULTS

TABLE 1.1: shows means of heavy metal concentrations (mg/Kg) in fish samples 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**,**

OF_1- CATFISH GILLS, **OF_2-** CATFISH BODY **and OF_3-** CATFISH HEAD

DISCUSSION

Cadmium

Cd concentration is generally low in all samples when compare to the permissible limit of W.H.O/F.AO 2011 (2.00) (Effiong et al., 2019). 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. From the results recorded for cadmium, it can be concluded that tilapia fish accumulate high level of cadmium when compare to cat fish, this indicates that the consumption of tilapia fish over a long period of time can leads to accumulation of cadmium in the body .

Lead

The highest concentrations in 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) W.H.O/F.AO 2011

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 has a higher concentration than that of the catfish. The maximum permissible Zn level permitted 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 these permissible limits

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Fe concentration was high in tilapia's gill (1.93±0.01mg/Kg), the recorded concentrations body and head was 1.46±0.03mg/Kg and 0.74±0.03mg/Kg respectively. In both samples the gills have 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 limits in fish. Therefore, this fishes is not advisable for consuming.

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. It is reported that chromium is a trace metal require in minute quantity for glucose metabolism.

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.

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