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Heavy Metal Concentration in Fish Species Sold In Gwagwalada Market, Abuja

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Abstract: ***Contamination of the aquatic environment with heavy metals has prompted a lot of researches on the effect of heavy metal pollution. Pollutants of the aquatic body can be from industrial wastes, agricultural and geochemical structures, and these affects the quality of water as well as the aquatic species. Fish is one of the aquatic species and its toxic level can be used for estimation of heavy metal pollution. Six choice fish species were analyzed for heavy metal concentration and it was observed they exhibited different pattern of accumulation. Lead was below detection level in most of the fish samples except in sardine fish which was 0.01ppm. The mean concentration of the heavy metals were within the ranges Cu (0.07 – 0.23ppm), Fe (3.65 – 6.12ppm), Zn (1.89 – 3.74ppm) and Mn (0.05 – 0.40ppm). Tilapia accumulated the highest values of most of the heavy metals while titus showed the lowest values. However, the levels of heavy metals obtained for all the fish samples have not reached level of concern since the values were found to be low when compared with WHO allowable limits in food. Thus the fish species sold in the market at the time of study were safe for consumption.***

Keywords: Fish species, Gwagwalada, Heavy metals, bioaccumulation.

1. Introduction

Heavy metal is any metallic chemical element that has a relatively high density and is toxic or poisonous at low concentrations. Examples of heavy metal include mercury, cadmium, arsenic chromium , thallium and lead. As trace elements, some heavy metals (e.g. copper, iron, zinc, manganese and selenium) are essential to maintain the metabolism of the human body. However, at higher concentrations they can lead to poisoning [1]. Heavy metals can enter the human food through water, air, soil, plants and animals. The pollution of the environment by heavy metals is viewed as an international problem because of its effects. In recent years, the pollution of aquatic environment with heavy metals has become a worldwide problem because of their potential toxic effect and also most of them accumulate in tissues and organs of aquatic organism [2], [3]. The amount of absorption and assembling depends on ecological, physical, chemical and biological condition and the kind of element and physiology of organisms [4]. Heavy metals are considered the most important form of pollution of the aquatic environment because of their toxicity and accumulation by marine organisms [5], [6]. There is increasing concern about the quality of foods in several parts of world. The determination of toxic elements in food has prompted studies on toxicological effect of these elements in food. Fish is an important component of the human diet. It is generally appreciated as one of the healthiest and cheapest source of protein and it has amino acid compositions that are richer in cysteine than most of the other sources of protein [7].

In Nigeria,several surveys on heavy metals in fish have been reported. [8] working on whole body tissues of fishes from Ikpoba reservoir Benin city reported the concentration of Cd, Cr, Cu, Pb, Mn, Ni and Zn. The level of heavy metals Pb, Fe, Cd, Mn, Hg, Cu and Zn was investigated in fish samples from Nworie river [9]. Obasohan *et al* [10] examined the concentrations of Cu, Mn, Zn, Pb, Cr, Ni and Cd in fish tissues of two tropical fish species from Ogba river, Nigeria. Also Nwaedozie, [11] noted that heavy metals such as Hg, Cd, Pb, V, Zn and Fe were identified in appreciable quantities in the fish samples from Kaduna river.

This study aimed at investigating the presence and bioaccumulation pattern of heavy metal in some fish species sold in Gwagwalada market, Abuja to establish their suitability for human consumption.

2. Materials and Methods

2.1 Reagents

All reagents used were of British drug house (BHD) grades. Glasswares and plastic containers used were acid washed and rinsed with deionized water before using.

2.2 Sample collection and preservation:

Six fish samples, *Clarias gariepinus* (Cat fish), *Scomber scombrus* (Titus), *Johnius belangerii* (Croaker), *Zilli tilapia* (Tilapia), *Clupia trachurus* (Horse mackerel), and *Scardinella maderensis* (Sardine) were purchased from the Gwagwalada market, Abuja. They were preserved in an ice box from the market to the laboratory where they were washed clean with deionized water and later stored at -10 ^{o}C in the refrigerator prior to use.

2.3 Sample Treatment

The fish samples were dried in an oven at 60 - 70^{o}C for 48 hours. These samples were ground to fine powder using a porcelain mortar. 5g of each homogenized fish samples were measured into separate beakers. Then 20ml each of conc. HNO_3 and H_2O_2 was added into the beakers. The mixtures were swirled gently and allowed to digest on a hot plate in a fume chamber for 2 hours at 80^{o}C until the brown fumes disappears. The digested samples were filtered through Whatman filter papers and each solution made up to 25ml mark with deionized water and kept ready for AAS analysis. This was done in duplicate for all the samples analyzed. The digested samples were analyzed using bulk Atomic

Absorption Spectrophotometer (Perkin Elmer, Analyst 100) and the results were given in ppm.

3. Results and Discussions

The mean level of the heavy metal contamination in the fish samples are presented in table 1. Fe was the most accumulated in all the fish samples with tilapia (6.12ppm) having the highest concentration and catfish (3.65ppm) the lowest. The result showed values lower than the WHO recommended 40mg/kg in food. The concentration of iron observed in this study is comparable to levels reported by other authors. [9], [11] reported Fe mean concentration in fish samples between the ranges (3.275 – 4.73ppm) and (2.35 – 10.45ppm) with tilapia having (3.275ppm) and (8.16ppm) respectively. Iron is an essential component of haemoglobin which is responsible for oxygen transportation in the body. Severe iron deficiency in human causes anaemia.

The concentration of Pb was below detection level in all the samples except in sardine fish which gave the value 0.01ppm. Lead is a well known toxicant and has deleterious effect even at low concentration. Hence, the result revealed that Pb do not present any health risk to the consumers of these fish species at the time of study.

Table 1: Concentration of Heavy Metals in Fish Samples

S.No	*Fish Species*	*Nature*	*Cu ppm*	*Zn ppm*	*Mn ppm*	*Fe ppm*	*Pb ppm*
1	*Clarias gariepinus* (Cat fish)	Fresh	0.12	2.93	0.07	3.65	Nd
2	*Scomber scombrus* (Titus fish)	Frozen	0.07	2.81	Nd	4.34	Nd
3	*Johnius belangerii* (Croaker fish)	Frozen	0.20	2.09	0.05	5.20	Nd
4	*Zilli tilapia* (Tilapia fish)	Fresh	0.19	3.74	0.40	6.12	Nd
5	*Clupia trachurus* (Horse mackerel)	Frozen	0.23	2.03	0.25	4.42	Nd
6	*Scardinella maderensis* (Sardine)	Frozen	0.31	1.89	0.15	3.99	0.01

Nd: Not detected. Given values are mean of duplicate determinations.

Zinc was found in all the fish species and the pattern of accumulation follows the order: tilapia > catfish > titus > croaker > horse mackerel > sardine. The fresh fishes – tilapia (3.74ppm) and catfish (2.93ppm) showed higher Zn contents than all the frozen fishes. From previous studies, [11] observed a Zn concentration of 6.60ppm in tilapia from Kaduna river while [9] noted Zn level of 3.24ppm in tilapia from Nworie, river. The values in this study are below the WHO recommended limit of 60mg/kg in food. Zinc contamination has effect on the hepatic distribution of other trace metals in fish. This is because heavy metals such as Zn, Mn and Cu which are essential elements exhibit similar atomic structures and could therefore, compete for the same site [12]. Manganese was the least accumulated metal in the fish samples with tilapia showing the highest concentration value of 0.40ppm and croaker fish a value of 0.05ppm. Mn was below detection limit in titus fish. The results obtained were below the WHO (0.5mg/kg) recommended limit of Mn in food. Manganese in trace amount is an essential element. It interferes with iron metabolism, especially haemoglobin formation.

The results of this study showed that all the fish species were contaminated with Cu. Sardine fish has the highest copper concentration of 0.31ppm whereas horse mackerel, croaker, tilapia, catfish and titus fish gave 0.23, 0.20, 0.19, 0.12 and 0.07ppm respectively. The levels of Cu obtained in this study were below the WHO limit of 30 mg/kg. However, [9] reported a higher Cu concentration in fish samples ranging between (1.247 – 8.00ppm). Copper is an essential element and it enhances the enzymatic activity of the body.

4. Conclusion

Fish is one of the cheapest and healthiest sources of protein but pollution with heavy metal jeopardizes its value. This study observed traces of heavy metals in all the fish species. Iron was the most accumulated metal in all the fish species with tilapia fish having the highest (6.12ppm). This could be as a result of iron being an essential trace element and occurs naturally in plant and animal life. Lead was below detection level in all the fish samples except sardine fish (0.01ppm). Heavy metal concentration in fish samples decrease in the order for catfish, croaker and sardine as Fe > Zn > Cu > Mn > Pb, for horse mackerel and tilapia as Fe > Zn > Mn > Cu > Pb and for titus fish as Fe > Zn > Cu > Mn = Pb. Low concentration of Mn in all the fish species may be seen as a result of selective absorption of the metal. The high concentration of Fe, Zn and Cu indicates that these fishes are good bioaccumulator for these metals. At the moment, the fishes sold in the market are safe for human consumption. But increase in the level of these toxicants could pose potential health hazard. However, there is need for routine analysis of the fish samples in order to avert residual effects and to check the level of pollution in our environment.

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