WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 7.523
Volume 6, Issue 8, 1534-1539. Research Article ISSN 2277– 7105

BIOACCUMULATION OF CADMIUM AND LEAD CONTENT IN SELECTED FISH ORGANS: A RISK ASSESSMENT STUDY IN WATER BODIES OF SRIKALAHASTI

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Article Received on
29 May 2017,
Revised on 19 June 2017,
Accepted on 10 July 2017
DOI: 10.20959/wjpr20178-9027

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ABSTRACT

Fish meat is a perfect foodstuff which is up to standard of rational nourishment. It is source of healthy and good digestible material rich on proteins, minerals and vitamins. Fish muscles especially back and lateral muscles are the most important parts of fish excellent for human consumption. Proteins in fish meat are rich on high amino acids content. The content of fish fat is usually low with the high the high proportion of unsaturated fatty acids. Also minerals and B, A and d vitamins are important component of this foodstuff. According to rational nourishment the fish meat should be consumed minimal 2 times weekly. The presence of heavy metals in the aquatic environment due to human activities is a major concern because of their toxicity and threat to animal and plant life, thus disturbing the natural ecological balance (Bhattacharya et.al; 2008). The source of heavy metals in aquatic environment is due to industrialization and unscientific agricultural practice discharge the effluents into nearby water bodies either directly or through run off. Many metals like cadmium (Cd) and lead (Pb) can bio accumulate in food chain. Bio accumulation of metals reflects the amount of ingested by the organisms, the way in which the metals were distributed among the different tissue and the extent to which the metals are retained in each tissue type (Murugan etal: 2008). In light of the above this study seeks to address issues pertaining to the bio accumulation of some heavy metals cadmium and lead in different tissues of edible fish species collected from Thondamanadu water tank/pond which drains water and other pollutants into swarnamukhi

River surrounding srikalahasti town. In the present investigation the bio accumulation of both cadmium and lead heavy metal levels in various organs of different fish species studied are within the tolerable limits for human consumption and are in compliance to the standard levels specified by WHO/FAO and FSSAI. In the present study the accumulated levels of pb and cd in the liver is more followed by gills and muscles of different fish species.

KEYWORD: Cadmium, lead, pollutants.

INTRODUCTION

While in last decades the concentration of various toxic and risky elements in environment has increased due to man activities, it has caused the transfer of mentioned element into food chain. Substantial issue is to monitor their entries into environment, especially in areas with highly developed industry. Almost all of metals occur naturally in surface and also in ground water. Many of them are essential for life in trace amounts, but in higher concentrations could act negatively. Mainly lead, cadmium and mercury rank among toxic metals occurring in waters. One of the significant negative properties of these metals is their ability to cumulate in sediments. Especially mercury has great ability to accumulate in aquatic organisms. Fish can absorb metals through ingestion of suspended materials in water and food and adsorption on tissue and membrane surfaces. Since most of metals have bio accumulative properties, even when present in sub-quantities, they may be potentially hazardous if the concentration of these substances in the fish consumed exceeds the limits regulated by legislation. Lead and cadmium are chosen for the present study because at high concentrations they are highly toxic to fish and affects human beings who consume such fish.

MATERIAL AND METHODS

Samples of tissues from fish were obtained by section – muscle, liver and gills in amounts of 2-3g. for analysis. Each tissue sample was dissolved in a solution of nitric p.a (HNO_3:H_2O=2:1); sediment sample in solution of acids (HF-HNO_3-$HCLO_4$) and analyzed for presence of Cd, Pb by the atomic absorption spectrophotometer (AAS).

SIGNIFICANCE OF THE STUDY

The study area Thondamanadu water pond is surrounded by large scale industries as iron, steel, chemicals, Sugar, Bewarage factories and several small scale industries releasing their waste into these water bodies and polluting them. The determination of cadmium and lead in fish sample has large analytical interest due to the potential toxicity of these elements. To

educate aware the people around the study area about the heavy metal contamination in fish and the hazardous health effects of consuming them.

RESULTS AND DISCUSSION

Considerable variations in the heavy metals were observed in all fish sample and organs (muscle, liver, and gill). The heavy metals cadmium and lead accumulation were found in cat fish muscle, liver and gill. The lead concentration is high then compare with cadmium concentration. In exposed fish as Catla catla, Mrigala and Labeo rohita in Thondamanadu water tank, the cadmium and lead accumulation were found in muscle, kidney and gill in these fish organs. The lead (Pb) concentration is high when compare with cadmium levels in Thondamanadu water tank/pond.

Table: 1 The concentration of heavy metals in different fish species organs from Thondamanadu water tank/pond

S.No	FISH SPECIES	FISH ORGANS (g/kg)	Heavy Metals (ppm/Lt)	
			Cd	Pb
1	Cat fish (common name – jellalu & waluga)	Muscle	0.14	0.20
		Liver	0.21	0.27
		Gill	0.16	0.21
2	Catla catla (commom name – krishna bocha)	Muscle	0.12	0.23
		Liver	0.19	0.25
		Gill	0.15	0.24
3	Mrigala (white carp) (common name - yerramosu)	Muscle	0.16	0.22
		Liver	0.20	0.27
		Gill	0.19	0.25
4	Labeo rohita (common name – bocha(or) gendimosu)	Muscle	0.15	0.20
		Liver	0.22	0.28
		Gill	0.18	0.25

Standard value: fssai (2014) –Cd-0.3; Pb-0.3; FAO/WHO (1989) –Cd-0.5; Pb-0.5

The heavy metals cadmium (Cd) and lead (Pb) accumulation were found in the organs of muscle, liver and gill in the species of *Catla catla*, *Mrigala* and *Labeo rohita*. Lead (Pb) concentration levels are high when compare with cadmium concentration in the exposed fish of Thondamanadu water tank.

The order of cadmium accumulation were found in cat fish organs liver (0.26), gill (0.24). The order of lead accumulation was found in cat fish organs liver (0.29), gill (0.27), muscle (0.23). The high concentration of lead accumulation was observed as compared to cadmium metal.

The order of cadmium accumulation found in catla catla fish organs liver (0.23), gill (0.21) and muscle (0.19). The order of lead accumulation were found in catla catla fish organs liver (0.27), gill (0.25) and muscle (0.21). The catla catla was high concentration of lead accumulate them compare with cadmium. The order of cadmium accumulation were found in mrigala fish organs liver (0.20), gill (0.19) and muscle (0.18). The order of lead accumulation were found in mrigala fish organs liver (0.26), gill (0.25) and muscle (0.23). The mrigala was high concentration of lead accumulation then compare with the cadmium.

The order of cadmium accumulation were found in lebeorohita fish organs liver (0.20), gill (0.19) and muscle (0.17).The order of lead accumulation were found in lebeorhita fish organs liver (0.25), gill (0.24) and muscle (0.22). The Labeo rohita has high concentration of led accumulation when compare with the cadmium.

Heavy metal concentrations in Thondamanadu water pond. The considerable variations in the heavy metals observed in different fish species and organs (muscle, liver and gill).

The order of 'cadmium' accumulation were found in cat fish organs liver (0.21), gill (0.16) and muscle (0.14). The order of lead accumulation were found in cat fish organs liver (0.27), gill (0.21) and muscle (0.20). These fish has high concentration of lead accumulate when compared with cadmium level.

The order of cadmium (Cd) accumulation were found in catla – catla fish organs liver(0.19), gill (0.15) and muscle (0.12). The order of lead (Pb) accumulation were found in Catla- catla fish organ liver (0.25), gill(0.24) and muscle(0.23). The fish has high concentration of lead accumulate then compare with the cadmium level.

The order of cadmium (Cd) accumulation found in Mrigala fish organs liver (0.20), gill(0.19) and muscle(0.16). The order of lead (Pb) accumulation was found in Mrigala fish organs liver (0.27), gill (0.25) and muscle (0.22) .These fish has high concentration of lead accumulate when compared with the cadmium level.

The order of cadmium (Cd) accumulation found in Labeo rohita fish order liver (0.22), gill (0.18) and muscle(0.15). The order of lead (Pb) accumulation found in Labeo rohita fish organs is liver(0.28), gill (0.25) and muscle (0.20). These fish has high concentration of lead accumulate when compare with the cadmium levels.

Based on the analyses of above data the concentrations of Pb and Cd from different fish species studied that both Pb and Cd are below the harmful levels in all the organs of different fish species studied. The concentrations of Pb and Cd were more in liver followed by gill and muscle. As per result, Liver being valued as pollutant indicator may be due to its high metabolic activities and also it's detoxifying effect. The present investigation has indicated the concentrations of Pb and Cd of Thondamanadu water tank/pond based on the data analyzed on different fish species, the metal Pb and Cd bioaccumulation in the entire fish species studied did not exceed the permissible limits set for heavy metals FSSAI, 2014 and FAO/WHO,1989.

Although the level of cadmium and lead were within the normal range, in the minimum tolerable limits in the diet for human consumption. Continuous consumption of both Pb and Cd could lead to adverse health implication since cadmium has been linked to renal diseases and cancer. Heavy metals such as led (Pb) and cadmium (Cd) are dangerous for human health because of their accumulation proportion (Treassou et al., 2004) metals bioaccumulation through aquatic food webs to fish, humans and other pisciverous animal are of environment and human health concern(laws, 1981). The facts that toxic metals are present at high concentration in fish is of a particular importance in relation to the WHO and FSSAI standards. Higher levels of contamination were found in the organs of fish species for Pb. As per FSSAI maximum permissible dose for human consumption is 2.5 to 5 ppm by weight. Fish tissues were slightly contaminated by Pb, but overall fit for consumption.

Cd values were found to be just lower than acceptable limit proposed by the WHO and FSSAI. The FSSAI proposed threshold values of metal concentration in fish of 1.5 ppm by weight. Cadmium can be accumulated with matallothionins and up take ofv 3-330 mg/day is toxic and 1.5-9 mg/day is lethal to humans (Bowen, 1979). Although it is well known that the fish muscle is not an active tissue in accumulating heavy metals (Bahnasawy et al., 2009). The accumulation of metals in fish tissue depends on numerous factors, such environmental concentration, environmental conditions (pH, water, temperature, hardness) exposure time and specific living and feeding habits(Moore, 1984).

CONCLUSION AND SUMMARY

The present study was to provide information about characteristics affecting and occurrence of some risky heavy metals elements in biotic and a biotic environment. The content of

cadmium and lead does not pose a real risk of their increased entry into fish organisms. The content of cadmium in fish meat is lower than the highest acceptable amount (HAA) but in some parts of fish its contents is higher than HAA. Content of lead in fish meat is under hygienic limit, high accumulation was observed in muscle, liver and gill. Analysis of different fish species and the stand point of Cd, Pb contents showed that the concentration of pb and cd are below harmful levels in all the organs of different fish species in the muscle of different fish species and is suitable for human consumption and fulfill all hygienic limits determined for these elements. The concentration of cd and pb were more in the liver followed by gill and muscle. Liver is known to have high metabolic activities and has been widely recognized as valuable indicator of pollution. The present investigation indicated that the concentrations of pb and cd were within the acceptable limits of international standards (FAO, 1997 and FAO/WHO, 1983).

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