Effect of Heavy Metals on Antioxidant Enzyme of Fresh Water Major Carp Labeo Rohita from Mula Dam Ahmednagar

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ABSTRACT

Accidental industrial spills may lead to a high concentration of toxic metals in the aquatic environment which may lead to acute and chronic toxicity. Of all aquatic species, fish are most sensitive to water borne contamination and are recognized as bioindicators for water quality monitoring. The present study was planned to enumerate the accumulation of heavy metals like Fe, Cu, Ni and Zn in various tissues of fish like muscles, gills, liver, and kidneys). Level of these metals in different organs of fish was determined by Atomic Absorption Spectrophotometer (AAS). Total proteins and levels of antioxidant enzymes, Thiobarbituric acid reactive substance (TBARS), Superoxide dismutase (SOD) and Catalase (CAT) in the tissues of the Indian major carps were measured.

Keywords: Oxidative stress, Pollutants, heavy metal, antioxidant enzymes, Labeo rohita Mula dam

I. INTRODUCTION

Heavy metals are the metals or metalloid of the environmental concern. The term heavy metal originates with reference to the harmful effects of various elements like iron, copper, nickel, and zinc. Heavy metals have been reported to have a significant influence on all life forms mostly aquatic fauna. Heavy metals have been reported to affect aquatic animals like fish and indirectly pose a threat to human life. Heavy metals arrive in to the aquatic ecosystem through natural as well as anthropogenic sources, including industrial and domestic sewage, storm, run-off, leaching from landfills/dumpsites and atmospheric deposits (Forstner et al, 1983). The increasing concentration of heavy metals in the tissues of fish leads to biomagnifications in the successive tropic levels of food chain. Several studies have been carried out to examine the contamination of fish by various heavy metals.

Due to their high protein contents and less saturated fat value fish makes up a major part of the human diet (Sivaperumal et al.,2007; Raychaudary et al., 2008; Raouf et al ., 2009 ; Yilmaz et al., 2009, Bhattacharya et al .,2010). Fish makes up major forms of the aquatic fauna and are considered as the best bio-indicator of heavy metal pollution in aquatic systems (Alinnor et al., 2010). Fresh water bodies are being continuously contaminated with heavy metals released from various sources (Adnano 1986). When compared with other toxicant, heavy metals are considered to be unrelenting components of the aquatic habitats. Heavy metals are omnipresent, soluble in water, easily transported by water and are usually easily consumed by aquatic biota (Mendel et al., 2005). The study of bio- accumulation of heavy metal in the living tissues

of aquatic animals is a significant method to monitor the pollution level of water bodies and at the same time can prove to be helpful method to study the biological role of heavy metals present at an increased level in fish and other aquatic organisms (Ahmad et al .,2010).

II. METHODS AND MATERIAL

Study area: Mula Dam is located 19º20'to 19º35' N latitude & 74º25' to 74º25' to 74º36 E latitude. The dam was artificially built across the Mula river in 1971 and contains natural water and capacity of dam is 26 TMC. It experiences an average rain fall 58 cm. Maximum depth being 67.97 m. The physiography of basin is semi agricultural & semi-arid with cultivated top soil bank (A J Dhembare, 2011).

Experimental Animal: The fresh water major carp Labeo rohita was collected from Mula Dam by local fishermen using multifilament, nylon gill net of mesh sizes ranging from 30 mm. After collection, samples were kept in ice pack and brought to the laboratory on the same day and then frozen at -20ºC until dissection, according to standard FAO methods.

Heavy Metal Analysis: One gram of muscle, liver, kidney and gill racers from each sample was dissected for analysis. The dissected samples were transferred to a Teflon beaker and digested in an acid solution to prepare the sample for heavy metal analysis (Kenstar closed vessel microwave digestion) using the microwave digestion program. The samples were digested with 5 ml of nitric acid (65%). After complete digestion the samples were cooled down to room temperature and diluted to 25 ml with double distilled water. All the digested samples were analyzed for metals like Fe, Cu, Ni and Zn using Atomic Absorption Spectrophotometer (Perkin-Elmer AA 700). The instrument was calibrated with standard solutions prepared from commercially available chemicals procured from Merck, Germany (Kingston, Jassie et al., 1988).

III. RESULTS

The bioaccumulation rate of Cu, Iron, Zinc and Mn in different tissues of Labeo rohita follows the pattern

Copper (Cu) : Liver > Kidney >Muscles >Gills
Iron (Fe) : Kidney> Liver > Gills >Muscles
Zinc (Zn) : Liver > Kidney >Muscles >Gills Manganese (Mn) : Liver > Muscles > Gills > Kidney.

The concentration of heavy metals and enzymatic biomarkers determined from different tissues of Labeo rohita is tabulated as follows.

Table 1. : Concentration of metals like Cu, Cr, Mn and Zn in the tissues of Labeo rohita caught from Mula dam.

| Organs	μg/g dry weight			
	Cu	Fe	Zn	Mn
Liver	172.05 ±81.87	175.52±58.83	132.04±45.79	80.24±52.71
Muscle	10.70±3.47	50.67±5.3	31.12±9.82	52.28±31.03
Gill	6.83±0.67	117.56±18.18	25.37±3.36	20.17±4.34
Kidney	31.75±6.72	187.99±74.36	83.56±27.05	10.54±4.03
FAO/WHO guidelines	30	100	100	1.2

Values are expressed as Mean ± S.E

Table 2: Enzymatic Biomarkers of Labeo rohita caught from Mula dam.

Organs	MDA (µg/25mg)	SOD (U/mg)	CAT (µM/mg)
Liver	3.26±0.0666	25.37±1.4830	6.10±0.1907
Muscle	1.82±0.0777	20.24±0.9909	5.27±0.3354
Gill	1.62±0.0664	18.65±0.8130	0.13±0.1475
Kidney	2.07±0.0683	20.53±0.4916	7.06±0.1982

Values are expressed as Mean ± S.E

Graphic representation of heavy metal concentration in various tissues *of Labeo rohita*
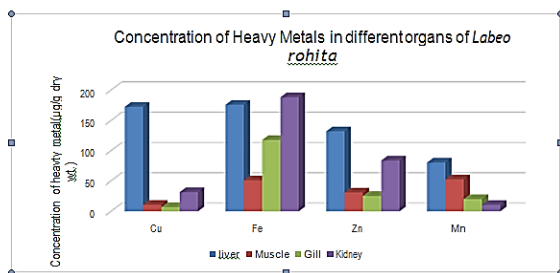
Graphic representation of enzymatic biomarkers in various tissues *of Labeo rohita*
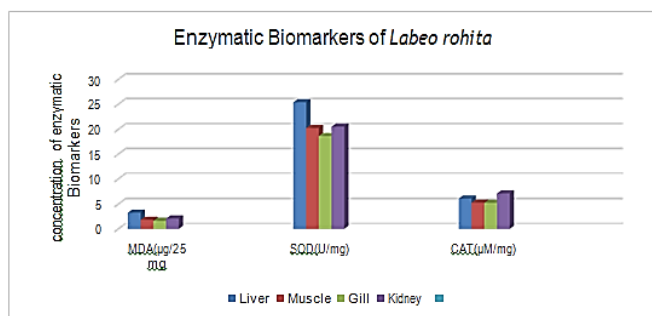
IV. CONCLUSION

The toxic effects of heavy metals in fish have been demonstrated in the present study. It is richly clear that metals induce an early response in the fish as proved by alterations both at structural and functional levels of different tissues include enzymatic and genetic effects, thereby affecting the innate immune system of exposed fish or increasing susceptibility to multiple types of diseases.

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