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Effect of Heavy Metals on Antioxidant Enzyme of Fresh Water Major Carp Catla Catlafrom 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 leadto acute and chronic toxicity. Of all aquatic species, fish are particularly sensitive towaterborne contamination and are recognized as bioindicators for water quality monitoring. Thepresent 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 were determined by Atomic Absorption Spectrophotometer (AAS).Total proteins and levels of antioxidant enzymes, Thiobarbituric acid reactive substance (TBARS), Superoxide dismutase (SOD) andCatalase(CAT) in the tissuesof the Indian major carps were measured.
Key words: Oxidative stress, Pollutants, heavy metal, antioxidant enzymes, Catla catla, Mula dam.

I. INTRODUCTION

Heavy metals are the metals or metalloid of the environmental concern.The term heavy metaloriginates 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.

Fish makes up a major part of the human diet due to their high protein contents and less saturated fat value (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 pollutionlevel of waterbodiesandat 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. Materials and Methods

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 *Catla catla*was collected from mula dam by 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).

Result:

The concentration of heavy metals and enzymatic biomarkers determined from different tissues of *Catla catla* is tabulated as follows.

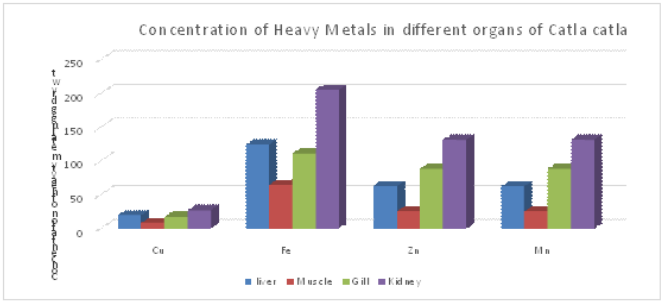
Table 1. Concentration of heavy metals in different tissues of *Catla catla*

Organs	**µg/g dry weight**			
	Cu	**Fe**	**Zn**	**Mn**
Liver	19.77±2.711	124.3±47.98	62.79±10.21	62.79±10.21
Muscle	8.37±1.29	64.58±5.24	25.66±7.05	25.67±7.05
Gill	17.5±4.49	111.04±28.47	88.66±33.52	88.66±33.52
Kidney	2.48±4.37	205.25±55.26	131.7±52.18	131.75±52.19

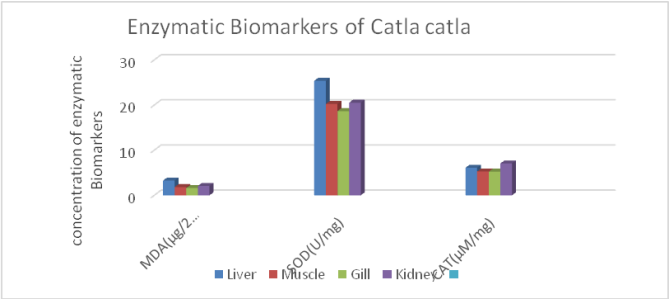
Table 2. Enzymatic Biomarkers of *Catla catla*from Mula dam.

Organs	MDA (µg/25mg)	SOD (U/mg)	CAT (µM/ mg)
Liver	2.34±0.0844	27.44 ±.0977	5.30±0.1562
Muscle	1.23±0.0393	26.16±0.6472	5.70±0.4856
Gill	1.10±0.0659	21.76±0.4985	5.10±0.0880
Kidney	1.58±0.0723	19.12±0.6674	6.64±0.3527

Graphic representation of heavy metal and enzymatic biomarkers of *Catla catla:*



Graph 1. Heavy metal concentration in various tissues of *catla catla*



Graph 2. Enzymatic Biomarkers of *Catla catla.*

III. 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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