

**IMPACT OF HEAVY METALS ON BIOCHEMICAL CONSTITUENTS IN THE TISSUES  
OF *CYPRINUS CARPIO*****A. Paritha Bhanu\***

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Article Received on 12/04/2016

Article Revised on 02/05/2016

Article Accepted on 22/05/2016

**ABSTRACT**

The LC<sub>50</sub> 96hr values were found to be 1.0% for zinc and 1.5% for both cadmium and lead with reference to *Cyprinus carpio*. To assess the long term toxicity of the heavy metals, the fishes were exposed to the subthal concentrations of metals for 30 days from the metal – treated fishes, liver, kidney and muscle were collected and processed to estimate total carbohydrates, total proteins and total lipids. There was an overall reduction of the above biochemical constituents in the fishes indicating altered biochemical machinery with disturbed metabolism in the fishes.

**KEYWORDS:** Heavy metals – tissues – biochemical constituents- *C. carpio*.**INTRODUCTION**

Aquatic degradation is mainly due to the discharge of organic and inorganic chemicals via anthropogenic activities. As a result, the water sources become unhealthy because of undesirable changes in physicochemical and biochemical conditions causing sudden and large scale mortality of fish population. The economically important fishes are highly affected by various pollutants including heavy metals. Therefore the fishes are often used as indicators of pollutants as they are the top aquatic food chain.<sup>[1]</sup>

The contamination of aquatic ecosystem by heavy metals is being a great concern in both developing and developed countries. This is because the heavy metals cannot be destroyed or degraded but they accumulate both in the environment and aquatic animals, ultimately affecting the humans.

Studies on bioaccumulation of heavy metals in different tissues of fishes.<sup>[2,3,4]</sup> In vertebrates, the tissues like liver, kidney and muscle are interrelated with each other as far as the metabolic activities are concerned.

In animals, carbohydrates, proteins and lipids provide necessary energy and metabolites for growth development and other essential functions. Proteins play important role in living organisms by the way of biological specificity in cells<sup>[5]</sup>. In all organisms, carbohydrates are the major source of energy for vital activities. Lipids are chief storage and structural compounds in living cells, providing a rich source of respiratory energy. As a consequence of aquatic pollution, these biochemical macromolecules would be

altered in organisms resulting in disturbed metabolism with resultant retarded growth, fecundity and longevity.

Therefore, the present investigation has been made to elucidate the adverse effects of heavy metals like zinc, cadmium and lead on the biochemical constituents in the tissues of freshwater fish *Cyprinus carpio*.

**MATERIALS AND METHODS**

Heavy metals like zinc, cadmium and lead as well as the freshwater fish *C. carpio* were selected to determine LC<sub>50</sub> 96 hr value of the metals to the fishes by using dechlorinated tap water, different concentrations of individual metals (0.5%, 1.0%, 1.5%, 2.0% and 2.5%) were prepared in each concentration, for 96 hrs. After the determination of the LC<sub>50</sub> 96 hr value of metals (1.0% for zinc and 1.5% for both cadmium and lead) sublethal concentrations such as 0.5%, 0.10%, 0.15%, 0.20% and 0.25% of individual metals were prepared. Group of fishes (10 in number) were exposed in these concentrations of each heavy metal for 30 days along with appropriate controls.

At the expiry of the experimental period, various tissues such as liver, kidney, muscle were collected from the experimental fishes and processed to estimate total carbohydrates<sup>[6]</sup>, total proteins<sup>[7]</sup> and total lipids.<sup>[8]</sup>

In all biochemical determinations, the results were exposed in mg/g weight of the tissues.

## RESULTS AND DISCUSSION

It is evident from tables 1-3 that the total carbohydrates, total proteins and total lipids are found to decrease in muscle, liver and kidney of *C. carpio* under the heavy metal toxicity. The effect of heavy metals on the biochemical constituents in the tissues of fishes seems to be in the order of liver, muscle and kidney. It is recorded that the heavy metals cause heavy damage in the liver of animals of because the liver is metabolic centre where the toxicants are metabolised and detoxified.<sup>[9]</sup>

The carbohydrates are rapidly utilized by the organisms to meet the energy demands in stress condition through glycolysis or hexose monophosphate pathway.<sup>[10]</sup> A fall in total carbohydrates in the species under study would be due to the breakdown of carbohydrates as the immediate source of energy under physiological disturbances in various tissues. If the organisms are unable to get the required amount of carbohydrates, then glucose is synthesised in the cells from non – carbohydrates sources via gluconeogenesis in liver and kidney.

The overall decrease of proteins in the tissues of the present experimental animals is indicative of physiological adaptability of fishes to overcome the stress caused by the metals. This would be either due to metabolic utilization of keto acids for the synthesis of free amino acids or due to both. Thus the depletion of protein in the tissues of *C. carpio* can be accounted for the diversification of energy to meet the energy demand under toxic condition. This observation coincides the findings.<sup>[11,12]</sup>

In *C. carpio* the lipid metabolism is greatly affected under heavy metal toxicity as revealed by the fall in total lipids in various tissues. During toxic conditions, the lipid metabolism is induced with the breakdown of lipids in to fatty acids which are converted in to triglycerides for the production of more energy. It is shown that the lipid synthesis is inhibited in stress condition and stored lipids become mobilized either through B- oxidation or through gradual unstaurations of lipid molecules.<sup>[13]</sup>

There is no doubt that heavy metals would inflict alterations in the biochemistry of fishes leading to disturbed metabolism affecting growth and other vital activities.

**Table1: Percent changes in the concentrations of biochemical constituents in the tissues of *Cyprinus carpio* under zinc toxicity.**

Concentration(%)	Muscle			Liver			Kidney		
	Total carbohydrate	Total protein	Total lipids	Total carbohydrate	Total protein	Total lipids	Total carbohydrate	Total protein	Total lipids
0.05	-6.65	-6.32	-2.46	-2.90	-7.57	-1.93	-4.52	-1.49	-1.47
0.10	-13.00	-14.89	-5.90	-17.23	-12.88	-7.25	-12.15	-14.51	-11.05
0.15	-20.24	-27.50	-12.26	-23.40	-21.11	-13.44	-20.58	-23.20	-21.92
0.20	-28.70	-36.06	-23.66	-26.60	-45.25	-22.77	-22.77	-32.78	-31.96
0.25	-33.84	-39.02	-32.46	-33.08	-37.69	-38.03	-33.03	-37.21	-45.89

Indicates percent decreased from control

**Table 2: Percent changes in the concentrations of biochemical constituents in the tissues of *Cyprinus carpio* under cadmium toxicity.**

Concentration(%)	Muscle			Liver			Kidney		
	Total carbohydrate	Total protein	Total lipids	Total carbohydrate	Total protein	Total lipids	Total carbohydrate	Total protein	Total lipids
0.05	-8.02	-8.79	-1.63	-11.18	-10.18	-7.61	-8.51	-6.24	-11.98
0.10	-18.10	-20.03	-11.03	-20.07	-22.63	-22.63	-16.47	-22.74	-23.35
0.15	-30.92	-35.39	-21.10	-32.94	-33.70	-33.70	-24.86	-14.89	-40.52
0.20	-37.08	-44.39	-30.64	-36.25	-45.00	-45.00	-34.90	-53.48	-49.54
0.25	-47.95	-53.88	-38.86	-45.00	-53.42	-51.40	-55.94	-60.09	-61.03

- Indicates percent decreased from control

**Table 3: Percent changes in the concentrations of biochemical constituents in the tissues of *Cyprinus carpio* under lead toxicity.**

Concentration(%)	Muscle			Liver			Kidney		
	Total carbohydrate	Total protein	Total lipids	Total carbohydrate	Total protein	Total lipids	Total carbohydrate	Total protein	Total lipids
0.05	-7.94	-8.41	-2.98	-2.38	-12.44	-3.14	-6.57	-9.23	-4.12
0.10	-20.31	-17.70	-12.80	-12.94	-16.73	-15.39	-14.80	-18.56	-11.11
0.15	-27.33	-28.02	-20.66	-22.36	-25.46	-26.73	-25.07	-27.02	-27.02
0.20	-38.04	-34.53	-25.92	-29.16	-35.02	-36.20	-30.34	-37.17	-39.45
0.25	-43.40	-45.03	-33.55	-35.71	-42.02	-45.42	-43.20	-14.71	-50.69

- Indicates percent decreased from control

**CONCLUSION**

The contamination of aquatic ecosystem by heavy metals is being a great threat to the living organism especially the fishes. In this it is evident that the impact by the heavy metal inflict alteration in the biochemistry of fishes leading to disturbed metabolises affecting growth and other vital activity.

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