



## ORIGINAL RESEARCH PAPER

Zoology

Effect of Cadmium Compound on the Biochemical Parameters of *Hetropneustes fossilis***KEY WORDS:** Hetropneustes fossilis, glycogen, protein, gills, liver and kidney.

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**ABSTRACT** In the present investigation the effect of cadmium sulphate on the histology of gill, liver and kidney were investigated in the edible freshwater fish *Hetropneustes fossilis*. Further its effects on glycogen and protein contents in the gills, liver and kidney were analysed. A significant decrease of glycogen content was registered in liver, gills and kidney of metal treated fishes when compared to their controls. Similarly, the protein levels were decreased in gills, liver and kidney of cadmium sulphate treated fishes when compared to their controls. The significance of biomarkers was discussed in this present study.

## 1. INTRODUCTION

The heavy metal Cadmium gets bioaccumulated in freshwater biota and affects severely. Normally a good correlation exists between total cadmium concentration in water and plant tissues. A positive correlation between residues of cadmium levels in benthic organisms and sediments are found. McIntosh et al. (1978) found that population of *Potamogeton crispus* inhabiting near industrially contaminated lake had absorbed 1.5 kg of cadmium and that release of cadmium from dead plants could rise water concentration by a maximum of 1.0 ppm.

The factors such as hardness and pH may affect amount of biologically active forms of cadmium, while others like dissolved oxygen and temperature may influence the tolerance capacity of the organisms. Silverberg (1976) reported that exposure of species of green algae to CdCl<sub>2</sub> resulted in the formation of intra mitochondrial cadmium granules. In tests conducted for 30 days with cadmium concentration of 0.003 to 0.006 ppm. Thurberg et al. (1973) found that the oxygen consumption was significantly increased. Lake et al. (1979) investigated that cadmium may induce a number of biochemical changes at acute and subacute levels; these include changes in enzyme activities, modification of carbohydrate metabolism, hematological changes, and changes in ability of blood proteins to bind cadmium. respiratory impairment or damage to the nervous system, is more likely to be the cause of death. Several studies have been carried on impact of cadmium on biochemical, histological haematological and behavioral responses of fish. Kumada et al. (1972) reported decrease in liver and kidney enzyme activities in rainbow trout following a chronic exposure. The acute lethal dose by ingestion has been estimated to be between 5 and 50 µg/gm of body weight. Chronic cadmium poisoning was first recognized in industrial workers and mostly involved kidney damage, obstructive lung disease and tubular proteinuria. The initial symptom of the diseases was lumber pain and muscular rheumatism in the legs and later skeletal deformation took place as a result of softening of the bones.

## 2. METRIALS AND METHODS

*Hetropneustes fossilis* were procured from fish farm. They were transported to the laboratory and reared. The fishes and the aquarium tanks are disinfected with potassium permanganate solution. The fishes are maintained in the aquarium tanks and acclimatized in the laboratory conditions for a period of 3 months. The medium was renewed alternative days. The fishes are fed with boiled egg and commercial fish feeds. The weight of the fishes ranges from 50 to 75 g. The biochemical analysis of Kidney, liver, gills and muscles were removed from the control and experimental fishes. Estimation of glycogen was carried out by the method of Carroll et al. (1956). Estimation of protein was carried out by the method of Lowry et al. (1951).

## 3. RESULTS

The kidney is composed of many nephrons and intestinal lymphoidal tissue. Nephron consists of malpighian capsule and urinary tube. Each malpighian capsule consists of glomerulus and Bowman's capsule, and it is made up of epithelial cells. Renal

tubules consist of proximal and distal convoluted tubules. The proximal convoluted tubule is lined by columnar epithelial cells and the distal convoluted tubule is lined by dome shaped cells, as well as basophilic cells. The experimental fishes showed some ruptured tubular cells and nuclei show sign of shrinkage and clumping of blood cells. The shrinkage of nuclei and tubular cells was observed. The vacuole formation was severe in cell components. Accumulation of melano macrophage resulted in the formation of brown colour pigments. The protein content in the control fish was 10.20 ± 0.50 mg/g wet weight of tissue. In the fish treated with sub-lethal concentration of cadmium sulphate the protein contents were 9.40 ± 0.40, 7.30 ± 0.35, 5.20 ± 0.20 and 3.10 ± 0.10 mg/g wet weight of liver tissue for 24, 48, 72 and 96 hours experimental periods respectively.

In the control fish the protein content in the kidney tissue was 8.95 ± 0.31 mg/g wet weight of tissue. In the sub-lethal concentration treated fish the protein contents were 7.60 ± 0.19, 5.51 ± 0.18, 4.29 ± 0.11 and 3.09 ± 0.05 mg/g wet weight of kidney tissues. 24, 48, 72 and 96 hours experimental periods respectively. The protein content in the control fish was 6.40 ± 0.17 mg/g wet weight of tissues. In the fish treated with sub-lethal concentration of cadmium sulphate the protein contents were 5.90 ± 0.10, 4.08 ± 0.08, 3.08 ± 0.05 and 2.10 ± 0.01 mg/g wet weight of tissue for 24, 48, 72 and 96 hours experimental periods respectively.

The glycogen in the control fish was 6.02 ± 0.03 mg/g wet weight of tissue. In the fish treated with sub-lethal concentration of cadmium sulphate the protein contents were 5.77 ± 0.08, 4.60 ± 0.30, 3.30 ± 0.40 and 2.90 ± 0.09 mg/g wet weight of liver tissue for 24, 48, 72 and 96 hours experimental periods respectively. In the control fish the protein content in the kidney tissue was 5.10 ± 0.13 mg/g wet weight of tissue. In the sub-lethal concentration treated fish the protein contents were 4.80 ± 0.20, 3.63 ± 0.15, 3.01 ± 0.03 and 2.47 ± 0.08 mg/g wet weight of kidney tissues for 24, 48, 72 and 96 hours experimental periods respectively.

## 4. DISCUSSION

Evidences reveal that exposure of lead (poisoning) brings the changes in the biochemical profiles of the fish. The observations indicate that alteration in the normal behaviour and biochemical parameters serve as an index of the toxic effects on different tissues in fishes. The glycogen content was depleted by 22.5% and 59% in the liver of *Barbus conchonus* after 30 and 60 days respectively when it was exposed to lead. Similar results were also reported in the fish *Cyprinus caprio* and *Channa punctatus*.

The results of the present study revealed a significant depletion of glycogen content in liver of *Hetropneustes fossilis* when exposed to cadmium sulphate. Al-Ekel (1994) studied the toxic effect of lead in *Cyprinus carpio* and reported that the glycogen content of liver has been decreased. Exposure of carbamate pesticide in *Channa punctatus* caused decrease of glycogen content in liver and muscle. Muscle glycogen was decreased when the fish *Nephrops norvegicus* exposed to copper and manganese. Radhakrishnaiah et al. (1992) reported that the muscle and liver

glycogen contents were decreased when *Labeo rohita* exposed to copper which may be due to the utilization of glycogen through anaerobic glycolysis to meet extra requirement under hypoxia caused by chemical stress and physiological dysfunctions.

It has been shown that the protein content in the control fish of *Heteropneustes fossilis* was maximum in the liver tissue followed by kidney and gill and blood. The highest protein content in the liver tissue might be due to greater concentration of enzymes in the liver. It has been shown that the protein content in the control fish of *Heteropneustes fossilis* was maximum in the liver tissue followed by kidney and gill and blood. The depletion of tissue protein contents in fish exposed to various toxicants were observed by many workers. Singh and Srivastava (1992) have also observed tissues of *Heteropneustes fossilis* exposed to toxicant and pointed out that the depletion might be due to decreased protein synthesis and decreased DNA and RNA contents during toxic stress. In conformity with the above observation, in the present study also the protein content in the fish *Heteropneustes fossilis* exposed to sub-lethal concentration of cadmium, the reduction in protein content reached the maximum at 96 hrs. It showed the cumulative effect of the cadmium stress on fish. Further the decline in the protein content in all the tissues might be due to intensive proteolysis in the respective tissues or inhibiting protein synthesis due to respective tissues of cadmium toxicated fish.

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