EFFECT OF CADMIUM SULPHATE ON CERTAIN BIOCHEMICAL PARAMETERS OF TELEOST, CLARIAS BATRACHUS

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ABSTRACT
Discharge of heavy metals into aquatic environment from various sources causes serious health hazards in aquatic organisms particularly to fish fauna. The persistence bioaccumulation of these heavy metals causes alterations, in various biochemical profile of one of the major food fish, Clarias batrachus. This paper investigates the effect of Cadmium Sulphate on biochemical parameters of Clarias batrachus viz. Serum Protein, Serum Cholesterol and Glucose after 30, 45 and 60 days of post treatment. Decline in Serum Protein after all three exposure periods 30, 45 and 60 days is suggestive of starved condition in fish. Inclination in Serum cholesterol profiles after 30, 45 and 60 days indicates hypercholesterolemia accounting to liver failure. Serum glucose showed increase after 30, 45 and 60 days of exposure causing hyperglycemia.

KEYWORDS: Clarias batrachus, cadmium sulphate.

INTRODUCTION
Among various types of pollution, aquatic pollution is of greater concern in present day conditions as each and every kind of the life depends on water. Among various types of aquatic pollutants, heavy metals are of greatest concern. Cadmium is one of the heavy metal, which is reported as major contaminant of aquatic ecosystem.\(^1\) It has severe toxic effects on aquatic organisms when present in large amounts and even if present in extremely low concentrations. Cadmium is a toxic substance for many organisms and its toxicity to fresh water organisms has been well documented in literature. It is widely used in Ni-Cd batteries manufacture, metal and mining industry, dentistry etc. It is released in considerable amounts

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through industrial effluents into soil and ground water systems. It has been listed in the ‘blacklist’ of European community.[2] The Asian catfish, *Clarias batrachus* is one of food delicacies in India because it has fewer inter muscular bones, good taste, flavor, high protein, iron contents, less fat, easy digestibility, characteristic aroma and medicinal qualities. *Clarias batrachus* is now facing a serious threat from pollution of cadmium. In aquatic systems fish occupy the upper trophic level and there are greater chances of transferring cadmium to higher organisms particularly to man. In fishes, pollutants absorbed via gills can be metabolized before reaching the liver and even with relatively low metabolic capacity.

Cadmium is regarded as a major contaminate of aquatic environment posing great threat to fish population. Basically metal uptake by aquatic organisms occurs in two phases, first it involves rapid adsorption and secondly transport into interior of cell. The health of fish is affected, either directly through uptake from the water, or indirectly through their diet. Cadmium, which is released into aquatic ecosystems, is responsible for several physiological irregularities found in fish. Cadmium uptake takes place through three routes namely gills, skin and from food via the intestinal wall.[3] The metal retention capacity of the fish is dependent on the metal assimilation and excretion capacity of fish concerned. Cadmium was reported to cause “itai-itai byo” disease in Japan 1985[4] because of high level of cadmium in local food stuffs due to irrigation water from soil heaps of abandoned mine. Bio enhancement of Cadmium along a food chain was studied by workers[5] and fish are known to be used as biological indicators to assess water pollution.[6]

**MATERIAL AND METHODS**

**Test fish**

Healthy living specimen of teleost, *Clarias batrachus* were collected from local fish market of Meerut. Fish measuring 15 ± 2cm in length and 60 ± 8 gm in weight were selected for the present study. They were brought to the laboratory as soon as to lessen the high mortality. Prior to the experimentation, fishes were thoroughly washed for 5 minutes with 0·01% *Kmno4* to avoid any dermal infection. Selected fishes were acclimatized to the laboratory conditions for period of 15 days.

**Determination of Lc-50 for Cadmium Sulphate and Chemical exposure to fishes**

*Lc50* was determined by exposing the fishes to seven (2,4,6,8,10,12,14)mg/l ascending concentrations of cadmium sulphate. Cumulative mortality was determined after 96-hr, the dead fishes were removed once they were observed. The 96-h *Lc*-50 13.8 mg/l for Cadmium
Sulphate was determined by graphically plotting the percentage mortality versus concentration of chemicals. Fishes were divided into 4 equal groups each comprising of 30 fishes. Each group was kept in separate glass aquaria of 250 litre capacity. First group was treated as control group. Fishes of other 3 groups were treated with sublethal concentration 1.38mg/l of cadmium sulphate for period of 30, 45 and 60 days. Water in the aquariums were renewed after 24 hours and fresh solution of the toxicants were added to bring the concentration to the desired level.

Blood Collection
The blood of the fish was collected by cardiac puncture after respective periods of 30, 45 and 60 days of exposure with cadmium sulphate. The blood was stored in vials.

Biochemical studies
All biochemical studies were performed with the serum of control as well as treated groups of fishes.

Preparation and preservation of serum
Fish blood was centrifuged at the speed of 3000 rpm. The serum was separated and preserved in the refrigerator at -20\(^\circ\)C in the deep freezer. These vials were properly labeled according to the experimental design. Whenever the serum was required, it was first of all brought to the room temperature and then further estimations were done.

1. Determination of Serum Protein
Total Serum Protein was determined by (Biuret method).

2. Determination of Serum Cholesterol
Serum Cholesterol was estimated with the help of one step method (Wybenga and Pilleggi).

3. Determination of Glucose
Glucose level was estimated by Kit method (End point o-toludine).

RESULTS
The Serum Protein was observed to be 3.15gm/dl in *Clarias batrachus* after 30 days of PT with cadmium sulphate. This parameter was observed to be decreased when (p<0.05), compared with control value after 30 days. After 45 days of PT with experimental chemical serum protein was observed to be 2.92mg/dl. The value was decreased when (p<0.05),
compared with control value after 45 days. After 60 days of PT the value was noted to be 2.25 gm/dl. The value was observed to be decreased when (p<0.05), compared with control value noted after 60 days. [Table1] Maximum decline was observed after 60 days of exposure and minimum after 30 days of exposure period.

Serum Cholesterol was observed to be 198 mg/dl in *Clarias batrachus* after 30 days of PT with cadmium sulphate. This parameter was observed to be increased when (p<0.05), compared with control value after 30 days. The value was observed to be 211 mg/dl in *Clarias batrachus* after 45 days of PT with cadmium sulphate. This value showed increase when (p<0.05), compared with control value after 45 days. After 60 days of PT with cadmium sulphate this parameter was observed to be 246 mg/dl in *Clarias batrachus*. The value was observed to be increased when (p<0.05), compared with control value observed after 60 days.

Serum Glucose was observed to be 60.3 gm/dl in *Clarias batrachus* after 30 days of PT with cadmium sulphate. This value was observed to be increased when (p<0.05), compared with control value after 30 days. This parameter was observed to be 82.6 mg/dl in *Clarias batrachus* after 45 days of PT with cadmium sulphate. The value was observed to be increased when (p<0.05), compared with control value after 45 days. After 60 days of PT with cadmium sulphate this parameter was observed to be 81.81 mg/dl in *Clarias batrachus*.

**Statistical analysis**

For Statistical analysis Gen Stat Statistical Analysis software was used to calculate analysis of variance and Ducan Multiple range test was used to test level of significance.

**Table 1:** Biochemical parameters in *Clarias batrachus* after 30, 45 and 60 days of treatment with Cadmium Sulphate (n = 3, *standard error*, **standard deviation).
DISCUSSION
During the present investigation significant decrease in serum protein 3.15gm/dl was found during 30 days of exposure period and 33.6% decline was observed. The value observed after 45 days showed decrease of 2.92gm/dl. 60 days of exposure period showed percentage decline of 43.18% and value corresponds to 2.25gm/dl in cadmium sulphate treated fish. Similar kind of decline in parameter was observed\(^7\) in *Heterobranchus bidorsalis* and
*Clarias gariepinus* and it was observed that plasma protein was lowered when exposed to sublethal effect of cadmium. It is known that Proteins are responsible for contributing to osmolarity of plasma and furnish nutritional requirement of tissues therefore decline in this parameter causes starved condition in fish.

Decline in Serum Protein level has been reported in *Clarias batrachus* after exposure to heavy metals. Many other workers also reported similar type of findings in other fish exposed to other chemicals. Thus it can be concluded that assessment of protein content can be used as diagnostic tool to determine physiological phase of cell.

In the present investigation Serum Cholesterol showed increase in value 198mg/dl observed after 30 days of exposure time and percentage increase was 16.47%. After 45 days this parameter showed increase when compared with control group of fishes and the percentage increase was 14% when compared with control group of fishes. 60 days of period showed percentage increase of 17.70%. The same range of values have been reported by workers in *Amphipnous cuchia*, *Clarias batrachus* and in air breathing fishes. Increase in cholesterol observed in present study was similar to findings of investigators who worked on other chemicals thus it is quite evident from the present study that hypercholesterolemia observed in *Clarias* is due to impairment of liver and inhibitions of enzymes.

Cholesterol concentration in the serum of metal-exposed fish generally increased when compared to the control values. The report of many investigators support the increase of serum cholesterol concentrations in the present study. The concentration of cholesterol is an essential structural components of membranes and the precursor of all steroid hormones.

In the present study slight increase in glucose 2.96mg/dl was observed after 30 days of exposure with cadmium sulphate whereas there was observed increase in this parameter after 45 and 60 days and which showed significant increase in value, when it is compared with control group of fishes. 60 days of exposure period showed percentage increase of 19.18%. This increase in value was found to be considerably significant. Similar observation were recorded by different investigators in different species of fishes when exposed to different concentrations of cadmium. Hyperglycemia and increased glycogen was reported in liver of flounder. The effect of cadmium concentrations on the level of glucose in the blood of rainbow trout was also reported which are in accordance with the present investigation.
CONCLUSION
The measurement of biochemical changes in blood of fish under exposure to any toxicant may be used to predict effects upon chronic exposure. Fish have been largely used as a bioindicators for environmental toxicity studies. Effect of Cadmium sulphate on the edible catfish, *Clarias batrachus* revealed significant changes in the biochemical constituents of the fish and hence give an idea about the health status of the fish population.

REFERENCES


