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67

EFFECTS OF MERCURY CHLORIDE ON BIOCHEMICAL PROFILE OF FRESHWATER FISH *CYPRINUS CARPIO*

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Abstract
Toxicants affect biologically active molecules, viz., carbohydrates, proteins and lipids. Carbohydrate, protein and lipid metabolism of fishes are disturbed under the condition of toxic stress and are known to cause increase or decrease in the biochemical constituents of the tissues. Toxicity of mercury chloride was tested on fresh water fish Cyprinus carpio the impact of toxicity on the fishes within a short period at the various concentrations of HgCl2 (1.5, 2, 2.5 and 3mg/L). significant depletion of glucose, total protein and total lipid content of muscle liver and kidney tissues was observed at all exposure periods.
Key words: *Protein, carbohydrate, enzyme, Cyprinus carpio*

Introduction*:* Toxicants affect biologically active molecules, *viz*., carbohydrates, proteins and lipids (Ghosh TK, 1985). Carbohydrate, protein and lipid metabolism of fishes are disturbed under the condition of toxic stress (Shaffi SA., 1978). Heavy metals are being passed on into aqueous environments through industrial processes, sewage disposal, soil leaching and rainfall. The concentrations of these heavy metals are sublethal or lethal to aquatic organisms when the duration of exposure to these metals are prolonged (Eisler and Gardener, 1973). It is well documented that effect of heavy metals are dependent upon the physical and chemical conditions of the environment especially water salinity, hardness, pH and dissolved oxygen and can act synergistically. Heavy metals from several industrial mining and other sources enormously contribute to the pollution problem in rivers and streams resulting in adverse impacts on biota including fish. Fish population is generally considered very sensitive to all kinds of environmental changes to which it is exposed as they are exclusively aquatic with external mode of fertilization. Certain stages in the life cycle of fresh water fish are more susceptible to environmental and pollution stresses (Von Westernhagan, 1988). Even though many studies are available in toxicity of various fishes (Jagadeesan *et al*., 1991; Margarat *et al*., 1991; Jagadeesan *et al*., 2001; Francis *et al*., 2002;). Hence the present study has been carried out on *Cyprinus carpio* with reference to mercury chloride.

Materials and Methods*:* The fish, *Cyprinus carpio* were collected and kept in aquarium and the water used was clear and unchlorinated. Fishes were fed daily with fish pellets and acclimatized for 5 to 6 days. Acute toxicity tests were conducted at the various concentration of HgCl2 (1.5, 2, 2.5 and 3mg/L). The LC_{50} was reached at 96h at 3mg/lit. The tissue was homogenized. The protein was estimated by Biurette (1951), glucose were estimated by Anthrone method and Total Fats were estimated by using Ethanol- ether method (Folch *et al.,* 1957).

Results*:* significant depletion of total protein content in the muscle, liver and kidney in lethal concentrations. was observed. The glucose content was highly decreased significantly in 24h and 48h. In 72h &96h muscle it was decreased significantly throughout the duration. while total fat was

also decreased significantly in all the tissues throughout the duration of exposure. depletion of glucose, total protein & total fat content was observed in all the tissues during the present investigation.

Graph no.1.
Showing effects of mercuric chloride on glucose, total protein & total fat content Of various tissues of *cyprinus carpio* for different time intervals

Discussion: Proteins are involved in major physiological events therefore the assessment of the protein content can be considered as a diagnostic tool to determine the physiological phases of organism. Proteins are highly sensitive to heavy metal poisoning (Jacobs *et al*., 1977). When an animal is under toxic stress, diversification of energy occurs to accomplish the impending energy demands and hence the protein level is depleted (Neff, 1985). In the present investigation Depletion of protein content has been observed in the muscle, liver and kidney. The depletion of total protein content may be due to breakdown of protein into free amino acid under the effect of mercury chloride at the lower exposure period (Shakoori *et al*., 1994). These indicate that mercury induces proteolysis in the fish even under Sublethal toxic stress resulting in elevated levels of protein content. Metals could alter the structure, permeability and integrity of lysosomal membranes resulting in the diffusion of their enzyme into cytosol (Sternlib *et al*., 1976). Hence high activity of protease, a lysosomal enzyme, in the organs of fish might be due to the damage caused by mercury to lysosomes. Elevated protease activity induced proteolysis; the intensity increased with the increase in exposure may be the increase in free amino acid pool due to increased proteolysis would act as osmotic and ionic effectors to bring the electrostatic equilibrium between the external medium and blood (Schmit- Nielson, 1975; Jurss, 1980). Decrease the level of total carbohydrate has been noticed in the muscle liver & kidney tissues. The disturbance in the carbohydrate metabolism was considered as one of the most outstanding biological lesions due to the action of heavy metal (De Bruin, 1976). The decrease in carbohydrate content in the muscle, liver & kidney may be due to glucose utilization to meet excess energy demand imposed by severe anaerobic stress of mercury intoxication (Margarat *et al*., 1999). Another possible reason for depletion in the tissue may be due to impairment of glycogen synthesis. Under hypoxic conditions; fish derive the energy by anaerobic breakdown of glucose which is available to the cells with the increased glycogenolysis. The observed depletion of carbohydrate in the present study explains the increased demand of these molecules to provide energy for the cellular biochemical process under toxic manifestations. Similar results were observed in *Thalmile crenata, Anabas testudienues* and *Anabas scandens*, when exposed to copper, and mercury chloride, respectively (Villalan *et al*., 1988; Mary Candravathy *et al*., 1991). Metabolic activity failed to recover indicating the effects of accumulated mercury in the tissues, indicating the reduced rates of glycogenolysis and glycolysis. The recovery could be attributed to restoration of regulatory function of phosporylases by elimination of toxicant (Holcombe *et al*., 1976; Richert *et al*., 1979) from the endocrine glands like pancreas and adrenals. Generally, more energy is needed to mitigate any stress condition and this may be obtained from carbohydrates and proteins. Increase in structural proteins could help the animal to fortify its organs for developing resistance and increase in soluble fraction from the general intracellular environment and help the animal to adapt to the imposed toxic stress Sivaramakrishnan *et al*., 1998).

Lipids are important constituent of cellular structures. Lipids are also essential for maintenance of normal cell permeability and structural integrity of cell membranes. in the present investigation the total fat was found to significantly a decrease in lipid content in all tissues of cyprinus carpio . Govindan *et al*.,(1994) reported a significant decline in the level of total lipids in the muscle, liver and brain of *Gambusia affinis* exposed to a pesticide, phosphamidon. A decrease in total lipid content during the present study in, muscle, liver and kidney tissue denoted the effect of metals.

The findings of Ram and Sathyanesan and Jha (1984) on *Channa punctatus* intoxicated with mercuric chloride on *Channa punctatus* under lead exposure support the present study. Loss of lipid may be a consequence of inhibition of lipid synthesis and mobilization of stored lipids. The decrease in tissue lipids and proteins might be partly due to their cell repair and tissue organization with the formation of lipoproteins, which are important cellular constituents of cell membranes and cell organelles present in cytoplasm.

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