ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Effect of Chromium on Protein Metabolisam in Different Tissues of Fish, *Cyprinus Carpio*

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ABSTRACT

The present study is designed to get the effect of chromium on Total proteins, Free amino acids, Protease, AST, AlAT, Ammonia, Urea, GDH contents in different tissues of fresh water edible fish to understand the protein metabolism and its role in fresh water edible fish, *Cyprinus carpio*. The fishes 7g body weight were treated with $1/7^{th}$ lower concentration of LC_{50} of chromium for 7days, 15days and 30days. In order to assess physiological changes in fishes the protein metabolism was taken up. The result shows a decrease in total protein content and increase in the levels of other parameters. The observations on biochemical composition reveal the protein metabolism is mostly affected with chromium.

Keywords: *Cyrinus carpio*, Chromium, protein metabolism, sub lethal concentration.

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ISSN: 0975-8585

INTRODUCTION

Effluents are run off from fields which comprise of chemicals of versatile nature, exert their toxic effects on fresh water animals by depleting the dissolved oxygen altering the ph, salinity, changing the oxygen and carbon dioxide content and there by directly or indirectly affecting the life cycle as well as the metabolic activity of the aquatic animals at the biochemical levels. The functional impairment of vital organs serves as an important biochemical tool for understanding environmental toxicity, as the toxicity induced biochemical lesions precede the onset of morphological and pathological features

Proteins are the chief organic macromolecule for all aspects of cellular structure and function is expected to react first upon metal exposure. Metals alter the buffering system of the intracellular environment very rapidly. The reason for the decrement of protein is that tissue protein might be metabolized to produce glucose by process of gluconeogenesis and glucose is utilized for energy production during stress condition by pesticide [10] and it may be caused for lower amounts of protein in experimental tissues. The elevated amino acid pool is due to the breakdown of tissue proteins.

Proteins are the primary structural and functional polymers in living systems. They have a broad range of activities, including catalysis of metabolic reactions and transport of vitamins, minerals, oxygen, and fuels. Some proteins make up the structure of tissues, while others function in nerve transmission, muscle contraction, and cell motility, and still others in blood clotting and immunologic defenses, and as hormones and regulatory molecules.

The degradation of proteins was mainly brought about by protein hydrolyzing enzymes which cleave proteins into peptides and amino acids. A dynamic equilibrium exits between proteolysis and synthesis which is mainly responsible for protein turnover and homeostasis in any tissue.

MATERIALS AND METHODS

Fingerlings of fish, *Cyprinus carpio* average length of 7cm, weight 7g were acclimatized for 10 days with water continuous aeration at 12hr light and 12 hr darkness. After acclimatization, fishes were divided into four groups each having ten fishes. First group considered as control. Remaining three groups exposed to chromium for duration of 7days, 15days and 30 days. Water was changed on alternate days and fishes were fed with commercial fish feed.

S.No	**Parameters**	**Methods employed**
1	Total proteins	Lowry et al., (1951)
2	Free Amino Acids (FAA)	Moore & Stein(1954)
3	Protease activity	Moore & Stein(1954)
4	Aspertate Amino Transferase (AST)	Reitman Frankel (1957)
5	Alanine Amino Transferase (AlAT)	Reitman Frankel (1957)

6	Ammonia	Berg Mayer (1965)
7	Urea	Natelson (1971)
8	Glutamate Dehydragenase (GDH)	Lee & Lardy (1965)

RESULTS AND DISCUSSION

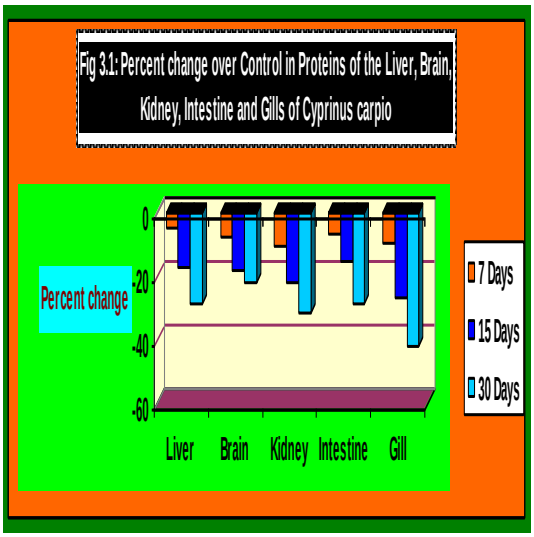
The total proteins in all the organs of fresh water edible fish, *Cyprinus carpio* exposed to chromium the total protein levels progressively decreased over time of exposure(fig:3.1). While FAA, protease, AST and AlAT, Ammonia, Urea and GDH activities are increased (figs:3.2 to 3.8). The experimental fish showed statistically significant ($P<0.05$) decrease of total protein content in all tissues.

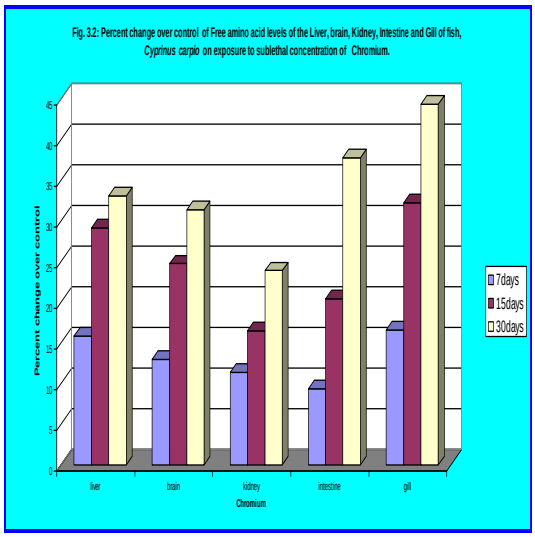
Gills of the fishes are generally direct contact with toxic medium hence the metals could cause disturbances in their structural rigidity by disturbing their cellular organelles, especially at 30days experimental fish exposed to chromium can be presumed that the fishes made an attempt to strengthen the gills by increasing their rigidity in order to prevent the entry of toxic substances.

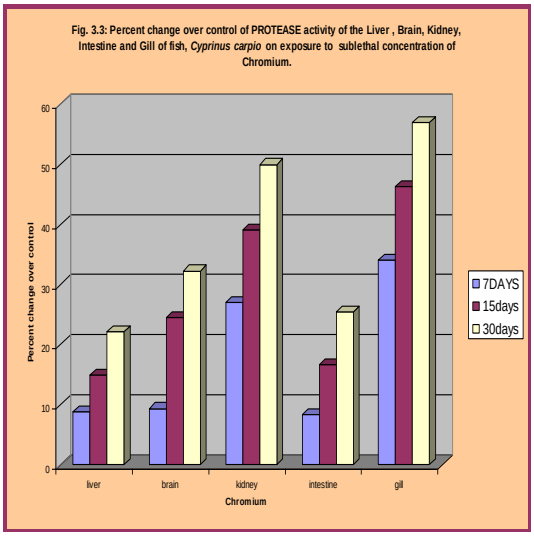
Total Protein content is decreased and it may be due to breakdown of proteins in the fabrication of some amount of energy for organism. The degree of increase in free amino acids is resulted by the decreased protein level. Protease activity is increased in all the tissues due to inactivation of oxidative enzymes, reduction in energy production and acceleration of proteolysis. AST activity levels increased in all experimental fishes. AlAT activity levels also increased in all experimental animals. AST & AlAT increased may be due to tissue damage under experimental conditions. The break down of protein leads to the elevation of amino acid level due to the increase of ammonia levels by the process of transamination and deamination. Increased urea levels might be due to activation of urea cycle for detoxification of ammonia. Increased urea levels might be due to activation of urea cycle for detoxification of ammonia. GDH activity is increased in all the tissues may be due to having a crucial function in detoxification of ammonia.

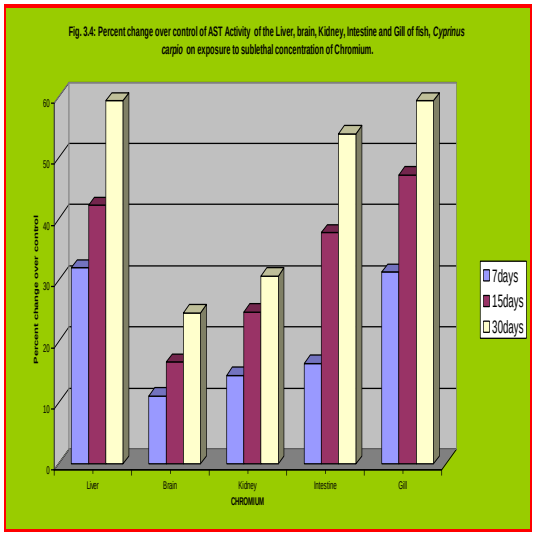
Effect of chromium on protein metabolism of the fish tissues exhibited more toxic effect. Whereas, the fish exposed to chromium the progressive increase in the level of ammonia indicates its accumulation in tissues. The main basic mechanisms of detoxification of ammonia are its conversion to urea and the arginase activity serves as an index of it [16]. Increase in urea level elevates the osmo concentration of body fluids and facilitates the fish to tolerate to the toxicity. It is well known that during hyper osmotic regulation the kidney of fresh water fishes has to continuously excrete excess of water from the body and at the same time reabsorb salts. In the present study increase in GDH activity in the organs of the fish exposed to chromium increased production of glutamate in order to eliminate ammonia.

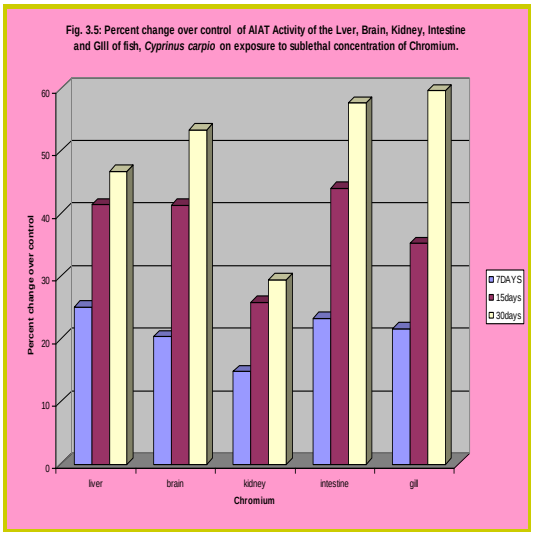
ISSN: 0975-8585

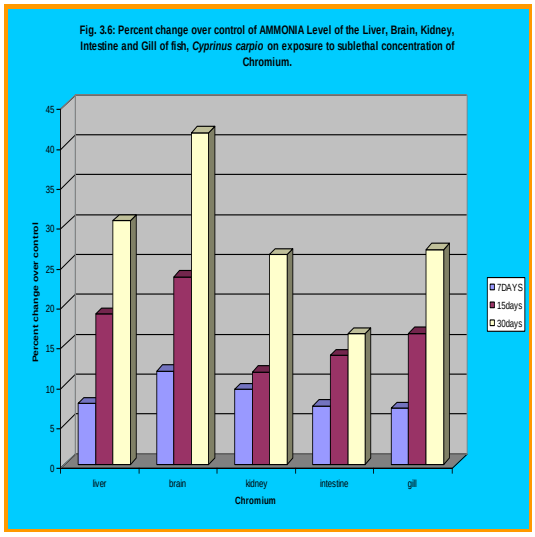












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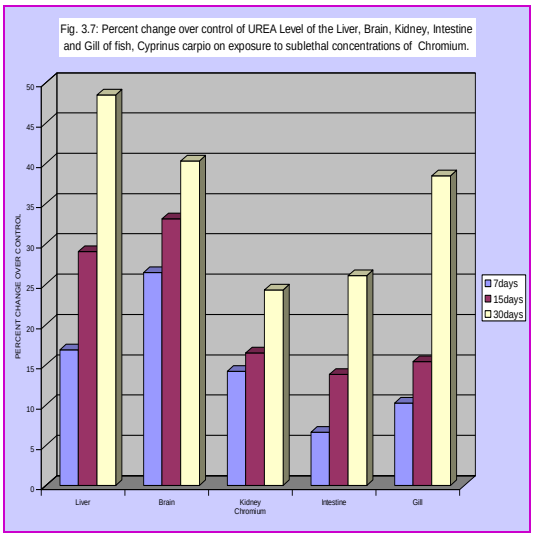

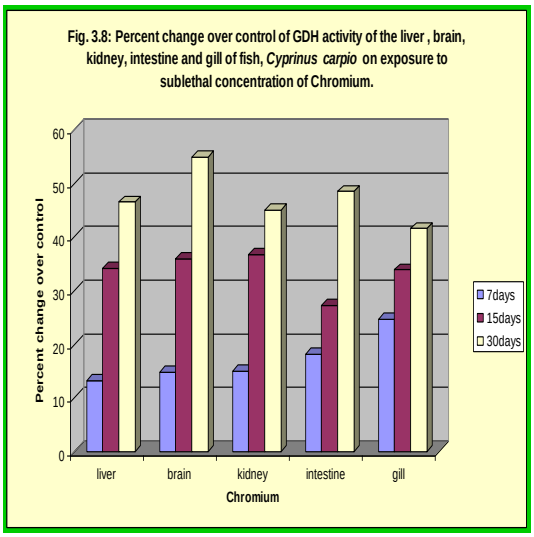

Tissues are damaged due to chemical action, may also elevate the levels of amino acids. Amino acids may not only act as precursors for the synthesis of essential proteins, but also contribute towards gluconeogenisis, glycogenisis and keto acid synthesis [13]. Several authors reported increased free amino acid levels in *Tilapia mossambica* and *Cyprinus carpio* [11].

Increase in the activities of AlAT and AST were observed in the serum of *Oreochromis niloticus* exposed to zinc, cadmium and both [7]. Treatment of *Tilapia zilli* with aluminum resulted in a significant increase in the activities of plasma AST and AlAT. AST and AlAT were increased in gill and kidney of fresh water fish, C*yprinus carpio* exposed to nickel [17].

AST and AlAT activities were significantly increased in the muscle of fingerlings of *Labeo rohita* due to the exposure of tannery and distillery effluents [6]. The increased activity of AST and AlAT suggests increased proteolysis. The tissue proteolysis was previously reported for different fish species subjected to pollution [1, 4, 9] Liver is the metabolic centre for detoxification of chemicals. Liver damage was confirmed by changes in the activities of AST and AlAT.It has been shown that the liver is the prime location for removing xenobiotics and biocides in fishes [14].

Effects of heavy metals especially chromium on biochemical parameters of animals are scanty and restricted to fishes. Buhler *et al.,* [5] observed tissue accumulation and enzymatic effect of hexavalent chromium in fish, *Salmo gaideneri.* Biochemical effects of long term exposure to chromium on rainbow trout, *Salmo gairdeneri* is documented [2].

Enrichment of chromium within aquatic organisms and its transfer through the food chain constitute their danger to human beings. Chromium is an essential function in the regulation of metabolism of the crab [15] although it is toxic at higher concentrations [19], while studying the effects of trivalent and hexavalent chromium on the tissues of fish, *Anabas scandens* observed that liver and kidney glycogen contents were depleted in both form of chromium. Metz and Baetier *et al .,* [3, 12] are of the opinion that the hexavalent chromium has

a greater ability to penetrate cell membranes, may be due to this reason there is continuous decrease in the proteins , which form structural elements of body cells.

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