Impact of Chromium on Glycogen in different types of muscles of a fresh water fish, Labeorohita

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ABSTRACT
Chromium is considered as a heavy metal, pollutant and as well as essential micro nutrient. Glycogen is a major fuel for aerobic metabolism and place an important role in osmo regulation. The present investigation was carried out to study the effect of chromium on glycogen in selected muscle tissues of a fresh water fish, Labeorohita. The alterations in glycogen activity on exposure to sub lethal concentration (1/10 of LC50, 96hrs) of chromium for 7 days and 30 days was investigated in the present study. In the present investigation cardiac muscle is found to have higher glycogen content compared to the rest of the tissues and the sequence is as follows CM > CR > PR > PP > CW.

Introduction:-
The aquatic environment is facing major pollution problems due to inorganic and organic chemicals released from industries and household water. Among the environmental pollutants, many metals plays major role due to their potential toxic effect and ability to bio-accumulate in aquatic eco systems. Heavy metals including both essential and non-essential elements have a particular significance in ecotoxicology. Since they are highly persistent and all have the potential to be toxic to living organism (Adenyi and Yusuf, 2007).

The heavy metals accumulate in various tissues in significant amounts which become highly toxic and dangerous to fish. Among pollutants, metals are of special concern because of their diversified effects and the range of concentrations that could cause toxic ill effects to fish (Rant et al., 2009). Heavy metals are able to disturb the integrity of physiological and biochemical mechanisms in fish that are not only an important ecosystem component but also used as food source (Basha and Rani, 2003).

Chromium is an essential element for organism such as Cu, Zn and Fe and acts as an insulin cofactor in animals. It is used widely in various metallurgy and chemical industries such as metal and electrode plating, leather tannery.

The increase of chromium concentration in aquatic environments results in accumulation in organisms which then transferred to higher trophic levels through the food chain (Langard and Norseth, 1979; Abbas and Ali, 2007). Chromium is commonly found in surface waters (Farag, et al., 2006) in small quantities, which is considered as most determinant toxicant to fish. Fishes are very good biosensors of aquatic contaminants and as bio-indicator species respond with great sensitivity to changes in the aquatic environment.

Material & Methods:-
Labeorohita is a fresh water major carp commonly found in AP. Labeorohita ranging in weighing from 15± 2 gms and length of 10 ± 2 cm were procured from local pond and transported to the laboratory, treated with 0.05 % KMnO4 solution for 2 min to avoid dermal infection. Fishes were kept in large cement tanks and supplied with clean de-chlorinated tap water and acclimated for about two weeks prior to the experiment under natural photo period with constant aeration. During this period the fish were fed with commercial fish feed twice a day. Analytical grade chromium as Potassium dichromate supplied by BDH was used as a metal toxicant throughout the experiment.

Fish divided into three groups containing 10 fishes each with the I group serving as control without any treatment. The group II, III fish were exposed to sublethal concentration (1/10th of LC50, 96 hours, 10 ppm) of Potassium dichromate for 7 days and 30 days after determining LC50 values (Finney, 1964). At the end of the each exposure period fishes were sacrificed and the muscle tissues like Pectoral pink, Pectoral red, Cardiac, Caudal white and Caudal red were isolated. Glycogen content was estimated by the method of Carrol et al., 1956.

Results:-
Glycogen is a major polysaccharide and found to have a major role in carbohydrate metabolism and place an important role through glucose and lactic acid. In the present study, cardiac muscle is found to have higher glycogen content compared to the rest of the tissues and the sequence is as follows CM > CR > PR > PP > CW.

Types of Muscles

Discussion:-
The higher content of glycogen in cardiac muscle may be due to rich carbohydrate metabolism. The glycogen content can be attributed to the increase synthesis of glycogen in the fibers or to the glycogen sparing action of fatty acid oxidation with increased fat utilization. Higher amounts of glycogen in cardiac and pectoral red muscle may be due to increased synthesis of glycogen than pink and white muscle. Glycogen serves as major source of energy for muscular work or movement. Low amounts of glycogen in fast muscles produce much of work for sudden burst of activity by anaerobic metabolism (Raynar and Keenan, 1967). Thus caudal white and pectoral pink muscles are highly capable of using glycogen as the fuel, and even may get depleted of their glycogen after prolonged muscular work (Drummond and Black, 1960). Wittenberg (1968) has reported about 1.5 time's higher glycogen content in the red muscle in contrast to the white muscle of carp. The red muscle usually has an adaptation for fat metabolism and contains high glycogen.

The present investigation, depletion of glycogen has been re-
corded in both 7 and 30 days experimental fish (fig1.1). Depletion of glycogen is pronounced in caudal red (-27.79%) followed by, caudal white (-26.09%), cardiac muscle (-16.95%), pectoral pink (-16.04%) and pectoral red (-11.10%) muscles of 7 days exposed fish. The consistent depletion is observed in 30 days exposed fish and it is highly significant in all the tissues.

Pesticide result in either anoxia or hypoxic conditions in surrounding environments (Jayantha Rao and Moorthy, 1983) these conditions normally increase glycogen utilization (Dezwan, 1973) and might have resulted in decrement of glycogen in tissues of fish. Decrease in glycogen was also supported by Upadyay and Shukla(1968) and Yasur et al. (1989) during stress conditions. Decrease in glycogen level in fish due to pesticide effect has been reported (Sambasiva Rao, 1984;Sasthry and Sunitha, 1984; Vijayavel et al., 2006 and Crestani et al, 2005). Tripati et al., (2003) reported decreased glycogen levels in Channa punctatus with an organophosphate, Dimethoate; Chandra mouli (2008) in Heteropneustes fossils exposed to cypermethrin, Shafi (1978) with copper intoxication and Rani et al., (1989) with ammonia toxicity.

Depleted glycogen levels following chromium stress reported in Cyprinus carpio communis (Ambrose et al., 1994; Shalaby et al., 2005) under hypoxic conditions also supports this view. A consistent decrease in tissue glycogen reserves observed in this study suggests impaired glycogenesis. Further, the decline in glycogen might be due partly to its utilization in the formation of glycoproteins and glycolipids, which are essential constituents of various cells and other membranes.

Summary and Conclusion:

The glycogen content is very high in cardiac tissue and then followed by pectoral red and caudal red muscles due to carbohydrate metabolism. Caudal white and pectoral pink muscles showed less amount of glycogen is due to higher glycolytic activity. Depletion of glycogen is observed in both 7 days and 30 days of chromium exposed fish.

REFERENCE