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Research Article

EFFECTS OF ZINC SULPHATE ON THE BIOCHEMICAL CHANGES IN THE FISH *CYPRINUS CARPIO*

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ABSTRACT

The toxicity of the heavy metals are affects the morphometry as well as the biochemical constituents in the aquatic organisms. The present observation was aimed to assess the effect of heavy metals on tissue of *Cyprinus carpio* and the fish was sampled from the fish farm of Tamil Nadu Fisheries Development Corporation Limited, Mettur, Tamil Nadu, India. The vital organs of fishes like gill, liver and kidney were found to be most affected organs due to the toxicity of the heavy metal accumulation like Zinc Sulphate, Copper, Mercury etc., in the present findings exhibits the graduate accumulation of Zinc sulphate in the muscle fiber and gill region predominantly. The severity of the heavy metal toxicity were depicted by the gradual decrement of glucose level in the gill and muscle region of the experimental animals and the toxicity level increased based on the duration of the exposure, concentration of the toxin, age of the fishes and sex of the experimental fishes.

Keywords: Zinc, Sulphate, Muscle, Sub-lethal concentration.

INTRODUCTION

Biochemical alter are altruistic imperative sign on the component of activity of metals on the cell. Metal may interact with cell film (Rothstein, 1971) and with intracellular organelles and Nucleus. The biochemical change is viewed as for the most part as a result of impedance of metals with catalyst framework which thus lead of useful change. Substantial metals include the most broadly disseminated gathering of very lethal and since quite a while ago held substances among the living creatures. Mercury, cadmium and lead are typically considered as the most unsafe toxicants. Zinc and Copper are utilized in horticultural works and known as fundamental components in creature and plants(Singh & Singh, 2005). The substantial metal complex development in amphibian and marine species is most unsafe, noxious to alternate creatures through the sustenance web or natural way of life and made a variety in the basic physiological and biochemical exercises in the creatures (Rothstein, 1971). Change in physiological and biochemical parameters of toxicant regarded angle has as of late developed as critical device for the water quality evaluation of fish culture condition and the neurotic status of fish in the field of ecological toxicology (Radhaiah *et al*., 1987). Radhakrishnan, (1991) detailed the sublethal impacts of substantial metals, for example, mercury, cadmium and lead on some physiological and biochemical parameters of *Channa striatus* and the helpfulness of these parameters in the water quality appraisal in the fish culture condition.

The poisonous impact of zinc and Cadmium identified with mortality, development, conceptive conduct and vertebral harm in phoxinus (Bengtsson *et al*., 1975; Geetha *et al*., 1996) watched the lethal impact of overwhelming metal copper on the fish *Lepidocehalichthys thermalis* in here and now introduction and reasoned that the protein content was most extreme in control fish and least in treated fishes. Subramaniyam *et al*. (2006) the lethality of divalent mercury on liver and muscle glycogen demonstrates consumption in its substance. Palanichamy & Baskaran, (1995) detailed the impact of substantial metals on chosen biochemical and physiological reactions of the fish *Channa striatus* and watched the protein content in muscle and liver diminished. Khan *et al*. (2001) considered the lethal impact of cadmium chloride in glycogen level of

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marine eatable grastropod and watched an expanded glycogen level.

Chandravathy & Reddy (1994) examined the harmful impacts of lead nitrate at sublethal fixation on specific parts of protein digestion in gill and cerebrum of the new water angle *Anabas scandens* and watched diminished proteins and free amino acids levels and the compound exercises were discovered increase. Thatheyus *et al*. (1992) chipped away at the impact of nickel on protein content in the different tissues of normal carp of ceaseless introduction and uncovered a decrease in protein substance of gill and muscle. Murthy *et al*. (1994) examined the versatile changes in hepatic lipid digestion created by the fish with a specific end goal to maintain in the fermented condition and saw there is an extensive exhaustion in different lipid holds like aggregate lipids, triglycerides, free unsaturated fats, and glycerols and expanded levels of phospholipids and cholesterol substance in the tissues. The impact of copper and zinc in gills of *Channa marculis* was contemplated by (Prasad & Singh, 2003) and a few changes were seen in the structure of gill of fish presented to both deadly and sulethal groupings of both copper sulfate and zinc sulfate appears to cause by bothering and assimilation of the poisons.

Among substantial metals, zinc is utilized in different structures which in the long run discover its way into the waterway or ocean. Over the top zinc enters the earth because of human exercises, for example, mining, cleaning of zinc, lead and cadmium minerals, consuming of coal and consuming of waste. Albeit, little amounts of zinc are required for the typical improvement and digestion (Shukla *et al*., 2002) however on the off chance that its level surpasses the physiological prerequisites, it can go about as a toxicant. These outcomes when all is said in done enfeeblement, hindrance of development and may realize metabolic and neurotic changes in different organs in angles (Singh & Gaur, 1997). With the above facts the present study has been move forward to observe the toxic effects of zinc sulphate on a freshwater edible fish, *Cyprinus carpio*.

MATERIALS AND METHODS

The fresh water common carp (*Cyprinus carpio* L.) of (9-15) cm length and 45.50 ± 0.30 g body weight) were collected from the fish farm of Tamil Nadu Fisheries Development Corporation Limited, Mettur, Tamil Nadu, India and brought in plastic buckets without any mechanical injury and kept in aquaria for seven days to get acclimatized to the laboratory conditions. The fish were kept in batches of 20-25 individuals with a photoperiod of 12:12 h light and dark cycle with constant filtration. All the fish were fed with commercially available fish feeds at a daily rate of 3-4% body weight throughout the experiment. Analytical grade Zinc sulphate supplied by BDH (India) was used as metal toxicant throughout the experiments.

Fish were divided into two groups, with the first group serving as control and other as experimental group. The experimental group was exposed to a sub lethal concentration of 50 ppm of combined zinc sulphate metal solution for a period of 32 days. The heavy metal concentrations were selected based on preliminary results, shown to be sublethal after a 32 day period of exposure. At the end of exposure period, the control and experimental fish were starved for 24 hrs, 48 hrs and 72 hrs for analyzing the biochemical assays such as glucose by glucose oxidase method (Bergmeyer, 1974), total cholesterol by the method of (Allain *et al*., 1974) were determined and finally protein were determined by Lowry *et al*., (1951) Data reported in the paper are means of two or more assays. All measurements were performed in triplicate and the results were expressed as mean ± S.D. The comparison of the control and experimental groups was statistically analyzed

RESULTS AND DISCUSSION

The present study was observed that the effect of zinc sulphate (50 ppm concentration) on biochemical changes in muscle and gills of *Cyprinus carpio* at 24 hrs interval such as 24 hrs, 48 hrs and 72 hrs with two groups viz., Control (CT) and experimental group (Ex). The experimental studies with heavy metals on fish and quantify the accumulation of heavy metal in different edible tissues of fishes and to observe the histochemical, histopathological, biochemical and enzymological changes (Gautam & Thakur, 2003). The length and body weight of control and experimental groups are tabulated (Table 1) and showed the length- weight of control group was 12.54 cm; weight 32.66 g respectively, at the same time as the length and weight of experimental group was 12.29 cm; 36.28 g.

Table 1. The length and weight of control and experimental group

Control group		Experimental Group	
Length (cm)	Weight (g)	Length (cm)	Weight (g)
12.54 ± 0.25	32.66 ± 1.23	12.29 ± 0.35	36.28 ± 0.98

Impacts of deadly and sublethal convergence of copper on glycolysis in liver and muscle of the freshwater teleost *Labeo rohita* (Hamilton) was contemplated (Gautam & Thakur, 2003). Similarly, Sornaraj *et al*.,(1995) contemplated the impact of overwhelming metals on biochemical reactions of the freshwater air-breathing fish *Channa punctuatus* and watched the protein content in muscle and liver of fish expanded upto 6 hrs presentation and the glycogen content likewise diminished upto 24 hrs introduction. The lipid substance of muscle and liver of *Channa punctuatus* expanded upto 3 hrs introduction and diminished. Some biochemical changes instigated by inorganic mercury on the blood, liver and muscles of freshwater Chinese grass carp, *Ctenopharyngodes idella* (Shakoori *et al*., 1994) and watched an expansion in glucose an a diminished level of proteins and cholesterol combination was restrained essentially all through the test time frame. Inoue (1976) revealed the reduction of hepatic cholesterol biosynthesis less than 50-100 ppm of Hg.

(Shaffi, 1981) has likewise detailed lifted glycogen in liver and muscle after mercury treatment. Figure 1- 3 showed the level of muscle glucose, protein and cholesterol level of control and experimental *Cyprinus carpio*. The level of muscle glucose (mg/100 mg) was reported to be in the range of 34.88 ± 0.82 to 38.46 ± 0.76 in control group and 22.46 ± 0.92 to 34.00 ± 0.50 in Experimental group (Figure 1). Similarly the muscle protein (mg/100mg) was reported to be in the range of 141.64 ± 0.52 to 143.18 ± 0.74 in control group and 119.10 ± 0.89 to 137.40 ± 0.40 in Experimental group (Figure 2); level of muscle Cholesterol (mg/100mg) was reported to be in the range of 28.38 ± 0.40 to 29.30 ± 0.29 in control group and 11.28 ± 0.50 to 18.44 ± 0.37 in Experimental group (Figure 3). Heavy metals

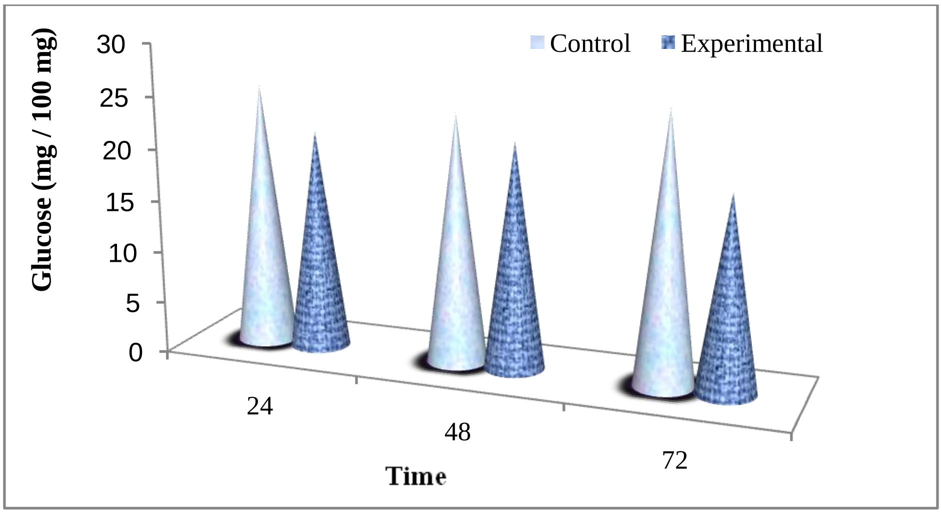

Figure 1. Muscle glucose level of fish *Cyprinus carpio* exposed to sublethal concentration of zinc sulphate (50 ppm) for 3 days at 24 hrs intervals.

such as cadmium, chromium, Nickel and lead might adjust the properties of hemoglobin by diminishing their proclivity towards oxygen restricting limit rendering the erythrocytes more delicate and porous, which likely outcomes in cell swelling distortion and harm (Elaiyaraja *et al*., 2012; Witeska & Kosciuk, 2003). It was proved that cadmium impacts the differential blood check and biochemical changes (Gill & Epple, 1993). Overwhelming metals instigated a huge lessening in the biochemical level of the common carp amid the introduction time of 24, 48 and 72 hrs. The present works that revealed a critical abatement the biochemical characters and hematological changes of new water angle presented to overwhelming metals (Shalaby, 2001; Vutukuru, 2005) and also the heavy metal accumulation are affect species diversity in freshwater and also marine ecosystem (Elaiyaraja *et al*., 2013).

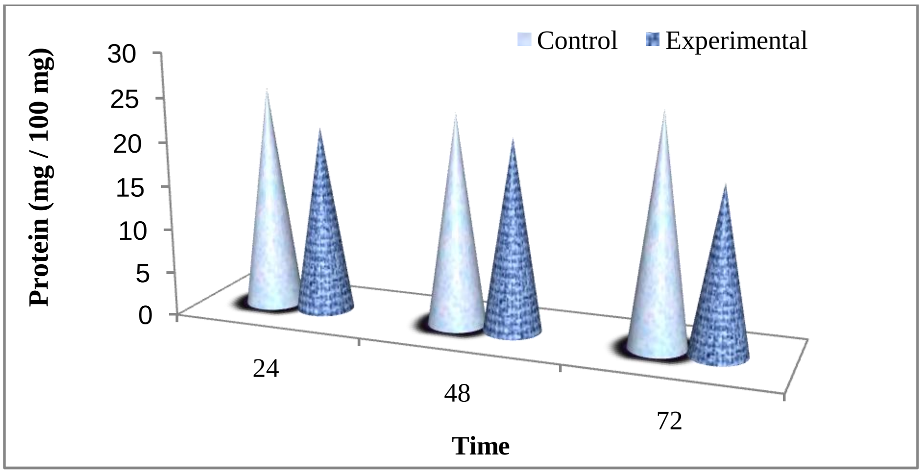

Figure 2. Muscle Protein level of fish *Cyprinus carpio* exposed to sublethal concentration of zinc sulphate (50 ppm) for 3 days at 24 hrs intervals.

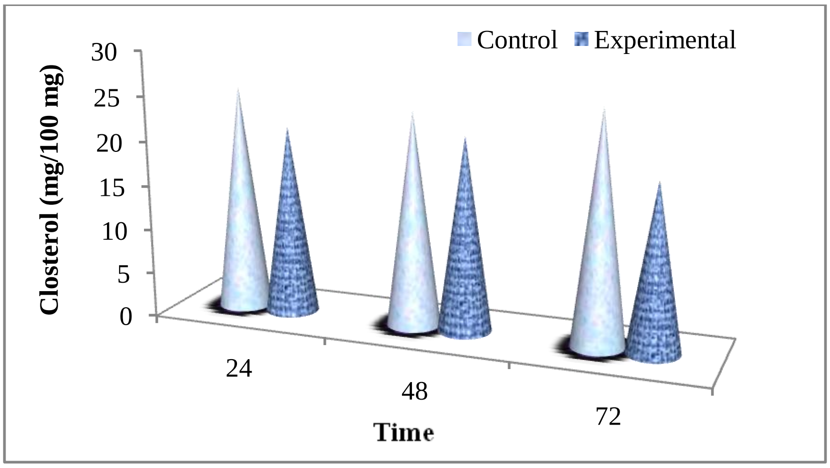

Figure 3. Muscle Cholesterol level of fish *Cyprinus carpio* exposed to sublethal concentration of zinc sulphate (50 ppm) for 3 days at 24 hrs intervals.

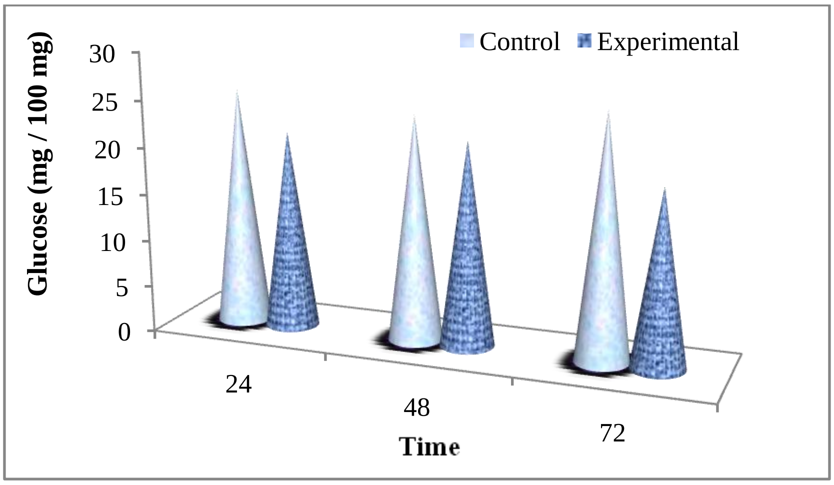

Figure 4. Gill Glucose level of fish *Cyprinus carpio* exposed to sublethal concentration of zinc sulphate (50 ppm) for 3 days at 24 hrs intervals.

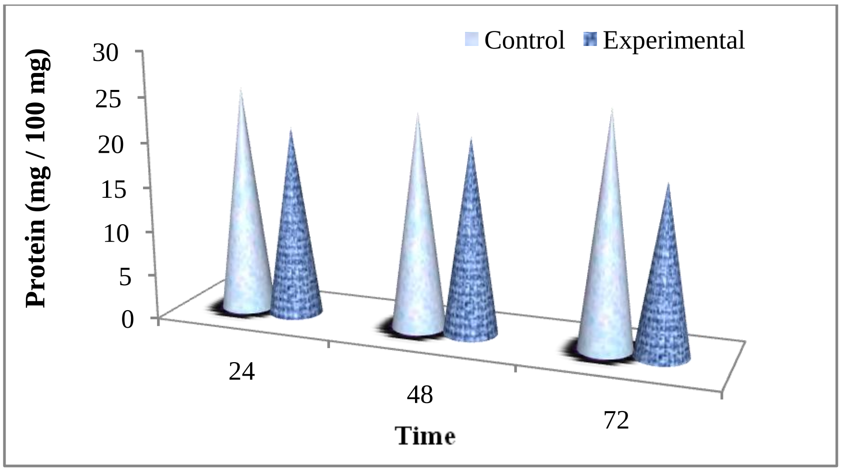

Figure 5. Gill protein level of fish *Cyprinus carpio* exposed to sublethal concentration of zinc sulphate (50 ppm) for 3 days at 24 hrs intervals.

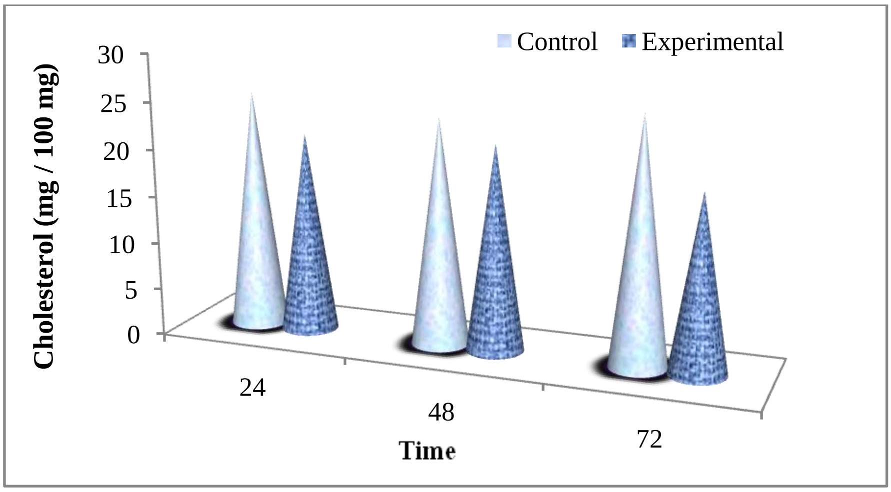

Figure 6. Gill Cholesterol level of fish *Cyprinus carpio* exposed to sublethal concentration of zinc sulphate (50 ppm) for 3 days at 24 hrs intervals.

The level of gill glucose, protein and Cholesterol (mg/100 mg) level of control group were in the range of 41.50±0.25 to 41.86 ± 0.64; 125.54 ± 0.49 to 127.04 ± 0.49 and 54.02 ± 0.55 to 25.88 ± 0.59 respectively (Figure 4, 5 and 6). Similarly, the level of gill glucose, protein and Cholesterol (mg/100 mg) level of Experimental group were in the range of 41.50 ± 0.25 to 41.86 ± 0.64; 125.54 ± 0.49 to 127.04 ± 0.49 and 54.02 ± 0.55 to 25.88 ± 0.59 respectively (Figure 4, 5 and 6). All the values were statistically significant at $p < 0.001$. While, (Gupta & Sharma, 1994) revealed the bioaccumulation of Zinc in *Cirrhinus mrigala* (Hamilton) fingerlings amid here and now static bioassay. The aggregation of zinc in freshwater and marine fishes have been all around contemplated in the west (Sprague, 1969). Also, the aggregation and maintenance of zinc were examined in chosen tissue of the fingerlings of Indian significant carp *Cirrhinus mrigala* amid the time of 96 hrs in and typical freshwater. All the above observations by several authors supports the present investigation which showed a decreased lipid content in a fish *Cyprinus carpio* var. communes, exposed to zinc sulphate, which indicates that the tissue lipids might have been utilized in the energy metabolism to overcome the physiological stress.

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