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RESEARCH ARTICLE

EFFECT OF ZINC SULPHATE ON THE BIOCHEMICAL CONSTITUENTS IN THE MUSCLE OF *POECILIA SPHENOPS*

Kamakshi, G. and *Sumithra Bai, A. M.

Department of Zoology, Ethiraj College for Women, Chennai-600 008, Tamilnadu, India

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ABSTRACT

Ornamentantal fish culture is an important small scale industry of any country which depends on the fresh water available at that area. Dumping of organic and inorganic waste into the ecosystem affects the water bodies and the ground water extensively to a considerable level. This study outlines the effect of zinc sulphate on the muscle biochemical constituents of *Poecilia sphenops* resulting in weight loss. Results are discussed with the available literature.

INTRODUCTION

The tremendous increase in the use of heavy metals over the past few decades has resulted in an increased flux of metallic substances in the aquatic environment (Yang and Rose, 2003). The metals are of special concern because of their toxic effect on the aquatic life forms. Industrial wastes constitute the major source of metal pollution in the natural water (Livingstone, 2001). Aquatic systems are exposed to a number of metal pollutants that are mainly released from industrial sewage treatment plants and drainage from urban and agricultural areas. These pollutants cause serious damage to aquatic life (Karbassi *et al*., 2006). Heavy metal contamination in the aquatic environment exerts an extra stress in fishes which tend to accumulate the heavy metals in their tissues and organs (Jarup, 2003). Zinc sulphate is a heavy metal ion exhibiting toxicity through the formation of co ordination complexes in the animal cells (Lugauskas *et al*., 2005). Low concentration of zinc sulphate induces a chronic stress which may not kill the individual fish but affects its size and body weight. The present study is to trace the effect of zinc sulphate on the biochemical constituents of an ornamental fish, *Poecilia sphenops* (Black molly) with reference to its muscle.

MATERIALS AND METHODS

Healthy specimens of *Poecilia sphenops* (Black molly), an ornamental fish ranging in size from 2.5 to 5.5 cms were purchased from a local aquarium. They were brought to the laboratory in polythene bags with oxygenated water. They were maintained in a glass aquarium of 50x24x30 cm size containing 20 litres of dechlorinated tap water for 7 days. During accilmatization, the fishes were fed on alternate days with fish meal (Taiyo).

Experimental design

Fishes were segregated into three groups of five each. First group served as the control while the second and third were experimental groups. Two sublethal concentrations of zinc sulphate were used in the present investigation. The experimental period for the second group was 7 days and for the third group, it was 14 days. Care was taken to maintain the fishes and dead animals, if any were removed to avoid contamination. Both the control and experimental animals were fed with regular fish meal.

Estimation of body weight of fishes

The effect of zinc sulphate on the body weight of fishes was determined.

Estimation of total protein, glycogen and lipid content

The protein content of the muscle was determined according to Lowry *et al*. (1951), glycogen by the method of Roe (1955) and lipid according to Bligh and Dyer (1959) in 100mg wet tissue.

***Corresponding author: Sumithra Bai, A. M.**
Department of Zoology, Ethiraj College for Women, Chennai-600 008, Tamilnadu, India.

RESULTS AND DISSCUSSION

Effect of sub lethal concentrations of zinc sulphate on the body weight of *Poecilia sphenops* recorded decline. Along with the increase in the zinc sulphate exposure period, body weight of *Poecilia sphenops* also decreased (Table 1). The muscle protein content declined with an increase in the zinc sulphate concentration and exposure period (Table 1).

Table 1. Effect of zinc sulphate on the body weight and the biochemical constituents of *Poecilia sphenops* muscle

S.No	Sample	Body weight in grams	Protein*	Glycogen*	Lipid*
1	Control	16.2	6.25	0.105	28
2	Experiment I	15.5	4.5	0.058	26
3	Experiment II	15	2.4	0.035	24

Values expressed in mg/100mg wet tissue.
All the values are the mean of 5 experimental fishes.

Similar results were noted in *Colisa fasciatus exposed to zinc sulphate* (Tripathy *et al*., 2012), *Cyprinus carpio* exposed to heavy metals (Gopal *et al*., 1997) and to zinc (Abdel Tawwab *et al*., 2013), *Channa punctatus* exposed to heavy metals (Jana and Bandyopadhya, 1987) and to zinc (Malik *et al*., 2006), *Notopterus notopterus* exposed to cadmium and mercury chloride (Sindha *et al*., 2002) and *Tilapia zilli* exposed to zinc (Hilmy *et al*., 1987). This decline in protein may be due to the metabolic utilization of keto acids by gluconeogenesis pathway for the maintainence of ionic and osmoregulation (Schmidt Nielson, 1975). It may also be due to the production of heat shock proteins or destructive free radicals or could also be a part of heavy metal induced apoptosis. Similar to the proteins, the muscle glycogen of *Poecilia sphenops* also reduced significantly when they were exposed to the sublethal concentrations of zinc sulphate for seven and fourteen days (Table 1).

Carbohydrates are stored as glycogen in the muscle tissues in order to supply the energy needs when there are hypoxic conditions, intensive stocking and lack of food (Wenderlaar Bonga, 1997). The muscle glycogen decline due to zinc sulphate exposure may be due to the inhibition of hormones involved in glycogen synthesis. It may also be due to the rapid utilization of glycogen to meet the respiratory stress during the experimental exposure period. Similar results were noted in *Colisa fasciatus* exposed to zinc sulphate (Tripathy *et al*., 2012), *Heteropneustes fossilis* exposed to cadmium (Sastry and Subhadra, 1982), *Cyprinus carpio* (common carp) exposed to chromium (Vinodhini and Narayanan, 2008) and to zinc (Abdel Tawwab *et al*., 2013), *Tilapia zilli* exposed to zinc (Hilmy *et al*., 1987) and *Channa punctatus* exposed to zinc (Malik *et al*., 1988).

The present study records decline in the muscle lipid along with the protein and glycogen of *Poecilia sphenops* exposed to the sublethal concentration of zinc sulphate in the muscle tissue (Table 1). Similar observations were made in the fish *Notopterus notopterus* exposed to cadmium chloride (Sindha *et al*., 2002), *Puntius ticto* (Hamilton) exposed to dimethoate (Ganeshwade, 2011), *Tilapia mossambica* exposed to monocrotophos (Remia *et al.,* 2008), *Cyprinus carpio* (common carp) exposed to zinc (Abdel tawwab *et al*., 2013) and *Channa punctatus* exposed to zinc (Malik *et al*., 2006) which were attributed to the inhibition of lipid biosynthesis in these fishes under stress.

Prolonged environmental stress to organisms makes adaptation difficult changing their metabolic efficiency. Presence of toxicants even in their sublethal concentrations as evidenced from this study affects the aquatic system and their inhabitance to a significant level. This emphasises the need to protect ecosystems free from pollution.

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