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Impact of cypermethrin on the serum biochemical composition of freshwater cat fish *Mystus vittatus*

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Abstract

The present investigation has been designed to study the impact of sublethal concentration (0.015 mg/L) of cypermethrin on the serum metabolites of *Mystus vittatus* after exposure to 96 hours. The present study shows that serum metabolites such as glucose and protein were significantly decreased while free amino acid and lipid were significantly increased. Thus, this paper gives an overview of the manipulation of fish, *Mystus vittatus* as a biomarker of pesticide pollution through alternation in serum biochemical parameters.

Keywords: Cypermethrin, metabolites, *Mystus vittatus*

1. Introduction

Pesticides are the biological toxicants, which are being used by the man to kill the pests for increasing the yield of many crops and insect vectors to control the spread of disease. The use of pesticides has caused severe environmental and health hazards to organisms including human beings (Srivastava *et al.*, 2012) [9]. The use of pesticides has caused severe environmental and health hazards to organisms including human beings (Prakash and Verma, 2014) [7].

Most of the insecticides are hydrophobic that they can be easily absorbed by soil particles and can migrate to natural water systems such as rivers, lakes and ponds through the run-off causing aquatic pollution. Consequently these xenobiotic molecules have been found in natural systems and they have a great impact on the environmental quality as they result in a toxicity risk to non-target organisms especially fishes. They can enter the food chain when they become accumulated in aquatic organisms (Prasad *et al.*, 2002) [8]. Cypermethrin is a synthetic pyrethroid used for the control of ectoparasites which infest cattle, sheep, poultry and some companion animals. Presently, the cypermethrin has been widely used as a chemotherapeutic agent for the control of ectoparasite infestations in marine cage culture and freshwater aquaculture (Monir *et al.*, 2015) [6]. It is highly toxic to fish because of their slow metabolism and delayed elimination of these compounds (Bradbury and Coats, 1989) [2]. Hence, this investigation is aimed to find out the biochemical alterations, if any, in cypermethrin exposed *Mystus vittatus* to sublethal concentration for short duration.

2. Materials and Methods

Freshwater cat fish, *Mystus vittatus* (average length 7.0-8.0 cm and average weight 6.0-6.5 gm) was collected from local freshwater bodies and dip in 0.1% of potassium permanganate solution for 2 minute. The fishes were acclimatized in laboratory conditions for 7 days. During acclimatization the fishes were fed with commercial feed. The feeding of fishes were stopped before experiment. The 96 hr LC₅₀ of cypermethrin was 0.044 mg/L (calculated by probit method of Finney, 1971). Based on 96 LC, fishes were exposed to sublethal concentration (0.015 mg/L) for the period of 86 hours. A control group was maintained in an identical environment. The fishes were fed with commercial food and the medium was changed daily to remove faeces and food remnants. Blood samples of these fishes were collected from caudal vein in the glass tubes and centrifuged at 3500 rpm for 10 minutes. The serum metabolites such as glucose, protein and lipid. by Mendel *et al.* (1954) [5], Lawery's method as described by David (1992) [3] and Barnes and Blackstock (1973) [1] method, respectively.

3. Results and Discussion

Alterations in the serum biochemical parameters often reflect physiological state of fish.

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Result of the quantitative estimation of serum metabolites such as glucose, total protein, and triglycerides in the control and Cypermethrin exposed freshwater cat fish, *Mystus vittatus*, are presented in Table 1.

The serum glucose levels were significantly decreased in Cypermethrin exposed fish, *Mystus vittatus* as compared to

control groups (Table1). The fall in the glucose content (hypoglycemia) in the serum indicate its rapid utilization by the fish as a consequence of metabolic toxic stress. Similar decrease in serum glucose level has also been reported by Singh *et al.* (2010) in phorate induced *Channa punctatus*.

Table 1: Effects of sublethal concentrations of Cypermethrin (0.015 mg/l) on serum metabolites of *Mystus vittatus* at different period of exposure (N=8).

Serum Biochemical Parameters	Group	Exposure periods in hours		
		48	72	96
Glucose (mg/dl)	Control	115.0±1.12	111.0±1.08	112.5±1.26
	Exposed	91.5±0.82	82.5±0.62*	74.5±0.48**
Total Protein (mg/dl)	Control	2.97±0.63	2.82±0.48	2.79±0.64
	Exposed	2.02±0.61*	1.79±0.73**	1.68±0.55**
Total Lipid (mg/dl)	Control	85.12±1.11	86.38±1.13	87.03±0.71
	Exposed	105.2±0.53	137.2±0.83*	156.8±0.17**

*Significant at $P < 0.05$; ** significant at $P < 0.01$.

Proteins are highly sensitive to pesticides and one of the earliest indicators of its toxicity. In the present study significant decline in the serum proteins contents was observed in Cypermethrin exposed fish, *Mystus vittatus* as compared to control groups (Table1). Similar decrease in serum protein level has also been reported by Devi (1982) [4] in endosulfan exposed *Channa punctatus*. This hypoproteinemia in the present study can be attributed to the enhanced proteolysis.

Lipid represent the major energy reserve in the fish. In the present study serum lipid undergo significant increase in cypermethrin exposed fish, *Mystus vittatus* when compared to control (Table 1). The increase in serum lipid level may be reduction in lipolysis rate that ultimately elevate the triglyceride level in blood. Similar increase in serum triglyceride level has also been reported by Devi (1982) [4] in endosulfan exposed *Channa punctatus*. Thus, it seems that reduced rate of lipolysis ultimately results in the elevated serum triglycerides levels. Thus it can be concluded that aquatic pollutant induced an energy crisis and altered carbohydrate, protein and lipid metabolism by exerting their manifestation in fishes that are important in their physiological activities, survival, growth and reproduction. Thus monitoring of serum metabolic like glucose, protein and lipid can be useful as a diagnostic tool in fish toxicology to identify their general health status and target organs affected by toxicant.

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