

Toxicity Of Cypermethrin On The Serum Enzymes In The Freshwater Fish *Cyprinus Carpio* (LINN.)

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Abstract

By static bioassays, the LC₅₀ 96 hr value of cypermethrin to the freshwater fish *C.carpio* was determined (2.0 ppm). After rearing groups of fishes in sublethal concentration (0.2 ppm) of the pesticide for 30 days, the blood was collected from the fishes for the estimation of enzymes like alanine aminotransferases (ALT), aspartate aminotransferase (AST) and alkaline phosphatase (ALP). In pesticide – treated fishes, these enzymes were found to increase in the blood indication of abnormal protein – carbohydrate metabolism and dysfunction of liver kidney and muscle.

Key words: cypermethrin, *Cyprinus.carpio*, Alanine aminotransferases (ALT), Aminotransferase (AST), Alkaline phosphatase (ALP).

Introduction

The indiscriminate use of pesticides has been increased throughout the world, especially in developing countries. Kavi Karunya and Saranraj (2014) have reported that the pesticides are carried to water bodies where they alter the nature of water even though they are used in restricted ways. The increased flux of pesticides into the aquatic environments would undoubtedly affect the non – target organisms. The pesticides are shown to produce many physiological and biochemical changes in aquatic organisms (Janarthana Reddy 2013). In recent times, the synthetic pyrethroid namely cyperthrin represents nearly 30 % world insecticide consumption replacing many earlier pesticide compounds.

The fishes are commonly found in most of the aquatic environments where they play major role in food webs. The changes caused by toxic pollutants in metabolic processes necessitate to study the alterations in various tissues of affected organisms. In animals, the nature of blood reflects the vital processes of the body and the variations of which can be used to identify the impact of environmental pollutions.

In organisms, the enzymes are responsible for normal cellular metabolism so that they are sensitive biochemical indicators of toxic effects in fishes (Mahdi Banaee 2013).

The present investigation has been carried out to find the harmful effects of cypermethrin on serum enzymes such as alanine aminotransferases (ALT), aspartate aminotransferase (AST) and alkaline phosphatase (ALP) in freshwater fish *Cyprinus carpio*.

Materials and methods

By using static bioassays, the LC₅₀ 96 hr value of cypermethrin to *C. carpio* was determined. Then the fishes in groups (10 individuals) were reared in the sublethal concentration of the pesticide (0.2 ppm) for 28 days. Appropriate controls were also maintained. The pesticide concentration was prepared by using dechlorinated tap water. In the test water, variables such as temperature ($30 \pm 1^\circ \text{C}$), pH (7.1 – 7.9), salinity (0.4 -0.7 ppm) and DO (5.5 – 6.2 mg/l) were conditioned. The experimental fishes were given artificial fish meal daily. The test solutions were changed daily with respective concentrations of cypermethrin. On day 4, 7, 14, 21 and 28, the blood from the fishes were collected by cardiac puncture for the estimation of the activity levels of enzymes.

The level of ALT was assessed by the method of King and Armstrong (1934), the AST by the method given by Reitman and Frankel (1957) and ALP by adapting the method described by Bessey *et al.* (1946)

Results and Discussion

In the present investigation, ALT, AST and ALP are found to increase in the blood of *C. carpio* on exposure to cypermethrin in duration – dependent manner. The percent increase of ALT is between 17.27 and 161.14, AST is between 19.66 and 68.73 and ALP is between 14.16 and 75.08 (Table 1.). As reported by Palas Samanta *et al.*, 2014, the elevated activity of transaminases in *C. carpio* indicate an increased transaminases process for the production of energy via TCA cycle to meet the energy demand under the stress caused by the pesticide. The increased aminotransferase levels, to cause liver disease or liver injury is shown by Ayse Er and Burak Dik (2014), damage in plasma membrane, liver or tissue damage by (Vuturu *et al* 2014 and Aruljothi 2013). In agreement with the work of Schwetha *et al.* (2012), the increased ALP activity in the present experimental fishes is indicative of liver impairment, kidney damage and bone diseases under cypermethrin toxicity. It is also shown that the metabolic deformities such as damaged liver, alterations in permeability of cell membrane and increased synthesis or decreased catabolism of aminotransferases could increase ALP activity in fishes under the stress caused by the pesticides (Kotb *et al* 2013).

Thus the present study evidences that the blood reflects changes in the activity levels of transaminases and alkaline phosphate in the form of abnormal protein – carbohydrate metabolism as well as liver, kidney and tissue damage in *C. carpio* when reared in sublethal concentration of cypermethrin. Therefore, the analysis of serum

enzymes in fishes under environmental stress would help to identify clinical diagnosis of a number of physiological processes.

Table 1. Cypermethr intoxicity on activity levels of serum enzymes in *C. carpio* (Each value is \pm SD of 5 observations)

Days of exposure	Enzyme activity		
	ALT (IU/l)	AST (IU/l)	ALP (IU/l)
Control	18.53 \pm 0.24	20.31 \pm 0.40	81.33 \pm 1.36
4	21.73 \pm 0.36 (+17.27) r = 0.901	25.28 \pm 0.53 (+19.66) r = 0.904	92.85 \pm 2.01 NS (+14.16) r = 0.904
7	27.09 \pm 0.71 (+46.20) r = 0.905	28.54 \pm 0.92 (+40.52) r = 0.912	103.44 \pm 2.98 (+27.19) r = 0.905
14	34.82 \pm 0.89 (+87.91) r = 0.905	31.66 \pm 1.06 (+55.88) r = 0.910	126.76 \pm 3.36 (+55.86) r = 0.998
21	39.26 \pm 0.99 (+111.87) r = 0.999	33.20 \pm 1.25 (+63.47) r = 0.908	138.23 \pm 3.65 (+69.96) r = 0.995
28	48.39 \pm 1.50 (+161.14) r = 0.901	34.27 \pm 1.68 (68.73) r = 0.907	142.39 \pm 3.89 (+75.08) r = 0.905

All values are significant at $P < 0.05$ (r = Correlation Coefficient ; + indicated percent increase over control)

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