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Research Article

Effect of Cypermethrin on Enzymes in Muscles of *Channa punctatus*

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Abstract: In the present study, biochemical data has been generated and tested with statistical software. This will highlight the pollutional effects of commonly used pesticides. These pesticides harm the fish health and these fishes finally eaten by human beings and they may get affected by pesticide toxicity. If we assess the harmful effects of pesticide on fish health, we can postulate the harms may be caused in human beings. With this point of view, the effect of cypermethrin is analysed on enzymes using muscle tissue sample of fish *Channa punctatus*.

Keywords: Pesticide, Pyrethroid, SGOT, SGPT, ALP.

1. Introduction

The present time is modern and technological time where every problem will be solved on the basis of manmade equipment, techniques, chemicals etc. Challenge to our crops, stored food products, human health are considered very sensitive issues and have been resolved very quickly through synthetic chemicals, commonly known as pesticides. As the scientific progress in the field of pesticides, many new products with specific properties came out and excessively used in and around society. Primary and follow-on studies are conducted by companies who were least bother about its aftereffects and fate in environment. All these chemicals with other type of pollutants will definitely flow in deep water i.e. ponds and river. Most of our fish culture is based on ponds and river. So that the fish health is of quite important for us.

Fisheries and aquatic resources (ponds, lakes, rivers, streams, and oceans) are exceptionally valuable natural assets. More indirect, but equally valuable, benefits of fish and aquatic ecosystems include recreational boating, sports fishing, swimming, relaxation and natural beauty. Appreciation of fisheries and aquatic systems has been accompanied by increasing concern about the effects of growing human populations and human activity on aquatic life and water quality. Pesticides are one group of toxic compounds linked to human use that have a profound effect on aquatic life and water quality. When pesticides enter aquatic systems, the environmental costs can be high. Unintentional pesticide-related fish kills occur throughout the world. Some of these kills have been large, involving thousands of fishes, as well as frogs, turtles, mussels, water birds and other wildlife. Fish and other wildlife species, including rare and endangered ones like the peregrine falcon, bald eagle, and osprey, have been victims of pesticide poisoning. Pesticide use is one of many factors contributing to the decline of fish and other aquatic species.

Fish and aquatic animals are exposed to pesticides in three primary ways:

(1) Dermally, direct absorption through the skin by swimming in pesticide-contaminated waters,
(2) Breathing, by direct uptake of pesticides through the gills during respiration, and
(3) Orally, by drinking pesticide-contaminated water or feeding on pesticide-contaminated prey.

Poisoning by consuming another animal that has been poisoned by a pesticide is termed "secondary poisoning." For example, fish feeding on dying insects poisoned by insecticides may themselves be killed if the insects they consume contain large quantities of pesticides or their toxic byproducts.

2. Material and Methods

2.1 Collection of material and treatments for laboratory experiments

The live specimen of *Channa punctatus* commonly known as “soli” were brought for the present study from ponds in surrounding vicinity of Agra and fish

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market of Agra. The selection of *Channa punctatus* as experimental fish went in for reason of its easy availability, its hardy nature in terms of survival despite pollutant treatments proposed which might indicate an advantage of long stay of toxic effects in soft tissues. Above all, fish has an economic food value. For experimental purpose fishes almost of the same size and weight so as to refer to similar age group as constant factor were used for noticing effects of treatments by several insecticides. The fishes were washed in 0.1% $KMnO_4$ solution to smear dermal infection if any. Then they were washed with ordinary water and smeared to aquaria filled with water. The latter was already equipped with sand and *Hydrilla* plants, overcrowding was avoided. The fishes were fed with readymade fish food after every 24 hrs. The water was changed to smear the faecal matter and excess food after every 24 hrs. If any mortality occurred the fish was removed immediately to avoid depletion of oxygen. Normally, the fish to be used for experiments were left for fifteen days. So they might acclimatize to the prevailing ecological conditions. For the analysis of insecticide toxicity, insecticide was used in commonly occurring chemical compound cypermethrin 25% EC. Cypermethrin 25% EC is a synthetic pyrethroid insecticide used to control various pests.

Test compound: Cypermethrin 25% EC
CAS number: 52315-07-8
Trade name: Super killer
Chemical formula: $C_{22}H_{19}Cl_{12}NO_3$
IUPAC number: (R,S)-alpha-cyano-3-phenoxylbenzyl I(IRS)-cis, trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropane-carboxylate

The diluent water that was used for keeping experimental fishes was subjected to analysis for various physicochemical characteristics as per procedure is given in "APHA (2000) standard methods for the examination of water and wastewater". The following data shows the physicochemical parameters and their average values.

2.2 Biochemical Analysis

2.1.1 Serum glutamate oxaloacetate transaminase (SGOT)

The estimation of glutamic oxaloacetic transaminase was done by Reitman and Frankel (1957). AST converts L-aspartate and α-ketoglutarate to oxaloacetate and glutamate. The oxaloacetate thus formed reacts with 2,4-dinitrophenylhydrazine to produce the corresponding hydrazone which in an alkaline medium produces a brown coloured complex whose intensity is measured. Serum and Homogenized tissue was used with minimal delay.

2.2.2 Serum glutamate pyruvate transaminase (SGPT)

The estimation of glutamic pyruvate transaminase was done by Reitman and Frankel (1957). ALT converts L-alanine and α-ketoglutarate to pyruvate and glutamate. The pyruvate formed reacts with 2,4-dinitrophenylhydrazine to produce the corresponding hydrazone which in an alkaline medium produces a brown coloured complex whose intensity is measured. Homogenized tissue was used with minimal delay.

2.2.3 Alkaline phosphatase (ALP)

Alkaline phosphatase was estimated by Kit method (Span). Alkaline phosphatase converts phenyl phosphate to inorganic phosphate and phenol at pH 10.0. Phenol so formed reacts in alkaline medium with 4-aminoantipyrine in the presence of oxidizing agent, potassium ferricyanide and forms an orange red coloured complex, which can be measured colorimetrically.

2.3 Statistical Calculations

In the present investigation, the formulae were used for different statistical calculations after Fisher and Yates (1950) using statistical software.

3. Results and Discussion

The results are significant after treatment and shown in Table 1 and Figs 1, 2 and 3 as below:

Table 1. SGOT (U/L), SGPT (U/L) and Alkaline phosphatase (KA Unit) in white muscle of *Channa punctatus* after acute (4 days), sublethal (20 days) and chronic (45 days) treatment of cypermethrin (25% EC).

Experimental set	SGOT (U/L) (Mean±S.E.)	SGPT (U/L) (Mean±S.E.)	ALP (KA Unit) (Mean±S.E.)
Control	28.50±0.90	48.95±0.84	5.00±0.10
Acute (4 days)	22.60±0.87 [a]	42.50±0.67 [a]	4.15±0.12 [a]
Sublethal (20 days)	18.00±0.09 [a]	31.58±0.34 [a]	3.90±0.22 [b]
Chronic (45 days)	14.59±0.12 [b]	26.35±0.30 [b]	3.33±0.06 [c]
Recovery	30.50±0.50 [a]	47.00±0.50 [a]	5.01±0.05 [a]

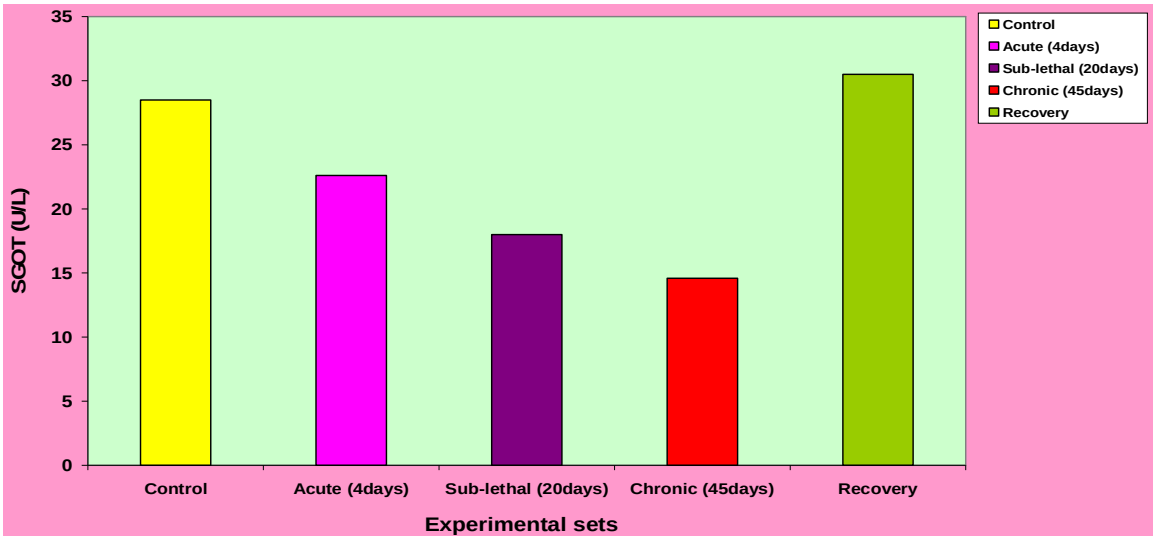

Fig. 1

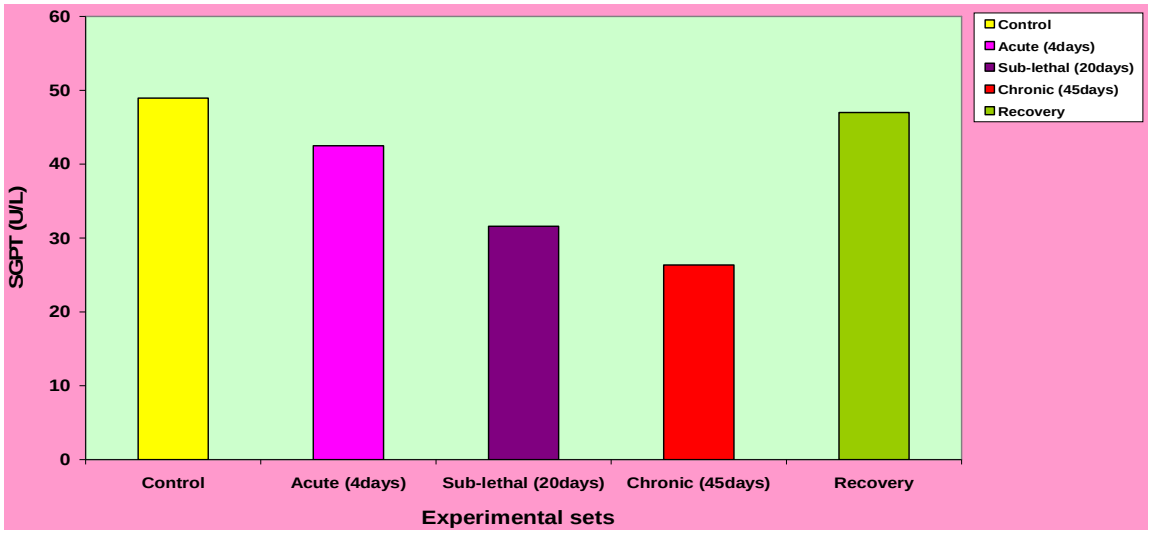

Fig. 2

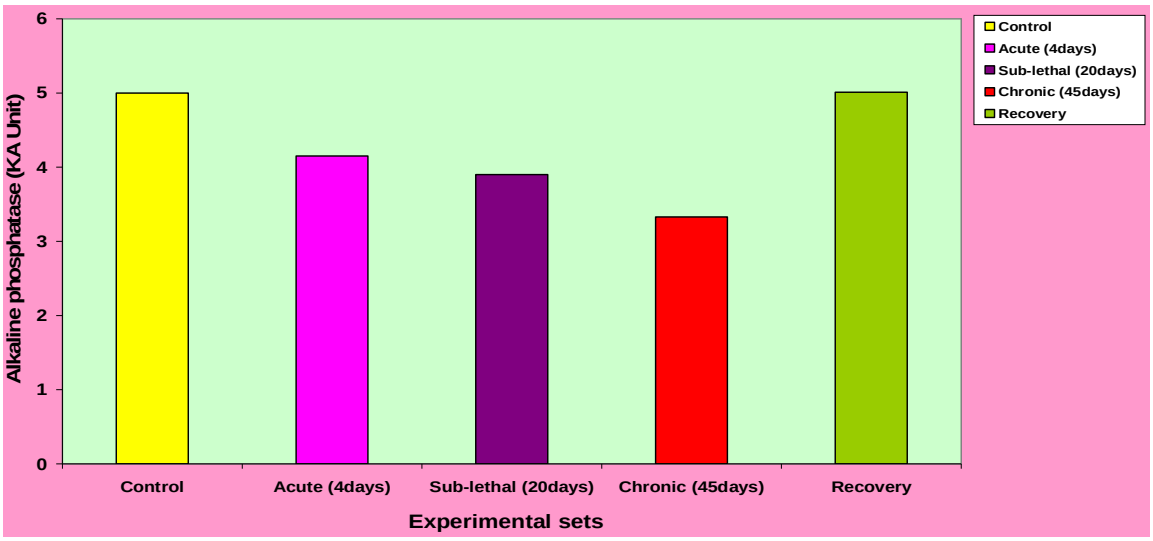

Fig. 3

Both the transaminases (GPT and GOT) are important in protein metabolism. Transaminases have been decreased with increased duration of exposure, however, at recovery, it comes to normal level. It is observed that in different species pesticides, heavy metal like cadmium, lead and mercury intoxications strongly depressed GOT and GPT activities as a consequence of serious cellular structure damage (Vaglio and Landriscina, 1999; Gill *et al*., 1991[a,b]; Shakoori *et al*., 1994; Rahman and Siddiqui, 2003). In addition, the present decrease in fish tissue glutathione and dependent enzymes combinedly react to defend insecticide toxicity. Allen and Rana (2004) showed that activities of glutathione-S-transferase, glutathione peroxidase, glutathione reductase and catalase decreased in liver and kidney as a result of heavy metal in liver. This can be correlated with the decrease in GOT and GPT activities in the fishes exposed to insecticides in this study.

Alkaline phosphatase is an important enzyme of animal metabolism. Enzyme activities decreased in muscles of insecticide (Cypermethrin) intoxicated fish (*Channa punctatus*). Phosphatases have been decreased with increased duration of exposure, however, at recovery, it comes to normal level. Decrease in phosphatase activity shown in present study might be due to increased insecticide level in water and its accumulation in the tissues of fishes. Depletion in acid and alkaline phosphate activities in liver also noticed by Rao (2006) in euryhaline fish, *Oreochromis mossambicus* treated with organophosphorus insecticide. Das and Mukherjee (2003) in *Labeo rohita* and Velisek *et al*., (2006) in rainbow trout treated with cypermethrin, Helge *et al*., (1995) in female rainbow trout (*Oreochromis mykiss*). Tiwari and Singh (2005) also reported decreased level of acid and alkaline phosphate in liver and muscles tissue of fish *Channa punctatus*. The decrease in ALP probably indicates an altered transport of phosphate (Engstrom, 1964) and an inhibitory effect on cell growth and proliferation (Goldfischer *et al*., 1964). The inhibitions of liver ALP activities were demonstrated in animals exposed to different heavy metal, pesticides and sewage (Ram and Sathyanesan, 1985; Sastry and Shubhadra, 1985; Rajan, 1990; Shakoori *et al*., 1994; Sharma, 1999; Rahman *et al*., 2000). Das and Mukherjee (2000) also noted depletion of ALP in liver and muscle tissue of *Labeo rohita* on the exposure of quinalphos. Toxicant other than insecticide such as heavy metal also reduces that activity level of acid and alkaline phosphate in muscle and liver tissue of the fish *Labeo rohita* (Nchumbeni *et al*., 2007).

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