

Biochemical Alterations Due to dimethoate in fresh water fish, *Channa punctatus*

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ABSTRACT

Activity of a few biomarkers have been investigated on fresh water fish, *Channa punctatus* exposed to three sub – lethal concentrations of dimethoate(1/5, 1/10 and 1/15 of 96hrs LC₅₀ values). The alteration in protein contents of liver, gill and muscle were investigated. The protein levels were found to be depleted in all the tissues after exposure to dimethoate over the control. All the organs showed the significant difference between control and exposed groups in all the estimated parameters on long exposure. The present study considers biochemical parameters as important biomarkers in determining the level of toxicity caused by the pesticide Dimethoate. Therefore the detailed results and observations are summarized in the present investigations.

Figure : 01

References : 18

Table : 01

KEY WORDS : Biochemical, *Channa punctatus*, Dimethoate, Toxicity.

Introduction

Dimethoate is a broadly used insecticide that rigorously causes toxic effects in various aquatic organisms especially in fish. The toxic effects of pesticides on biochemical parameters of fresh water fishes are well illustrated from the recent research in the field of toxicology. In the midst of the biochemical components proteins are of prime importance as they determine nutritive value of fresh water fishes.

Several environmental problems have arisen due to different forms of wastes created by our lifestyle and economic development. The industrial and automotive

emission create acid rain and breathing problems while industrial and commercial effluents create groundwater and surface water pollution.

Fish is an important commodity from the standpoint of human consumption. Aquatic pollution undoubtedly has direct effects on fish health, reproduction and survival. Pesticides are considered as serious pollutants of the aquatic environment because of their persistence in the environment and tendency to be concentrated in aquatic organisms.

Proteins are the important biopolymers of great interest and importance. They play not only a key role

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TABLE- 1: Effect of dimethoate on protein content in different tissues of freshwater fish, *Channa punctatus* after exposure to sublethal concentrations for 30 days.

S. No.	Tissue	Control	4.25 ppm (1/5)	% changes	2.12 ppm (1/10)	% changes	1.41 ppm (1/15)	% changes
1	Liver	24.5412 ± 0.2337	14.1504* ± 2.0242	42.3404	15.4998** ± 3.0920	36.8416	20.223* ± 2.0242	17.5960
2	Gill	17.0112 ± 0.7257	11.3165* ± 0.4048	33.4763	12.1262* ± 0.4048	28.7166	12.3960* ± 0.4674	27.1301
3	Muscle	16.1746 ± 0.4048	11.9912** ± 0.6184	25.8636	12.5985** ± 0.5094	22.1092	13.3407* ± 0.4048	17.5205

1. The values are expressed in mg/100 mg dry weight (mean ± S.D).
2. ± indicates S.D.
3. *P < 0.005, **P < 0.01, ***P < 0.001

informing and maintaining the structure of the cell but also as enzyme and hormones that catalyze numerous reactions and integrate the body functions.

The toxicity of pesticides, industrial effluent and heavy metals result in pathology of normal structure, physiology, biochemistry, cellular and molecular biology. The pesticides, industrial effluent and heavy metals are known to interfere with functional group of macromolecules, the presence of any pesticides, industrial effluent and heavy metals above threshold level result in the irrevocable alterations in the histopathological, physiological and biochemical changes are the reflections of these pollutant stress.

The major metabolites are namely protein, fat and carbohydrates etc. They are of prime importance to determine nutritive value of fish. Occurrence of polluted water bodies has exposed biota and particularly fish to an unlimited extent of danger. Industrial effluent affects fish to variable degree depending upon concentration of pollutants in the water and thereby makes fish unsuitable as food or a constant hazard posed knowingly or unknowingly if such fish are eaten by human population. Therefore, it is necessary to evaluate nature and extent of alterations in metabolites of fish.

In India, few efforts have been made to study the mode of action of pesticides, their involvement in physiological disturbances, biochemical changes and histopathological abnormalities. The protein level decreased in all the tested tissues whereas the free amino acid levels were increased in the fish *Labeo rohita* after exposed to cypermethrin².

The steady decrease observed in the protein

content in gill of *Clarias batrachus* to malathion exposure⁵. Decline in the lipid, protein and cholesterol content observed in ovaries of *Notopterus notopterus* to heavy metal exposure¹⁵.

The harmful biochemical effects of fenvalerate were observed at sublethal concentrations in fish, *Channa punctatus*¹⁴. The effects of fenvalerate on biochemical contents were observed in freshwater fish, *Cirrhinus mrigala*⁸. The effects of nuvan on protein contents were observed in gill, liver of the fish, *Rasbora daniconius*³. The toxic impact of dimethoate was observed on the protein, lipid and glycogen content in muscle, gill, liver and kidney of fish, *Arius dussumieri*¹³.

There was a paucity of information on effects of pesticides on biochemical constituents in fishes. In the present study, an attempt has been made to study the effects of pesticides on biochemical constituents such as protein in *Channa punctatus*.

Material and Methods

The live specimens of *Channa punctatus* were collected for biochemical study, from Shivana river near Dhoregaon, 26 km away from Aurangabad (M.S.) and brought to the laboratory. The fishes were maintained in glass aquaria and were acclimatized for four weeks. After acclimatization healthy fishes, showing normal activities were selected for biochemical estimations.

The test fishes, *Channa punctatus* were exposed to three sublethal concentrations of dimethoate for 30 days. Simultaneously, a control aquarium was also maintained. On 30th day's exposure, fishes from each experimental group were sacrificed, liver, gill and muscle were dried in oven at 75 °C to 80 °C till constant weight

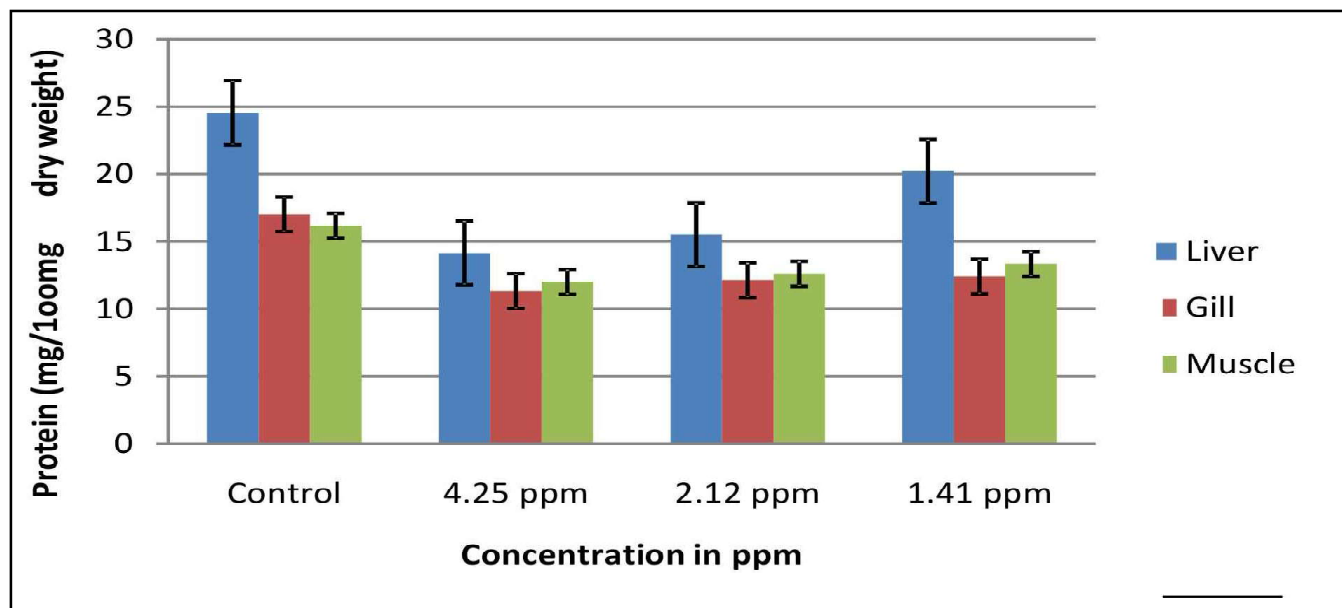


Fig. 1: Effect of dimethoate on protein content in different tissues of freshwater fish, *Channa punctatus* after exposure to sublethal concentrations for 30 days.

was obtained and blended into dry powder. These powders were used for the estimation of various biochemical components such as protein, lipid, glycogen and ascorbic acid. The methods applied for estimations are as follows.

Estimation of total protein:

100 mg of tissue was homogenized in 5 ml of cold distilled water. 5 ml of 30% TCA was immediately added to precipitate the protein. Precipitate was collected after centrifugation at 3000 rpm for 15 minutes. The supernatant was discarded. The pellet was repeatedly washed with distilled water to remove the traces of TCA. Precipitated protein was redissolved in 0.1 NaOH and estimated by using folin phenol reagent⁶. The protein was expressed in terms of mg/100 mg dry weight of the tissues.

Results

In the present investigation, changes in the biochemical constituents in body tissues of test fishes, *Channa punctatus* were exposed to dimethoate for long term (30 days) exposure at different sublethal concentrations have been recorded for protein. Dimethoate induced changes in biochemical constituents which have been represented in the form of percentage in alterations of biochemical constituent. The data were supported by various statistical analysis and the variance, standard deviation and standard error of the mean were calculated. Student's 't' test was used to find out the significance. The level of significance was used in the present study ($P < 0.1$, $P < 0.05$, $P < 0.01$, $P < 0.001$).

Protein:

Protein recorded in control group of fishes, *Channa punctatus* were 24.5412% mg in liver, 17.0112 mg in gill

and 16.1746 mg in muscle. The fishes, *Channa punctatus* exposed to three sublethal concentrations of dimethoate for long term (30 days) exposure, showed that there were significant decrease in level of protein content in liver, gill and muscle at 53.4 ppm, 26.6 ppm and 17.8 ppm dimethoate exposure. In liver decrease recorded were 42.3404 %, 36.8416 % and 17.5960 % as compared with control values. In gill decrease recorded were 33.4763 %, 28.7166 % and 27.1301 % as compared with their control values. In muscle decrease recorded were 25.8636 %, 22.1092 % and 17.5205 % as compared with their control values. These variations are recorded in Table No. 1 and Fig.1. Maximum depletion in protein content was observed in *Channa punctatus*. It was dose dependent effect.

Discussion

Complex composition and cumulative action of synthetic chemicals and industrial effluent from different sources of discharge cause enormous amount of stress on the recipient ecosystem⁷. During exposure, organism goes through a shift in all the metabolic process to overcome the toxic effects by undergoing all protective measures. Toxic effect of any pollutant leads to changes in biochemical and physiological mechanisms in the organisms. In order to investigate the physiological and biochemical changes have been studied during the course of the present study

During stress, an organism needs sufficient energy which can be supplied from reserve material *i.e.* glycogen protein cholesterol lipid *etc.* If the stress is mild, then only stored glycogen is as source of energy but when

stress is strong then energy stored in the form of lipid, protein cholesterol may be used. The toxicant also affects the metabolic or physiological activities in the animals particularly those organs in which phosphorylation, oxidation and hydrolization processes are carried out. The liver is the main spot for all the activities and also for detoxification of toxic materials. Metabolic products are broken down in liver cells due to which the liver cells may get damaged more severely than any other cells. This causes changes in biochemical composition. These changes were studied by earlier workers.

The total protein, glycogen and lipid content undergo a significant depletion in the tissue of the tannery effluent treated fish, *Cyprinus carpio*⁹. Decrease in total protein content of liver, muscle, brain and gill of monocrotophos exposed *Channa punctatus* at sublethal concentrations (0.46, 0.96, and 1.86 ppm) for 30 days¹.

The exposed fish *Clarias batrachus* to fenvalerate induced a significant decrease in protein contents of liver, brain and skeletal muscle¹⁷. The fish *Clarias batrachus*

exposed to sublethal concentration of malathion for 7, 15 and 30 days and protein content of gill was studied. They reported that gradual decrease in protein content was observed during the experimental period⁵.

In the present investigation protein content in different tissues showed decreased values in treated fishes *Channa punctatus*. Decrease in protein content may be attributed to the impairment to protein synthesis or increase in the rate of its degradation to amino acid. The fall in protein level during dimethoate exposure may be due to increased catabolism and decreased anabolism of protein⁴.

Similar results have been reported by number of researchers^{10,12,16,18}. The alteration in protein value may be due to some structural changes in the liver, the arrangement of hepatic cords leading to alteration of liver metabolism. Decrease in protein content could be possibly due to protein break down and suggests that decreased protein is due to damage of hepatic tissue and an intensive proteolysis¹¹.

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