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# Quinalphos Induced in Some Haematological and Biochemical Alteration in a Catfish, Heteropneustes Fossilis Bloch

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**Abstract**
In the present investigation, the alterations in the levels of haemoglobin, total plasma proteins, glucose, and lactic acid in the blood, glycogen and lactic acid content of liver and white skeletal muscle were examined in the fresh water catfish, Heteropneutes fossilis (Bloch). After exposure to a sublethal concentration (25 µg/liter) of Quinalphos for 60 and 120 days. It was found that Quinalphos produced marked changes in the chemical composition of blood, liver and muscles of Heteropneustes fossilis. In blood, all the four parameters namely, haemoglobin, total plasma protein, glucose and lactic acid decreased significantly in both treatment periods. The percentage of decrease was higher after 120 days in comparison to 60 days treatment. Haemoglobin, plasma protein, glucose and lactic acid decreased in Quinalphos-exposed catfish, Heteropneustes fossilis. The glycogen content of the liver and muscles increased but lactic acid decreased. The decrease was more marked in the case of lactic acid than in the other parameters. There was a gradual increase in liver and muscle glycogen content in both treatment periods. In contrast, the levels of liver and muscle lactic acid fell significantly, and the decrease was more marked in muscle. The present study showed that formation of glycogen and its breakdown was impaired in the liver, and aerobic oxidation of nutrients was adversely affected in Quinalphos-exposed catfish Heteropneustes fossilis (Bloch).

**Keywords:** Quinalphos, Haematological, Biochemical, catfish, Alteration, Heteropneustes fossilis.

## Introduction

Quinalphos (O, O-diethyl-O- (quinox-alinyl-1- (2)-phosphorothioate) is widely used to control pests of cotton and coppage like the spotted bollworm (Earis insulana, Earis febia), pink bullworm (Playtydera gossypiella), leaf rollers (Syleptaderogata) and the diamond back moth (Plutella mculipennis), and also sucking pests.

Pesticides have been found to be highly toxic not only to fishes, but also to fish food organisms. A number of reports have appeared in recent years on the uptake and tissue distribution of pesticides in a number of fish 5-6. Therefore, it is important to examine the toxic effects of pesticides on fishes, as they form an important part of human food.

The hazards of pesticides to fish are of great concern. In recent years, incidences of fish mortality due to pesticides, industrial effluents, and sewage pollution have been reported a number of times [1-4].

In India, although the importance of such studies is appreciated, very few reports are available concerning the effects of pesticides on the chemical composition and metabolism of fish. Due to the persistent nature of organochlorine pesticides, Organophosphorous compounds are favored and are used in large quantities in agricultural pest control. Organophosphorous compounds are cholinergic in hibitors, and are known as nerve poisons [7-10]. Anees [11] examined the concentration of haemoglobin in the blood of fish exposed to organophosphorus pesticides. Koundinya and Ramamurthi [12] studied the effect of fenitrothion on the blood of Tilapia mossambica, and noted a decrease in erythrocyte count and haemoglobin concentration. The in vivo and in

vitro effects of Carbetox on glycolysis in fish and rat liver were examined by Dragomirescu et al. [13]. Srivasthawa and Singh [14] and Singh and Srivasthawa [15] investigated the effects of methylparathion and formathion on the carbohydrate metabolism of a catfish, Heteropneustes fossilis.
The present investigation has been undertaken to examine the toxic effects of the organophosphorus pesticide,/quinalphos on the same haematological and biochemical parameters of a catfish, Heteropneustes fossilis (Bloch).

## Materials and Methods

Adult healthy and live specimens of a fresh water catfish, Heteropneustes fossilis were obtained from local fish catchers of District Etawah, U.P. They were washed with 0.1% Potassium Permanganate solution and acclimatized for a week. The properties of the test water were analysed as room mended in standard methods. Preliminary toxicity tests have shown that 25 µg/liter quinalphos is a sublethal concentration for 120 days exposure to the test fish. Quinalphos (Ekalux) was procured from M/s Sandoz (India) Ltd. Bombay.
Specimens of each male and female measuring 18.0 + 3.5 cm in length and 75.0 + 5.0 g in weight were used for this study. The fishes were fed regularly with dried shrimp powder or commercial fish pellets. The fishes were divided into four equal groups.
A stock solution of quinalphos was prepared in acetone. The first two groups were exposed to 25 µg/liter quinalphos for 60 and 120 days, respectively, and the remaining two groups were maintained in quinalphos-free tap water to which a volume of acetone equal to that used in the test was added to serve as controls.
The fish were fed twice daily with commercial fish pellets. Water in the aquaria was renewed after every 24 hr and freshly prepared quinalphos solution was added to maintain the concentration of quinalphos constant during the periods of exposure. Three fish in the first group exposed for 60 days and four fish in the second group exposed for 120 days died during the experiment. On the 61st and 121st days fish were removed from the aquaria and immediately stunned by a blow on the head.
The animal was washed with distilled water and blotted dry with the help of clean turkish towels and weight Blood samples were collected either from caudal vessel by serving the caudal penducle or directly from ventral aorta and heart by heparinized syringe.
The levels of haemoglobin [16], plasma protein [17], glucose [18] and lactic acid [19] were measured in the blood. Glycogen [20] and lactic acid [19] were estimated in liver and muscles. Students t-test [22] was employed to calculate the significance of difference between control and experimental means.

## Results and Discussions

Alterations in levels of haemoglobin, total plasma proteins, glucose and lactic acid in the blood; glycogen and lactic acid content of the liver and white skeletal muscle are examined in the fresh water teleost, Heteropneustes fossilis, after exposure to a sublethal concentration (25 µg/liter) of Quinalphos for 60 and 120 days.
In the present study, it was found that Quinalphos produced marked changes in the chemical composition of blood, liver and muscles of Heteropneustes fossilis. The results obtained in the present investigations are summarized in the Table. In blood, all the four parameters examined, namely haemoglobin, total plasma protein, glucose and lactic acid decreased significantly in both treatment periods. The percentage of decrease was higher after 120 days in comparison to 60 days treatment. The decrease was more marked in the case of lactic acid than in the other parameters.
There was a gradual increase in liver and muscle glycogen content in both treatment periods. In contrast, the levels of liver and muscle lactic acid fell significantly, and the decrease was more marked in muscle.
Similar results were obtained in previous study [23] in C. punctatus exposed to the same concentration of quinalphos for 15 and 30 days. Quinalphos-exposed fish were anemic. A similar decrease in the haemoglobin content of blood was noted in Tilapia exposed to fenitrothion by Koundinya and Ramamurthi [12]. The blood glucose level decreased in pesticide-exposed fish as compared to control fish, indicating a hypoglycemic response. The glycogen content of liver and muscle was elevated. An increase in liver glycogen and a fall in blood sugar level are indicative of a decrease in the rate of glycogenolysis in quinalphos-exposed fish. Another reason for this increase in liver and muscle glycogen content may be an increase in the rate of glycogenesis or gluconeogenesis in liver. This assumption is supported by the findings of Grant and Mehrle [24], who reported a similar increase in the liver glycogen content of rainbow trout, Salmo gairdneri, chronically exposed to endrin, and they attributed this condition to an increase in glycogenesis or gluconeogenesis.
An increase in liver glycogen content could also be explained in terms of increased adrenocorticosteroid output due to the pesticide induced stress. Srivasthawa and Singh [14], in their study on the acute effects of methylparathion on the carbohydrate metabolism of H. fossilis, found an initial decrease in liver glycogen content after 3 and 6hr of exposure, followed by increase after 12 and 48hr. The increase in liver glycogen after 12 and 48hr was attributed to the increased adrenocorticosteroid output in pesticide stressed fish, which stimulated the synthesis of liver glycogen presumably by stimulating gluconeogenesis. Contrary to the present findings, Koundinya and Ramamurthi [27] observed hyperglycemia accompanied by a decrease in the levels of glycogen in the liver and muscles of Sarotherodon mossambica treated with 6mg/liter (48 hr $LC_{50}$) fenitrothion. The increase in the glycogen content of liver and muscle, and the decrease in lactic acid noted in the present study suggest that glycolysis in pesticide-exposed fish is impaired.

**Table 1:** Haematological and Biochemical values of Heteropneustes fossilis (Bloch) and those exposed to 25µg/leter Quinalphos.

| Tissue and components | Control | 60-Days Exposure | Percentage Alteration | Control | 120-Days Exposure | Percentage Alteration |
|---|---|---|---|---|---|---|
| **Blood** | | | | | | |
| Haemoglobin[a] | 12.4 + 0.1 | 11.2 + 0.2 | 9.7 | 12.2 + 0.1 | 11.0 + 0.1 | 9.8 |
| Plasma Protein[a] | 3.8 + 0.2 | 3.0 + 0.1 | 21.0 | 9.6 + 0.2 | 2.5 + 0.2 | 30.5 |
| Glucose[b] | 64.5 + 2.0 | 52.5 + 1.5 | 18.6 | 65.2 + 1.7 | 50.2 + 1.7 | 23.0 |
| Lactic Acid[b] | 13.2 + 0.6 | 10.3 + 0.5 | 21.0 | 12.1 + 0.4 | 8.2 + 0.3 | 32.2 |
| **Liver** | | | | | | |
| Glycogen[c] | 5.25 + 0.14 | 7.95 + 0.12 | 51.42 | 6.10 + 0.12 | 8.25 + 0.15 | 35.24 |
| Lactic Acid[c] | 6.30 + 0.04 | 5.20 + 0.07 | 17.46 | 5.90 + 0.12 | 5.28 + 0.07 | 10.50 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Muscles**<br>Glycogen[c]<br>Lactic Acid[c] | 0.95 + 0.04<br>12.30 + 0.15 | 1.40 + 0.05<br>10.50 + 0.10 | 47.37<br>14.63 | 0.90 + 0.03<br>11.80 + 0.10 | 1.52 + 0.04<br>9.87 + 0.10 | 68.88<br>16.35 |

Values are means + S.E.
a= g/100 ml of blood.
b = Mg/100 ml of blood.
c = Mg/fresh wt of tissue.
* $P < 0.05$
** $P < 0.01$

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