Biochemical Profile of Channa gachua (Ham.) Exposed to Sub-lethal Doses of Dichlorvos (DDVP)

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Abstract

In the present study, the sub-lethal effect of dichlorovos on various biochemical parameters of Channa gachua was studied. The fish was exposed to acute toxicity of dichlorvos for 16, 24 and 48 hours. While for chronic toxicity, it was exposed for 15, 30 and 45 days. The dichlorovos was found to be toxic to the fish, which was found to be increasing with the increase of its concentration. Alterations in various biochemical parameters such as plasma glucose, cholesterol, alkaline phosphatase in plasma, triglyceride in plasma, total protein, serum bilirubin, serum creatinine, SGPT, SGOT and lipid peroxidation were observed.

INTRODUCTION

Widespread application of various pesticides has aggravated the problem of pollution to aquatic environment. Due to these synthetic chemicals, environment has failed to keep its healthy characteristics. The insecticides of proven economic potentialities could not do good in the ecosystem when viewed on extra fronts since these revenue poisons, in a residual form or as a whole, get into the aquatic ecosystem. They cause a series of problems to aquatic organisms, especially for the fishes (Mukhopadhyay and Dehadrai, 1980a, Sastry and Sharma, 1981, Sastry et al., 1984).

In recent years, a considerable research work has been done on a variety of alternative pest control measures. However, the use of chemical pesticides is still main stay in the control of insects, weeds, fungi and pests on large scale. Pesticides have a great impact on human health, production and preservation of food, fishes and other cash crops. On the other hand use of pesticides has given rise to many serious problems. Most of the chlorinated non-degradable pesticides leave residues in various living systems for prolonged periods of their life span and are presumably responsible for a variety of known and unknown toxic symptoms. Even when present in minute quantities, their variety, toxicity and persistence has an adverse effect on ecological systems, such a birds, fishes and plants, with which human welfare is inseparably bound (Mukhopadhyay and Dehadrai, 1980a, Sastry, and Sharma, 1981, Sastry et al., 1984).

Dichlorvos is extensively used in baits and aerosol formulation for the control of house hold insects and other insects of public health importance such as, flies and mosquitoes in open places and for the control of insects of stores and food processing plants such as, flies and moths in stores, mills, bakeries, dairies etc. it is available as emulsifiable concentrate e.g. 20% E,C. and 100% E,.C. formulations. This compound is moderately toxic to fish and highly toxic to bees. The present paper reports the sub-lethal effect of dichlorovos on biochemical parameters of Channa gachua.

MATERIALS AND METHODS

PROCUREMENT OF TEST FISHES

Alive, healthy and disease free fishes (Channa gachua, weight 15-20gm and length 12-18cm) were used for the experiment. The fishes were procured from the local fish market, Bhopal and brought to the laboratory. The fishes were kept in the glass aquaria to observe any visible pathological symptoms. Before introducing into the aquarium, fishes were treated with 0.1%$KmNO_4$ solution to obviate any dermal infection.

ACCLIMATIZATION OF TEST FISHES

Fishes were acclimatized to laboratory conditions for a period of one week. No mortality was recorded during this period. The fishes were fed with chopped meat daily. After acclimatization, fishes were kept in different concentrations of dichlorvos in different aquaria.

SOURCES OF DICHLOROVOS AND ITS EXPOSURE

Dichlorovos DDVP (20%EC) was obtained from the local market. Renewal toxic test method (APHA, 1992) was used to find out the LC_{50} concentration. Fishes were exposed to sub-lethal concentration for 16, 24 and 48 hours in acute studies and 15, 30 and 45 days in chronic studies. Control fish were also maintained under identical conditions without pesticide in the medium.

COLLECTION OF BLOOD

At the end of the exposure period, blood was collected from the dorsal arota into plastic vials containing 0.1ml of EDTA. Then, the blood was gently mixed with the oxalate mixture to avoid coagulation. Various biochemical tests were performed by using the kit procured from MERCK.

STATISTICAL ANALYSIS

The obtained data was subjected "t" test find out the significance of difference between control and treated values.

RESULTS

In the present study, attempts have been made to investigate the effect of sub-lethal concentration of dichlorovos on various biochemical parameters of Channa gachua on comparative approach from 8 to 24 hours for acute studies and 15 to 45 days for chronic studies.

ACUTE STUDIES

In 16 hrs exposed fishes, the recorded values of plasma glucose, cholesterol, alkaline phosphatase in plasma, triglyceride in plasma, total protein, serum bilirubin, serum creatinine, SGPT, SGOT and lipid peroxidation were 62.213mg/dl, 168.33 mg/dl, 138.367 mg/dl, 298.0 mg/dl, 4.17 mg/dl, 3.017 mg/dl, 1.058 mg/dl, 99.25 µl, 652.667 µl, and 0.552 mg/dl, respectively (Table 1).

In 24 hrs exposed fishes, the value of plasma glucose, cholesterol, alkaline phosphatase in plasma, triglyceride in plasma, total protein, serum bilirubin, serum creatinine, SGPT, SGOT and lipid peroxidation were 56.265 mg/dl, 182.0 mg/dl, 146.0 mg/dl, 307.0 mg/dl, 3.99 mg/dl, 2.533 mg/dl,0.732 mg/dl,95.667 µl, 691.167µl, and 0.147mg/dl, respectively (Table 1).

In case of 48 hrs exposed fishes, the value of plasma glucose, cholesterol, alkaline phosphatase in plasma, triglyceride in plasma, total protein, serum bilirubin, serum creatinine, SGPT, SGOT and lipid peroxidation were 44.406 mg/dl, 210.0 mg/dl, 168.0 mg/dl, 310.0 mg/dl, 4.112 mg/dl, 2.553 mg/dl, 1.00 mg/dl, 97.833 µl, 765.83 µl, and 0.458 mg/dl, respectively (Table 1).

Figure 1

Table - 1. Sub-lethal effect of Dichlorovos on certain biochemical parameters of (Ham.) - Acute Studies (0.012mg/l)

S.No	Parameters	No. of fish treated	After 16hrs	After 24hrs	After 48hrs	Control
1	Plasma Glucose (mg/dl)	25	6	62.213±1.603	56.256±1.0722	72.116±1.001
2	Cholesterol (mg/dl)	25	6	168.33±2.32	182.0±1.2909	130.0±2.38
3	Alkaline Phosphatase in plasma (mg/dl)	25	6	138.367±1.123	146.0±2.768	132.167±1.674
4	Triglycerides in plasma (mg/dl)	25	6	298.0±2.38	307.0±3.415	121.0±2.38
5	Total Protein (mg/dl)	25	6	4.17±0.054	3.99±0.106	5.827±0.137
6	Serum Bilirubin (mg/dl)	25	6	3.017±0.211	2.533±0.262	1.083±0.343
7	Serum Creatinine (mg/dl)	25	6	1.058±0.405*	0.732±0.135*	1.16±0.49914
8	SGPT(µl)	25	6	99.25±2.116	97.833±10.067	40.0±2.58
9	SGOT(µl)	25	6	652.667±2.134	765.83±4.099	480.05±1.707
10	Lipid Peroxidation (mg/dl)	25	6	0.552±0.017	0.458±0.0318	0.80±0.081

Values expressed in Mean ± S.D. of 6 replicates. Student "t" test was performed between control and treated values. The mean values are found to be significantly different at 1% level of significance (P<0.01). (* - not significant)

Values expressed in Mean ± S.D. of 6 replicates. Student "t" test was performed between control and treated values. The mean values are found to be significantly different at 1% level of significance (P<0.01). (* - not significant)

CHRONIC STUDIES

In 15days exposed fishes, the recorded values of plasma glucose, cholesterol, alkaline phosphatase in plasma, triglyceride in plasma, total protein, serum bilirubin, serum creatinine, SGPT, SGOT and lipid peroxidation were 58.951 mg/dl, 165.55 mg/dl, 138.367 mg/dl, 296.5 mg/dl, 4.610 mg/dl, 2.837 mg/dl, 1.028 mg/dl, 102.0µl, 643.667µl and 0.508 mg/dl, respectively (Table 2).

In 30 days exposed fishes, the recorded values of plasma glucose, cholesterol, alkaline phosphatase in plasma, triglyceride in plasma, total protein, serum bilirubin, serum creatinine, SGPT, SGOT and lipid peroxidation were 52.935 mg/dl, 186.617 mg/dl, 151.333 mg/dl, 297.667 mg/dl, 4.512 mg/dl, 3.658 mg/dl, 1.32 mg/dl, 109.667µl, 691.33 µl, and

0.452mg/dl, respectively (Table 2).

In 45 days exposed fishes, the recorded values of plasma glucose, cholesterol, alkaline phosphatase in plasma, triglyceride in plasma, total protein, serum bilirubin, serum creatinine, SGPT, SGOT and lipid peroxidation were 41.94 mg/dl, 221.417 mg/dl, 170.5 mg/dl, 301.167 mg/dl, 4.433 mg/dl, 3.442 mg/dl, 1.67 mg/dl, 110.467µl, 757.167 µl, and 0.40mg/dl, respectively (Table 2).

Thus, the exposure of dichlorovos to Channa gachua led to increase in cholesterol, alkaline phosphatase in plasma, triglyceride in plasma, serum bilirubin, serum creatinine, SGPT and SGOT parameters, in both acute and chronic studies. It is evident from the results that the sub-lethal concentration of dichlorovos has influence on various biochemical parameters in exposed fishes.

Figure 2

Table - 2. Sub-lethal effect of Dichlorovos on certain biochemical parameters of (Ham.) - Chronic Studies (0.012mg/l)

S.No	Parameters	No. of fish treated	After 15 days	After 30 days	After 45 days	Control
1	Plasma Glucose (mg/dl)	25	6	58.951±1.275	41.94±0.990	75.79±1.087
2	Cholesterol (mg/dl)	25	6	165.55±0.3201	221.417±0.2409	132.6±0.115
3	Alkaline Phosphatase in plasma (mg/dl)	25	6	137.367±1.011	170.5±1.979	132.417±0.134
4	Triglycerides in plasma (mg/dl)	25	6	296.5±1.258	301.167±1.067	130.617±0.1067
5	Total Protein (mg/dl)	25	6	4.610±0.0081	4.433±0.137	5.733±0.1105
6	Serum Bilirubin (mg/dl)	25	6	2.837±0.0169	3.442±0.026	1.012±0.0106
7	Serum Creatinine (mg/dl)	25	6	1.028±0.0134	1.67±0.0129	0.822±0.0106
8	SGPT(µl)	25	6	102.0±1.29	110.467±0.197	34.167±1.067
9	SGOT(µl)	25	6	643.667±2.867	757.167±1.343	481.833±1.572
10	Lipid Peroxidation (mg/dl)	25	6	0.508±0.053	0.40±0.0163	0.76±0.025

Values expressed in Mean ± S.D. of 6 replicates. Student 't' test was performed between control and treated values. The mean values are found to be significantly different at 1% level of significance (P<0.01).

DISCUSSION

A sizeable amount of organophosphatases have been used to boost up agricultural yield. The run-offs from treated lands are known to interfere with nutrio-economically important animal and growth in water bodies by altering and disrupting the different physiological processes.

Gopal et al., (Gopal et al., 1985) studied neuro behavioral changes in fresh water fish, Channa punctatus exposed to endosulphan. Mukhopadhyay and Dehadrai (1980b) observed a marked decline in liver glycogen and protein contents in the catfish with sub-lethal concentration of malathion. Sastry and Sharma (1981) and Singh and Shrivastava (1982) studied in various carbohydrate metabolites in Ophiocephalus punctatus and Heteropneustes fossilis treated to toxicants. Mukhopadhyay and Dehadrai (1980b, 1980a) noticed various biochemical changes such as SGOT and SGPT in the air-breathing catfish, Clarias batrachus under sub-lethal malathion exposure. Murthy and Devi (1982) reported decreased level of protein, glycogen and lipid concentration in liver and increased level in brain of Channa punctatus.

Joshi and Desai (1981) investigated sub-lethal concentration of monocrotophos on acid and alkaline phosphatase activity in the tissue of freshwater fish, Tilapa mossambica. Shrivastava and Shrivastava (1984) reported alterations in blood glucose values in Hereropneustes fosilis to sub-lethal concentration of chlordane for 15, 30, 50 and 70 days. Sastry and Dasgupta (1991) noticed significant alterations in blood glucose, lactic acid and protein in Clarias batrachus, Anguilla anguilla and Channa pnctatus acutely or chronically exposed to aldrin, lindane and nuvacron. Singh and Shrivastava (1982) have noticed hyperglycemia in Hereropneustes fosilis treated with sub-lethal concentrations of organphosphate insecticides.

In the present study, it has been observed that the exposure of dichlorovos led to the decrease in the level of plasma glucose, total protein, and lipid peroxidation while significant increases was observed in the levels of cholesterol, alkaline phosphatase In plasma, triglyceride in plasma, serum bilirubin, serum creatinine, SGPT and SGOT. Similar results were also noticed by Murthy and Devi (1982), Borah and Yadav (1995), Katti and Sathyanesan (1983), Ram and Sathyanesan (1984, 1985) Dalela et al., (1978), Agrahar and Bhartiya (2004), Santhakumar and Balaji (2000, 1999), Tilak et al., (2003, 2001) and Sharad Srivastava et al., (1990).

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