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Biochemical Changes induced by Carbaryl, Carbosulfan and Parathion on Fresh Water Catfish *Clarias batrachus (*Linn.*)*

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Abstract

The aim of the study was to assess the effect induced by carbaryl, carbosulfan and parathion pesticides on biochemical indices of catfish, Clarais batrachus (Linn.) after exposed to sub lethal concentration of 0.5 ml (1/5 of LC_{50}) of Carbaryl, 0.1 ml (1/5 of LC_{50}) of carbosulfan and 0.09 ml (1/5 of LC_{50}) of parathion at different time intervals 24, 48, 72 and 96 hrs. The LC50 of Carbaryl, carbosulfan and parathion was determined by the method of Finney[1]. The present study showed statistically significant increase value in blood glucose and significant decrease value in serum total protein level.

Keywords: Carbaryl, Carbosulfan, parathion, *Clarais batrachus*, blood glucose and serum total protein.

Introduction

Pesticides are widely used substances in agriculture practices. The use of pesticides has resulted in increased crop production and has raised concerns about potential adverse effects on the environment and human health. Aquatic ecosystems that run through agricultural areas have high probability of being contaminated by run off and ground water leaching by a variety of chemicals. Pesticides are used tremendously, which on entering the aquatic environment lead toxic effects on aquatic organisms and alters biochemical changes in aquatic organisms. Among aquatic organisms fishes are the main and best source of food, so it is essential to secure the health of fishes[1].

Carbamate and organophosphate pesticides are used widely for agricultural and residential applications as insecticides and fungicides. The toxicity of carbamate and organophosphate pesticides results inhibition of acetyl cholinesterase (AChE), a key enzyme of the nervous system. The inhibition causes an accumulation of acetylcholine in synapses with disruption of the nerve functions, which can result in death[2].

Materials and Methods

The fresh water catfish, *Clarias batrachus* was obtained from the local fish market. It was acclimatized in glass aquaria for two weeks prior to experimentation. The weight and length of the experimental animals varied between 100 – 130g and 16 – 20 cm respectively. The experiment was conducted in thirteen aquariums one was used for control and other aquaria used for the pollution study. Each aquarium contains ten fishes. The LC50 of Carbaryl, carbosulfan and parathion was determined by the method of Finney[3]. The experimental fishes were exposed to sub-lethal concentration 0.5 ml (1/5 of LC_{50}) of Carbaryl, 0.1 ml (1/5 of LC_{50}) of carbosulfan and 0.09 ml (1/5 of LC_{50}) of parathion separately at different time intervals 24, 48, 72 and 96 hrs. The acclimated fish were starved for 24 hrs prior to their use in the experiment and were not fed during the course of experiments[4]. The water was changed after every 24 hrs. Blood from the experiment and control groups was collected from the cut caudal vein into the plain sterilized glass centrifuge tubes. The blood was used for the biochemical estimation of glucose by GOD/POD kit method by Trinder[5] and total protein by Biuret and Dumas described by Dumas *et al.*[6] of experimental fish. The experimental data were analyzed by student's t test for determining the significance of the changes from control.

Results and Discussion

Clarias batrachus exposed to concentrations of 0.5 ml of Carbaryl, 0.1 ml of carbosulfan and 0.09 ml of parathion separately exhibit many biochemical alterations have been summarized in tables.

Effect of carbaryl, carbosulfan and parathion on blood glucose: The blood glucose in the experimental animals after carbaryl, carbosulfan and parathion sub lethal intoxication separately shows an increasing trend at different time intervals (24, 48, 72 and 96 hrs). The elevated blood glucose level (hyperglycemia) is indicative of disrupted carbohydrate metabolism. The hyperglycemic condition observed on exposure to pesticide may be due to the increased liver glycogenolysis or toxicant may have damaged islets of Langerhans which in turn reduce the insulin secretion due to which glucose level may have increased. Present finding gain support with the finding of Dalela *et al.*[4] who observed hyperglycemia in *Mystus vittatus* exposed to there different pesticides: thiotox, dichlorvos and carbofuran and their combination. They suggested that hyperglycemia indicates the disrupted carbohydrate metabolism which might be due to enhanced breakdown of liver glycogen, perhaps mediated by

adrenocorticotropic hormone (ACTH), glycogen hormone and reduced insulin activity.

Begum and Vijayaraghavan[7] find an increase in blood glucose levels in *Clarias batrachus* exposed to ragor. Similarly Ferrando and Moliner[8] noticed hyperglycemia in *H. fossilis*, *Ophicocephalus punctatus* and *Cyprinus carpio* treated with endosulfan, lindane respectively.

Blood glucose concentration is regulated by complex interaction of hormones such as glucagons and cortisol. Ramesh and Saravanan[9] resulted significant increase of fish plasma glucose level might have showed from gluconeogenesis to provide energy for the increased metabolic demands imposed by chlorpyrifos stress, particularly in osmoregulation which may contribute to the restoration of plasma osmoregularity in the face of failing blood levels of Na^+ and Cl.

Effect of carbaryl, carbosulfan and parathion on serum total protein: The serum total protein shows decreasing trend on exposure to sub-lethal concentration of carbaryl, carbosulfan and parathion at different time intervals (24, 48, 72 and 96 hrs). The decrement of total protein may be due to the inhibition of RNA synthesis disturbing the protein metabolism or this may be due to liver damage where most protein synthesis usually occurs, these results agreed with that of Sing *et al.* [10] carbosulfan induced biochemical changes in *Clarias batrachus* treatment resulted in drastic decrease in the protein content in gill, brain, muscle, liver, kidney and heart of magur fish. Under conditions of stress many organisms will mobilize proteins as an energy source via oxidation of amino acids. The depletion in total protein content may be due to augmented proteolysis and possible utilization of their product for metabolic purposes as reported by Ravinder *et al.* [11]. On the other hand Neff [12] has opined that decline in protein content may be related to impaired food intake, increased energy cost of homeostasis, tissue repair and detoxification mechanism during stress.

Table-1
Blood glucose and serum total protein content of *Clarias batrachus* exposed to sub lethal concentration of carbaryl

Biochemical parameter	Control groups Range Mean ± S.Em.	Exposure in hours			
		24 hrs range Mean ± S.Em.	48 hrs range Mean ± S.Em.	72 hrs range Mean ± S.Em.	96 hrs range Mean ± S.Em.
Blood glucose (mg/dl)	30.30 – 33.10 30.60 ± 1.80	34.05 – 38.15 35.90 ± 0.60^{NS}	40.90 – 43.15	46.25 – 47.20	65.00 – 68.00
			41.80 ± 0.50**	46.75 ± 0.47***	66.00 ± 0.44***
Serum total protein (gm/dl)	3.20 – 4.10	2.92 – 3.95	2.47 – 3.72	2.25 – 3.46	2.16– 3.30
	3.60 ± 0.15	3.45 ± 0.18*	3.17 ± 0.21*	2.72 ± 0.23*	2.55 ± 0.24***

Results are expressed as ± S.Em., NS = Non-significant at $p > 0.05$; * = Significant at $p < 0.05$, ** = Highly significant at $p < 0.01$; *** = Very highly significant at $p < 0.01$

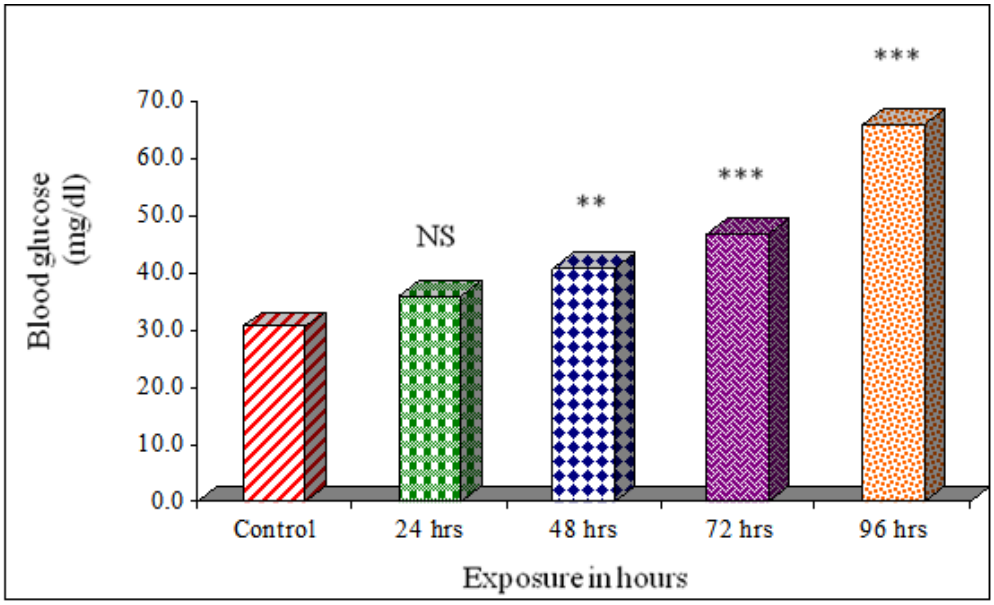

Figure-1
Biochemical estimation of blood glucose (gm/dl) after carbaryl intoxication in experimental fish *Clarias batrachus*

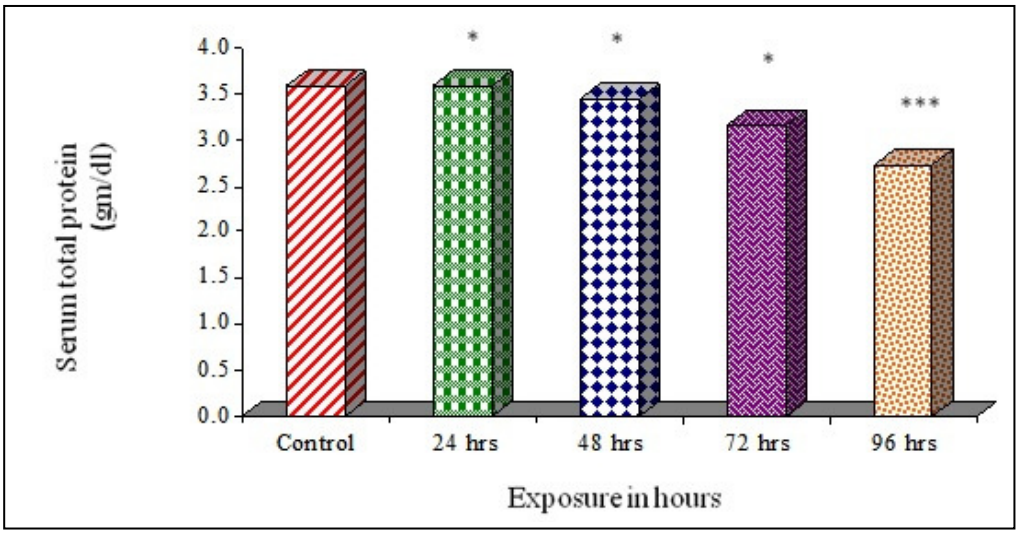

Figure-2
Biochemical estimation of serum total protein (gm/dl) after carbaryl intoxication in experimental fish *Clarias batrachus*

Table-2
Blood glucose and serum total protein content of *Clarias batrachus* exposed to sub lethal concentration of carbosulfan

Biochemical parameter	Control groups Range Mean ± S.Em.	Exposure in hours			
		24 hrs range Mean ± S.Em.	48 hrs range Mean ± S.Em.	72 hrs range Mean ± S.Em.	96 hrs range Mean ± S.Em.
Blood glucose (mg/dl)	30.10 – 33.30	34.20 – 38.10	41.10 – 43.20	46.00 – 48.11	64.20 – 68.00
	31.66 ± 1.89	36.10 ± 0.62^{NS}	41.49 ± 0.55**	47.05 ± 0.48***	66.15 ± 0.45***
Serum total protein (gm/dl)	3.97 – 4.80	3.35 – 4.25	2.97 – 4.10	2.50 – 3.45	2.15 – 3.20
	4.36 ± 0.13	3.70 ± 0.16*	3.46 ± 0.26**	2.93 ± 0.23***	2.67 ± 0.25***

Results are expressed as ± S.Em. NS = Non-significant at $p > 0.05$; * = Significant at $p < 0.05$, ** = Highly significant at $p < 0.01$; *** = Very highly significant at $p < 0.01$

In the present investigation, serum total protein may be depleted probably because of excessive renal excretion (Albuminuria) or due to the liver disorder after the pesticide exposure. This is correlated with the finding of Maya [13] and Garg *et al.*[14].

Maya[13] evaluated the toxicity of rogor to *Clarias batrachus* by studying its morphological and physiological impact and found that it causes depletion in the serum total protein.

Garg *et al.*[14] observed that fall in serum protein may be due to the impaired function of kidney or due to reduced protein synthesis owing to liver cirrhosis.

Dalela *et al.*[4] reported that decrease in serum protein level of pesticide treated *Mystus vittatus* may be due to kidney disorder (Albuminuria) or impaired protein synthesis as a result of liver disorder and Shaikh *et al.*[15] also reported decrease in serum protein level of *channa puncatus* after nuvan treatment.

Table-3
Blood glucose and serum total protein content of *Clarias batrachus* exposed to sub lethal concentration of parathion

Biochemical parameter	Control groups Range Mean ± S.Em.	Exposure in hours			
		24 hrs range Mean ± S.Em.	48 hrs range Mean ± S.Em.	72 hrs range Mean ± S.Em.	96 hrs range Mean ± S.Em.
Blood glucose (mg/dl)	35.20 – 39.10	41.60 – 44.30	45.20 – 48.50	47.30 – 50.10	48.10– 52.50
	37.10 ± 0.70	42.80 ±0.65^{NS}	46.10±0.62*	48.60 ± 0.59**	50.10±0.55**
Serum total protein (gm/dl)	5.28 – 6.20	3.98 – 4.97	3.23 – 3.97	2.17 – 3.00	1.76 – 2.15
	5.94± 0.115	4.36±0.130**	3.68 ±0.118**	2.50 ± 0.128***	2.01 ± 0.104***

Results are expressed as ± S.Em. NS = Non-significant at $p > 0.05$; * = Significant at $p < 0.05$ ** = Highly significant at $p < 0.01$; *** = Very highly significant at $p < 0.01$

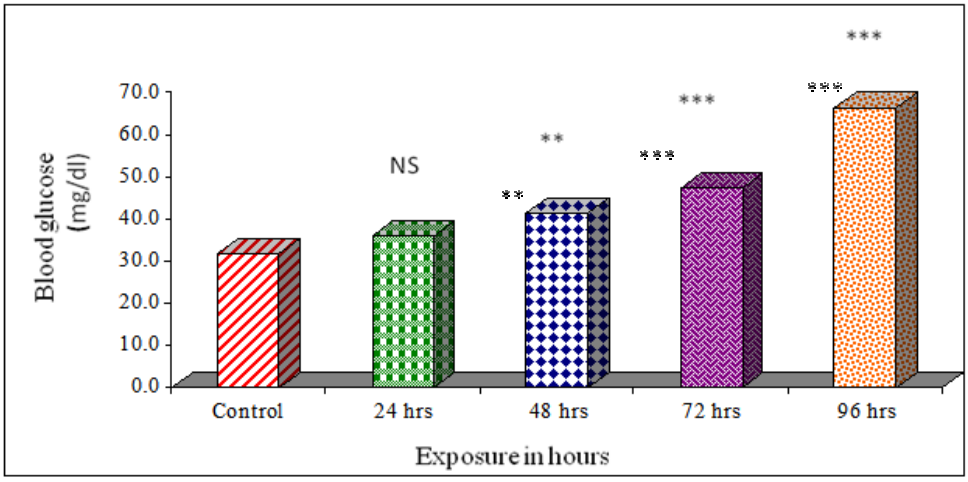

Figure-3

Biochemical estimation of blood glucose (mg/dl) after carbosulfan intoxication in experimental fish Clarias *batrachus*

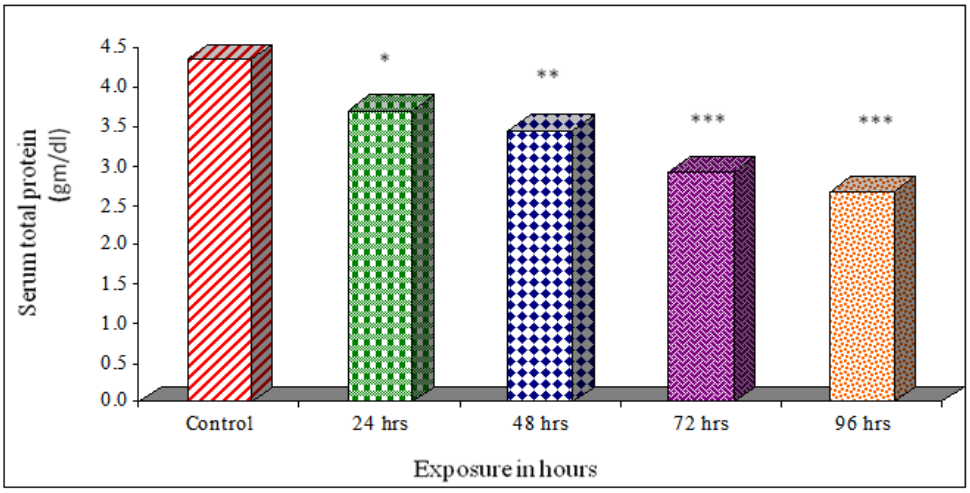

Figure-4

Biochemical estimation of serum total protein (gm/dl) after carbosulfan intoxication in experimental fish *Clarias batrachus*

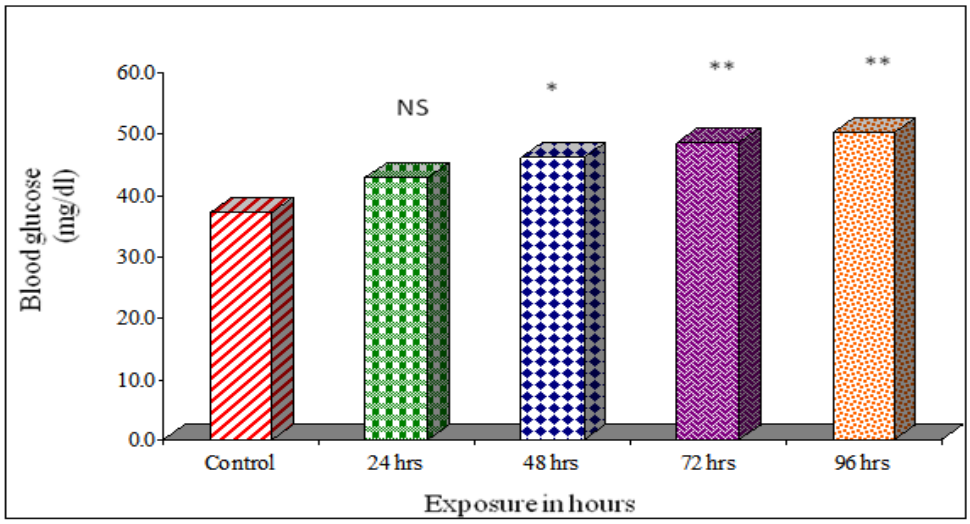

Figure-5

Biochemical estimation of blood glucose (mg/dl) after parathion intoxication in experimental fish Clarias *batrachus*

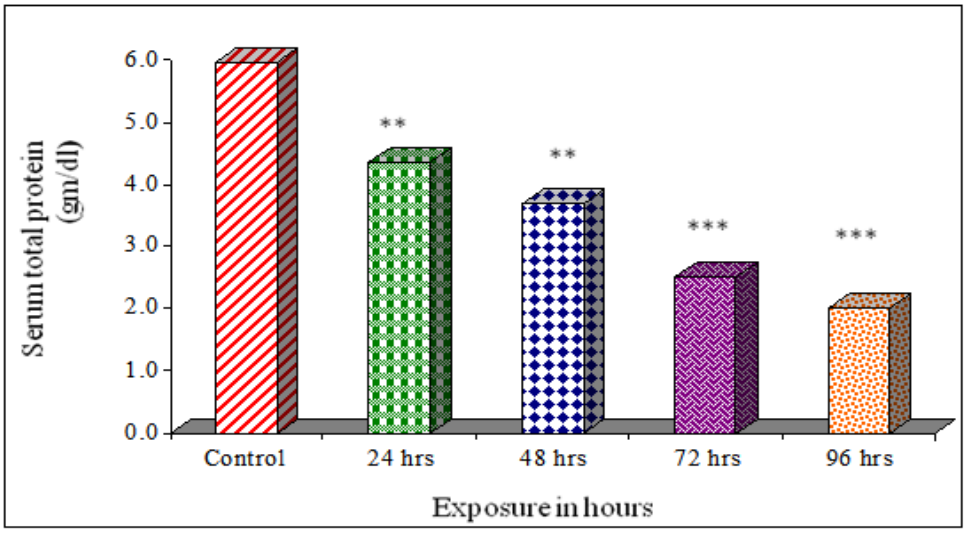

Figure-6
Biochemical estimation of serum total protein (gm/dl) after parathion intoxication in experimental fish Clarias batrachus

In the present investigation reduction in the serum total protein may also be attributed to intensive proteolysis which contributes to the increase in the free amino acids to be fed into TCA cycle as keto acids. This view is supported by the findings of Velisek *et al.*[16] reported significantly lower plasma total protein in rainbow trout after metribuzin toxicity. Min and Kang [17] also reported decline trend as same *Nile tilapia* after benomyl toxicity

Conclusion

In the present study after sub lethal exposure of carbaryl, carbosulfan and parathion on fresh water fish Clarias batrachus (linn.) shows increasing trend of blood glucose after different time intervals because pesticides led increased liver glycogenolysis , damage to islands of Langerhans which led to decreased insulin secretion and on the other hand respective pesticides show decreasing trend in serum total protein because of inhibition of RNA synthesis, liver damage where most protein synthesis usually occurs, excessive renal excretion (Albuminuria) and proteolysis.

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