RESEARCH ARTICLE OPEN ACCESS

# Impact of Azodrin on Protein Content in the Freshwater Fish *Catla Catla*

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**ABSTRACT**
*Catla catla,* a freshwater fish exposed to lethal (3.654 ppm) and two sub lethal concentrations of azodrin (1.827 ppm and 0.913 ppm) for 96h and 60 days and protein content was observed from different tissues after the exposure period. Acute exposure (6.25 ppm) results in significant decrease in the level of protein in testis, ovary and brain and slight decrease in intestine, muscles, liver and gills; whereas increased protein level was observed in kidney. Chronic toxicity results showed decrease in the level of protein content in ovary, brain, intestine, muscles, gills and liver to 3.50 ppm and 1. 50 ppm exposure; whereas in testis protein level was increased to 1.50 ppm and decrease protein content was observed in 3.50 ppm exposure.

## I. INTRODUCTION

It is well known that extensive usage of organophosphorus (OP) compounds in agriculture has resulted in a widespread distribution in the environment. The OP pesticides (OPs) have largely replaced organochlorine (OCl) compounds in the agricultural activities. OPs have been widely used to control agricultural pests, but these are harmful to non-target aquatic organisms when frequently used, due to contamination of aquatic environment through run-off (1). Although at present usage of several pesticides contribute to increased agricultural production and to eradicate vector borne diseases, their harmful effects on the non-target animals are not ruled out and also concentrated in them more readilythan to the terrestrial organisms(2).

Aquatic animals inhabiting polluted water bodies tend to accumulate many chemicals in high concentrations even when the ambient environmental contamination levels are low (3) a potentially hazardous situation for the entire food chain. Once a toxicant enters an organism, several biochemical and physiological responses occur which may be adaptive or may lead to toxicity. The biochemical processes represent the most sensitive and relatively early events of pollutant damage. Thus, it is important that pollutant effects be determined and interpreted in biochemical terms, to delineate mechanisms of pollutant action, and possibly ways to mitigate adverse effects.

OPs are known to inhibit acetyl cholinesterase (AchE) enzyme, which plays an important role in neurotransmission at cholinergic synapses by rapid hydrolyzing the neurotransmitter acetylcholine to choline and acetate (3). Some Ops are highly soluble in water and can therefore easily contaminate aquatic ecosystems, thereby increasing the exposure risk of aquatic flora and fauna (4). Pesticides in water cause damage to biotic life especially to fish. Fishes are very sensitive to a wide variety of toxicants in water. Various species of fish show uptake and accumulation of many contaminants or toxicants such as pesticides, polychlorinated biphenyls and heavy metals. Among these, pesticides have been found to be highly toxic not only to fishes but also to fish food organisms. Pesticides produce many physiological and biochemical changes in the freshwater fauna by influencing the activities of several enzymes and metabolites(5,6,7). It has also been reported that acute and chronic toxicities of pesticides caused biochemical alterations in organs (8, 9, 10, 11 &12).

The fish serves as bioindicator of water quality and the impact of pesticides can be well understood by analyzing the biochemical parameters of different tissues of it. As protein budget of a cell can be taken as an important diagnostic tool in the evaluation of its physiological state.

The alterations in biochemical contents in different tissues of fish due to toxic effects of different heavy metals and pesticides have been reported by many workers (13,14,15,16,17&7) Extensive work has been done on the toxic effects of pesticides on protein, carbohydrate and lipid contents of fishes, but very little work have been done on biochemical changes in *Catla catla*. Therefore the present work has been an attempt to assess the extent of alteration in protein content in *Catla catla* under azodrin toxicity.

## II. MATERIALS AND METHODS

The freshwater fish *Catla catla* were collected from the freshwater sources around Aurangabad city. Fishes were acclimatized in aged, dechlorinated and well aerated water for two weeks. During acclimatization they were fed on alternate days with pieces of live earthworms. The $LC_{50}$ values are

determined by following the guidelines given on committee of toxicity tests with aquatic organisms (18). The $LC_{50}$ values are calculated by Probit Analysis Method (19). The acclimatized fishes were exposed to lethal concentration (5.012 ppm) for 96h and two sublethal concentrations (3.50 ppm and 1. 50 ppm) for 60 days. Simultaneously a control group of healthy fishes were maintained under identical conditions. The fishes were sacrificed immediately at the end of exposure period and different tissues viz. gill, liver, gonads, brain, kidney, intestine and muscles were processed for the biochemical estimations. Protein content was estimated by Follin phenol reagent method (20).

## III. RESULTS AND DISCUSSION

In present study, an attempt has been made to examine the sub lethal toxic effect of organophosphate pesticide azodrin on protein metabolism in terms of tissue proteins in fish (**Table-1**).

Acute exposure (3.654ppm) resulted in significant decrease in the level of protein in testis, ovary and brain and least decrease in intestine, liver, gills and muscles. Whereas increased protein level was observed in kidney. The two sublethal exposure (1.827 ppm and 0.913 ppm) results show that there is decrease in the level of protein content in ovary, brain, intestine, muscles, gills and liver. Whereas in testis protein level increases at 1.50 ppm and decreases in 3.50 ppm exposure. Sub lethal exposure result when compared, we find, the protein level increases with decrease in the pesticide concentration i.e. increased protein level in ovary, testis, intestine, gills, brain and liver, whereas decreased amount of protein in muscles and kidney were observed at low concentration (1.50 ppm) (**Table-1**). Decrease in protein content after exposure to azodrin may be attributed to the improvement of protein synthesis and or increase in the rate of its degradation to amino acids which may be fed to TCA cycle through aminotransferases probably to cope up with high energy demands in order to meet the stress condition. The decrease in protein content suggests an increase in proteolytic activity and possible utilization of its products for metabolic purpose. Depletion of protein as a result of toxicity stress has already been reported by a number of workers (21, 22, 23, 24 and 25) reported decrease in protein content of muscles after DDT treatment in the fish Clarias batrachus. Saxena et al., (26) observed decreased level of protein in gonads of Channa punctatus after fenitrothion and carbofuran exposure. Reddy et al., (27) observed decreased level of protein in brain, liver and muscles of fenvalerate exposed fish Cyprinus carpio. Singh and Bhati (28) reported progressive decrease in the protein content with increase in exposure time in liver of Channa punctatus under 2, 4-D stress. Similar results were observed during present investigation. The changes in protein content may be due to damage caused to hepatic tissue and increased proteolysis. Ghousia and Vijayaraghavan (30) reported decrease in protein content of Dimethoate intoxicated fish (Clarias batrachus) indicated physiological adaptability of the fish to compensate for pesticide stress. To overcome the stress the animals require high energy, this energy demand might have led to the stimulation of protein catabolism. Rajyashree (29) also observed decline in protein level in liver, muscles, gills and brain during carbamide exposure of Labeo rohita. Das et al., (8) observed marked decrease in the protein content of various tissues like kidney and muscles and slight increase in the protein content of brain and gills in cypermethrin treated fish, Channa punctata. Susan et al., (30) have also reported a significant decrease in protein content under sublethal concentrations of pyrethroid fenvalerate in the gills of *Catla catla*.

The survival ability of animals exposed to stress mainly depends on their protein synthetic potential. The degradation of protein suggests the increase in proteolytic activity and possible utilization of their products for metabolic purposes and cause damage to tissues. (31). Similar trend was also observed by Ghosh et al. (32).

The decreased trend of protein content in various tissues of *Catla catla* in the present study may be due to metabolic utilization of keto acids in the synthesis of glucose or for the osmatic and ionic regulation as reported by Vutukuru (33), Venktramana et al. (34), Mamata Kumari (35), Chezhian et al.(36) and Murthy and Devi (37). The present study revealed the reduction in protein levels in the tissues of *L. rohita* by following acute exposure of toxicant Phenthoate. Similar changes were also recorded in *C. punctatus* exposed to malathion by Agrhari et al. (38) and Tilak et al., 39) have also explained the reduction of protein content of liver, brain and ovary of *C. punctatus* exposed to fenvalerate.

The fall in protein level during OP exposure may be due to increased catabolism (40,5,6) and decreased anabolism of proteins (17). The reducing trend of protein content may be attributed to metabolic utilization of ketoacids to gluconeogenesis pathway for the synthesis of glucose or for the maintenance of osmotic and ionic regulations (41). The alteration in protein value in liver may also be related to some structural changes in the liver, the arrangement of hepatic cords leading to the alterations of liver metabolism. Decrease in protein content could possibly be due to protein breakdown and suggests decrease in protein is due to damage of hepatic tissue and an intensive proteolysis. (42, 43, 6, 7).Thus, a decrease in the protein content during exposure to azodrin naturally affects the nutritive value of fish.

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**Table-1: Variations in Protein content in various tissues of *Catla catla*, exposed to lethal and sub lethal concentrations of Azodrin.**

| **Tissues** | **Control** | **Exposure Concentrations** | | |
|---|---|---|---|---|
| | | **Lethal (3.654ppm)** | **Sub-lethal (1.827 ppm)** | **Sub-lethal (0.913ppm)** |
| **Testis** | 18.6084 ± 0.1753 | 8.6263 ± 0.0945 | 10.1895 ± 0.2316 | 10.6526 ± 0.1158 |
| **%Change** | | (-53.64) | (45.24) | (42.75) |
| **Ovary** | 16.0549 ± 0.3063 | 6.9474 ± 0.1158 | 10.9999 ± 0.2895 | 17.2105 ± 0.895 |
| **%Change** | | (-56.72) | (-36.70) | (7.19) |
| **Kidney** | 25.7925 ± 0.2316 | 40.5263 ± 0.5789 | 32.9548 ± 0.5789 | 28.9473 ± 0.2316 |
| **%Change** | | (57.12) | (27.76) | (12.23) |
| **Liver** | 23.9629 ± 1.0942 | 21.5368 ± 0.4632 | 18.2368 ± 0.2895 | 20.3017 ± 0.3537 |
| **%Change** | | (-10.12) | (-23.89) | (-15.27) |
| **Muscle** | 11.9968 ±0.0884 | 10.1562 ± 0.0579 | 8.4629 ± 0.0579 | 7.3168 ± 0.1523 |
| **%Change** | | (-15.34) | (-29.45) | (-39.01) |
| **Gill** | 12.7542 ± 0.2397 | 11.5034 ± 0.1769 | 9.3314 ± 0.1158 | 9.8167 ± 0.11 |
| **%Change** | | (-9.80) | (-26.83) | (-23.03) |
| **Brain** | 31.6518 ± 0.6127 | 12.5873 ± 0.1158 | 17.6574 ± 0.2895 | 25.3259 ± 0.2316 |
| **%Change** | | (-60.23) | (-44.21 ) | (-19.98) |
| **Intestine** | 10.4625 ± 0.3063 | 9.2105 ± 0.1158 | 9.9893 ± 0.2316 | 10.6130 ± 0.1158 |
| **%Change** | | (-11.96) | (-4.52) | (1.43) |

Mean values are significant at $P<0.05$. (n=10)