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BIOCHEMICAL ALTERATIONS OF LAMBDA CYHALOTHRIN (SYNTHETIC PYRETHROID) AGAINST THE FRESH WATER FISH, *LABEO ROHITA* UNDER SHORT AND LONG TERM EXPOSURE PERIODS

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ABSTRACT

Pesticides directly and indirectly alter the aquatic organism's tissue biochemistry and physiology. These pesticides are posing a great threat to aquatic fauna especially to fishes, which constitute one of the major sources of protein rich food for mankind. Lambda cyhalothrin is a synthetic pyrethroid insecticide used in agriculture field to control pests and increase yield. This chemical mainly affects the stomach wall and central nervous system which damage the nervous transmission. Observing the biochemical factors led to the identifications of various effects produced by the toxicants. Lipid in an essential component of animal tissue which plays a prime role in energy metabolism. Lipids are also important in the cellular and sub cellular membranes.

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INTRODUCTION

With the advancement of industrialization usage of chemical pesticides and fertilizers and its application to agricultural field has increased. Pesticides directly and indirectly alter the aquatic organism's tissue biochemistry and physiology. These pesticides are posing a great threat to aquatic fauna especially to fishes, which constitute one of the major sources of protein rich food for mankind (Sharma and Singh, 2007). Detergent and other synthetic chemicals and agricultural wastes pose a serious threat to the water ecosystem and aquatic life (Allison *et al*., 1963; Ganeshwade, 2012). Fishes are highly sensitive to chemicals and *Labeo rohita*, one of the Indian major carp in the present study selected due to its availability, nature and effects. Pyrethroids belong to the most commonly used pesticides worldwide. Synthetic pyrethroid insecticides are derived from natural compounds (the pyrethrins) isolated from the *Chrysanthemum* genus of plants.

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Lambda cyhalothrin is a synthetic pyrethroid insecticide used in agriculture field to control pests and increase yield. This chemical mainly affects the stomach wall and central nervous system which damage the nervous transmission. Lambda cyhalothrin is categorised as restricted use pesticide in Extension Toxicology Network for its toxicity to fish (Maund *et al.,* 1998). Lambda cyhalothrin is proved to be highly toxic to aquatic invertebrates and fishes. (Kumar *et al.,*2010). Observing the biochemical factors led to the identifications of various effects produced by the toxicants. Lipid in an essential component of animal tissue which plays a prime role in energy metabolism. Lipids are also important in the cellular and sub cellular membranes (Shigmatsu and Takeshita 1959). Rao *et al.,* 1987, studied bio-chemical composition in respect to pH and fluoride in the bivalve *Indonaia caeruleus*. Pesticides exposure causes severe alterations in the tissue biochemistry and physiology. (Velisek *et al.,* 2009). Liver, kidney and gills are adversely affected due to the entry of pesticides. These studies indicates that pesticide exposure seriously alter the biochemical status of aquatic organisms mainly fishes.

Table 1. Effect of the pesticide lambda cyhalothrin on the lipid content in the fish *Labeo rohita* exposed for short term exposure periods

Sample (mg/g wet tissue)	Exposure periods				
	Control	24 hrs	48hrs	72hrs	96hrs
Gill	25.01±0.008	22.73±0.008	21.54±0.008	20.61±0.008	18.43±0.008
't value'		9.11**	13.87**	17.59**	26.30**
Liver	21.41±0.008	20.50±0.08	18.57±0.008	17.28±0.008	14.39±0.008
't value'		4.25**	13.26**	19.29**	32.78**
Kidney	26.83±0.008	23.07±0.008	21.01±0.008	22.25±0.008	19.01±0.008
't value'		14.01**	21.69**	17.07**	29.14**

**-Significant at one percent level;*-significant at five percent level; NS-Non significant.

Table 2. Effect of the pesticide lambda cyhalothrin on the lipid content in the fish *Labeo rohita* exposed for long term exposure periods

Sample (mg/g wet tissue)	Exposure periods			
	Control	10 days	20 days	30 days
Gill	19.02±0.008	17.27±0.008	16.12±0.008	15.22±0.008
't value'		9.20**	15.24**	19.97**
Liver	22.21±0.008	20.09±0.008	18.07±0.008	15.20±0.008
't value'		9.54**	18.64**	31.56**
Kidney	30.13±0.008	27.20±0.08	26.74±0.008	21.21±0.008
't' value		9.72**	11.25**	29.60**

**-Significant at one per cent level;*-significant at five per cent level; NS-Non significant.

MATERIALS AND METHODS

Estimation of Lipid

Cholesterol was estimated based on enzymatic method using cholesterol esterase, cholesterol oxidase and peroxidase.

Principle

Cholesterol esterase hydrolyses cholesterol esters into free cholesterol and fatty acid. In the second reaction oxidase converts cholesterol to cholest-40 en-3 one and hydrogen peroxide. In the presence of peroxidase, hydrogen peroxide oxidatively couples with 4-aminoantipyrine and phenol to produce red quinoneimine disc which has absorbance maximum at 540nm. This intensity of red colour is proportional to the amount of total cholesterol in the specimen.

Cholesterol esters Cholesterol + Fatty acid
Cholesterol + O_2 H_2O_2 + Cholest 4-en-3-one

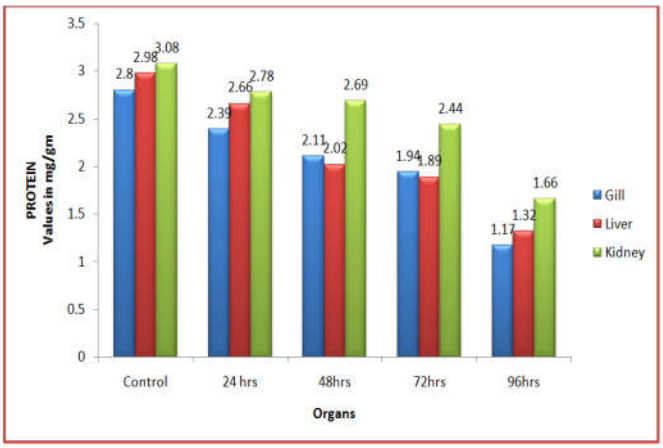
$2H_2O_2$ + 4 amino antipyrine + Peroxidase Red quinoneimine → Dye + H_2O

Procedure

0.5-2.5ml of working cholesterol solution was pipetted out into a clean dry test tube. The total volume in each tube was made upto 5ml with $FeCl_2$ dilution reagent. 0.1ml of the sample, 4.9ml of $FeCl_2$ precipitation reagent was mixed well and allowed to stand for a while and centrifuged. Transferred 2.5ml of supernatant in a dry test tube and added 2.5ml of $FeCl_2$ diluting reagent. Then added 4ml of concentrated H_2SO_4. After 30 minutes the colour was developed and read calorimetrically at 540nm. Similarly 2.5ml of standard solution and 2.5ml $FeCl_2$ dilution solution were taken and 4ml of concentrated H_2SO_4 was added and after 30 minutes read at 540 nm using calorimeter.

RESULTS

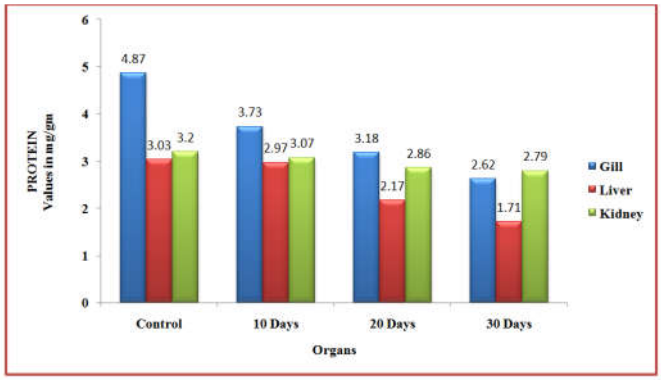
Short term exposure: The amount of lipid in gill tissue contain 22.73, 21.54, 20.61, 18.43 mg/g in the fish exposed to short term exposure of lambda cyhalothrin at 24, 48, 72, 96 hours respectively. While the control fish contain 25.01 mg/g in short term exposure. In short term the lipid content in liver where 20.50, 18.57, 17.28, 14.39 mg/g at 24, 48, 72, 96 hours respectively. In liver the control value for short term exposure is 21.41 mg/g. Kidney recorded 26.83 mg/g of lipid in control fish and 23.07, 21.01, 22.25, 19.01 mg/g of lipid fish exposed to short term exposure of lambda cyhalothrin for at 24, 48, 72, 96 hours respectively. The values are significant at P<0.01 level.



Graph 1. Effect of the pesticide lambda cyhalothrin on the lipid content in the fish *Labeo rohita* exposed for short term exposure periods

Long term exposure

The lipid content in the fish gill which exposed to long term exposure of lambda cyhalothrin (10, 20 and 30 days) where found to contain 17.27, 16.12, 15.22 mg/g. While the control fish contain 19.02 mg/g for long term exposure. In liver tissue the long term exposure it was 20.09, 18.07, 15.20 mg/g for 10, 20 and 30 days. In liver the control value is 22.21 for long term exposure period. For kidney tissue the long term exposure it was 27.20, 26.74 and 21.21 mg/g for 10, 20 and 30 days respectively. The control value was 30.13 mg/g for long term exposure period. The values are significant at P<0.01 level.



Graph. 2. Effect of the pesticide lambda cyhalothrin on the lipid content in the fish *Labeo rohita* exposed for long term exposure periods

DISCUSSION

Lipids are rich with energy when compared with other nutrients like carbohydrate and proteins. When the animal is under stress the energy rich compounds such as carbohydrate and lipids, stored in vital organs, get oxidized rapidly by lipases. Therefore, there is a depletion in the lipid content in the vital tissues. It may be due to the increased lipase activity. The decrease in total lipid content might be due to the utilization of lipids to meet the energy demands associated with the situation of stress. (Ganesan et *al,* 1989). The cholesterol level decreased during present study corroborates the earlier findings of Hota **(**1995). The greater energy demand caused by the stress of toxicant exposure can result in the mobilisation of lipid energy reserves and subsequent decline in the total lipid content of the organism. Arasta *et al.* (1996) noted the decrease of lipid contents in Indian cat fish, *Mystus vittatus* exposed to nuvan. Arockia and John (2006) reported declining trend of lipid content in the tissues like brain, gill, kidney, liver and muscles upon exposure to carbamate in the fish *Oreochromis mossambicus.* Bantu *et al.* (2013) reported that total lipid in liver and muscle decreased in *Labeo rohita* when exposed to sub-lethal concentration of chlorantraniliprote. In all test groups the level of lipid decreased in a time dependent manner. In the present study the decreased level of biochemical parameters indicates the action of insecticide. In conclusion, the results indicates that the pyrethroid insecticide lambda cyhalothrin negatively affects the biochemical parameters of the fish *Labeo rohita.*

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