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IMIDACLOPRID TOXICITY ON BIOCHEMICAL CONSTITUENTS IN LIVER TISSUE OF FRESH WATER TELEOST *CHANNA PUNCTATUS*

B.PADMA PRIYA * AND Y.AVASN MARUTHI

Research Scholar, Associate Professor Department of Environmental Science, GITAM Institute of Science GITAM University, Visakhapatnam, AP

ABSTRACT

There is a lack of information regarding the alterations in liver metabolities induced by Imidacloprid Insecticide. In the present study, the fresh water teleost *Channa punctatus* (Bloch) were exposed to Imidacloprid Insecticide for 96h to assess the Biochemical constituents of Glycogen, Proteins, Lipids and Cholesterol of liver tissue. The liver tissue showed significant depletion of Glycogen, Protein and Lipids and significant increase of Cholesterol. In view of results, the present study reports metabolic dysfunction in response to Imidacloprid toxicity in the test fish.

KEYWORDS : ***Channa punctatus*, Imidacloprid, Biochemical and Liver.**

B.PADMA PRIYA
Research Scholar, Associate Professor Department of Environmental Science, GITAM Institute of Science GITAM University, Visakhapatnam, AP

Corresponding author

INTRODUCTION

The indiscriminate use of pesticides has been causing environmental problems and their deposition in aquatic biota influencing structure and functional activities of the aquatic ecosystem[1]. The application and contamination of pesticides signify a relevant stressor for many non target aquatic and terrestrial species like fishes, prawns and bivalves etc. of the fresh water ecosystem. Recently, a great deal of awareness has been paid to assess the hazardous effect of pesticides on physiology of many non-target organisms, particularly fish. The insecticides pollute the aquatic environment and they are carried by rain water from here they pass into the food chain, eventually produced toxicity to fish[2]. Biochemical studies are the best studies to assess the health and functional activity of fish which helps to analyse the effect of pesticide in vital tissues. Sambasiva Rao[3] reported that carbohydrate metabolism and changes in proteins and glycogen in liver and muscle tissues of fish was due to pesticide hypoxia. Kumble and Muley[4] reported that insecticides mainly affect the liver tissue of fish. Mishra and Sharma[5] stated that proteins are the main source of energy which also plays a vital role in tissue manufacturing. Imidacloprid is a neo-nicotinoid insecticide of Bayer group (India) and it is used mainly to kill the pest and sold under trade names of Kohinoor, Admire, Advantage, Confidor, Premise and Winner. Imidacloprid is a systemic chloro – nicotinyl insecticide, it is the first member of a new family nicotinic acetylcholine receptor (nAChR) agonists nicotine and epibatidine. It is neurotoxic in nature and blocks the neuronal pathway (Nocotinergic) that is more abundant in insects than in warm blooded animals. Imidacloprid is considered as possible replacement for the widely used organophosphate pesticides. A review of literature and investigations in the field of pesticide pollution on fish fauna indicated that several researches have been carried out on the effects of organophospharous, organochlorine and pyrethroids. However, Imidacloprid effect on biochemical constitutes have not been much studied. Hence, the present study has been made to study the sub lethal effects of Imidacloprid on the biochemical parameters Glycogen, Total Protein, Total Lipids and Cholesterol in Liver tissue of fresh water edible Teleost *Channa punctatus*.

MATERIALS AND METHODS

The adult *Channa punctatus* weighing 20-25cm have been chosen as the experimental fish to evaluate the Biochemical parameters of Imidacloprid a systemic insecticide widely used for agricultural applications in various sectors. The fish were procured from River Sharada Anakapalli, Visakhapatnam Dist., Andhra Pradesh, India. They were brought to the laboratory and acclimatized under laboratory conditions for a period of 2 weeks. The tubs were disinfected with 0.01% KMnO4 solution and washed thoroughly to prevent dermal infection and fish were maintained in a circular plastic tubs with dechlorinated water which was continuously aerated. The fishes were fed once a day with commercial pellets and rice bran. Water was renewed daily and feeding to fish was withheld 24h before the commencement of the experiment. Five groups of 10 acclimatized fish were taken in each circular plastic tub of 10 litres of water capacity and different concentrations of Imidacloprid (0.002ppm, 0.00ppm, 0.006ppm, 0.008ppm and 0.01ppm) were added. Respected controls were maintained simultaneously. All experiments were carried out in triplicates. At the end of 96 h acute exposure period, the liver tissue was dissected out and processed for biochemical studies. The biochemical parameters Liver Glycogen[6], Total Protein[7], Total Lipids[8] and Cholesterol[9] were estimated as per the methods. Mean and standard error were calculated by using Graphpad.com/quickcals/t-test1.cfm from the triplicate samples. Student's t-test were employed to calculate the difference of significance (p<0001).

Table 1
Effect of Imidacloprid on biochemical constituents of Liver tissue in fresh water teleost Channa punctatus (96h exposure)

Parameter	Control	0.002 ppm	0.004 Ppm	0.006 ppm	0.008 Ppm	0.010 ppm
Glycogen	7.64±1.49	6.59±1.04 (63.57)*	6.43±0.88 (72.77)*	6.17±0.829 (74.35)*	5.56±0.80 (68.96)*	5.28±0.58 (90.72)*
Protein	7.44±0.101	7.15±0.076 (93.99)*	6.84±0.074 (91.84)*	6.40±0.075 (87.42)*	6.05±0.0522 (115.86)*	5.75±0.0322 (178.30)*
Lipids	0.85±0.058	0.75±0.038 (19.71)*	0.71±0.036 (19.64)*	0.65±0.033 (19.36)*	0.54±0.029 (18.13)*	0.46±0.025 (18.17)*
Cholesterol	121.62±1.07	134.63±1.15 (116.36)*	144.13±1.23(116.51)*	163.47±1.29 (126.23)*	185.29±1.33 (138.89)*	194.03±1.64 (118.30)*

Values are expressed as Mean ± Standard Error (SE) of 5 individual observations.
Values in brackets indicate t-test values. Significant at <0.001* and <0.005**.

RESULTS

In the present study, the percentage of biochemical constituents in the test fish have been recorded. The Table 1 indicates that the data on Biochemical changes in Liver Glycogen during acute toxicity exposed to Imdicaloprid in fresh water fish *Channa punctatus* after 96 h. At the end of 96 h the mean values of Liver Glycogen has showed a siginificant decrease (P<0.001) when compared to control group (7.64 mg/g) were 6.59,6.43,6.17,5.56 & 5.28 mg/g. The analysis of Liver Protein has showed significant decrease (P<0.001) 7.15, 6.84,6.40, 6.05 and 5.75 mg/g when compared to control group (7.44 mg/g). At the end of 96h the analysis of Lipids has showed significant decrease (P<0.001) when compared to control group (0.85 mg/g). The mean values in all five concentrations were 0.75, 0.71, 0.65,0.54 and 0.46. At the end of 96 h the liver Cholesterol in all five concentrations was 134.63, 144.13, 163.47, 185.29 and 194.03 (mg/g). The analysis of Cholesterol has showed significant increase when compared to control (121.62 mg/ml).

DISCUSSION

In the present study, Liver Glycogen found to be decreased as it is the chief organ of carbohydrate metabolism. The tissue-specific decline in Glycogen may be due to its speedy consumption to assemble the energy demands for more strapping activity under toxic symptom. Thangavel et al[10] conducted studies on *Sarotherodon mossambicus* (Peters) exposed to Dimecron and Ziram who suggested that the decrease in Glycogen meet the energy requisites for muscular activity. Tilak et al[11] observed a rate of oxygen consumption in three fresh water fish *Labeo rohita*, *Catla catla* and *Cirrhinus mrigala* exposed to Chlorpyrifos and suggested that the fish favours anaerobic metabolism to meet the energy demands when aerobic condition was lowered. In the present study also exposed fish *Channa punctatus* with various concentrations of Imidacloprid has showed a gradual depletion of glycogen content, suggesting the possibility of an alter from aerobic to anaerobic mode of energy metabolism of liver. The liver does a varied array of biochemical activities not only the organ of carbohydrate metabolism but also the organ of biotransformation of xenobiotics. A similar observation also has been observed by Tripathi et al[12]. The above changes support the alterations of glycogen in the present study. Protein is the most primary biochemical ingredient present in large quantities in the body of fish. Liver Protein is rich and centre for various metabolism of the fish. In the present study decrease in liver total protein in *Channa punctatus* is due to increased rate of proteolytic activity or repeated break down of protein to yield energy due to stress. The quantity of protein is dependent on the rate of protein synthesis or on the rate of its degradation. It may also be affected due to impairment incorporation of amino acid in to polypeptide chain[13]. Proteins may be attributed to the impairment of protein synthesis or increased rate of its degradation

to keto acids due the proteolytic activity which may fed to Tricarboxylic aicd phase during aminotransferases probably to cope up with high energy demands in order to meet the stress condition of toxicant[14]. Recently Shailendra Kumar Singh et al[15] and Tantrapale[16] observed in *Colisa fasciatus* and *Channa straitus* decrease in protein, and they stated that forceful tension may increase muscle action which may perhaps supply to protein filth that is proteolysis exposed to Cypermethrin. Similar findings also reported by Anita Susan et al[17]. In conformity with the above, it was noticed that in the present acute toxicity investigation liver protein content was decreased in test fish. Yazhni Jagadeesan and Sheela Darcus[18] also confirmed the above view when *Catla catla* was exposed to Profenofos insecticide.

Lipids are tremendous different group of compounds which function as significant resource of metabolism force. Lipids are full of energy than other biological compounds such as proteins and carbohydrates[19]. In the present study, low Lipid content in Imidacloprid exposed *Channa punctatus* might be due to lipolysis to assemble the energy preserve. Jayantha Rao[20] also noticed decreased lipid content in phosphamidon exposed fish *Tilapia mossambica* due to less eating under stress condition and used preserved lipid for immediate energy requirement. Rathod et al[21] and Shoba et al[22] also observed similar decreased levels of lipids. It is evident from the foregoing discussions that the lipid content has been declined when *Channa punctatus* exposed to Imidacloprid treatment and the collapse in total lipid level in acute toxicity may be due to alterations in metabolism under stress conditions in order to meet the instant energy. Cholesterol is a fat derived compound. In the present study Cholesterol was increased in liver due to severe toxic stress of Imidacloprid. Jaroli et al [23] observed increased cholesterol in *Channa punctatus* exposed to Chlorpyrifos due to destruction of excretory manner which lead to an incline in Cholesterol. Yazhni Jagadeesan[16] observed reduced cholesterol in *Catla catla* exposed to Profenfos due to toxic stress. Afaq et al[24] observed decreased cholesterol due to consumption of cholesterol in exposed fish *Cirrhinus mrigala* and obstruction in metabolism.

CONCLUSION

In view of above results and discussion in the present study, Glycogen, Protein and Lipids were decreased and Cholesterol levels were increased when exposed to sub lethal concentrations of Imidacloprid. Thus the present study suggests that Insecticde intoxification has been disturbed the functional activity of cells with consequential changes in the biochemical system in fish. Insecticides also reduce the nutritional value of aquatic fauna and deteoriatng the value of fish and at the same it will become peril to human beings due to its bioaccumulation of the insecticide integrated in fish.

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