



EFFECT OF SUB LETHAL CONCENTRATION OF IMIDACLOPRID ON GLUCOSE LEVEL OF *CHANNA PUNCTATUS*

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Abstract : The present study was aimed to observe the impacts of Imidacloprid (IMI) on the glucose levels in blood plasma of *Channa punctatus* and experiments were designed having control without insecticide and four treated at sublethal concentration 0.282 ppm for 24, 48, 72 and 96 hrs to assess the alterations in the level of glucose in blood plasma for acute exposure. At the end of 24 hrs, minimum percent decrease was 9.8% and a maximum percent decrease was 23.7% at the end of 96 hrs of treatment and 1.24% after recovery were recorded. Decreased glucose level was observed in blood plasma of *Channa punctatus* with an increase in the exposure periods of Imidacloprid (Confidor).

Keywords: Plasma glucose, Imidacloprid, *Channa punctatus*.

I. Introduction

Proper knowledge on the biochemical composition of fish finds application in several areas. Today there is an ever-increasing awareness about healthy food and fish is finding more acceptances because of its special nutritional qualities. In this context a proper understanding about the biochemical constituents of fish has become a primary requirement for the nutritionists and dieticians. Fish and fishery products are used in animal feeds. In this case also, proper data on the biochemical composition is essential for formulating such products. Impairment of carbohydrate metabolism is one of the outstanding biochemical lesions caused by the action of toxic compounds (Rama Murthy, 1988). The present study was designed to assess the effect of chloronicotinyl insecticide Imidacloprid on glucose level of fresh water teleost *Channa punctatus*. The alterations of the biochemical parameters could be used as an important tool to assess the physiological and metabolic activity of test fish. Toxicity depends on the toxicant concentration and the duration of exposure in the tissue. Several investigators have reported a number of changes in biochemical parameters of aquatic organisms due to pesticidal exposure.

II. Material and Methods

Healthy fresh water fish, *Channa punctatus* (av. length 08.40 ± 1.14 to 10.50 ± 1.56 cm and av. weight 12.14 ± 0.45 to 15.54 ± 0.48 gm) of both sexes were purchased from local market of Amalner, district, Jalgaon and used as the test animal, carefully brought to the laboratory avoiding any injury to the fish during transport. The fish were disinfected with 0.01% solution of $KmNO_4$ for two minutes and then transferred to a 45 litre capacity aquarium to acclimatize for 15 days in laboratory conditions. The fish were fed daily in the morning with chopped goat liver, boiled egg, meat, boiled intestine of goat, chicken as well as pieces of earthworm.

The commercial grade Imidacloprid purchased from the local market of Amalner. Its original name is Imidacloprid. Imidacloprid is a Chloronicotinyl insecticide, 1-((6-Chloro-3-pyridinyl) methyl)-N-nitro-2-imidazolidinimine ($C_9H_{10}ClN_5O_2$), is a nicotine mimic (nicotinoid insecticide). LC_{50} concentration determination was done by Finney (1971) as per Organisation for Economic Co-operation and Development (OECD) guidelines for testing of chemicals (OECD 203 "Fish, acute toxicity test", 1992 and 2010).

Imidacloprid (Confidor) 0.282 ppm was taken for studying effect of sub lethal concentration of Imidacloprid on fresh water fish, *Channa punctatus*. After completion of control and each experimental group, four fish were taken without anesthesia after an interval of 24, 48, 72 and 96 hrs for biochemical study and four fish were kept for recovery study. For this study blood samples were collected by heart puncturing using Ethylenediaminetetraacetate (EDTA) as anticoagulant (Schmitt, *et al.*, 1999). Collected blood volumes varied from 0.3-1ml depending on fish size. The blood was immediately centrifuged at 1500 rpm for 15 min. Plasma was then removed and stored at 4°C prior to immediate determination for various blood parameter. All experimental work was repeated five times.

Glucose was estimated by using GOD-POD (Trinder, 1969) method. Glucose (GLU) was determined using Biochemical analyser (Quantamate-RM 2012, Tulip Diagnostics, (P) Ltd. India, Mfg. by B.S.I., Italy) as per test kit manual. After completion of treatment, fish were removed from tubs, washed with water and sacrificed. All experimental work was repeated at least five times. The obtained results were analyzed by statistically using two-way analysis of variance (ANOVA) by using Microsoft Excel, 2007.

III. Result and Discussion

In present study normal values of plasma glucose level was reported the range of glucose 94 to 100 mg/dl. After an interval of 24, 48, 72 and 96 hr the serum Glucose (65-101 mg/dl) was measured significantly as compared with the control group in exposed to Imidacloprid treatment with sub lethal concentrations (0.282ppm). Pesticide toxicity in fish has been studied by several workers who have shown that at acute level, it causes diverse effects on biochemical parameters which are sensitive index to change due to pesticide toxicity and can constitute important tools in toxicological studies (Siddiqui, 2004).

A significant decline in glucose level in blood plasma of exposed fish was also observed. In present study glucose of control 77.14 ± 1.67 mg/dl as well as 69.54 ± 0.673 mg/dl, 66.5 ± 1.457 mg/dl, 62.46 ± 0.74 mg/dl, 58.86 ± 2.262 mg/dl and 76.18 ± 1.599 mg/dl for 24, 48, 72 as well as 96 hrs and after recovery period respectively. Reduction in glucose level was significantly ($P < 0.05$) time dependent as compared to control group. Maximum reduction in glucose level was found for 24, 48, 72 and 96 hrs and after recovery 9.8%, 13.8%, 19.03%, 23.7% and 1.24% respectively (Table 1.). The variations and percentage decreased in glucose content is graphically represented in fig. 1.1 and 1.2 respectively. After 10 days recovery period increased glucose level in blood plasma as like normal fish.

Pesticides are easily available in the food chain and subsequent accumulation in both aquatic and terrestrial flora and fauna. Chlorpyrifos insecticide caused significant increase in the activity of alkaline phosphatase, acid phosphatase and cholesterol while decrease in glycogen and protein contents in the liver of *Channa punctatus* (Bloch) (Jaroli and Sharma, 2005). Singh, *et al.* (2010) reported toxic effect of phorate on the serum biochemical parameters of snake headed fish *Channa punctatus* (Bloch). Azadirachtin, a botanical pesticide derived from the neem tree, *Azadirachta indica* is one of the most promising natural compounds (Winkaler *et al.*, 2007). Rehman *et al.* (2002) concluded due to the residual effects of pesticides, important organ like liver and kidney are damaged in fishes the role of any pesticide can be well understood by analyzing either tissue or blood of an animal species. The toxicants effect on hormonal balance as well as alterations in tissue protein levels.

The toxicity of Imidacloprid showed a direct correlation with the concentration and time exposure. Depletion of glycogen may be due to direct utilization for energy generation, a demand caused by Imidacloprid induced hypoxia. Decrement in pyruvate level is due to higher energy demand during pesticidal exposure. Shahi and Singh (2011) noticed a significant decrease was observed in serum total protein, glucose, calcium and chloride in experimental groups. Murty and Devi (1982) reported changes in concentration of protein, glycogen and lipid in *Channa punctatus* exposed to endosulfan. Fluoride alters enzyme activity in muscle and liver as well as decreased glucose and protein levels in blood and in muscles of *Channa punctatus* (Chitra *et al.*, 1983 and Gupta, 2003). Tripathi *et al.* (2003) have noticed 43% and 48% decrement in glycogen level in liver tissues. 71% and 76% Pyruvate level decreased in muscle tissue. Radhaiah, *et al.* (1987) noticed decreased carbohydrate content in the kidney and blood in Heptachlor treated fish *Tilapia mossambica* and stated this may be due to the rapid utilization of carbohydrates by the tissue possibly to overcome the pesticides induced stress.

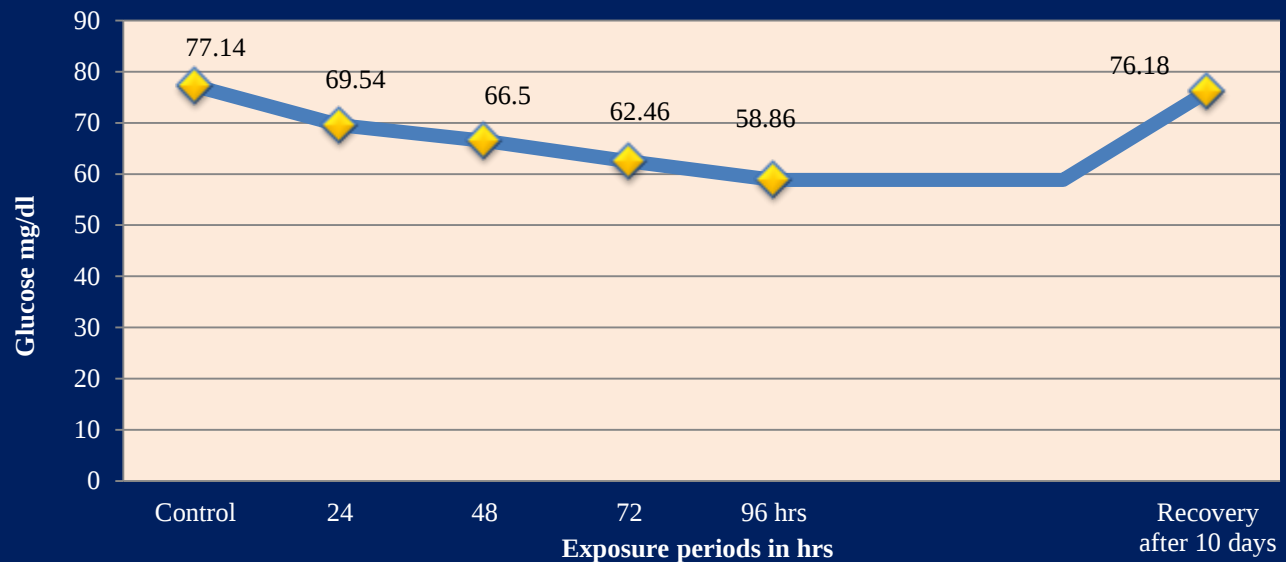


Fig. 1.1. Variation in glucose contents (mean) in *Channa punctatus* after exposure of sublethal concentration of Imidacloprid

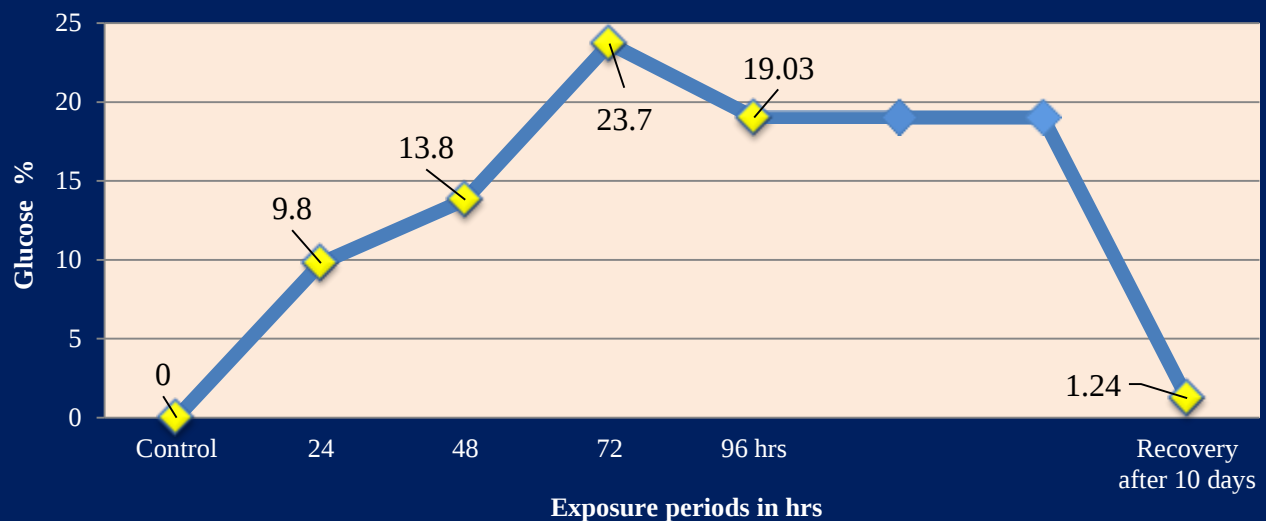


Fig. 1.2. Percent decrease of glucose in *Channa punctatus* after exposure of sublethal concentration of Imidacloprid

Exposure period (hrs)	Glucose (mg/dl)	Decrease in %
Control	77.14±1.671	-
24	69.54±0.673*	9.8*
48	66.5±1.457*	13.8*
72	62.46±0.74*	23.7*
96	58.86±2.262*	19.03*
Recovery	76.18±1.599	1.24

Data are represented as mean±SD

Data were analyzed through two-way ANOVA.

*Significant ($P < 0.05$), when treated groups were compared with control

Table 1. Variation in Glucose content in *Channa punctatus* exposed to sublethal concentration of Imidacloprid.

Reddy, et al. (2015) reported total glycogen and protein levels were decreased in the tissues such as liver, gill, kidney, brain and muscle of the fresh water fish *Labeo rohita* (Hamilton) on exposure to sub-lethal and lethal concentrations of Confidor (Imidacloprid ingredient) and showed that the liver a vital organ of carbohydrate metabolism was drastically affected by Confidor due to stress condition. Possibility for reduction

in the glycogen level may be due to destruction of glucose-6-phosphatase, which is located in the membrane of endoplasmic reticulum. The histological damage to hepatocytes and disappearance of glucose-6-phosphate by Dursban may be a possible cause for decrease in glycogen content of *Channa punctatus* (Jaroli and Sharma, 2005). Magar and Dube (2013) observed effect of the insecticide Malathion on biochemical study of protein, lipid and glycogen content showed decrement *Channa punctatus* during 96 hrs. Therefore, our results are in agreement with the observations of the previous workers. Hence the current results are helpful reference for evaluating the metabolic activity levels of Imidacloprid treated fish.

IV. Conclusion

In conclusion, alterations of glucose level in blood plasma can change the body metabolism and *Channa punctatus* exposed to Imidacloprid exhibited a significant dose and time dependent decrease in glucose. It is concluded Imidacloprid (Chloro-Nicotinyl) insecticide has a profound influence on plasma glucose of test fish. Fish with low glucose values (due to insecticide or any toxicants) is not fit for human consumption. The present investigation showed a need for continuous pollution assessment study of aquatic organisms in fresh water body.

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