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Assessment of Protein Content in Some Organs of Snake Head Fish *Channa gachua* (F.Hamilton) After Sub Lethal Exposure to Chlorpyrifos

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Abstract
Present study was conducted to assess the protein content in various tissues of snake head fish, *Channa gachua* after sub lethal exposure to chlorpyrifos. Chlorpyrifos is an organophosphate insecticide widely used in agricultural and domestic field for control of the pest. The lethal conc. was found to be 0.05ml/L under laboratory condition and 1/4th of lethal concentration was considered as sub lethal concentration. The acute toxicity of chlorpyrifos on *C.gachua* was assessed for 24, 48, 72 and 96 hrs. to sub lethal concentration (0.0125 ml/L) i.e. 1/4thconc. of LC50 and changes in protein content of various tissues like muscle, gill, stomach, intestine and brain was studied. The study revealed gradual decrease in protein content in above tissues. Hence, it was concluded that the pesticide intoxication made defective consequences in the normal metabolic pathways which increased the rate of mortality in fish population and risk of biomagnifications in food chain.

Keywords: acute toxicity, chlorpyrifos, protein content, *Channa gachua*

1. Introduction
With rapid industrialization and increase in human population, the water pollution has become a universal problem in the present days [1]. The important sources of water pollution are industrial effluent, domestic waste, sewage and pesticides which pollute the river and other water sources [2]. Pesticides entering in to aquatic environment bring multiple changes in non target organisms by altering the growth rate, nutritional value and behavioral pattern. The use of pesticide for pest control has certain drawbacks like potential health hazards of pesticide residue and biomagnification [3]. Many investigators have reported that synthetic organic pesticides like organochlorine, organophosphates (OP) and carbamates (CM) extremely affect to non target organism in freshwater fauna and food web. Chlorpyrifos is one of such an organophosphate pesticide widely used in agricultural, aquacultural and domestic pest control. Numerous environmental issues have arisen due to excessive use of these pesticides [4]. Chlorpyrifos has various detrimental effects on fish such as neurotoxicity [5], biochemical and histopathological alterations [6], Genotoxicity [7] etc.

Fish is highly nutritious, easily digestible and much saught after food [8], so they possess the high economic value. Nutritional value of fish depends on its biochemical composition which is alter by pollutants. Fishes are more sensitive to polluted water. Pesticides may significantly damage certain physiological and biochemical processes, when they enter in to the organ of fish. Alteration in biochemical components in response to pesticidal stress were authenticated by many workers [9, 10, 11, 12, 13, 14]. It is therefore necessary to focus attention on change in biochemical composition of organism which are constantly living in polluted water bodies. So, the present study was under taken to evaluate the toxic effect of chlorpyrifos used widely by farmers on protein profile of *C. gachua,* the fresh water fish from local river Krishna.

2. Material and Methods
2.1 Procurement of test fish
The fish *Channa gachua* were selected for experiment keeping in mind their economic value and availability throughout the year. The fishes were collected from river Krishna near karad city and brought to laboratory. Fishes were disinfected with 1% $KMnO_4$ solution and acclimatized at laboratory condition in glass aquarium for ten days before experimentation. The healthy fishes having average length 15 ± 1 cm and the weight about 50 ± 5 gm were selected for experimentation.

2.2 Pesticide
The organophosphate pesticide, chlorpyrifos purchased from local agro chemist shop was used for the present study.

2.3 Experimental set up
Healthy fishes were divided in to three groups, of 10 fishes per aquarium. Group first and second considered as experimental group and group third served as control. The fishes in experimental group were transferred to glass aquaria containing sublethal concentration of chlorpyrifos solution (0.0125 ml/L). The control group of fishes was maintained simultaneously in separate aquarium containing tap water. The experimental fishes were sacrificed after 24, 48, 72 and 96 hrs. The desired organs of experimental and control fishes such as muscle, gill, stomach, intestine and brain were taken for the estimation of total protein content.

2.4 Biochemical method
The assessment of protein content of tissues of control and experimental fishes was done by using Lowry's method [15].

3. Result
The calculated values for total proteins in various tissues of control and experimental group along with standard deviation are given in Table 1 and graphically represented in fig. 1. In

control fish the total protein content was in the order of Intestine > Gill > Stomach > Muscle > Brain. In present study it is observed that the protein content in muscle, gill, stomach, intestine and brain of fish were significantly decreased at different exposure period.

Table 1: Protein content (mg/g wet wt of tissue) in different tissue of control fish and experimental fishes.

Tissue	Control	24hrs	48hrs	72hrs	96hrs
Muscle	20.17±0.41	16.91±0.38	13.64± 0.32	11.26±0.22	8.26±0.28
Gill	24.58±0.70	20.61± 0.35	18.08± 0.30	14.08±0.12	10.47±0.18
Stomach	23.88± 0.47	18.73± 0.09	13.88± 0.08	11.39±0.20	7.73±0.22
Intestine	26.52± 0.05	20.08± 0.15	15.20± 0.17	13.32±0.21	10.76±0.21
Brain	12.49± 0.08	10.32± 0.15	8.47± 0.22	6.82± 0.08	4.29±0.21

Each value is the mean of 5 individual determinations ± indicates SD.

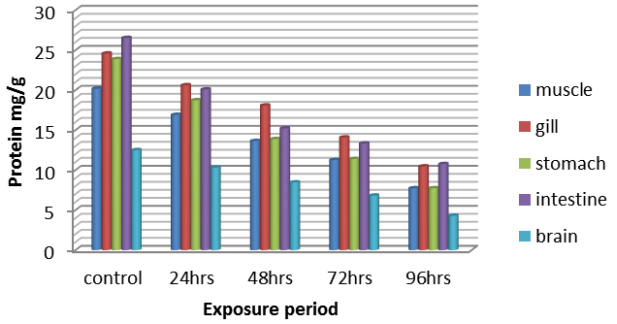

Fig. 1. Protein content (mg/g wet wt. of tissue) in different tissue of control fish and experimental fishes.

The values were found to be 16.91, 13.64, 11.26 and 8.26 mg/g wet wt of tissue in muscle for 24, 48, 72 and 96 hrs. respectively which were linearly decreased in comparison with control (20.17) mg/g wet wt. of tissue. Total protein content in gill of treated fish exposed to sublethal concentrations for 24, 48, 72 and 96 hrs were 20.61, 18.08, 14.08 and 10.47 mg/g wet wt of tissue respectively, these values showing decreasing trend according to exposure period. Stomach showed 18.73, 13.88, 11.39 and 7.73 mg/g wet wt of tissue of protein after 24, 48, 72 and 96 hrs exposure of pesticide respectively which was significantly decreased as compared to control (23.88 mg/g wet wt of tissue). The protein content showed marked decrease in intestine of experimental fish at 24, 48, 72 and 96 hrs. exposure that were 20.08, 15.20, 13.32 and 10.76 mg/g wet wt of tissue respectively where as in control fish it was 26.52 mg/g wet wt of tissue. In brain the protein content in control fish was 12.49 mg/g wet wt of tissue which was linearly decreased in treated fish as 10.32, 8.47, 6.82, and 4.29 mg/g wet wt of tissue for 24, 48, 72 and 96 hrs respectively. After exposure to chlorpyrifos depletion in protein content in above tissues of fish *C.gachua* was in the order of Stomach > Brain > Muscle > Gill > Intestine.

4. Discussion

The proteins are indeed of primary and paramount importance in the living world not only because of their peculiars but also they appear to confer their biological specificity among various types of cells [16]. Proteins are important organic substances required by organisms in tissue building and play an important role in energy metabolism [17]. Protein being the essential substance which is needed for growth and development of body and also serves as energy source during the stress condition [10].

Sublethal dose of chlorpyrifos produced severe biochemical abnormalities in various tissues of fish and that affects the metabolism and growth of the fish. In the present study the pesticide chlorpyrifos induced pronounced changes in protein content in *C. gachua* indicating altered metabolism. It causes drastic depletion in protein content of muscle, gill, stomach, intestine and brain protein content at all exposure periods. Similar findings are reported by number of workers that is decline in protein level in various organs and tissues under toxic stress of various chemicals. Decreased protein content in the liver, brain and kidney tissues of *C. punctatus* during lihosin treatment was observed by Naveed *et al.* [18]. Singh *et al*. suggested that the cypermethrin is toxic to fresh water teleost fish *C. fasciatus* [19]. The sub lethal doses of cypermethrin significantly altered the total protein in the fish. Cypermethrin affect total protein in muscle and liver tissues of *C. striatus* therefore proteins are mainly involved in energy and metabolic process Tantarpale [20]. Rohankar *et al.* revealed significant decrease in both soluble and insoluble proteins in muscle, liver, kidney and tissues of the fish *C. punctatus* under the exposure of phosphamidon [21]. Cypermethrin causes reduction in total proteins in the gill, liver and kidney of *C. mrigala* when exposed to its sublethal concentration. (Vasantharaja *et al.* [22]. Rajput *et al*. reported that imidacloprid, sodium fluoride and butachlor are the three toxicants that caused remarkable protein loss in fish *C. batracus* during lethal and sub lethal concentrations [23]. Satyavardhan noticed that the fenvalerate and malathion causes reduction in total proteins in the various tissues of exposed fish *C. idella* [24]. Nirmalakallagadda and Rathnamma indicated that flubendiamide caused alterations in the protein content of fish *L. rohita* [25]. Due to phenthoate pesticide intoxification the total protein content decreased in various tissues of *L. rohita* [26]. A remarkable decrease in protein was observed by Jain with higher concentration of methyl parathion in the gill of *C. gachua* [27]. Ramesh Raju *et al*. investigate that quinolphos alter the biochemical metabolism in the fish *C. carpio* by changing the level of total protein content in different tissues at different exposure [28]. The depletion of proteins under the stress of endosulphan and fenvalerate toxicity in different tissues of *L. rohita*, due to the proteolysis, whereas proteins were utilized to meet the excess energy demands during toxic stress [29].

Energy is stored in the form of biochemical constituents which are utilized to cope up with pesticidal stress, so the protein content in different tissues falls down. Pesticide toxicity brings destruction or necrosis of the cell and impairment of protein synthesis machinery this may leads in to decrease in total protein content.

5. Conclusion

It is concluded that the chlorpyrifos is toxic to the fish *C.gachua.* The sublethal dose of this pesticide significantly alters the total protein content in various tissues of the fish, that decrease its nutritional value. Such fish with altered protein content is not good for human consumption. Therefore, the use of such pesticides should be minimized in vicinity of aquatic habitat.

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