TOXICITY EFFECT OF METHYL PARATHION ON PROTEIN ALTERATIONS IN THE FISH, *Labeo rohita*

[1]ANANDAN, P., [2]SURESH KUMAR, R., AND [3*]KRISHNAMURTHY, R.,

P.G. & Research Department of Advanced Zoology and Biotechnology, Nanthanam Government Arts College, Chennai, Tamil Nadu, India - 600 035.

Abstract: Organophosphate pesticide methyl parathion is the most commonly used pesticides worldwide in the pest control of crops. Freshwater fish, *Labeo rohita* is an important fish species popularly called rohu in Tamil Nadu region having good nutritional values. Fishes living in close association with may accumulate pesticides. To analyze total protein content in fish *Labeo rohita* exposed under organophosphate pesticide methyl parathion. Present study, toxic effects of the pesticide methyl parathion LC_{50} 4.5 ppm was observed. The 10% and 30% sublethal concentrations of total protein content in the tissue of gill, liver and muscle of freshwater fish, *Labeo rohita* were estimated. Toxicity effect of methyl parathion resulted in decrease of total protein in all concentration of time intervals. Lowest total protein content was observed gill tissue and highest protein content were observed in muscles. Decrease was more pronounced with increasing time of exposures. There is decreased in all tissues of total protein content increasing exposure periods compared with control fish *Labeo rohita*. Present results indicated the toxic nature of the pesticide methyl parathion. Therefore it is advised to pesticide workers to take all precautions regarding protection from pesticide exposure and proper use of prophylactic supplementation for their healthy life.

Index Terms*: *Freshwater fish, Labeo rohita, Methyl parathion, Total protein.

I.INTRODUCTION

Pesticides are extensively used in intensive agricultural production and fish farms to control the pest population. These pesticides can reach natural waters either via transfer of the chemicals from the soil or by direct spraying on the target organisms. Pesticides affect non-target organisms, such as prawn and fish, which are of great economic importance to humans[1]. Fishes are one of the most susceptible animals to pesticide pollution because of their anatomy and physiology. Fishes live in intimate contact with surrounding water through their gills and branchial surface comprises over half the surface area of the body. Therefore, contamination of water bodies by pesticides causes acute and chronic poisoning of fish and results in severe damage to vital organs[2&3].

Parathion is an organophosphate compound and is a potent insecticide. EPA[4] has classified parathion as a Group C, possible human carcinogen. Most of methyl parathion is discharged with urinary and some of it is discharged with stools[5].

Alteration in biochemical contents in different tissues of fish due to toxic effects of different pesticides have been reported by a number of workers[6]. The biochemical parameters either increase or decrease in the metabolic rate depending on the site of action. Most of the chemicals pesticides acts as metabolic depressor in the environment and generally causes pressure on biologically active molecules such as proteins, glycogen, carbohydrates and lipids[7]. Proteins are the building blocks of the animal's body, and it is most fundamental biochemical substance to maintain the blood glucose and energy source during the stress period. Proteins play a major role in the interaction process of the cellular medium in the organisms[8].

II. MATERIALS AND METHODS

Fish, *Labeo rohita* were collected from Thiruvannamalai district, India and were brought to the laboratory in large plastic troughs and acclimatized for one week. Healthy, fish having equal size (length 11 to 12 cm) and weight (50 to 60 g) were used for experimentation. Stock solution of pesticide methyl parathion was prepared by dissolving appropriate amount of salt in distilled water. Physico-chemical characteristic of test water have analyzed regularly during the test periods following the standard method describe by APHA[9]. Batches of 10 healthy fishes were exposed to different concentrations of methyl parathion to calculate the medium lethal concentration LC_{50} value (4.5 ppm) using probit analysis Finney method[10]. Fishes (Four groups) were exposed to the two sublethal concentrations ($1/10^{th}$ and $1/30^{th}$ mg/L) of pesticide methyl parathion for 4, 8 and 12 days respectively. Another group was maintained as control. At the end of each exposure period, fishes were sacrificed and tissues such as gill, liver and muscle were dissected and removed. Tissues (10 mg) were homogenized in 80% methanol, centrifuged at 3500 rpm for 15 minutes and the clear supernatant was used for the analysis of total proteins. Total protein concentration was estimated by the method of Lowry *et al.* [11].

III. RESULTS

Median lethal concentration (LC_{50})

Pesticide methyl parathion caused 50% mortality of fish *Labeo rohita* at 96 hours was 15 ppm. The LC_{50} values of methyl parathion for 24, 48, 72 and 96 hours were 3.0, 3.5, 4.0 and 4.5 ppm respectively.

In the present investigation, alteration in total protein content of gill, liver, and muscle tissues of fish, *Labeo rohita* exposed to lethal concentrations of pesticide methyl parathion was studied along with control fish. The data was supported by various statistical analyses and the standard deviation of the mean

was calculated. Changes in the total protein in different tissues such as gill, liver and muscle of fish *Labeo rohita* exposed to two sublethal concentrations of methyl parathion for the period of 4, 8 and 12 days respectively (Table 1 and Fig. 1 to 3).

Gill Protein

Fish *Labeo rohita* treated with sublethal concentrations of pesticide methyl parathion on 10% & 30% showed a decreasing trend in the gill protein when compared to control (Table 1 and Fig. 1). Protein values of control fish were recorded from 4.67, 4.72 and 4.69 mg/g. The 10% sublethal concentration of gill protein values were noted from 4.49, 4.24 and 3.38 mg/gm, and the 30% sublethal concentration of gill protein values were recorded from 4.38, 4.12 and 3.51 mg/g after exposure of 4, 8 and 12 days respectively.

Liver Protein

Freshwater fish *Labeo rohita* treated with sublethal concentrations of pesticide methyl parathion on (10% & 30%) showed a decreasing trend in the total liver protein compared to control (Table 1 and Fig. 2). The 10% sublethal concentration of liver protein values were recorded from 6.11, 5.69 and 5.31 mg/g and the 30% sublethal concentration of liver protein values were estimated from 5.87, 5.42 and 5.17 mg/g respectively. Liver protein of control fish tissues was noted from 6.24, 6.24 and 6.39 mg/g after exposure of 4, 8 and 12 days respectively.

Muscle Protein

Fish *Labeo rohita* treated with sublethal concentrations of pesticide methyl parathion on 10% and 30% showed a decreasing trend in the muscle protein when compared to control (Table 1 and Fig. 3). Control fish muscle protein values were noted from 8.16, 8.17 and 8.15 mg/g. The 10% sublethal concentration of muscle protein values were recorded from 7.98, 7.55 and 7.21 mg/g and the 30% sublethal concentration of pesticide methyl parathion treated fish muscle protein values were reported from 7.78, 7.32 and 7.04 mg/g after exposure period of 4, 8 and 12 days respectively.

Table 1 : Total protein content (mg/g) in wet weight tissues of fish, *Labeo rohita* exposed to two sublethal concentrations (10% and 30%) of pesticide methyl parathion.

Days	Exposure	Gill	Liver	Muscle
4 days	Control	4.67 ± 0.21	6.24 ± 0.09	8.16 ± 0.06
	10 % SLC	4.49 ± 0.06	6.11 ± 0.04	7.98 ± 0.10
	30 % SLC	4.38 ± 0.11	5.87 ± 0.11	7.78 ± 0.11
8 days	Control	4.72 ± 0.17	6.24 ± 0.06	8.17 ± 0.12
	10 % SLC	4.24 ± 0.18	5.69 ± 0.12	7.55 ± 0.14
	30 % SLC	4.12 ± 0.08	5.42 ± 0.15	7.32 ± 0.09
12 days	Control	4.69 ± 0.19	6.39 ± 0.26	8.15 ± 0.13
	10 % SLC	3.88 ± 0.14	5.31 ± 0.012	7.21 ± 0.09
	30 % SLC	3.51 ± 0.24	5.17 ± 0.12	7.04 ± 0.06

Means ± SD (N=4) - SLC – Sublethal concentration

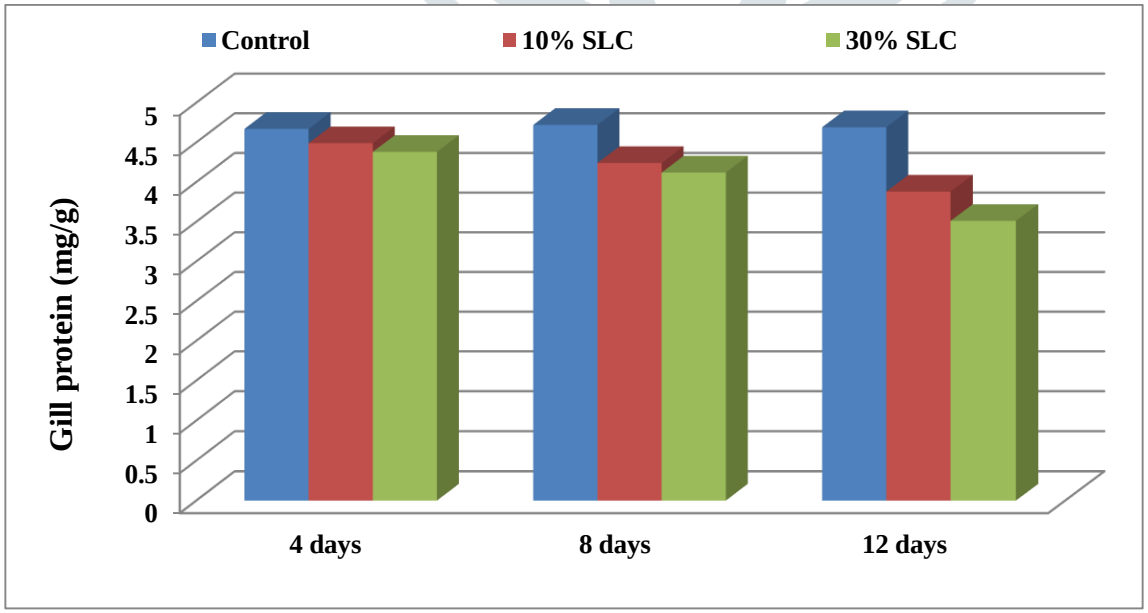

Fig. 1. Total protein content in gill tissues of fish *Labeo rohita* exposed to sublethal concentrations of pesticide methyl parathion.

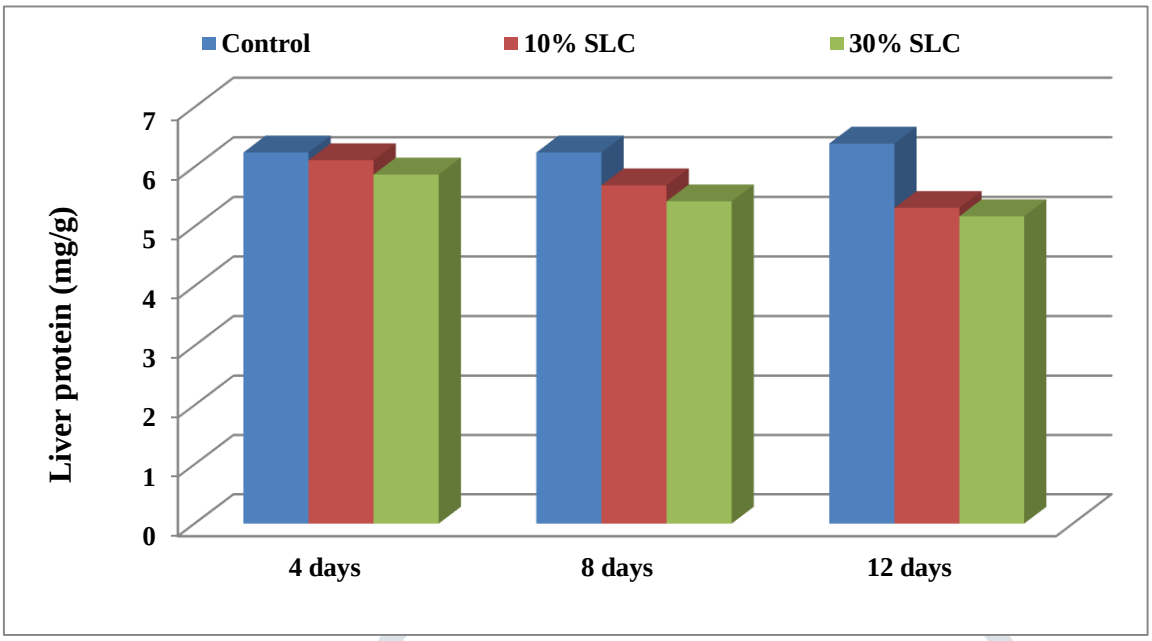

Fig. 2. Total protein content in liver tissues of fish *Labeo rohita* exposed to sublethal concentrations of pesticide methyl parathion.

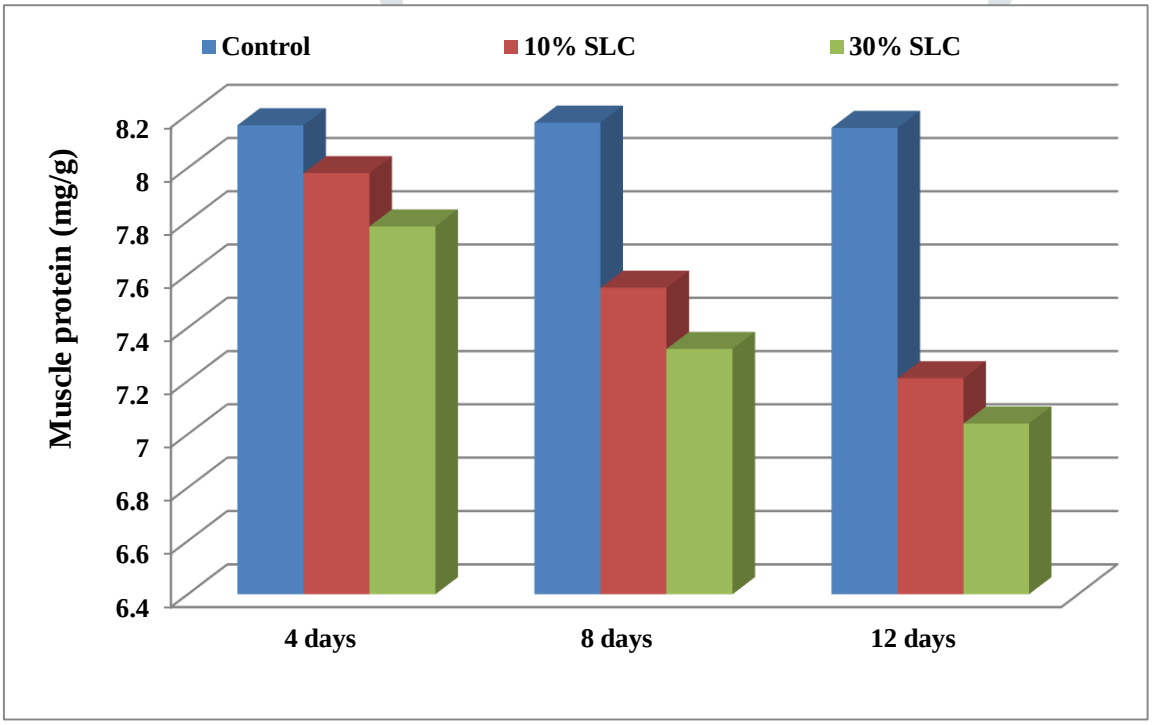

Fig. 3. Total protein content in muscle tissues of fish *Labeo rohita* exposed to sublethal concentrations of pesticide methyl parathion.

IV. DISCUSSION

In the present study, total protein content in gill tissue of fish *Labeo rohita* was found to be abating in the pesticide infected fishes with the dependence of concentration and span of exposure of pesticide methyl parathion for 4, 8 and 12 days showed decreasing trend in the gill protein. The proteins reduction

might be due to the impaired or low protein synthesis under the toxic stress condition and enhancement of photolytic activity in the organisms. The similar results have been recorded by the previous workers[12]. Proteins are involved in major physiological events therefore the assessment of the protein content can be considered as a diagnostic tool to determine the physiological phases of fish. Result of the present study showed significant decrease in liver protein content of methyl parathion exposed fish, when compared to control.

Palanikumar *et al*.[13] noted the protein contents were reduced in the highest concentrations of pesticides chlorpyrifos and carbendazim, respectively. Maximum reduction in total protein content was observed in chlorpyrifos exposed fish *Chanos chanos.* After 4 days (96 hr) period of exposure the total protein content was progressively depleted with the percent change of 11.90%, 11.69%, 14.92%, 20.29%, 15.17%, and 14.8 % in this six tissues whereas on 8th day protein percent change have been deducted to 18.43%, 18.98%, 28.36%, 39.13%, 26.45%, and 21.02% in the tissues with increase the time period[14]. In both 4 and 8 days of exposure period the protein levels have fallen much in the liver and muscle followed by the kidney, gill, brain and gut. The decline in protein content in the different tissues might be due to degradation of proteins into free amino acids for various metabolic activities, which is supported by Kumar and Gopal [15].

Cypermethrin and malathion decreased protein contents in *Labeo rohita*[16]. Monocrotophos exposure resulted in significant decrease in protein contents in freshwater fish, *Labeo rohita*[17]. Endosulfan exposure resulted in significant decrease in protein contents in Cyprinus carpio[18]. Present study carried out 10% and 30% sublethal concentrations of total protein content in the tissue of gill, liver and muscle of freshwater fish, *Labeo rohita* were estimated. Toxicity effect of methyl parathion resulted in decrease of total protein in all concentration of time intervals. The lowest total protein content was observed gill tissue and highest protein content were observed in muscles. Decrease was more pronounced with increasing time of exposures. There is decreased in all tissues of total protein content increasing exposure periods compared with control fish *Labeo rohita*. This results indicated the toxic nature of the pesticide methyl parathion.

V. CONCLUSION

Present study indicates that presence of low concentration of pesticide methyl parathion in the water is toxic to fishes and alters the protein of the fish tissues. This result indicates that the usage of the pesticide methyl parathion in the agriculture fields may be a threat to aquatic fauna and flora as well as humans. Therefore, the information obtained may be useful for management and monitoring of agricultural pesticide contamination in aquatic ecosystem. .

VI. ACKNOWLEDGEMENTS

Author is grateful thanks to the Principal, Head of the Department and other staff members of Zoology and Biotechnology, Govt. Arts College, Nanthanam, Chennai, India for providing necessary facilities.

REFERENCES

[1] Saravanan, M., Kumar, K.P., and Ramesh, M., 2010. Haematological and biochemical responses of freshwater teleost fish *Cyprinus carpio* (Actinopterygii: Cypriniformes) during acute and sublethal exposure to lindane. *Pestic. Biochem. Physiol*., 100: 206-211.

[2] Singh, P.B., and V. Singh. 2006. Impact of endosulfan on the profiles of phospholipids at sublethal concentration in the male *Heteropneustes fossilis Bloch. J. Environ. Biol*., 27(3): 509-514.

[3] Singh, R. N. 2013. Effects of dimethoate (30%), an organophosphate pesticide on liver of common carp. *J. Environ. Biol*., 657-661.

[4] EPA. 2016. http://www3.epa.gov/airtoxics/hlthef/p arathio.html.

[5] Yildirim, M. 2006. Metil paratiyonun ratlarda nefrotoksik etkisi ve Vitamin Cve E'nin koruyucu rolü. Yüksek Lisans Tezi, Gazi Üniversitesi, 1-50, Ankara.

[6] James, R., and K. Sampath. 1995. Sublethal effects of mixtures of copper and ammonia on selected biochemical and physiological parameters in the catfish *Heteropneustes fossilis* (bloch). *Bull. Environ. Contam. Toxicol*., 5(2): 187-194.

[7] Agrahari, S., and K. Gopal. 2009. Fluctuations of certain biochemical constituents and markers enzymes as consequence of Monocrotophos toxicity in the edible freshwater fish, *Channa punctatus*, Pesticide *Biochem. Physiol*., 94: 5-9.

[8] Magar, R.S., and A. Shaikh. 2012. Biochemical changes in proteins and amino acids in *Channa punctatus* in responses to sub lethal treatment with the insecticide malathion, 1(3): 2319-4731.

[9] APHA. 1998. Standard methods for the examination of water and waste water, 20th Edition, Washington, DC.

[10] Finney, D.J. 1971. Probit analysis, 3rd (Ed.), Cambridge University Press, London, 333.

[11] Lowry, O.H., N.J. Rosebrough., A.L. Farr., and R.J. Randall. 1951. Protein measurement with the Folin phenol reagent. *J. Biol. Chem*., 193: 265-275.

[12] Shinde, R.V., M. U. Veeresh and R. S. Kulkarni. 2002. Ovarian changes in response to heavy metals exposure to the fish *Notopterus notopterus* (Pallas), *J. Environ. Biol*., 23(2): 137-141..

[13] Palanikumar , L., A.K. Kumaraguru., C.M. Ramakritinan., and M. Anand. 2014. Toxicity, biochemical and clastogenic response of chlorpyrifos and carbendazim in milkfish *Chanos chanos*, *Int. J. Environ. Sci. Technol*., 11: 765-774.

[14] Tripathi, V.K., and Rajesh Kumar Yadav. 2015. Effect of pesticide (organophosphorus) on aquatic fish *Labeo rohita*. *Int. J. Chem. Sci*.,13(2): 625-640.

[15] Kumar, S., and K. Gopal. 2001. Impact of distillery effluent on physiological consequences in the freshwater teleost *Channa punctatus, Bull. Environ. Contaminat. Toxicol*., 66: 617-622.

[16] Thenmozhi, C., V. Vignesh., R. Thirumurugan., and S. Arun. 2011. Impacts of malathion on mortality and biochemical changes of freshwater fish, *Labeo rohita. Iran. J. Environ. Hlth. Sci. Eng*. 8, 387-394.

[17] Muthukumaravel, K., B. Sivakumar., P. Kumarasamy., and M. Govindarajan. 2013. Studies on the toxicity of pesticide monocrotophos on the biochemical constituents of the freshwater fish, *Labeo rohita. Int. J. Curr. Biochem. Biotechnol*. 2 (10): 20-26.

[18] Bibi, N., A. Zuberi., M. Naeem., I. Ullah., H. Sarwar., and B. Atika. 2014. Evaluation of acute toxicity of karate and its sub-lethal effects on protein and acetylcholinesterase activity in *Cyprinus carpio. Int. J. Agri. Biol*. 16: 731-737.