ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 8, Issue, 11, pp.40860-40863, November, 2016

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

EFFECT OF MALATHION TOXICITY ON PROTEIN ALTERATIONS IN THE FISH, OREOCHROMIS MOSSAMBICUS

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ARTICLE INFO

Article History:
Received 24th August, 2016
Received in revised form
04th September, 2016
Accepted 23rd October, 2016
Published online 30th November, 2016

Key words:
Freshwater fish,
Oreochromis mossambicus,
Malathion, Protein.

ABSTRACT

Pesticides is a common pollutants of freshwater ecosystems where they induce adverse effects on the aquatic biota. Freshwater carp fish, *Oreochromis mossambicus* is an important carp species in Tamil Nadu region having good nutritional values. Fishes living in close association with may accumulate pesticides. In the present investigation, the toxic effects of the malathion LC_{50} 0.25 ppm on some biochemical characteristics (total protein in gill, kidney, liver and muscle) of the freshwater carp fish, *Oreochromis mossambicus* were estimated. There is decreased in all tissues on compared with control. The results indicated the toxic nature of the pesticide malathion.

Citation: Janani, N., Rengarajan, R. and Ravathi, K. 2016. "Effect of malathion toxicity on protein alterations in the fish, oreochromis mossambicus", *International Journal of Current Research*, 8, (11), 40860-40863.

INTRODUCTION

Malathion, an organophosphate pesticide is being extensively used as dust, emulsion, and vapour to control wide variety of insect pests under different conditions. Like other pesticides, lethal and sublethal treatment of malathion exerts various toxic effects on fish. Malaoxon, a primary metabolite of malathion is 60 times more toxic than malathion and it seriously and chronically poison the occupants living in the environment Detectable liver injury in the fish *Heteropneustes fossilis* exposed to 30 ppm of rogor have been observed by Gadhia (1989). Pollutants can produce metabolic changes at cellular levels by a way of influencing enzyme systems. Many authors have reported the changes in acid and alkaline proteases in fish exposed to sub lethal levels of pesticides. Fish is highly nutritious, easily digestible and much sought after food. Nutritional value of fish depends on their biochemical composition which is affected by the water pollution. Alterations in biochemical components as response to environmental stress are authenticated by Arockia and Mitton, (2006) in *Oreochromis mossambicus*. Pesticide is one such group which consists of clastogenic compounds leading to mutations in exposed organisms.

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Carcinogenicity checking is becoming important aspect as people are getting exposed to different chemicals directly and indirectly in day to day life. There has been lot of concern about the cellular and molecular changes leading to carcinogenesis. Studies regarding these chemicals need screening for their properties that do not cause mutation but still are having carcinogenic potential (Tweats *et al.,* 2007). Indiscriminate use of pesticides and their untreated effluents affects fish and other aquatic animal (Wanee *et al.,* 2002). If concentration of pesticides reaches above certain limits in exposed organism, it leads to harms like change in metabolism, reproductive disorders, and disruption of endocrine system. Death of the organisms occurs when pesticide is more toxic in nature. Malathion is an organophosphorus insecticide widely used in agriculture and houses to control variety of insects including aphids, beetles, scales and pill bugs. Apart from target specimens, non-target animals including fish are greatly affected by these pesticides. According to Al-Othman *et al.* (2011) were studied the increasing industrialization human beings are continuously disturbing the delicate ecological balance in aquatic ecosystems. Pesticides are mainly synthetic organic compounds that are deliberately introduced into the environment to control selected organisms. Organophosphorous insecticides are used throughout the world for control of agricultural and domestic insect pests. Organophosphorous insecticides are employed in medicine and industry, because of their relatively low persistence due to biodegradability.

MATERIALS AND METHODS

Freshwater fish, *Oreochromis mossambicus* were collected from Thanjavur area and were brought to the laboratory in large plastic troughs and acclimatized for one week. Healthy, carp fish having equal size (length 10 to 12 cm) and weight (20 to 25 g) were used for experimentation. Stock solution of malathion was prepared by dissolving appropriate amount of salt in distilled water. The physico-chemical characteristic of test water have analyzed regularly during the test periods following the standard method describe by APHA (1998). Batches of 10 healthy fishes were exposed to different concentrations of insecticide malathion to calculate the medium lethal concentration LC_{50} value (0.25 ppm) using probit analysis Finney method (1971). The fishes (Four groups) were exposed to the two sub lethal concentrations ($1/10^{th}$ and $1/30^{th}$ mg/L) of malathion for 10, 20 and 30 days respectively. Another group was maintained as control. At the end of each exposure period, fishes were sacrificed and tissues such as liver, kidney, gills and muscles were dissected and removed. The 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 (1951).

RESULTS

Malathion insecticide caused 50% mortality of fish *Oreochromis mossambicus* at 96 hours was 0.25 ppm. The level of total protein content in mg/g of the wet tissue in control fish *Oreochromosis mossambicus* and fish exposed to sub lethal doses of malathion are presented in Table 1. The data presented it clear that the 10% and 30% exposure, the exposure to sub lethal concentration for 7, 14, 21 and 28 days.

Liver Protein

Fish *Oreochromosis mossambicus* when treated with sublethal concentration of malathion on (10% & 30%) showed a decreasing trend in the total liver protein compared to control (Table 1 and Fig. 1). In 10% (malathion) sublethal concentration liver protein value recorded 5.06, 4.33, 3.55 and 2.19 mg/g respectively during 7, 14, 21 and 28 days of exposure periods. In the 30% sublethal concentration the recorded liver protein values 4.78, 4.12, 3.06 and 2.12 mg/g respectively during 7, 14, 21 and 28 days of exposure. The control values observed 9.72, 9.93, 9.38 and 9.51 mg/g during 7, 14, 21 and 28 days of exposure periods.

Kidney Protein

Oreochromosis mossambicus treated with 10% and 30% sublethal concentration of malathion showed a decreasing trend in the kidney protein (Table 1 and Fig. 2). In 10% malathion sublethal concentration protein content were recorded as 4.67, 4.43, 4.04 and 3.23 mg/g, where as in 30% malathion sublethal concentration the protein value were 4.57, 3.92, 3.36 and 2.29 mg/g respectively. The control protein values were recorded from 8.38, 8.16, 8.85 and 8.61 mg/g respectively during 7, 14, 21 and 28 days of exposure periods.

Gill Protein

Total protein content in the gills of *Oreochromosis mossambicus* treated with sublethal concentration of malathion on (10% & 30%) showed a decreasing trend when compared to control (Table 1 and Fig. 3).

Muscle Protein

A significant recession in the total muscles protein was noticed in the 10% and 30% sub lethal concentration of malathion treated fish *Oreochromosis mossambicus* (Table 1 and Fig. 4). In the present study LC_{50} values of malathion of fish *Oreochromis mossambicus* at 96 hours was 0.25 ppm and Sub lethal concentrations namely 10% and 30% values were selected, studying their effects protein alteration in the study animal. Krishnamohan *et al*. (1985) and Chandravathy and Reddy (1994) have suggested that decline in the muscle protein content may be due to reduced protein synthesis, increased proteolysis and also due to utilization for metabolic processes under lead toxicity. The protein level gradually decreased in heart of treated fish with 0.5 ppm for 24 and 96 hr.

It is presumed that reduction in protein content could be due to its utilization to mitigate the energy demand when the fish are under stress, as reported by Rao *et al.* (1987) and Baskaran *et al*. (1989). Jha and Jha (1995) have observed protein depletion in liver, muscle and gonads of *Anabus testudineus* under the stress of nickel chloride. According to Kale Monika *et al.* (2006) were reported proteins are the main source of energy there degradation is to cope with high energy demand augmented during malathion stress in *Cyprinus carpio*). Decrease in the liver and muscle protein level has been reported in the *Channa punctatus* exposed to phenyl mercuric

Table 1. Levels of total protein in selected tissues of fish *Oreochromis mossambicus* exposed to sub lethal concentration of malathion

Days	Exposure	Liver	Kidney	Gills	Muscles
7 days	Control	9.72 ± 0.04	8.38 ± 0.03	7.17 ± 0.61	8.53 ± 0.57
	10% SLC	5.06 ± 0.51	4.67 ± 0.09	6.12 ± 0.54	7.89 ± 0.10
	30% SLC	4.78 ± 0.04	4.57 ± 0.05	5.71 ± 0.04	5.93 ± 0.04
14 days	Control	9.93 ± 0.07	8.16 ± 0.12	7.42 ± 0.03	8.47 ± 0.11
	10% SLC	4.33 ± 0.06	4.43 ± 0.62	6.64 ± 0.11	6.29 ± 0.02
	30% SLC	4.12 ± 0.04	3.92 ± 0.05	4.46 ± 0.06	4.27 ± 0.06
21 days	Control	9.38 ± 0.69	8.85 ± 0.15	7.5 ± 0.04	8.32 ± 0.07
	10% SLC	3.55 ± 0.08	4.04 ± 0.74	6.48 ± 0.03	6.25 ± 0.08
	30% SLC	3.06 ± 0.05	3.36 ± 0.06	4.56 ± 0.06	4.10 ± 0.07
28 days	Control	9.51 ± 0.83	8.61 ± 0.72	7.49 ± 0.12	8.21 ± 0.09
	10% SLC	2.19 ± 0.07	3.23 ± 1.08	3.94 ± 0.03	4.10 ± 0.41
	30% SLC	2.12 ± 0.06	2.29 ± 0.04	3.91 ± 0.04	3.53 ± 0.06

Values are mean ± SD – or + indicate present decrease or increase over control acetate (Karuppasamy, 2000). Atamanlap *et al*. (2002) reported decrease in protein content in rainbow trout (*Oncarhynchus mykiss)* due to contaminated environment condition.

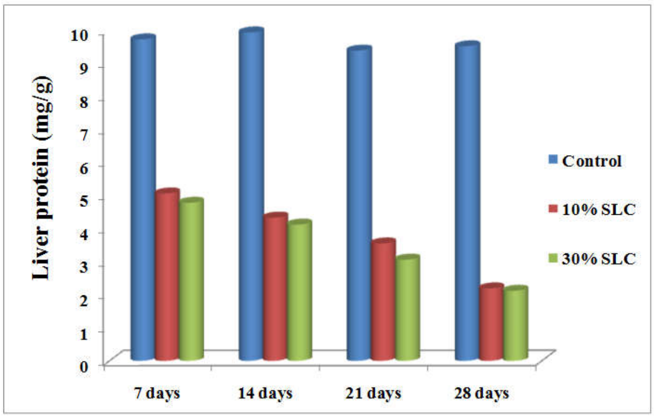

Fig. 1. Levels of total protein in liver of fish *Oreochromis mossambicus* exposed to sub lethal concentration of malathion

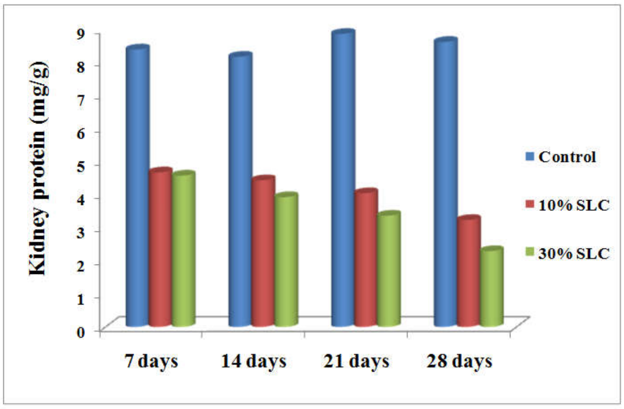

Fig.2. Levels of total protein in kidney of fish *Oreochromis mossambicus* exposed to sub lethal concentration of malathion

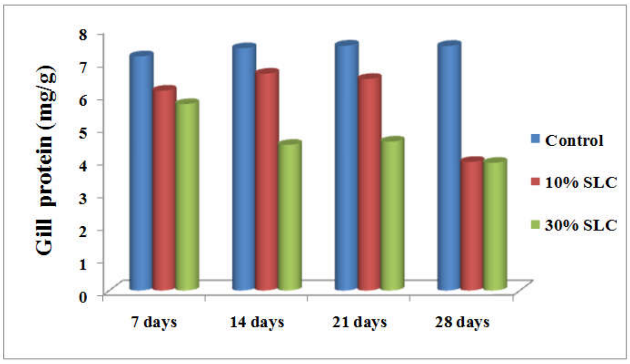

Fig. 3. Levels of total protein in gill of fish *Oreochromis mossambicus* exposed to sub lethal concentration of malathion

Decreased in protein level may be attributed to impaired synthetic machinery due to cypermethrin effect David *et al.* (2004). Sathyanarayan (2005) described the physiological status of animal is usually indicated by the metabolic status of protein. The depletion of protein fraction in liver, brain and kidney may have been due to their degradation and possible utilization for metabolic purposes. Similar results were also found by Vutukuru (2005), Venkatramana *et al.* (2006). According to Venkataramana *et al*. (2006) were observed the changes in protein level in heart muscles of fish after the treatment with malathion are presented. The muscle protein showed decreasing trends of 28.75 %, 23.08 % and 29.80% with 0.05, 0.25 and 0.5 ppm of malathion treatment respectively during 24 hr compared to control.

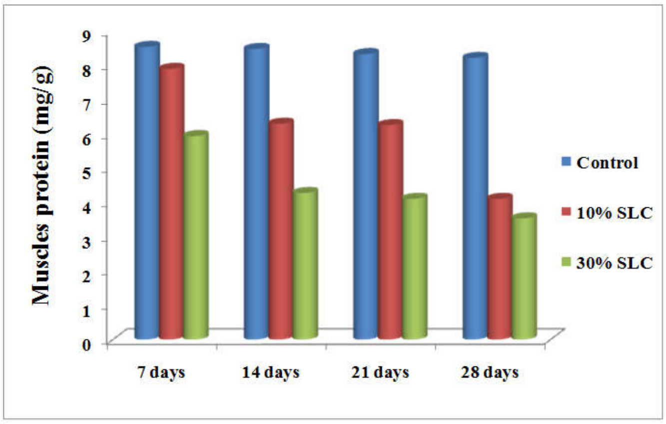

Fig. 4. Levels of total protein in muscles of fish *Oreochromis mossambicus* exposed to sub lethal concentration of malathion

The decrease was found to be greater in all exposures in liver tissue. The reduction of protein may be due to proteolysis and increased metabolism under toxicant stress (Remia *et al*. 2008). Proteins can be expected to be involved in the compensatory mechanism of stressed organisms. The result showed that when the fish were exposed to malathion (0.5 ppm) the protein content were found to have decreased (Gehan H. Fahmy, 2012). In the present study showed that when the fish *Oreochromis mossambicus* were exposed to (10% and 30%) sublethal concentrations of pesticide malathion in the total protein content were found to be decreased in the tissues of liver, kidney, gills and muscles, when compared to control.

Conclusion

The present study indicates that presence of low concentration of malathion in the water is toxic to fishes and alters the protein content of the fish tissues. The results indicate that the usage of the malathion in the agriculture fields may be a threat to aquatic fauna and flora as well as humans. Finally, concluded that the assured greater significance due to the increasing emphasis on fish culture and greater awareness of the pollution in aquatic ecosystem. Therefore, the information obtained may be useful for management and monitoring of agricultural insecticide contamination in aquatic ecosystem.

REFERENCES

Al-Othman, A. M., Khaled, S. A., Gaber E., E. E., Kareem, Y., Zeid, A. A., Mourad, A. M., and John, P. G., 2011. Protection of α-tocopherol and selenium against acute effects of malathion on liver and kidney of rats. *Afr. J. Pharm. and Pharmacol.*. 5(10):1263-1271.

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

Arockia, J.J, and John M.C. Mitton., 2006. Effect of carbamate pesticide lannate (methomy1) on the biochemical components of the freshwater cichlid *Oreochromis mossambicus* (Peters). *Indian J. Environ & Ecoplan*. 12:(1) 263-268.

Atamanlp, M., Keles, M.S., Haliloglu, H.I., and Aras, M.S., 2002. The effect of cypermethrin (a synthetic pyrethroids) on some biochemical parameters(Ca,P,N and TP) of rainbow trout (*Oncorhynchus mykiss*) Turk *J.Vet Anim Sci. 26:*1157-1160.

Atef M. Al-Attar., 2010. Physiological and Histopathological Investigations on the Effects of *α*-Lipoic Acid in Rats Exposed toMalathion, *J. Biomed. Biotechnol*. 1-8.

Baskaran, S., Palanichamy, P.S., and Balasubramani, M.P., 1989. Effect of pesticides of protein metabolism in the *Mystus vittatus. J. Ecobiol*., 1(2), 90-97.

Chandravathy, V.M., and Reddy, S.L.N., 1994. In vivo recovery of protein metabolism in gill and brain of freshwater fish, *Anabus scadens* after exposure to lead nitrate. *J. Environ. Biol*., 15, 75-82.

David, M., Mushigeri, S.B., Shivakumari, R., and Philip, G.H., 2004. Response of *Cyprinus carpio* (Linn) to sublethal concentration of cypermethrin Alteration in protein metabolic profile. *Chemosphere*. 56(4):347-352.

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

Gadhia, M., 1989. Histopathological lesions induced by rogor in the liver of a siluroid. *J. Inland Fish. Soc. India*. 21 (1): 55-57.

Gehan H. Fahmy, 2012.Malathion Toxicity: Effect on Some Metabolic Activities in *Oreochromis Niloticus*, the Tilapia Fish, *Int. J. of Biosci. Biochem and Bioinform.,* Vol. 2 (1): 52 – 55.

Jha, B.S., and Jha, M.M., 1995. Biochemical effects of nickel chloride on the liver and gonads of the freshwater climbing perch, *Anabas testudineus* (Bloch). *Proc. Nat. Acad. Sci. India*, 65(B):39-46.

Kale Monika, K., Joshi, P.P., and kulkarni, G.k., 2006. Effect of cadmium toxicity on biochemical composition of freshwater fish *Rasbora daniconicus*. In ecology and Environment (B.N. Pandey and M.K. Joyti Eds.) APH publicATION, New Delhi. Pp 271-278.

Karuppasamy, R., 2000. Short and long term effects of phenyl mercuric acetate on protein metabolism in *Channa punctatus* (Bloch). J. Natcon 12(1):83-93.

Krishnamohan, P.K., Indira., and Rajendra, W., 1985. Protein degradation in functionally different muscles of rat during exhaustive exercise. *J. Exp. Biol*., 23, 655 - 657.

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

Rao, S.K., Moorthy, K. S., Reddy, B. K., Swami, K.S., and Chetty, C. S. R., 1987. Effect of benthiocarb on protein metabolism of freshwater teleost fish, *Sarotherodan mossambicus. J. Environ. Biol*., 8, 1-8.

Remia, K. M., Logaswamy, S., Logankumar, K., and Rajmohan, D., 2008.Effect of an insecticide (Monocrotophos) on some biochemical constituents of the fish *Tilipia mossambica*. *Poll. Res*. 27(3):523-526.

Sathyanarayna, D., 2005. Biochemistry book and allied (P) std 8/1 Chintamani Das Lane Kolkata 70009. India 349.

Tweats, D.J., Scott, A.D., Westmoreland, C., and Carmichaell, P.L., 2007. Determination of genetic toxicity and potential carcinogenicity in vitro, Seventh Amendment to the European Cosmetics Directive Mutagenesis 22 (1), pp-5-13.

Venkataramana, G.V., Sandhya Rani, P.N., and Murthy, P.S., 2006. Impact of Malathion on the biochemical parameters of gobiid fish, Glossogobius giuris (Ham). *J. Environ. Biol*., 27: 119-122.

Vutukuru, S.S., 2005. Acute effects of hexavalent chromium on survial, oxygen consumption, Hematological parameters and some Biochemicals profiles of Indian major carp*, Labeo rohita. Int. J.Environ. Res. Public health*. 2 (3): 456-462.

Wanee, J., Upatham, E., Maleeya, K., Somphong, S., Grams, S. and Prayad, P. 2002. Histopathological effects of Roundup, a Glyphosate herbicide on Nile tilapia (*Oreochromis niloticus*), *Sci. Asia* (28), pp-121-127.

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