Journal of Advanced Laboratory Research in Biology
E-ISSN: 0976-7614
Volume 7, Issue 4, 2016
PP 99-102
https://e-journal.sospublication.co.in

Research Article

Studies on Liver Marker Enzymes (SGOT and SGPT) of fish *Heteropneustes fossilis* (Bloch.) after Famfos intoxication

Sanjay Singh[1], R.S. Rawat[1], Surendra Singh[2] and H.N. Sharma[2*]

[1]*Department of Zoology, Agra College, Dr. B.R. Ambedkar University, Agra-282002 (U.P.), India.*
[2]*Department of Zoology, School of Life Sciences, Khandari Campus, Dr. B.R. Ambedkar University, Agra-282002 (U.P.), India.*

Abstract: Pesticide pollution is on increase through its increasing application in almost every field either it is household or agriculture where it is used widely. These pesticides reach to aquatic life by means of runoff water and other ways. The residual impact is increasing in aquatic fauna. Fishes are the best indicator of aquatic pollution and also used for human consumption. The residual effect adversely affects the liver marker enzymes (in serum) of fishes which are measured and discussed in the present study to assess the extent of damage caused by non-target effect of famfos to *Heteropneustes fossilis* (Bloch.).

Keywords: Pesticide, Toxicity, LC_{50}, Serum glutamic oxaloacetic transaminase, Serum glutamic pyruvic transaminase.

1. Introduction

For the control of pests, the pesticides are used since about 1850. Nowadays due to the advancement of technologies and requirement of the huge amount of grains, the use of pesticides increased on large scale. Both types of pesticides are used by the farmers, natural as well as chemical. The natural pesticides are easily used, safe and more biodegradable. But the synthetic pesticides like pyrethroids, polycyclic chlorinated hydrocarbon are less degradable and more dangerous to the environment. These chemicals when enters in food chain then they create most dangerous effects on human beings as well as other animals like fishes, reptiles and aves etc. Famfos also a dangerous pesticide which is used in the agricultural field for the control of pests. When the pesticides runoff from the agricultural fields to the rivers much aquatic fauna have been affected and generally mammals and fishes show less susceptibility to famfos.

Oxidative stress and role of reactive oxygen species (ROS) in disease and toxicity have been studied on two major issues in biomedical science in recent times. These aspects have also been studied in aquatic animals.

Recently a great deal of attention has been paid to evaluate the hazardous effect of organophosphorus compound on physiology of many non–target organisms particularly fish. The symptoms of organophosphorus compound toxicity generally involve respiratory distress, increase glycolytic rate, decreased oxidative metabolism protein and RNA synthesis (Sastry and Gupta, 1978; Sastry *et al*., 1984). Though a lot of work has been done on the pollutional characters and determinate effect of the organophosphorus compound, their indiscriminate use has increased the pollutional hazards, posing much danger to fish and other aquatic life.

Heteropneustes fossilis is selected for present study due to easy availability and handling. The fish *Heteropneustes fossilis* are the most sensitive of all aquatic animals towards such pollutant while passing through the river receiving wastes from adjoining human settlement and industries. The fish easily gets its tissues damage due to water pollutants.

The number of workers have been studied on several aspects of toxicity of pollutants on the SGOT and SGPT of fishes but studies on the effect of famfos toxicity of serum enzymes of *Heteropneustes fossilis* is so meager. So, therefore, this study is needed.

2. Materials and Methods

Heteropneustes fossilis, a catfish belongs to the family Heteropneustidae. It is commonly known as Asian Stinging catfish or fossil cat. It is found in India,

*Corresponding author:
E-mail: drhnsharma2015@gmail.com.

Pakistan, Nepal, Sri Lanka, Thailand, and Myanmar. In Sri Lanka, this fish is called Hunga by the Sinhala speaking community, in India it's called Singhi. Juvenile live fishes were purchased from the local fish market during September to April when the room temperature ranges from 25 to 36^{0}C and water temperature from 20 to 25^{0}C. The fish averaging 6-10cm standard length and average body weight of 60-70gm were used for the study. After examining carefully for any injury they were kept in one percent solution of potassium permanganate for few minutes to get rid of any dermal infection. After acclimatization for 15 days, they were reared in large glass aquaria measuring 75cm X 37.5 X 37.5cm and fed on boiled egg yolk and fish food. To assess the effect of famfos the fish, *Heteropneustes fossilis* were grouped into five sets, four acute and one control each consisting six.

The *Heteropneustes fossilis* were taken live and cut at peduncle to collect the blood directly from caudal vein for biochemical estimations. The blood samples were collected in the centrifuge tubes and serum was separated by centrifugation.

Famfos has been selected for the present study. It is a crystalline powder, soluble in chlorinated hydrocarbons and polar solvents and soluble in water at 100mg/L. Famfos is an organophosphorus systemic insecticide and acaricide applied to a variety of field crops, insects (mites), and edible beans etc. with contact and stomach (duet) poisonous activity. It is formulated in emulsifiable concentration. It is a moderately persistent insecticide with residual effect. It is also known as Famophos, Fanfos, Warbex, Dovip, Cyflee with Chemical name O,O-Dimethyl hydrogen phosphorothioate. The compound is active against a broad range of insects.

For LC_{50} determination, the *Heteropneustes fossilis* were divided into four groups (A, B, C and D). Each group consisting of six individuals. The mortality and survival number of fish was recorded for each concentration after 96 hours. The statistical analysis of data was done by log dose/probit regression line method (Finney, 1971). Six fishes from each set (control set and experimental sets) were sacrificed for the biochemical studies after 1, 7, 14, 21 and 28 days treatment of famfos at sub-lethal dose (1/10th of LC_{50}).

SGOT and SGPT were determined by Reitman and Frankel method (1957). The data were analyzed through statistical software for accuracy.

3. Results and Discussion

The LC_{50} value in the present study for famfos has been calculated as 468.12 ppm and the toxicity is dose dependent (Table 1). In *Heteropneustes fossilis* the toxicity of famfos results in reduced activity with enormous extrusion of mucous which practically covers the body before death. This may be due to the fact that mucous hinders the exchange of the gases resulting in the deficiency of oxygen in the blood, which in turn affects the general physiology of the body resulting in death. These results again support by the findings of Sastry and Siddiqui (1982) in *Channa punctatus* in response to the toxicity of carbamate pesticide by Skidmore and Tovell (1972). Famfos is extremely toxic to fish *Channa punctatus* which were followed by observable behavioural changes and disruption in glycogen metabolism was considered as a cause of death. However, in some cases Gopal and Ahuja (1989) have suggested behaviour of fish in different test concentration of insecticide has been observed and it was found that each set of fish exhibits certain physical reactions fish swim rapidly with pronounced excitation followed by jerky movement of the body and made jumped frequently. Fish was also observed striking their head against the walls of the experimental aquarium. Dalela *et al.*, (1981) and Verma *et al.*, (1979) supported the present findings.

Serum glutamic oxaloacetic transaminase of experimental fishes showed a remarkable increase after famfos treatment (200, 400, 600, 800 ppm) at different time intervals (1, 7, 14, 21 and 28 days) (Table 2). Marked excess of SGOT is common in myocardial damage (Varley, 1976). Increased SGOT after pesticidal stress was also reported by Shoba Rani *et al*., (1989), in *Clarias batrachus* after exposure to trichlorfon.

Table 1. Toxicity evaluation of famfos to *Heteropneustes fossilis* (Bloch.) specifying fiducial limits.

Experimental fish	Compound	Regression equation	LC_{50} (in ppm)	Variance	Fiducial limits
Heteropneustes fossilis	Famfos	Y = 5.43+5.74 (X-2.76)	489.77	0.003	m_1 = (+) 2.695 m_2 = (-) 2.684

Table 2. SGOT (IU/L) after treatment with famfos in *Heteropneustes fossilis* (Bloch.).

Dose (ppm)	Control		Days									
	0 day		01 day		07 days		14 days		21 days		28 days	
	Range	Mean±S.Em.	Range	Mean±S.Em.	Range	Mean±S.Em.	Range	Mean±S.Em.	Range	Mean±S.Em.	Range	Mean±S.Em.
200	27.50-29.00	28.10±0.52	30.00-31.00	30.54±0.50*	30.80-31.50	31.00±0.20*	30.99-32.55	31.50±0.09*	31.15-33.54	32.50±0.88*	34.20-36.00	35.20±0.87*
400	27.50-29.00	28.10±0.52	31.00-33.00	32.00±0.74*	32.00-34.10	32.50±0.33*	33.12-36.10	34.40±0.67*	37.50-39.50	38.47±0.62*	41.50-43.00	42.30±0.43**
600	27.50-29.00	28.10±0.52	32.20-35.00	33.33±0.51*	34.50-35.67	35.00±0.20*	38.00-39.00	38.46±0.15*	42.25-43.25	43.25±0.53**	48.00-49.00	48.50±0.33***
800	27.50-29.00	28.10±0.52	34.10-36.00	35.00±0.50*	38.12-39.88	38.66±0.50*	44.25-46.52	45.20±0.33**	48.50-49.30	49.00±0.10***	50.60-52.00	51.66±0.67****

*Non-significant; **Significant; ***Highly significant; ****Very highly significant

Table 3. SGPT (IU/L) after treatment with famfos in *Heteropneustes fossilis* (Bloch.).

Dose (ppm)	Control		Days									
	0 day		01 day		07 days		14 days		21 days		28 days	
	Range	Mean±S.Em.	Range	Mean±S.Em.	Range	Mean±S.Em.	Range	Mean±S.Em.	Range	Mean±S.Em.	Range	Mean±S.Em.
200	48.50-49.50	48.59±0.19	53.00-55.00	54.11±0.99*	54.10-55.91	55.00±0.16*	54.20-56.30	55.12±0.30*	55.45-56.95	56.00±0.12*	55.40-57.60	56.33±0.88*
400	48.50-49.50	48.59±0.19	54.10-56.80	55.20±0.45*	58.00-59.45	58.50±0.34*	59.50-60.50	60.00±0.15**	61.88-62.99	62.33±0.33**	66.50-68.74	67.25±0.45**
600	48.50-49.50	48.59±0.19	56.00-57.50	56.88±0.20*	59.50-60.98	59.85±0.30*	62.10-63.10	62.35±0.20**	69.00-70.85	69.62±0.33***	69.33-73.00	71.50±0.86****
800	48.50-49.50	48.59±0.19	55.90-58.20	57.99±0.55*	59.50-62.00	61.00±0.30**	64.00-66.50	64.58±0.55**	69.54-71.53	70.53±0.67***	73.22-75.55	74.53±0.67****

*Non-significant; **Significant; ***Highly significant; ****Very highly significant

The altered pattern of SGOT indicates distorted metabolism resulting from liver dysfunction or from cellular injuries in different tissues of experimental fish under the stress of famfos. These findings also coincide with the findings of Goel and Maya (1986) under the pesticidal stress of roger in *Clarias batrachus*. Verma *et al*., (1981) observed the similar elevation patterns of SGOT in *Mystus vittatus* after pesticidal exposure.

Serum glutamic oxaloacetic transaminase (SGOT) is maximally present in heart followed by liver, skeletal muscles, and kidney. Any damage to these organs raises the SGOT level as in myocardial infarction, Liver diseases such as Liver cirrhosis, Viral Hepatitis, Liver necrosis and skeletal muscle diseases. On a similar pattern, Mathur (1965) have also been reported that pesticide damages liver tissue in fishes.

The increase in activity of SGOT might be due to the disruption of the enzyme by blocking the active sites and to cause tissue damage (Verma *et al.*, 1981). Similar results of SGOT elevation due to tissue damage by pesticidal stress has also been reported by Revathi *et al*., (2003) in *S. mossambicus.*

Changes in activities of SGOT have been used to demonstrate tissue damage in fish by Arasta *et al*., (1996). Present findings gain conformity with the results of Sulodia and Singh (2004), Wieser and Hinterleitner (1980), Sastry and Gupta (1978), Garg *et al.*, (1990) in various fishes.

Serum glutamic pyruvic transaminase (SGPT) level in the experimental fishes increased due to famfos intoxication (200, 400, 600, 800 ppm) at different time intervals (1, 7, 14, 21 and 28 days) (Table 3). The increased activity of serum glutamic pyruvic transaminase is due to the liver damage under the stress of famfos. Present findings gain support from findings of Agarwal *et al*., (1982) who reported the increased level of transaminases in the *Clarias batrachus* exposed to achlor. Similar results have been reported by Verma *et al.*, (1981) in *Mystus vittatus* after exposure to dichlorvos.

SGPT is in highest concentration in the liver followed by the kidney. Under pesticidal stress, these organs get damaged and the enzyme level elevates in the serum. The SGPT level is found to be raised in liver diseases such as infective hepatitis, liver cirrhosis, cholestatic jaundice and skeletal muscle damage.

Raised level of serum transaminase (SGPT) was also reported by Sulodia and Singh (2004) in *Channa punctatus.* Revathi *et al*., (2003) also reported similar results in the fish *Sarotherodon mossambicus* exposed to organophosphorus pesticide tempos.

Changes in activities of SGPT along with SGOT have been used to demonstrate tissue damage in the fish. Arasta *et al*., (1996) Magare (1997) have reported the similar alteration of transaminases in the fish, *Barbus ticto*. The findings in the present investigation can collaborate with the results of Nemcsók *et al*., (1987) in *Cyprinus carpio* after exposed to an organophosphate insecticide methidation in which they mentioned the increased levels of transaminase enzymes due to subsequent liver damage.

Similar findings have also been reported by Goel and Maya (1986) in *Clarias batrachus* under the stress of roger.

References

[1]. Agarwal, V.P., Sharma, M.L., Wadhwa, S., Gupta, K. and Mishra, B.P. (1982). Lithium induced haematological and biochemical changes in *Heteropneustes fossilis. Proc. Symp. Environ. Van. Sp.*, 6: 27-31.

[2]. Arasta, T., Bais, V.S. and Thakur, P. (1996). Effect of Nuvan on some biochemical parameters of Indian catfish, *Mystus vittatus*, *J. Environ. Biol*., 17(2): 167 – 169.

[3]. Dalela, R.C., Bhatnagar, M.C. and Verma, S.K. (1981). *In vivo* hematological alteration in a freshwater teleost *Mystus vittatus* following subacute exposure to pesticides and their combination. *J. Environ. Biol*., 2(2): 79 – 86.

[4]. Finney, D.J. (1971). Probit analysis. Cambridge University Press, London, pp. 333.

[5]. Garg, V.K., Garg, S.K. and Tyagi, S.K. (1989). Manganese induced haematological and biochemical anomalies in *Heteropneustes fossilis*. *Journal of Environmental Biology*, 10(4): 349-353.

[6]. Goel, K.A. and Maya (1986). Haematological anomalies in *Clarias batrachus* under the stress of rogor. *Adv. Biosphere*, 5: 187 – 192.

[7]. Gopal, P.K. and Ahuja, S.P. (1979). Lipid & growth changes in organs of chicks (*Gallus domesticus*) during acute & chronic toxicity with disyston and folithion. *Indian J. Exp. Biol.*, 17(10):1153-4.

[8]. Magare, S.R. (1997). Enzymatic changes caused by the pesticides in a fish, *Barbus ticto*. Proc. 84th Indian Sci. Cong., Part – III. P. 105.

[9]. Mathur, D.S. (1965). Histopathological changes in the liver of certain fishes induced by dieldrin. *Sci. Cult.*, 31: 285-289.

[10]. Nemcsók, J., Benedeczky, L., Boross, L., Asztalos, B. and Orbán, L. (1981b). Subcellular localization of transaminase enzymes in fishes and their significance in the detection of water pollution. *Acta Biol. Szeged.*, 27: 9–15.

[11]. Reitmann, S. and Frankel, S. (1957). A colorimetric method for the determination of serum glutamic oxalacetic and glutamic pyruvic transaminases. *Am. J. Clin. Pathol.*, 28(1): 56-63.

[12]. Revathi, K., Sharmili, R. and Usha Sangeetha, R., (2003). Biochemical studies on the effect of organophosphorus compound *Sarotherodon mossambicus* (Peters). *J. Exp. Zool. India.*, 6(2):365 - 368.

[13]. Sastry, K.V. and Gupta, P.K. (1978). Effect of mercuric chloride on the digestive system of *Channa punctatus*: A histopathological study. *Environ. Res*., 16: 270-278.

[14]. Sastry, K.V. and Siddiqui, A.A. (1982). Some hematological, biochemical, and enzymological parameters of a fresh-water teleost fish, Channa punctatus, exposed to sublethal concentrations of quinalphos. *Pesticide Biochemistry and Physiology*, 22: 8-13.

[15]. Sastry, K.V., Siddiqui, A.A. and Singh, S.K. (1984). Alteration in some biochemical and enzymological parameters in the snake head fish *Channa punctatus*, exposed chronically to quinalphos. *Chemosphere*, 11: 1211-1216.

[16]. Shoba Rani, V.J., Venkateshwarlu, P., Janaiah, C. (1989). Alteration in aminotransferases of freshwater fish *Clarias batrachus*, after exposure to trichlorfon. *J. Environ. Ecol.*, 7: 930–932.

[17]. Singh, A. and Agarwal, R.A. (1994). Effect of three synthetic pyrethroids to a Non‐target Fish, *Channa striatus* Wirkung von drei synthetischen Pyrethroiden auf einen Nichtziel‐Organismus, den Fisch *Channa striatus*. *Acta hydrochim. hydrobiol.*, 22: 237-240.

[18]. Skidmore, J.F. and Tovell, P.W.A. (1972). Toxic effects of zinc sulphate on the gills of rainbow trout. *Water Res.*, 6: 217-230.

[19]. Sulodia, S. and Singh, S. (2004). Assessment of total lipid of *Channa punctatus* (Bloch.) with special references to intoxicant folidol. *Indian J. Environ. Ecoplan.*, 8(3): 631-633.

[20]. Varley, H. (1976). Practical clinical biochemistry, 4th Edn. William Heinemann, London.

[21]. Verma, S.R., Bansal, S.K., Gupta, A.K. and Dalela, R.C. (1979). Pesticide induced haematological alterations in a freshwater fish, *Saccobranchus fossilis*. *Bull. Environ. Contam. Toxicol.*, 22(4-5):467-474.

[22]. Verma, S.R., Kumar, V. and Dalela, R.C. (1981). Acute toxicity of three newly formulated pesticides to fish *Mystus vittatus*. *Indian Journal of Environmental Health*, 23: 215 – 221.

[23]. Wieser, W. & Hinterleitner, S. (1980). Serum enzymes in rainbow trout as tools in the diagnosis of water quality. *Bull. Environ. Contam. Toxicol.*, 25: 188-193.