IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS)
e-ISSN:2278-3008, p-ISSN:2319-7676. Volume 13, Issue 1 Ver. IV (Jan. – Feb. 2018), PP 06-09
www.iosrjournals.org

Phenthoate 50% EC Toxicity and Its Impact on Aminotransferases of Freshwater Fish Catla (*Gibelion catla)*

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Abstract: *The toxicity of commercial grade Phenthoate 50% EC. to the freshwater fish Catla (Gibelion catla) using static system, LC_{50} values were determined as 14.2, 13.0, 12.0 and 7.0 ppm respectively. The fish were exposed to Lethal and Sub-lethal concentrations ($1/10^{th}$ of static 96 h LC_{50} value) of the pesticide for 96 h and the biochemical changes of amino transferases, Aspartate aminotransferase (SGOT/AST) and Alanine aminotransferase (SGPT/ALT) were estimated in the test fish. Increased activities of AST and ALT in different tissues of brain, liver, muscle, gill and kidney in the test fish suggest either increased operation of transamination or increased synthesis of amino acids from other sources like glucose or fatty acids during Phenthoate 50% EC intoxication, The changes in lethal exposure were more prominent compared to sub-lethal exposure fish. These changes were attributed to the intoxication of the test toxicant Phenthoate 50% EC.*
Key words*: Acute toxicity, Static test, Phenthoate 50% EC, Gibelion catla, Aminotransferases.*

Date of Submission: 19-01-2018 Date of acceptance: 03-02-2018

I. Introduction

Among the aquafauna, fish form an important group due to their nutritive value. Feeding cost often constitutes more than 50% of the total cost of production in intensified culture systems (Sehagal and Toor, 1991; De Silva, 1992). Fish have high dietary protein requirement (Deng *et al*., 2006). The significance of qualitative and quantitative feeds is well recognized (Jauncey, 1982; Mohanty and Samantary, 1996; Gunasekera *et al.*, 2000; Yang *et al*., 2002; Deepak and Garg, 2003; Cortes-Jacinto *et al*, 2005; Kim and Lee, 2005; Tibbetts *et al.*, 2005). Increase in dietary protein has often been associated with higher growth rate in many species. However, there is a certain level beyond which further growth is not supported, and may even decrease (Mohanty and Samantary, 1996; Mc Googan and Gatlin, 1999; Gunasekera *et al.*, 2000; Yang *et al.*, 2002; Abbas *et al*., 2005; Debnath *et al*., 2007; Kvale *et al.*, 2007).

Phenthoate (Organophosphate) the commercial grade formulation of Phenthoate 50% EC (Emulsifiable Concentrate), an organophosphorous pesticide.The trade name is Phendal manufactured by Shanghai Tenglong Agrochem Co., Ltd. (Yangpu Building 24B, No. 2005, Yangpu Shanghai, China) was purchased from local pesticide market. The characteristics of Phenthoate an organophosphorous pesticide are as follows Phendal is considered moderately toxic. Animal-based studies indicate that the metabolic byproduct of Phendal, a potential carcinogen, is eventually formed by the breakdown of methomyl in the stomach.

This enzyme has several metabolic functions with great physiological significance. It is closely associated with the detoxify-cation mechanisms of tissues. A number of workers have investigated the toxicity, uptake and tissue distribution of pesticides in a number of fishes (Anderson and Defoe, 1980; Guiney and Peterson, 1980; Tilak *et al.*, 1980). The effect of pesticides on muscle protein has been studied by many workers (Ganesan et al., 1980; Panigrahi and Mishra, 1980; Murty and Devi, 1982). Changes in acid phosphatase (ACP) and alkaline phosphatase (ALP) of brain induced by pesticides have been recorded by Sastry and Sharma (1981). A progressive increase was noticed in the activities of Aspartate aminotransferase (SGOT/AST) and Alanine aminotransferase (SGPT/ALT) in all the organs of the fish exposed to cyper-methrin (Khalid Abdullah Al-Ghanim, 2014).

The present study was undertaken to examine the effect of Phenthoate 50% EC on certain bio-chemical enzyme activities of an Indian major carp, *Gibelion catla* which forms an important candidate species in the carp in India.

II. Materials and Methods

The fish *Gibelion catla* of size 5-6 $\pm^{1}/_{2}$ cm and 7-8$\pm^{1}/_{2}$ g weight were brought from a local fish farm (Kuchipudi) and acclimatized at 28 ± 2^{0}C in the laboratory for one week. Such acclimatized fish were exposed to Sub-lethal and lethal concentrations of Phenthoate 50% EC 75% wp commercial grade for 96h. The vital

tissues like muscle, brain, liver, gill and kidney of the fish were taken for the estimation of Alanine aminotransferase (SGPT/ALT) and Aspartate aminotransferase (SGOT/AST) along with control exposures. The activity of Aspartate and Alanine aminotransferases respectively was determined by the method of Reitman and Frankel (1957).

III. Results and Discussion

Exposure of *Gibelion catla* to Sub-lethal and lethal concentrations of Phenthoate 50% EC produced changes in Aminotransferases level in tissues of different organs. The calculated values of amino-transferases and per cent change over control along with standard deviations were graphically represented in Fig.I. The changes in the levels of AST and ALT were studied in different tissue of brain, liver, muscle, gill and kidney in the test fish *Gibelion catla* under Sub-lethal and lethal concentrations of Phenthoate 50% EC commercial grade after 96h of exposure. The values were expressed IU/L of pyruvate formed /mg protein /h. The AST activity in brain, liver, muscle, gill and kidney of the control fish *Gibelion catla* was in the order of: Liver > Gill> Muscle >Brain> Kidney. Under exposure to Sub-lethal concentrations of Phenthoate the lyotropic gradation series in terms of per cent change in AAT activity in fish was in the order of: Liver >Brain >Gill >Muscle>Kidney. Under exposure to lethal concentrations the lyotropic gradation series in terms of the per cent changes of AAT activity in *Gibelion catla*, in the order of: Kidney >Liver > Brain> Gill >Muscle.

The calculated per cent change of ALT activity of control and exposure were given in Fig.II. The ALT activity in different tissues of control fish was in the order of: Gill > Liver > Kidney > Brain > Muscle. Under exposure to sub-lethal concentrations of Phenthoate 50% EC the lyotropic gradation series in terms of elevation in ALT activity in *Gibelion catla* is in the order of: Gill >Liver > Brain > Muscle > Kidney. Under exposure to lethal concentrations of Phenthoate 50% EC commercial grade, the lyotropic gradation series in terms of elevation in ALT activity in *Gibelion catla* was in the order of: Gill > Liver > Brain > Muscle > Kidney. Since the pesticide stress was known to induce significant change in protein metabolism, it is likely that the amino transferases were also considerably affected. Increased activities of AAT and ALAT in different tissues of fish suggest either increased operation of transamination or increased synthesis of amino acids from other sources like glucose or fatty acids during Phenthoate intoxication. The increase in activities of aminotransferases as observed in the present study were in agreement with earlier reports, demonstrating a consistent increase in the activities of these enzymes under conditions of enhanced gluconeogenesis.

AST and ALT are located in both mitochondrial and cytosal fractions of the cell. A close relation appears to exist between the mitochondrial integrity and transaminase levels (Bonitenko, 1974) and any modification in the organization of mitochondria is bound to alter the enzyme systems associated with it. The increase in the activities of AST and ALT as observed in the present study may also be due to the mitrocondrial distruption and damage as a result of Phenthoate induced stress. Increase in aminotransferases activity was reported in *Gibelion catla* and *Tilapia mossambica*, under different pesticides exposure (Girija, 1987 and Radhaiah 1988). Rajeev Tyagi (2011) reported after exposed to the sub-lethal concentrationof methyl parathion-A pesticide to fresh water fish *Channa punctatus* (Bloch) the alterations in the enzymatic synthesis in fish liver Serum Glucose Oxaloacetate Transminase(SGOT), similar results were ascertained by Veeraiah (2001); Tathaji (2007); Vijaya kumar (2011); Japamalai (2012); and Prasada Rao (2012). A progressive increase was noticed in the activities of Aspartate aminotransferase (SGOT/AST) and Alanine aminotransferase (SGPT/ALT) in all the organs of the fish exposed to cyper-methrin (Khalid Abdullah Al-Ghanim, 2014).

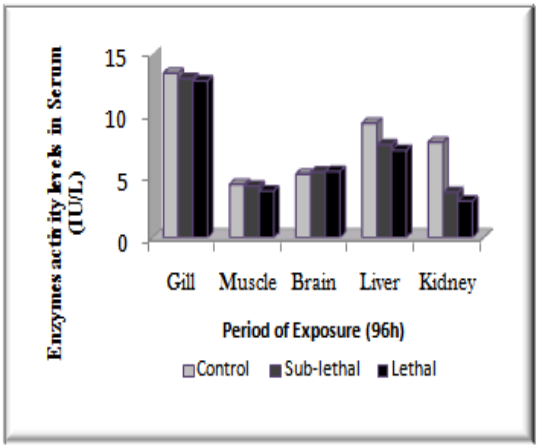

Fig.I.

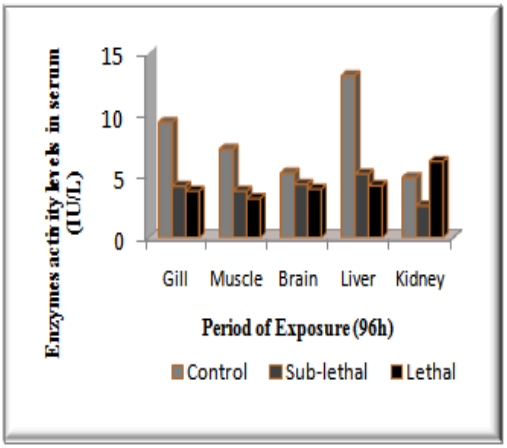

Fig.II.

Changes in the total SGOT (AST) (Fig.I) and SGPT(ALST) (Fig.II) enzymes activity (IU/L) and % change over the control in different tissues of the freshwater fish *Gibelion catla*, exposed to Sub-lethal and lethal concentrations of Phenthoate 50% EC for 96h.

Elevated levels of AST and ALT indicate the enhanced transamination of amino acids, which may provide keto acids to serve as precursors in the synthesis of essential organic elements. It is likely that toxic stress imposed by Phenthoate 50% might be one of the factors for the observed activities of AST and ALT in the present study. It can be concluded from the current study that the Sub-lethal exposure of Phenthoate 50% EC produced less change in the protein metabolism. It has also been observed that the liver, gill and muscle were affected and the stress was found to be more in liver and gill than that of muscle tissue. With respect to the toxic effects on exposure to Sub-lethal concentration of Phenthoate, the fish tries to withstand the toxic effects imposed by the pesticide by modulating their physiological and metabolic response towards proper utilization of enzymes and proteins for synthetic processes.

Abbrivations Used

SGOT, Serum glutamic oxaloacetatic Transminase; SGPT, Serum glutamic pyruvic transminase AST, Aspartate aminotransferase; ALT, Alanine aminotransferase; WP, Wet powder.

Acknowledgements

The authors are grateful to Dr.K.Veeraiah, Head of the Department of Zoology, Acharya Nagarjuna University for providing necessary facilities. They also thank UGC for providing equipment to carry out this work under Special Assistance Programme.

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IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS) is UGC approved Journal with Sl. No. 5012, Journal no. 49063.

T.Kusuma Kumari "Phenthoate 50% EC Toxicity and Its Impact on Aminotransferases of Freshwater Fish Catla (Gibelion catla)." IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS) 13.1 (2018): PP 06-09.