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RESEARCH ARTICLE

EFFECT OF DIMETHOATE ON THE LIPID CONTENT IN THE FINGERLINGS OF CAT FISH *CLARIAS BATRACHUS*

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ABSTRACT

Dimethoate is an organophosphorous insecticide mostly used in the agricultural field. It exhibits contact and systemic action. The aim of the study is to prove the impact of the dimethoate in relation to the alteration in the lipid content in the kidney, liver and muscle of the fingerlings of cat fish. The fishes were exposed to lower (1.923ppm) and higher (0.961ppm) sub lethal concentration of dimethoate for the experimental periods 15, 30 and 45 days. Thereafter, the tissues were taken for the analysis of cholesterol, phospholipids, triglycerides and free fatty acids. The outcome of this research proves that dimethoate produces significant alterations in the content of cholesterol, phospholipids, triglycerides and free fatty acids when compared to the control fish.

INTRODUCTION

In now a days the domestic requirements of human increases the demand of fresh water resources. Due to the exponential increase of industrialization, human population and harmful chemicals directly and indirectly affects the aquatic environment. The final result of aquatic pollution is imbalances in the ecosystem by affecting the plants, animals and humans. In the structure of cell, lipid was an important component. In plasma membrane, Cholesterol and phospholipids have been implicated as an essential one to maintain the permeability and structural integrity of cell membranes (Dhake *et al*., 2004). The normal bone formation, brain function, growth and development, regulation of metabolism and maintenance of reproductive tissues requires essential fatty acids (Matty, 1985). For energy requirements the cell utilize the free fatty acids, and for the synthesis of glyceride, the unutilized free fatty acids are used by the normal cells (Prosser, 1973). In fishes liver is an important one for the synthesis of fatty acids (Lin *et al*., 1977). For the metabolic requirements in fishes, Triacyl glycerol is served as a source of stored energy (Sheridan and Kao, 1994). Maintenance of the structure of tissue requires the cholesterol and lectin that increases the maximum animal growth and its survival (Harrison, 1990). *Clarias batrachus* exposed to carbofuran the liver tissue shows decrease in the lipid content (Begum and Vijayaraghavan, 1991).

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During stress the lipids are mobilized and metabolized in the aquatic organisms to meet the demand of energy (Henderson and Tocher, 1987). For assessing the magnitude of physiological stress it gives a most reliable and sensitive index. Decrease in lipid content was noticed in *oreochromis mossambicus* (Kaushik and Srivatsava, 2003). In the reproductive tissues lipids play a major role. In fishes, it is one of the structural components of testis and seminal vesicle and the synthesis of cholesterol and phospholipids in the reproductive tissues depends on androgenic stimulation (Umapathy and Rai, 1980). Freshwater prawn *Macrobrachium rosenbergii*, exposed to endosulfan in sub lethal concentration for 96 hours exposure. Lipid content was decreased in the gills, muscle and hepatopancreas (Bhavan and Geraldine, 1997).

MATERIALS AND METHODS

Healthy fingerlings of *clarias batrachus* in the size range of 10-13 cms., of the same stock of a given season were procured from seed fish india (P) Ltd., Budhur, Trivellore (Taluk), Chengai M.G.R. District, Tamilnadu. The fish stocks were fed after acclimatization and the feeding was stopped one day prior to experimentation. The acclimated fish were exposed to lethal concentration (9.613 ppm) for 96 hrs and two sub lethal concentrations (1.923 and 0.961 ppm) for 15, 30 and 45 days. LC_{50} values are determined by the guidelines given by Finney (1971) and Annon (1975). A control group was maintained till the end of experimental period.

For the analysis of lipid profile in liver, muscle and kidney the fingerlings of catfish was dissected and the tissues were taken out from the control and experimental group. Total lipids were extracted by folch *et al*., (1957). Cholesterol was estimated by the method of parekh and jung (1970). Phospholipid was estimated by the method of Marinetti (1962). Triglyceride was estimated by the method of foster and dunn (1973). Free fatty acid was estimated by the method of Itaya (1981).

RESULTS

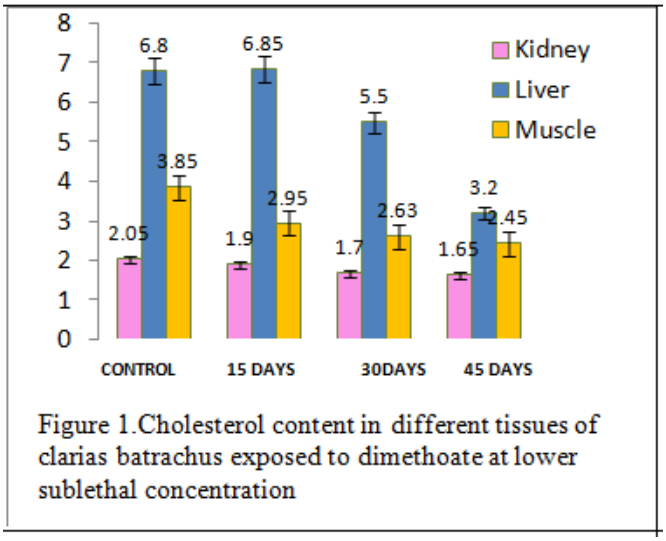

Figure 1.Cholesterol content in different tissues of clarias batrachus exposed to dimethoate at lower sublethal concentration

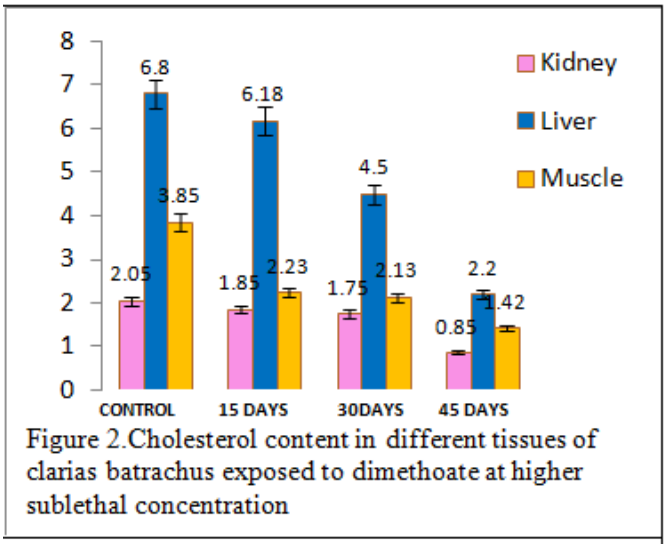

Figure 2.Cholesterol content in different tissues of clarias batrachus exposed to dimethoate at higher sublethal concentration

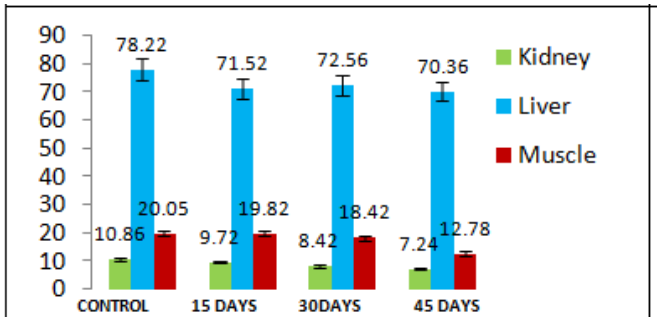

Figure 3. Phospholipid content in different tissues of clarias batrachus exposed to dimethoate at lower sublethal concentration

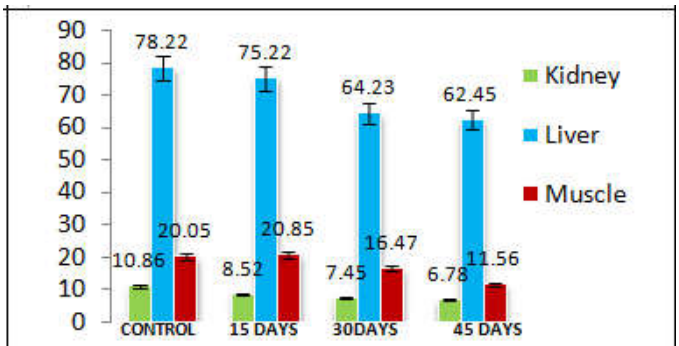

Figure 4. Phospholipid content in different tissues of clarias batrachus exposed to dimethoate at higher sublethal concentration

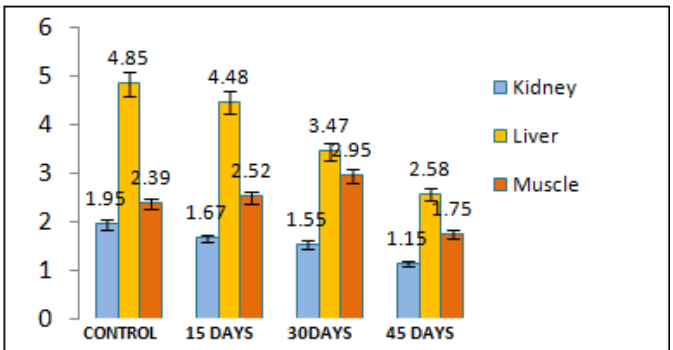

Figure 5. Triglycerides content in different tissues of clarias batrachus exposed to dimethoate at lower sublethal concentration

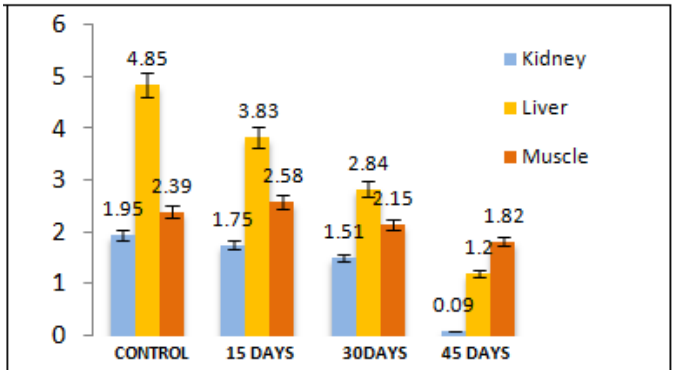

Figure 6. Triglycerides content in different tissues of clarias batrachus exposed to dimethoate at higher sublethal concentration

Cholesterol content in the kidney of fish shows significant decrease in lower and higher sub lethal concentration during the experimental period (15^{th}, 30^{th} and 45^{th} day). Cholesterol content in the liver of fish show gradual decrease in lower and higher sub lethal concentration during the experimental period (15^{th}, 30^{th} and 45^{th} day). But in lower sub lethal concentration there is a slight increase of cholesterol content was noticed in 15^{th} day of exposure of the pesticide. Cholesterol content in the muscle of fish show gradual decrease in lower and higher sub lethal concentration during the experimental period (15^{th}, 30^{th} and 45^{th} day). But there is no significant decline during 15^{th} and 30^{th} day of exposure in higher sub lethal concentration (Figure 1 and 2).

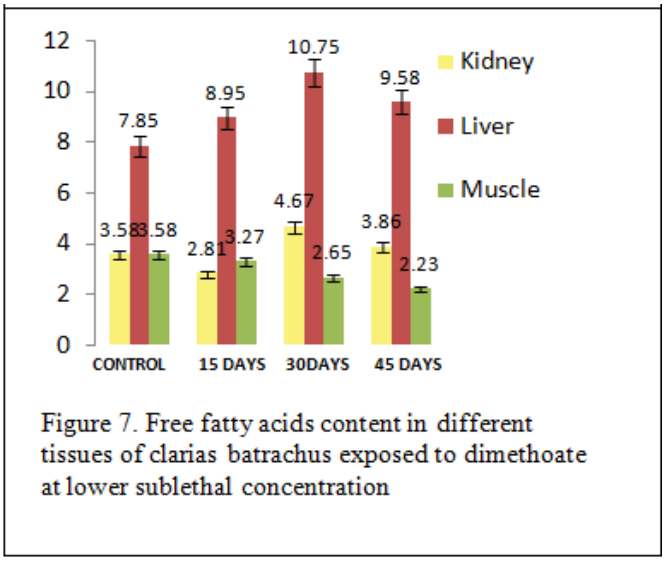

Figure 7. Free fatty acids content in different tissues of clarias batrachus exposed to dimethoate at lower sublethal concentration

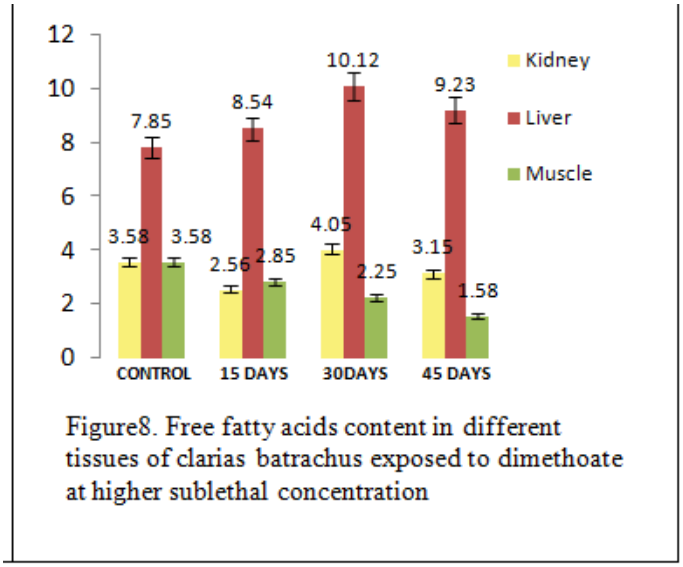

Figure8. Free fatty acids content in different tissues of clarias batrachus exposed to dimethoate at higher sublethal concentration

Phospholipid content was significantly decreased in the kidney, liver and muscle of fishes exposed to the lower and higher sublethal concentration of dimethoate at the end of 15th, 30th and 45th day. But in liver tissue decrease of phospoholipid was observed in lower sub lethal concentration of dimethoate only 15th day of the experimental period (Figure 3 and 4). But in muscle tissue slight increase of phospoholipid was observed in higher sub lethal concentration of dimethoate only 15th day of the experimental period. Triglyceride content in the kidney and liver of the animal shows significant decrease in the lower and higher sub lethal concentration of dimethoate during the 15th, 30th and 45th day of exposure (Figure 5 and 6). In muscle tissue, there is a significant increase in the level of triglyceride was observed during 15th and 30th day of exposure in lower sub lethal concentration, and in higher sub lethal concentration increase in the level of triglyceride was observed only during 15th day of exposure. In kidney tissue, the free fatty acid level was increased during 30th day of exposure in both the concentration of dimethoate, but there is a significant decrease was noticed during the 15th and 45th day of exposure. Free fatty acid level in liver of the animal exposed to both the concentration of dimethoate, there is an increase in the level of free fatty acid was noticed at the end of 15th and 30th day, and followed by a significant decrease was noticed during the 45th day of exposure (Figure 7 and 8). In muscle tissue there was a gradual decrease was observed in both the concentration of dimethoate during all the experimental period when compared to the control groups.

DISCUSSION

Due to the decrease in the cholesterol and phospholipids may cause an effect on the structural integrity and permeability of the cellular and sub cellular membranes (Umapathy and Rai, 1980). Due to oxidation or hydrolysis of lipids that leads to the decrease in lipid contents (Levesque *et al*., 2002). Accumulation of pesticides in tissues can alter the function of structural lipids of membranes and can disturb membrane functions (McKeown and Marux, 1978). In fish, lipid metabolism was regulated by cortisol (Sheridan, 1987). The hepatocyte of catfish was stimulated by the mobilization of lipid provide fuel stimulation (Vijayan *et al*., 1981). The vacuoles within the cytosol in the renal tubules, there is an accumulation of triglycerides (Thomas, 1990). Changes in the triglycerides content in the cytoplasm of affected cells, may function as a good indicator of acute, sub acute and chronic activity of the renal tubules (Wester, *et al*., 1990). In summary the effect of dimethoate produces significant alterations in the level of cholesterol, phospholipid, triglycerides and free fatty acids in different tissues of cat fish. These alterations may affect the normal growth, reproduction, biochemical and physiological process in the cat fish, also affect the nutritional quality of these edible fish and may also affect the health of the consumers.

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