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Toxic effects of Merit Alpha (Organochlorine) pesticide on muscle protein level in a fresh water fish, *Heteropneustes fossilis* (Bloch)

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Abstract :The present study deals with the effect of an organo- chlorine pesticide, Merit Alpha on the muscle protein of an air breathing fish, *Heteropneustes fossilis* (Bloch). The fish exposed to the pesticide sub-lethally and lethally showed a wide variation in muscle protein as compared to the normal, thus showing its toxic nature.

Keywords:- Toxic, Merit Alpha, organo-chlorine, protein, *H.fossilis*

INTRODUCTION

Industrial growth, rapid industrialization, heavy dependence of agro-chemicals and lack of proper solid waste management has put severe environmental stress resulting in higher level toxicity in water bodies, adversely affecting the aquatic biota, specially fishes which are a major source of proteinous food of our mass. These pesticides adversely affect the physiology, histology, biochemistry and reproductive biology of fish fauna. Proteins, which form a major part of the dry weight of an animal, are known to serve as energy source particularly in fishes during stress condition. The food value of fish is directly dependent on protein content of different tissues in general and the muscle tissue in particular.

Pesticides are known to interfere with the protein content of different tissues in fishes and this has been well documented in a number of fishes exposed to a wide spectrum of pesticides (Sheela et al., 1992; Radhaiah and Rao, 1992; Begum and Vijayaraghavan, 1995; Lal, 1999; Jha and Verma, 2002; Tilak et al, 2005; Aman and Sah,

2010 and Monalisa, 2013).

Hence, the present investigation is an attempt to study the effect of an organochlorine pesticide, Merit Alpha, on the muscle protein of an air-breathing fish, *Heteropneustes fossilis* (Bloch).

MATERIALS AND METHODS

Control and Merit Alpha exposed (to sub-lethal concentration of 0.0035 mg/litre for 1, 3, 6, 12, 24, 48, 72, 96, and 120 hrs and to lethal concentration of 0.0065 mg/litre for 1, 3, 6 and 12 hrs in separate jars). Fishes were removed from the glass jars and stunned by a blow on the head. Tissue samples (of muscle) were quickly dissected out and used for the estimation of protein content. Estimation of protein content of tissues (muscle) was done by employing the method of Lowry et al., (1951) as described in detail by Bakthavathsala (1980). 50mg of muscle tissue was homogenized with 2.5ml of 10 percent TCA (representing 2% homogenate) in all glass homogenizer. The homogenate was centrifuged at 3000rpm for 20minutes. The residue was collected and suspended in 5ml of 0.1N sodium hydroxide. 2.0ml of this mixture was transferred into a clean test tube and 4ml of carbonate- copper solution was added. The contents

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of the test tube were mixed well by shaking and 0.4ml of Folin- phenol reagent was added. The tubes were shaken well and kept at laboratory temperature for 30minutes. The blue colour developed was read at 600 mu against a reagent blank using a photoelectric colorimeter (Systronics, Model- 112). Bovine serum albumin was used to construct the standard curve and protein content of tissue was expressed in mg/gm wet weight of tissue.

RESULTS AND DISCUSSION

The protein level in muscle of control and sub-lethally (96 hr LC₀) (0.0012 mg/litre) Merit Alpha- exposed H. fossilis are presented in Table-1 and the percent changes (from control level) in the protein content of muscle of sub-lethally Merit Alpha exposed fishes are represented in table-2. Table 1 provides the data on the protein levels in the above tissues of control and sub-lethal (24hr LC₁₀₀) (0.0012mg/litre) Merit Alpha exposed fishes and their percent changes form control levels are represented. From Tables 1 and 2 it is discernible that the overall effect of sub-lethal and lethal concentrations of Merit Alfa on the protein levels of the fish is not significant (based of ‘F’ test).

Of the above tissues studied, muscle tissue of control H. fossilis registered the highest level of protein content

of 20.70±0.57 mg/gm tissue which showed an overall insignificant response (based on ‘F’ test) to both the sub-lethal and lethal concentration of merit alfa.

Under sub-lethal exposure , the Fish registered significant (except that of 72 hrs.) reductions in muscle protein content to the tune of about 23 percent, 15 percent, 19 percent, 24 percent, 23 percent, 8 percent, 1 percent, 16 percent, and 28 percent following 1,3,6,12,24,48,72,96 and 120 hrs respectively. The estimated protein contents of muscle tissue following the above periods respectively were, 15.90±0.38 mg/gm tissue, 17.60±0.78 mg/gm tissue, 16.70±0.81mg/gm tissue, 15.70±0.42 mg/gm tissue, 15.90±0.36 mg/gm tissue, 14.90±0.17 mg/gm tissue, 20.50±0.40 mg/gm tissue, 17.40±0.62 mg/gm tissue and 19.00±0.14 mg/gm tissue (Table 1).

Lethal merit alfa exposure of H.fossilis caused insignificant changes in the muscle protein content following the four periods of exposure. The estimated muscle protein contents following 1,3,6 and 12 hours of lethal exposures were, 19.80±0.23 mg/gm tissue (with an insignificant 4 percent drop); 19.74±0.19 mg/gm tissue (with an insignificant 5 percent drop); 19.44±0.28mg/gm tissue (showing an insignificant 6 percent drop) and 19.76±0.22 mg/gm tissue (with an insignificant 5 percent drop) respectively (Table 2).

Table 1: Protein levels in muscle (mg/gm tissue) of control and sub-lethal (96 hr LC₀) (0.0012 mg/litre) Merit Alpha exposed air breathing fish, H. fossilis. Value are mens of 5 observations±S.E. Percent changes from control level are given in parentheses.

Tissue	Control	Hours of exposure									F value
		1 hr.	3hr.	6hr.	12hr.	24hr.	48hr.	72hr.	96hr.	120hr.	
Muscle	20.70±.57	15.9±.13 (-23) HS	17.6±.78 (-15) HS	16.7±.81 (-19) HS	15.7±.42 (-24) HS	15.9±.36 (-23) HS	14.9±.17 (-28) HS	20.5±.4 (-1) NS	17.4±.62 (-16) HS	19±.14 (-8) S	0.69 NS

‘+’ denotes percent increase from control level
 ‘-’ denotes percent decrease from control level
 HS- Highly significant, statistically, P<0.01
 S- Significant, statistically, P<0.05
 NS- Non significant, statistically, P<0.05.

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Table 2: Protein levels in muscle (mg/gm tissue) of control and lethal (24hr LC100) (0.0065 mg/litre) Merit Alpha exposed air-breathing fish *H. fossilis*. Values are means of 5 observations±S.E. Percent changes from control, level are given in parenthesis.

Tissue	Control	Hours of exposure				F value
		1hr.	3hr.	6hr.	12hr.	
Muscle	20.70±0.57	19.8±.23 (-4) NS	19.74±.28 (-5) NS	19.44±.22 (-6) NS	19.76±.22 (-5) NS	0.65 NS

Each body cell is composed mainly of protein. Protein makes up the membrane bounding the cell and also occurs within the cell. Protein plays a vital role in the formation of enzymes, antibiotics, and hormones and other substances that regulate the body process (Sujatha, 2011, Velumurugan, 2012).

Reduction in the protein content of different tissues of fishes under pesticide toxicity has been uniformly reported by a number of authors. Such a reduction in the tissue protein content, while indicating severe proteolysis, was taken to suggest a possible degradation of protein into amino acids which were fed into TCA cycle for increased energy production (Ramalingam and Ramalingam, 1982); Palanichamy et al., 1986; Begum and Vijayaraghavan, 1995; Yeragi et al. 2000; Tilak et al 2005). Depletion of protein content in liver and kidney tissues of *Heteropneustes fossilis* exposed to dimethoate was considered as a result of increased activity of acid phosphatase enzyme following disruption was considered as a result of increased activity of acid phosphatase enzyme following disruption of lysosomal membranes (Dubale and Awasthi, 1982). Reduced tissue protein synthesis, probably due to reduced activity levels of RNA Synthetase enzymes, was reported by Mukhopadhyay and Dehadrai (1980) in melathionexposed *Clarias batrachus* and by Natesan (1985) in sevin-exposed *Sarotherodon mossambicus*. Stimulation of protein catabolism in liver and the subsequent utilization of amino acids as energy precursors for physiological reorganization under the pesticide impact was reported in dimethoate- treated *Clarias batrachus* (Begum and Vijayaraghavan, 1995).

However, the air-breathing fish, *H. fossilis* in the present study, shows varying patterns of changes in the

protein contents of muscle tissues as well as during different periods of sub-lethal and lethal exposures to Merit Alpha. Unlike the other physiological parameters investigated in the present study, the protein levels of muscle tissues of *H. fossilis* showed similar response both under sub-lethal and lethal exposures. Though *H. fossilis* showed selective patterns of changes (Comparatively to lesser magnitudes) in the protein content of muscle tissues under merit Alfa exposure, the observed insignificant (based of 'F' test) overall effect of Merit Alpha on tissue protein contents is indicative of the fact that the fish, perhaps, maintains the quality of its protein content unaltered under pesticide exposure which could be of applied value from fisheries point of view.

Thus, in light of the above discussion on protein depletion in the present study may be associated with an impairment in carbohydrate metabolism which may have stimulated gluconeogenesis by utilizing proteins. Hence, care is needed while spraying the pesticide in the crop-field so as to save the fish wealth.

REFERENCES

1. **Aman, Sabana and Sah Shobha 2010.** Quantitative analysis of protein, glycogen and Cholesterol in the body muscle of fresh water carp, *Labeo rohita* (Ham). *Life.Sc. Bulletin* 7(1): 62-64
2. **Bakthavatsalam, R. 1980.** Toxicity and physiological impact of three selected pesticides on an air- breathing Fish, *Anabas testudineus* (Bloch), Ph D Thesis Annamalai University T.N.
3. **Begum, G. and Vijayaraghavan, S. 1995.** *Bull. Environ. Contam. Toxicol.* 54: 370-375
4. **Dubale, M.S. and Awasthi, Mohini 1982** Biochemical changes in the liver and kidney of a cat fish *H. fossilis*

Biospectra : Vol. 9(1), March, 2014.

An International Biannual Refereed Journal of Life Sciences

- exposed to Dimethoate. *Comp. Physiol. Ecol.* 17(2): 111-114
5. **Jha, B.S. and Verma, B.P. 2002.** Effect of pesticidal mixture on protein content in the fresh water fish, *Clarias batrachus*. *J.Ecotoxicol. Environ.Monit.* 12(3):117-118
 6. **Lal, A.P.,1999.** *Biochemistry. The Molecular logic of living organisms.* 2nd ed. Worth Publisher, New York
 7. **Lowry, O.H., Roseburgh, N.J., Farr, A.L. and Randal, R.J. 1951.** Protein measurement with folin phenol reagent. *J.Biol.Chem.* 193: 265-275
 8. **Monalisa, 2013.** Physio-biochemical effect of lead nitrate on the common Indian catfish, *Heteropneustes fossilis*. Ph.D. Thesis S.K.M. University, Dumka, Jharkhand.
 9. **Mukhopadhyay, P.K. and Dehadrai, V.P. 1980.** Biochemical changes in the air-breathing catfish, *Clarias batrachus* exposed to Malathion. *Env.Pollut. (Series A)* 22: 149-158
 10. **Natesan, R. 1985.** Effect of sevin on protein levels of different tissues of *S. mossambicus*. M.Sc. Dissertation, Bharathiar University, Coimbatore, T.N. India
 11. **Palanichamy, S., Baskaran, P. and Balasubramanian, M.P. 1986.** Sublethal effects of selected pesticides on protein, carbohydrate and lipid content of different tissues of *Oreochromis mossambicus*. *Proc. Symp. Pest. Resid. And Env. Pollut.* 97-102
 12. **Radhaiah V. and Rao, K.J. 1990.** Toxicity of the pyrethroid insecticide, Fenvalerate to a fresh water fish, *Tilapia mossambica*. Changes in glycogen metabolism of muscle. *Ecotoxicol. Env. Saf.* 19(1): 116-121
 13. **Ramalingam K. and Ramalingam , K. 1982.** Effect of sub-lethal levels of DDT, malathion and mercury on tissue protein of *Sarotherodon mossambicus* (Peters). *Proc. Ind. Acad. Sci. (Anim. Sci.)* 91(6): 501-505
 14. **Sheela, M., Mathivanan, R. and Muniandy S.C. 1992.** Impact of fenvalerate on biochemical status of different tissues in the fish, *Channa striatus* (Bl.) *Env.Ecol.* 10(3): 547-549
 15. **Tilak, K.S. Veeraiah K. and Koteswara Rao, D.K. 2005.** Biochemical changes induced by chlorpyrifos an organophosphate compound in sublethal concentrations to the freshwater fish *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala* *J.Env.Biol.* 26(2): 341-347
 16. **Yeragi, S.G., Koli, V. and Yeragi, S. 2000.** Effect of pesticide malathion on protein metabolism of the marine crab, *Uca merionis*. *J.Ecotoxicol.Monit.* 10(1): 59-62.

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