ORIGINAL RESEARCH PAPER

Zoology

CHANGES IN BIO-CHEMICAL PARAMETERS OF C. BATRACHUS ON CADMIUM CHLORIDE EXPOSURES

KEY WORDS: Clarias batrachus, cadmium, biochemical parameter

Dr. Sanjeeta Bishwas*

Research Scholar, Dept. Of Zoology, B. N. Mandal University, Madhepura, Bihar. *Corresponding Author

ABSTRACT

The variables monitored at blood metabolites levels are blood glucose, serum protein, serum cholesterol level glycogen, total protein, total lipids, total cholesterol, acid phosphatase, alkaline phosphatase Lactic acid and pyruvic acid in liver, Kidney, testis and ovary of experimental fish Clarias batrachus.

INTRODUCTION

The carbohydrates, proteins and lipids are the three principal constituents of the cell. These are also known as metabolites and play a major role as energy precursors for fishes exposed to stress conditions (Umminger, 1970: Rajan, 1990). The optimum concentration of these organic biomolecules is required for the proper and normal functioning of a cell. Any alteration in their organization or concentration may therefore, disturb the normal physiology of the cell. Therefore, the ultimate search for any disruptive process brought about by the chemicals must be made within the cell. One of the probable ad logical ways which may eventually lead to an understanding of the events that follows heavy metal treatment could be an examination at biochemical level. In any living tissue toxic influences exert their effects first at the molecular and biochemical levels (Robbins and Angell, 1976), hence, alterations in normal biochemical parameters serve as the earliest indicators of toxic effects on tissues. These have been referred to as reliable tools for evaluating the extent of hazard of any chemical much before any gross signs become apparent. furthermore, the biochemical indices have special significance since they signal the development of sublethal changes that make the affected population less efficient in coping with the normal stress and strain of survival. Cadmium and lead induced alteration in some biochemical parameters have been reported on various fish species (Lersson and Haux, 1982; Katti and Sathyanesan, 1983; 1984; Jha and pandey, 1989 b; Jha 1992 Jha & Jha 1995; Harichandra *et al.,* 2003; Choudhary, 2004; Seema *et al.,* 2005; Rita & Milton, 2006; Rakesh *et al.,* 2007 and Rekha Rani *et al.,* 2008). It was thought worthwhile to identify the metabolic dysfunctions in the non-target species, the fish (C. batrachus) in the present case challenged with a chronic sublethal concentration (2.31 ppm) of cadmium chloride.

MATERIALS AND METHODS

Estimation Of Glycogen:

The glycogen content of liver, kidney, testis and ovary was estimated following the method of Carroll et al. (1956) which is a modified method of Roe (1955). In the method 0.2% freshly prepared anthrone in concentrated H2SO4 and 10% Trichloroacetic acid (TCA) were used as reagents. Glucose was taken as standard 0.05% glucose solution was prepared in 10% TCA to be used as standard. Accurately weighed tissue was homogenized in 5 ml of 10% TCA which precipitated the protein the protein.

Alkaline Phosphatase:

The activity of this enzyme was measured by the technique of Wootton (1964). The tissue was homogenized in chilled KC1 (0.15 M) solution and 10% homogenate (w/v) was prepared using Potter Elvehjun homogenizer at 400 rpm with 10 up and down strokes.

Estimation Of Pyruvic Acid And Lactic ACID:

For the estimation of pyruvic acid and lactic acid of liver, kidney, testis and ovary by the methods of Friedman et al. (1942) 100 mg of sample was homogenized in 10 ml of buffer and centrifuged at 3000 rpm for 10 minutes. 0.1 Ml of sample is made to 1 ml with buffer is added. Place tube is boiling water bath for 15 minutes. Further cool, dilute with 3 ml of water. After 30 minutes the optical density was noted against the appropriate blank at 570 nm with the help of spectrophotometer.

RESULTS AND DISCUSSION

Table - 1 Change In The Blood/serum Metabolite Levels In Clarius Batrachus Exposed To Cadmium Chloride (2.31ppm) For 30 Days. Values Are Mean+- Se Pf 5 Observation.

Tissue	Control	Cadmium chloride exposed
Liver	28.80±2.44	15.56±0.59 (-45.97)
Kidney	47.706±0.838	43.774±0.834 (-8.25)
Testis	17.92±0.12	12.09±0.26 (-32.53)
Ovary	21.29±0.17	16.05±0.47 (-24.61)

The results have been summarized in table-1. The glycogen profiles of the liver, kidney, testis and ovary of the fish of control group has been estimated to be 28.80±2.44; 47.706±0.838; 17.92±0.12 and 21.29± 0.17 mg/g wet tissue respectively (Valves are mean ± S.E. of five fish in each group). The pattern of glycogen distribution was found to be following decrease over as kidney>liver>ovary>testis.

Table -2 Cadmium Chloride Induced Alterations In The Activities Of Alkaline And Acid Phosphatase (n Moles Phenol/min/mg Protein) In Tissues Of *Clarias Batrachus*

Parameters	Group	Liver	Kidney	Testis	Ovary
Alkaline Phosphatase	Control	4.01± 0.35	7.38± 0.11	1.87± 0.25	1.98± 0.21
	Cd. Treated	2.49± 0.66 (-37.90)	4.41± 0.23 (-59.86)	0.89± 0.08 (-52.40)	0.75± 0.19 (-57.67)
Acid Phosphatase	Control Treated	1.89± 0.22	4.05± 0.32	1.05± 0.32	1.24± 0.25
	Cd. Treated	3.34± 0.71 (+76.71)	4.75± 0.24 (+17.28)	1.75± 0.24 (+66.66)	2.46± 0.42 (+98.38)

The table-2 reveals that the enzymatic activity of alkaline phosphatase (ALP) was found to be significantly inhibited and that of the acid phosphatase (ACP) increased significantly in all the tissues of the test fish under the toxic influence of Cadmium chloride. The depressed alkaline phosphatase activity under Cadmium exposure was in the order Ovary>Kidney>Testis>Liver. Similarly, they increase activity of ACP was in the order kidney>Testis>Liver>Ovary.

Table -9 Cadmium Chloride (2.31ppm) Induced Alterations In The Pyruvic Of Acid And Lactic Acid (mg/g Wet Tissue) Of *Clarias Batrachus*for30 Days Values Are Mean±se Of 5 Observations.

Parameters	Group	Liver	Kidney	Testis	Ovary
Pyruvic	Control	2.19±0.22	3.10±0.03	1.80±0.06	2.00±0.22

Acid	Cd. Treated	1.19±0.25 (-45.66)	2.90±0.02 (6.45)	1.93±0.05 (-49.20)	1.5±0.22 (-25.0)
Lactic Acid	Control Treated	1.19±0.25	2.5±0.02	1.5±0.06	1.2±0.22
	Cd. Treated	1.83±0.05 (-31.6)	1.9±0.42 (-24.0)	.75±0.06 (-50.0)	.65±"022 (-45.83)

During exposure of lactic acid, decreased trend was found in liver, kidney, testis and ovary as follows Testis> Ovary> Liver> Kidney. The highest decrease reported in Testis i.e., 50% while in ovary it is 45% as followed by liver 31.6% and kidney 24.0% All the tissues are significant ($p<0.01$). Similarly, pyruvic acid decreased trend was found in Liver, Kidney, Testis and Ovary as follows Testis>Liver>Ovary>Kidney. The highest decrease was recorded in the Testis (49.2%), Liver (45.66) followed by Ovary and kidney i.e., 25% and 6.45% respectively.

REFERENCES

1. **Argahari, S. Gopal, K., 2009.** Fluctuation of certain biochemical constituents and marker enzymes as a consequence of monocrotophos toxicity in the edible freshwater fish, Channa punctatus. Pest. Biochem. Physiol. 94, 5-9.
2. **Argese, E., Marcomini, A., Miana, P., Bettiol, c., Perin, G.,** 1994. Submitochondrial particle response to linear alkylbenzene sulfonates, nonylphenol polyethoxylates and their biodegra -dation derivatives. Environ. Toxicol. Chem. 13 737-742.
3. **Arine, E, Sen, A. Bozeaarmutlu, A, 2000.** Cytochrome P4501A and associated moxed function oxidase induction in fish as a biomarder for toxic carcinogenic pollutants in the aquaric environment. Pure Appl. Chem. 72,985-994.
4. **Benarji, G, Rajendranth T.** 1990. Haematological changes induced by an oranophosphorus insecticide in a freshwater fish *Clarias batrachus* (Linnaeus). Trop. Freshwater. Biol. 2197 -202.
5. **Bhatnagar, M. C. and Tyagi, M. (1994):** Toxicity of Durmet and Mortal to a freshwater teleost *Clarias batrachus*) Lim. Proc. Acad. Environ. Biol. 3(2) : 177-180.
6. **Campbell, J.W. (1991):** Excretory nitrogen metabolism. in Experimental and Metabolic Animal Physiology. Comparative Animal physiology, 4 edition (ed. C.L. Prosser), Wiley-Interscience, New York, pp. 277-324.
7. **Draper R.P. Trimbret J.A. (1996):** Urinary Creatine as a potential marker of testicular damage: Effect of Vasectomy. Reprod. Toxicol. 10(1) 79-85.
8. **Dubowski, K. M. (1962):** An o-toluidine method for body fluid glucose determination. Clein. Chem. 8 : 215-235.
9. **Gopal, K. Anand, M. Khanna, R. N. and, Mishra, D. (1980) :** Endosulfan induced changes in blood glucose of the catfish *Clarias batrachus*. J. Adv. Zool. 1(2) :68.
10. **Gorbman, A; Dickhoff, W. W. Vigna, S. R; Clark N. B. and Ralph, C. L. (1983):** Comparative Endocrinology. A. Willey. Inter science Publication, John Wiley and Sons, New York.
11. **Higgins, T. E. Desher, D. P. (1986) :** Electroplating, metal finishing and cyanide wastes. J. Water pollut control Fed, 58: 586-589.
12. **Kumar, K and Ansari B. A. (1986):** Malathion toxicity: Effect on the liver of the fish, *Brachydanio rerio* (cyprinidae). Ecotoxicol. Environ. Saf. 12: 199-205.
13. **Malaisse W. Malaisse Lagae F. Wright P.H. and Ashmore J. (1967):** Effects of adrenergic and cholinergic agents upon insulin secretion in vitro, endocrinology, 80: 975.
14. **Nordberg, G.F. Piscator, M and Lind, B (1971 A):** distribution of cadmium among fractions of Mouse Liver, Acta Pharnacol, and toxicol 29: 456-470.
15. **Peakall, D. W.,** (1994): Biomarkers: The way forward in environmental assessment. Toxicoloy and Ecotoxicology News 1, 55 – 60.
16. **Perry, S. F., Flik, G.,** (1988) : Characterization of branchial transepithelial calcium fluxes in fresh water trout, *Salmo gairdneri*. Am. J. Physiol. 254, 491 – 498.
17. **Radhaiah, V. and Rao, K. J.** (1990): Toxicity of the parathyroid insecticide fenvalerate to a freshwater fish, *Tilapia mossambica* (Peters): Changes in glycogen metabolism of muscle. Ecotoxicol. Environ. Saf. 19 : 116 – 121.
18. **Shaffi, S.A. (1978 a):** Changes in tissue glycogen content due to cadmium intoxication on three freshwater teleosts. Curr. Sci. 47: 668-670.
19. **Shaffi, S.A. (1979):** Biochemical compartmentation of fish tissues, I. Brain energy reserves and metabolic products Acta. Physiol. 38: 85-91.
20. **Thakur, N. K. and P. Das. (1986):** Synopsis of biological data on koi *Anabas testudineus* (Bloch, 1792). *Bull. Cent. Inland. Fish Res. Inst*. Barrackpore. India. 40: 47 pp.
21. **Varley, H., Gowenlock, A.H. and Bell, M. (1980):** Practical Clinical Biochemistry, vol. 1, General topics and commoner tests. William Heinemann Medical Books Ltd. London.
22. **Wong, P.T.S.; Silverberg, B.A., Chan. Y.K. and Hodson, P.V. (1978):** Lead and aquatic biota. In: Biogeochemistry of lead in the environment, Part B (ed. J.C. Nriagu), Elsevier, North Holland.