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Haematochemical alterations in a Catfish, *Heteropneustes fossilis* (Bloch) induced by lithium

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Keywords

Haematochemical, Alterations, Catfish, *Heteropneustes fossilis*, Lithium.

Abstract

The present investigations deal with the haematological profile of a catfish, *Heteropneustes fossilis* of the administration of 7500 ug lithium nitrate. The RBC count, Hb% and PCV decreased significantly with an increase in WBC count. The values of MCV, MCH and MCHC also showed varied pattern. Serum proteins and cholesterol levels declined while blood sugars and urea elevated markedly. Inorganic minerals- phosphorus, iron but calcium was found decreased significantly in blood of intoxicated catfishes, *Heteropneustes fossilis.*

Introduction

Lithium is a chemical element with the symbol Li and it is a soft, silvery-white alkali metal. It is the least dense metal and the least dense solid element. Since 1949, the researchers are paying good attention upon lithium ion following the discovery of its useful actions in controlling manic depressive psychosis (1). The salts of this lightest alkali metal are frequently used today in pharmaceutical works, air conditioning plants, ceramics and lubricants from where it is drained out to nearby water reservoirs and causes toxic effects in aquatic flora and fauna. A few authors have examined its toxicity among land and aquatic animals (2-6). Our previous studies revealed that $LiNO_3$ treatment exhausts carbohydrate content in liver and kidney and alters the activities of several metabolic enzymes in fresh water teleosts (7). In the present study, an attempt has been made to investigate some haematochemical alterations in a catfish, *Heteropneustes fossilis* under the metallic stress of lithium.

Materials and Methods

Fishes were collected from ponds, rivers, lakes and fish farm of Karba Bujurg (Distt. Etawah). They were acclimatized for a week and then transferred to the experimental aquaria. Fishes were treated with 0.1% potassium permanganate solution to remove fungal infection.

During investigation Forty healthy fishes, irrespective of sex, weighting 60 ± 10 gm were collected for the experiment. Procedures for acclimatization of fish to laboratory conditions, preparation of stock solution and dose along with other test conditions were the same as adopted Goel et. al. (7)

The fishes were divided into two groups of 20 each. The animals of 1st group were administered 500 ug lithium nitrate (in distilled water) by subcutaneous injections at the base of caudal peduncle on alternate days. Fishes of 2nd group (control) were injected with equal volume of distilled water on respective days. After 15 doses (while each animal had received 7500 ug $LiNO_3$) the animals of both groups were sacrificed and blood was collected in different vials for analysis.

Total RBC and WBC counts, packed cell volume (PCV) and Hb% alongwith absolute values (MCH, MCV and MCHC) were done in fresh blood (8). Serum proteins, hexose, cholesterol, phosphorus and calcium were determined following the methods of Oser (9) in 'Hawk's Physiological Chemistry'. Blood urea (10) and iron (11) were also assayed in serum of lithium nitrate treated animals. All the data were analysed statistically at 0.1%, 1% and 5% levels of significance (12).

Results and Discussion

In this investigation, the haematochemical data of experimental and control fishes are presented in Table. The recorded values reveal a significant fall in RBC count (-20.55%). Hb content (-44.94%) and PCV (-50.85%) alongwith marked rise in total lencocytic count (+39.66%). Serum proteins and cholesterol diminished markedly while serum levels of glucose and blood urea elevated. Significant rise in serum calcium ($P<0.01$) with a corresponding fall in phosphorus and iron were also observed in experimental animals. According to Enrlich and Diamond (13) reaching the blood, Li^+ can cross the RBC membrane by several parallel routes and causes ill effects therein.

In the present study significantly decreased erythrocytes along with heamoglobin content reflect the anaemic conditions of animals. Panigrahi and Misra (14) have correlated erythropenia to decreased respiration rate. Reduced RBC count, Hb%, PCV and changes in other absolute values i.e. mean corpuscular haemoglobin, mean corpuscular volume and mean corpuscular haemoglobin concentration, here, are in consonance with our earlier findings (15). Increased leucocytic count might be to neutralize the harmful foreign bodies (toxicant) and of an adaptive value, to cope up for removing the dabris of damaged tissues (16). It coult be said that the toxicant has evoked a change in the homeostatic mechanism of fish which has been expressed as leucocytosis.

Diminished serum protein level may be associated with excessive loss either due to nephrosis or to reduced protein synthesis due to cirrhosis (17). Our earlier results have also revealed that the loss in plasma proteins may be a consequence of liver and kidney damage in metal salt treated catfishes (15, 18). Hyperglycemic conditions of test animals is attributed either to the enhanced glycogenolysis or induced activation of adrenal pituitary glucocorticol hormone which stimulates the hepatic glucose production and thereby elevates the blood sugar level (19). Or it may be a physiological response to meet the critical need of energy under stressed conditions (20).

Hypercholesterolamia is often seen in anemia (21) and is considered due to liver dysfunctioning which esterifies it and excretes a part of it with bile (cholic acid). Lithium induced hypercholesterolaemia has also been registered among fresh water teleosts which supports the present results(2). An elevated level of blood urea implies uraemia which appears a sequel of malfunctioning of kidney (16).

Hypercalcemia, hypophosphatasia and decreased serum iron may again be correlated to renal damage under metallic stress. According to Varley (21), these constituents of blood either filtered more or reabsorbed less during intoxicated state. Parallel to our results have been shown in fresh water teleosts exposed to metal and azodye (15,16).

Table-1 Showing Haematochemical alterations in *Heteropneustes fossilis* (Bloch) under the metallic stress of Lithium.

Parameters	Control	Experimental	% Alter
Haemoglobin %	14.53±0.03	8.00±0.10a	-44.94
PCV%	50.45±0.39	21.77±0.42a	-50.83
RBC x $10^6/mm^3$	3.39±0.07	2.49±0.49a	-20.55
WBCx$10^3/mm^3$	11.60±0.07	16.20±0.58a	+39.66
MCV/um^3	147.84±0.03	87.43±1.80a	-40.86
MCHC%	28.80±0.22	36.70±0.46c	+27.40
MCH Pg	42-87±0.09	32.13±0.35c	-25.05
Glucose mg/mL	9.33±0.08	10.67±0.09a	+14.36
Protein mg/mL	15.56+0.32	13.75±0.21b	-11.63
Cholesterol mg/mL	0.908+.01	0.824±0.01e	-9.25
BUN mg/mL (Blood Urea Nitrogen)	26.16±1.21	36.77±1.11b	+40.56
Calcium mg/mL	7.53±0.34	9.92±0.20b	+31.74
Phosphorus mg/mL	0.098±0.004	0.078±0.003a	-20.41
Iron ug/mL	97.67±2.16	86.38±1.54e	-11.56

All the values are mean ± S.E. (10 estimation).
a:P < 0.001; b:P < 0.01 c:P<0.05

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