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CHROMIUM INDUCED HAEMATOLOGICAL CHANGES IN THE CAT FISH, *HETEROPNEUSTES FOSSILIS* (BLOCH)

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In the present investigation the effect of toxicity in the *Heteropneustes fossilis* was studied with oral administration of trivalent chromium in the form of chromium trioxide after 96h of exposure to a sub-lethal concentration of 32mg.l^{-1}. When the catfish, *Heteropneustes fossilis* was exposed to a sub-lethal concentration of chromium of 32 mg.l^{-1} after 96h showed marked increased in the number of Erythrocytes, haematocrit values, clotting time, where as Leukopenia due to reduction in the number of small Lymphocytes, thrombocytopenia and significant decrease in the ESI were also noted. However, the number of immature erythrocytes, large lymphocytes and heamoglobin were not affected by metal exposure.

Key words : Chromium toxicity, Haematology, catfish, *Heteropneustes fossilis*

INTRODUCTION

Toxicants are known to damage the tissue organization, impair the lesions. The environmental impact of chemicals has become a matter of great concern and in some of the broad spectrum synthetic insecticides which have been commonly used are now being phased out.

Chromium one of the most common pollutants of natural water is primarily due to industrial wastes and effluents, and causes injury to aquatic fauna. During the present study was conducted to determine certain haemotological parameters in, *Heteropneustes fossilis* would change following acute exposure to sub-lethal levels of trivalent chromium in the form of chromium trioxide. Hexavalent chromium is more toxic than trivalent chromium (Krenkel, 1974; Stevens & Chapman, 1984). In the past years, studies using fishes have been combined to determination of lethal concentrations (LC_{50} values) of Hexavalent chromium (Adelman *et. al.*, 1966). With little information available on the effects of sub-lethal concentrations of this metal (Stokes & Fromm, 1965).

Haematology of this fish has proven useful in monitoring stress responses (Srivastava & Agarwal, 1977) including those due to exposure to sub-lethal levels of heavy metals (Srivastava & Mishra, 1979). McLeay & Gordon (1977) have also suggested that changes in the blood may well represent the most definitive test in determining physiological responses of fish to toxic substances.

MATERIALS AND METHODS:

Adult healthy and live specimens of a fresh water catfish were obtained from local fish catchers of Distt. Etawah. The fishes were treated with 0.1 % potassium permagnate solution remove any dermal infection. They were acclimatized for a week and than transferred to the experimental aquaria. The properties of the test water was the procedure

as recommended in Standard Methods (APHA *et. al.*, 1995). Specimens of each male and female (Weight 45.0 ± 5.0g; length 18.0 ± 3.5 cm) were used for this study. Fishes were fed regularly with dried shrimp powder.

The fishes were divided into six groups each with ten animals. They were exposed for 96h to chromium trioxide at a sub-lethal concentration of $32mgl^{-1}$. The 96h LC_{50} value, determined concurrently by graphical interpolation in plotting percentage survival *Vs* log CrO_3 concentration (APHA *at. al.*, 1995) was 32 $mg.l^{-1}$. Similar groups of fish were not treated with the metal acted as controls. Each fishes were anaesthetized with MS-222 (Sankyo Co., Tokyo, Japan). The animal was washed with distilled water and blotted dry with the help of clean turkish towels and weight.

Blood samples were collected either from caudal vessel by severing the caudal penducle or directly from ventral aorta and heart by heparinized syringes. The haematological techniques followed as described by (Srivastava, 1968a&b, 1969;. Srivastava & Mishra, 1979). The results were subjected to statistical analysis by student's 't' test.

Table I : Haematological values of *Heteropneustes fossilis* exposed to $32mgl^{-1}$ of chromium trioxide for 96 h.

Parameters	Control group	Experimental group
Erythrocytes (x 10^6/mm^3)	4.82 ± 0.25	6.20 ± 0.35*
Leukocytes (x 10^3 mm^3)	55.20 ± 6.75	30.50 ± 5.00[a]
Thrombocytes (x 10^3 mm^3)	39.20 ± 6.50	15.00 ± 2.40
Total differential cell counts[a]		
Mature erythrocytes	950.23 ±1.56	990.50 ± 1.22***
Immature erythrocytes	2.30 ± 0.26	1.52 ± 0.55
Small lymphocytes	35.10 ± 1.61	15.00 ± 1.15***
Large lymphocytes	1.92 ± 0.38	1.00 ± 0.18
Thrombocytes	3.00 ± 0.10	1.20 ± 0.16***
Haematocrit (%)	50.00 ± 3.02	59.92 ± 1.80**
ESR (mm/h)	1.97 ± 0.15	0.90 ± 0.04***
Haemoglobin (g%)	10.82 ± 0.10	10.60 ± 0.25
Clotting time (sec)	28.00 ± 0.93	36.30 ± 1.20***

Values are mean + S.E. (N=5); * P<0.05; ** <P0.01; *** < 0.001, Student's 't' test;.
[a]Per thousand cells of all types.

RESULTS AND DISCUSSION:

In the present study the total erythrocyte count, number of red blood cells and haematocrit value were significantly higher than the control values after 96h exposure to 32 mgl^{-1} of chromium trioxide. Whereas, erythrocyte sedimentation rate (ESR), total leucocyte count, and number of small lymphocyte decreased significantly in treated fish. The number of thrombocytes count was not already significantly, but is showed a trend towards decrease. The number of immature erythrocytes, large lymphocytes and the haemoglobin content were not altered appreciably by metal exposure (Table I).

The increased in the number of red blood cell count probably reflects a hypoxic stress exposure resulting in secondary polycythemia. This increase in the total erythrocyte count also explains the decrease in erythrocyte sedimentation rate. The leukopenia in *Heteropneustes fossilis* following exposure to chromium is mainly due to a decrease in small lymphocyte. Lymphopenia has also been reported in *Colisa fasciatus* exposed to sublethal concentrations of cobalt (Srivastava & Agarwal, 1979).

The increased blood clotting time in treated fishes may have resulted mainly from a decrease in the number of circulating thrombocytes which function in the fish blood clotting process (Doolittle & surgenor, 1962). Srivastava (1969) reported that clotting rate in teleosts was an apparent function of the number of thrombocytes present.

The result of this investigation suggest that besides leukopenia, an indicator of generalized stress response, erythrocytosis and hypocoagulability of whole blood may be used in monitoring chromium toxicity in *Heteropneustes fossilis.*

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REFERENCES

ADELMAN, I.R. SMITH, L.L. & SIESENNOP, G.D. !966. Acute toxicity of sodium chloride, pentachlorophenol, Guthion and hexavalent chromium to fathead minnows (*Pimephales promelas*) and gold fish (*Carassius auratus*). *J. Fish. Res. Bd. Canad,* **33**(2) : 203-208.

APHA, AWWA, WPCF : 1995. *Standard Methods for the examination of water and waste water American Public Health Association pub. Washington, D.C.* 19th. Edn pp. 874.

DOOLITTLE, R.F. & SURGENOR, D.M. 1962 Blood coagulation in fish. *Amer. J. Physiol.* **203**(3) : 964-970.

KRENKEL, P.A. 1974. Sources and classification of water pollutants. In *Industrial pollution* (Sax, N.I. Ed..), Van Nostrand Reinbold, New York, pp. 197-219.

MCLEAY, D.J. & GORDON, M.R. 1977. Leucocrit : A simple haematological technique for measuring acute stress in salmonid fish, including stressful concentrations of pulpmill effluent *J. Sifh. Res. Bd. Canad.* **34**(9) : 2164-2175.

SRIVASTAVA, A.K. 1968a. Studies on the haematology of certain fresh water teleosts. I. Erythrocytes. *Anat. Anz.* **123**(2) : 233-249.

SRIVASTAVA, A.K. 1968b. Studies on the haematology of certain fresh water teleosts. IV. Haemoglobin. *Folia Haematol. (Leipzig).* **90**(3) : 411-418.

SRIVASTAVA, A.K. 1969. Studies on the haematology of certain fresh water teleosts. V. Thrombocytes and the clotting of blood. *Ant. Anz.* **124**(3) : 368-374.

SRIVASTAVA, A.K. & AGRAWAL, U. 1977. Involvement of pituitary interrenal axis and cholinergic mechanism during the cold-shock leucocyte sequence in a fresh water tropical teleost, *Colisa fasciatus. Arch. Anat. Microsc. Morphol. Exp.* **66**(2) : 97-108.

SRIVASTAVA, A.K. & AGRAWAL, S.J. 1979. Haematogical anomalies in a fresh water teleost *Colisa fasciatus,* on an acute exposure to cobalt. *Acta Pharmocal. Toxicol.,* **44**(2) : 197-199.

SRIVASTAVA, A.K. & MISHRA, S. 1979. Blood dyscrasia in a teleost (*Colisa fasciatus*) following acute exposure to sub-lethal concentration of lead. *J. Fish Biol.* **14**(2) : 199-203.

STEVENS, D.G. & CHAPMAN, G.A. 1984. Toxicity of trivalent chromium to early life stages of steelhead trout (*Salmo gairdneria*). *Environ. Toxicol. Chem.* **3**(1) : 125-134.

STOKES, R.M. & FROMM, P.O. 1965. Effects of chromate on glucose transport by the gut of rainbow trout. *Physiol. Zool.* **38**(2) : 202-205.

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