

HAEMATOLOGICAL EFFECTS OF TOXICITY OF SUBLETHAL CONCENTRATION OF SOME HEAVY METAL SALTS ON *CHANNA PUNCTATUS* II. LEUCOCYTES

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ABSTRACT

Adult *Channa punctatus*, treated at sublethal concentration of $CdCl_2$, $Pb(NO_3)_2$ and $ZnSO_4$ for 10, 20, 30 and 40 days of exposure exhibited marked changes in total WBC count of blood. Significant decrease in the value was observed as a result of toxicity of all three heavy metal salts. Although a slight increase in the values after 30 and 40 days treatment of $CdCl_2$ and $Pb(NO_3)_2$, and 30 days treatment of $ZnSO_4$ was observed in comparison to their shorter exposures, but normal control values were not recovered.

INTRODUCTION

The earth crust is made up of 90 different chemical elements. While many of them are essential for the sustenance of organisms, a few like cadmium, lead and zinc are harmful to them. Though zinc is a toxic element, it is essential in traces for growth and well being of animals with an important role in metabolism (Ansari et al. 1975). Changes in conditioned reflexes at low levels of exposure to lead (Gusev 1960) have been reported. These heavy metals, in subacute concentrations, get gradually intensified in various aquatic organisms and reach to the higher trophic levels through food chains (Zitko et al. 1979), resulting in alteration in growth (Crandall and Goodnight 1963), reproduction and maturity (Albaster and Lloyd 1982) as well as in various vital physiological and biochemical parameters.

Changes in blood parameters have been observed in fishes and other vertebrates following exposure to toxicants by many workers (Mc Kim et al. 1983-89, Bhaleroa et al. 1986, Beena and Viswaranjan 1987, Banerjee and Kumar 1988, Das and Kaviraj 1990, Ruparelia et al. 1991). However, most of the studies are on high concentration with short exposure of toxicants, an unusual condition for natural environment. In the present paper, effects of three heavy metal salts namely cadmium chloride, lead nitrate and zinc sulphate have been studied at their sublethal concentrations i.e. 10 ppm, 6 ppm and 10 ppm respectively after 10, 20, 30 and 40 days of exposure on leucocytes of *Channa punctatus*.

MATERIAL AND METHODS

More than 100 live adult specimen of *Channa punctatus*, weighing 70 ± 20 g and measuring 15 ± 2 cm were procured from local fish dealer. In the laboratory, the fish were acclimatized for a week. Acclimatized fish were divided into four groups of 25 specimen each and kept in four

glass aquaria (60 L). Group A served as control and the fish of group B, C and D were treated with CdCl_2 (10 ppm), $\text{Pb}(\text{NO}_3)_2$ (6 ppm) and ZnSO_4 (10 ppm) respectively. Long term experiment of 40 days was performed during which the fish were fed by pieces of goat liver and earthworms daily. Water of aquaria was renewed on alternate days to avoid the adverse effects of faecal matter. Throughout the experiment same concentration of toxicants was maintained. The blood samples from control and treated groups of fish were collected in vials, containing 5% EDTA, an anticoagulant, after 10, 20, 30 and 40 days of experiment by cutting the caudal peduncle of fish. Enumeration of total WBC count of blood was made by usual haematological methods. Changes in the values were expressed in percentage and also tested for their significance using 't' test.

RESULTS AND DISCUSSION

The total WBC count in the blood of 10, 20, 30 and 40 days control fish were 39,275, 40,025; 39,200 and 38,475 cells/mm³ respectively (Table 1).

Table 1. Total WBC count (cells/mm³) in normal and in CdCl_2 , $\text{Pb}(\text{NO}_3)_2$ and ZnSO_4 treated fish *Channa punctatus* along with percent of decrease in parentheses. (Values are the means of 4 observations \pm S.E.)

Heavy Metal salt	Dose Concentration (ppm)	DURATION							
		10d		20d		30d		40d	
		Control	Treated	Control	Treated	Control	Treated	Control	Treated
CdCl_2	10	39,275	34,975	40,025	29,625	39,200	32,475	38,475	31,700
		± 932.319	± 403.69	± 354.21	± 671.169	± 681.909	± 575.95	± 210.28	± 536.19
			(10.94)		(25.93)		(17.15)		(17.60)
		$p < 0.02$		$p < 0.001$		$p < 0.01$		$p < 0.001$	
$\text{Pb}(\text{NO}_3)_2$	6	39,275	31,250	40,025	33,775	39,200	34,360	38,475	34,050
		± 932.319	± 540.254	± 354.21	± 1231.04	± 681.909	± 686.93	± 210.28	± 804.285
			(20.43)		(15.61)		(10.72)		(11.50)
		$p < 0.001$		$p < 0.01$		$p < 0.01$		$p < 0.01$	
ZnSO_4	10	39,275	35,462.5	40,025	32,737.5	39,200	35,962.5	38,475	34,100
		± 932.315	± 337.904	± 354.21	± 217.496	± 681.909	± 372.229	± 210.28	± 625.499
			(9.7)		(18.20)		(8.26)		(11.37)
		$p < 0.02$		$p < 0.001$		$p < 0.02$		$p < 0.01$	

In CdCl_2 treated fish, after 10 days exposure, the value decreased to 34,975 cells/mm³. At 20 days the value decreased further but after 30 days it increased slightly in comparison to 20 days. At 40 days of exposure, it again declined to 31,700 cells/mm³.

In $\text{Pb}(\text{NO}_3)_2$ treated fish the value decreased to 31,250 cells/mm³ after 10 days, but it gradually increased to 34,350 cells/mm³ after 40 days of exposure remaining for below the control level.

In ZnSO_4 treated fish also the value decreased at 10 days of exposure, but increased slightly and gradually after 20 and 30 days reaching 34,100 cells/mm³ at 40 days.

Similar decrease in total WBC count in blood of *Channa punctatus* (Bluekev) has been reported by Natrajan (1981) following lethal (LC_{50}) and short term exposure (48 hrs) of metasytox.

Sublethal doses of some organophosphorus insecticides on *Channa punctatus* also revealed similar decrease in WBC count (Lone and Javed 1976). In an study of independent and combined toxicity of carbaryl and penthoate on *Channa punctatus* by Sambasiva Rao and Ramana Rao (1986), a similar decrease in WBC count was observed. The observations made by Ahmad and Ahsan on *Amphipnous cuchia* are also in conformity with the decreasing trend of WBC as an effect of heavy metal toxicity similar to insecticides and pesticides.

After 10, 20, 30 and 40 days of treatment with 10 ppm cadmium chloride 10.94% ($p < 0.02$); 25.93% ($p < 0.001$); 17.15% ($p < 0.01$) and 17.60% ($p < 0.001$) decrease respectively in the WBC count was noticed while at the same interval of treatment by 6 ppm of lead nitrate the decrease was of the order of 20.43% ($p < 0.001$); 15.61% ($p < 0.01$); 10.72% ($p < 0.01$) and 11.50% ($p < 0.01$) respectively. The 10 ppm concentration of zinc sulphate resulted in the reduction of WBC count by 9.70% ($p < 0.02$); 18.20% ($p < 0.001$); 8.26% ($p < 0.02$) and 11.37% ($p < 0.01$) after 10, 20, 30 and 40 days of exposure.

The decrease in total WBC count in the present investigation shows that the fish loses its resistance and is highly susceptible to the stress caused by the heavy metal salts. Moreover slight increase in value during the experiment (at longer exposures), shows that the fish endeavours to combat toxicant stress in due course.

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