



Effect of lead on certain haematological parameters of the fresh water fish *Oreochromis Mossambicus* (Peters)

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ABSTRACT

Metal pollution today is the highest cause of concern in developing countries. The effects of sub - lethal concentration (1/10th - 1.87ppm of the 96 hr Lc50) of lead acetate on the haematological parameters in the fresh water fish *Oreochromis mossambicus*. The Red blood corpuscles, Haemoglobin, Haematocrit, MCH and MCHC where as the showed an increase at all exposure periods. The decrease in RBC has led to an anaemic state while the increase in WBC count may play a part in the development of certain degree of tolerance during the stress condition imposed by the lead acetate. In conclusion, the changes observed indicate that haematological parameters can be used as an indicator of metal related stress in fish on exposed to elevate level of metals in the water due to climate change impacts.

Keywords: *Oreochromis mossambicus*, Lead acetate, Haematological Parameters.

1. INTRODUCTION

The problem of environmental pollution associated with heavy metal is the result of the redistribution by man's industrial and agricultural society (Higgins and Burns, 1975). The industrial effluents constitute a major source of organic and inorganic pollutants of environment. These pollutants tend to alter the biological structure and systems in to irreversible and inflexible change leading to deformity or death (Lucky and Venugobal, 1977). These pollutants in aquatic environment can pose adverse effects on growth, physiology, reproduction and survival risk of aquatic organisms especially on fish (Malik, *et al.*, 2010). The most common cause of water pollution in developing countries is domestic and industrial waste that is directly released in to streams or ponds without treatment. These wastes mostly contain various types of pollutants such as heavy metals, radioactive substances, pesticides, herbicides and corrosive substances like acids and bases (Mahadhbi *et al.*, 2012). Heavy metal salts constitute a serious type of pollution in fresh water and being stable compounds they are not readily removed by oxidation. Lead is used in many industries like Haematology of fish was gained recognition as an applied science compositions of the blood of fishes varies with the changing conditions of the environment and responds immediately to any change in water quality because of the intimate contact through gill surface. Blood is valuable diagnostic tool for the investigation of disease and physiological or metabolic alterations (Bansal *et al.*, 1979). Studies dealing with effect of environmental stress on fish blood parameters. Haematology is used as an index of fish health status in a number of fish species to detect physiological changes following different stress conditions like exposure to pollutants, diseases, metals, hypoxia etc., (Blaxhall, 1972, Duthie and Tort, 1985). Linkaraj *et al.*, (2004) have studied the eco toxicological effects of cadmium on the effects haematology of fresh water fish *Oreochromis mossambicus*. Hence the present study was undertaken to determine the changes in the haematological parameters to lead in the fresh water fish *Oreochromis mossambicus* at 10,20 and 30 days respectively.

2. MATERIALS AND METHODS

Fresh water fish *Oreochromis mossambicus* ranging from 10-12 cm in length and weighing between 20-25g were collected from fish farm located in puthur, Chidambaram, Tamilnadu, Annamalai University campus and was acclimatized under laboratory conditions ($29\pm 1^\circ\text{C}$). The fishes were fed daily on oil less groundnut cake. The unused food was removed after two hours and water was changed daily. Prior to experimentation *Oreochromis mossambicus* were acclimatized in experimental tanks for atleast one week. The LC_{50} value were determined (Finney, 1971) which was found to be 18.7 ppm. Sublethal studies are helpful to assess the response of the test organism under augmented stress caused by metals. According to Konar (1969) and Sprague (1971) One-tenth (1.87ppm) of the 96 hour LC_{50} values of lead acetate were selected for the present investigation as sublethal concentration respectively 10,20 and 30days. The haematological parameters Viz Red blood cells (RBC), White blood cells (WBC), Haemoglobin(Hb), Haematocrit (Ht), Mean cell haemoglobin (MCH), Mean cell haemoglobin concentration were determined by adopting the method of Daecie and Lewis (1984). Hence the present study was undertaken to determine the changes in the haematological parameters to lead in the fresh water fish *Oreochromis mossambicus* at 10, 20 and 30 days respectively.

3. RESULTS

Haematological parameters in *Oreochromis mossambicus* exposed to lead was very much affected, when compared to that of control. In the fish treated with sub lethal concentration of lead, the RBC counts were continued. Haematological parameters like the number of Red Blood Corpuscles (RBC), White Blood Cells (WBC), Haemoglobin (Hb), Haematocrit (Ht), Mean Cell Haemoglobin (MCH), Mean Cell Haemoglobin Concentration (MCHC) in the control and experimental fish are presented in Table-1. The RBC counts were 1.86, 1.72 and 1.51 million mm^3 of blood for 10, 20 and 30 days of exposure period respectively. The percent decrease over the control were -5.58, -11.34 and -22.95 in sublethal concentration for 10, 20 and 30 days of exposure periods respectively (Table1; Fig1). *Oreochromis mossambicus* when exposed to sublethal concentration of lead shows an increasing trend in the WBC compared to untreated controls. The steady and gradual increase in the number of WBC counts were observed from 10 to 30 days of exposure period. The percent increase over the control was 9.588, 9.989 and 13.787 for the period of 10, 20 and 30 days of sublethal exposure of lead (Fig-2). A decreasing trend in the Hb level was observed in the blood of sublethal exposed fishes. The percent decrease of Hb level over the control was -8.18, -14.86, -21.25 for 10, 20 and 30 days of exposure periods respectively (Table1-Fig-3). *Oreochromis mossambicus* treated with sublethal concentration of lead exhibited a significant decrease in the mean Ht contents in the blood at all periods. The maximum mean Ht decrease was noticed at 30 days of sublethal exposure of lead. The percent decrease over the control was -5.08, -12.75 and -19.5 (Table 1- Fig.4). The percent decreases in MCH level were -2.75, -3.98 and -6.15 in sublethal concentration of lead for the period of 10,20 and 30 days respectively (Fig-5). *Oreochromis mossambicus* treated with sublethal concentration of lead exhibited a significant decrease in the mean MCHC levels in the blood at all periods. The maximum decrease of MCHC was noticed at 30 days of sublethal exposure of lead. The percent decrease over the control was -3.28, -4.118 and -4.33 in sublethal concentration of lead (Fig-6). The results of the present investigation revealed a time dependent lead accumulation in the different tissues of fishes exposed to different periods of sublethal concentration of lead.

Table 1

Changes in the Haematological profiles in *Oreochromis mossambicus* exposed to sub-lethal concentration of Lead acetate at different periods

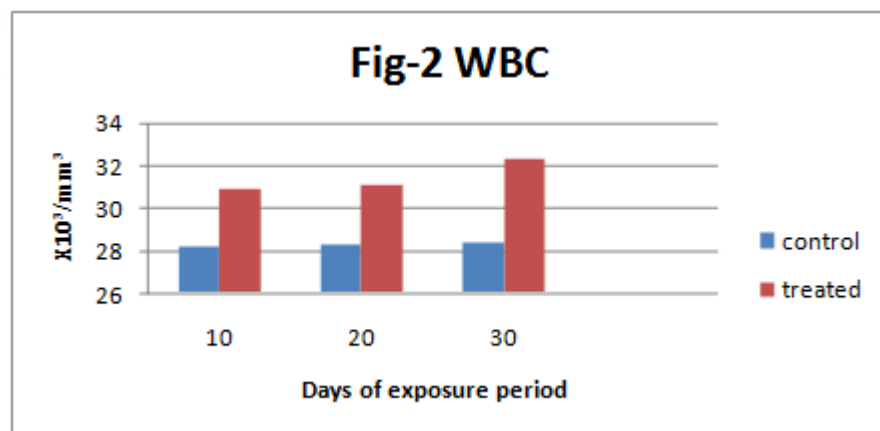
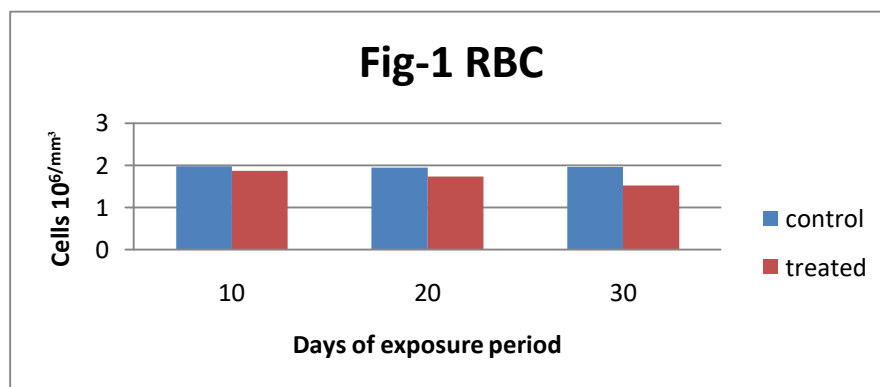
Blood parameters	Group	Days		
		10	20	30
RBC ($\times 10^6/\text{mm}^3$)	C	1.97 ± 0.014	1.94 ± 0.125	1.96 ± 0.021
	SL	$1.86^* \pm 0.031$ (-5.58)	$1.72^* \pm 0.025$ (-11.34)	$1.51^* \pm 0.15$ (-22.95)
WBC ($\times 10^3/\text{mm}^3$)	C	28.16 ± 0.028	28.23 ± 0.125	28.36 ± 0.084
	SL	$30.86^* \pm 0.412$ (9.588)	$31.05^* \pm 0.025$ (9.989)	$32.27^* \pm 0.193$ (13.787)
Hb (g/100 ml)	C	6.23 ± 0.033	6.19 ± 0.024	6.21 ± 0.016
	SL	$5.72^* \pm 0.011$ (-8.18)	$5.27^* \pm 0.023$ (-14.86)	$4.89^* \pm 0.042$ (-21.25)
Ht (%)	C	14.94 ± 0.236	14.82 ± 0.31	14.86 ± 0.293
	SL	$14.18^* \pm 0.013$ (-5.08)	$13.16^* \pm 0.216$ (-12.75)	$12.23^* \pm 0.173$ (-19.51)
MCH (Picogram)	C	31.62 ± 0.023	31.90 ± 0.017	31.68 ± 0.042
	SL	$30.75^* \pm 0.037$ (-2.75)	$30.63^* \pm 0.028$ (-3.98)	$29.73^* \pm 0.019$ (-6.15)
MCHC (%)	C	41.70 ± 0.24	41.76 ± 0.031	41.79 ± 0.042
	SL	$40.33^* \pm 0.37$ (-3.28)	$40.04^* \pm 0.039$ (-4.118)	$39.98^* \pm 0.019$ (-4.33)

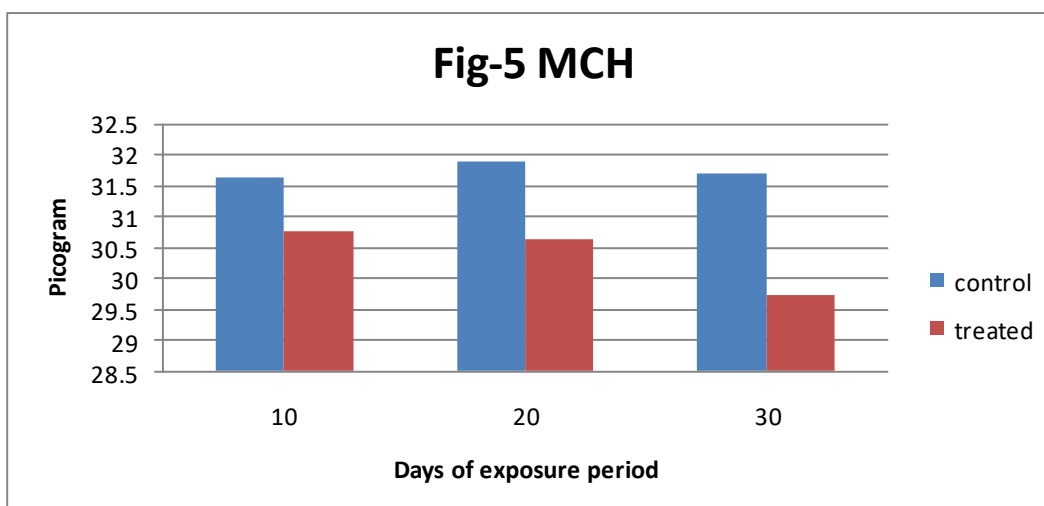
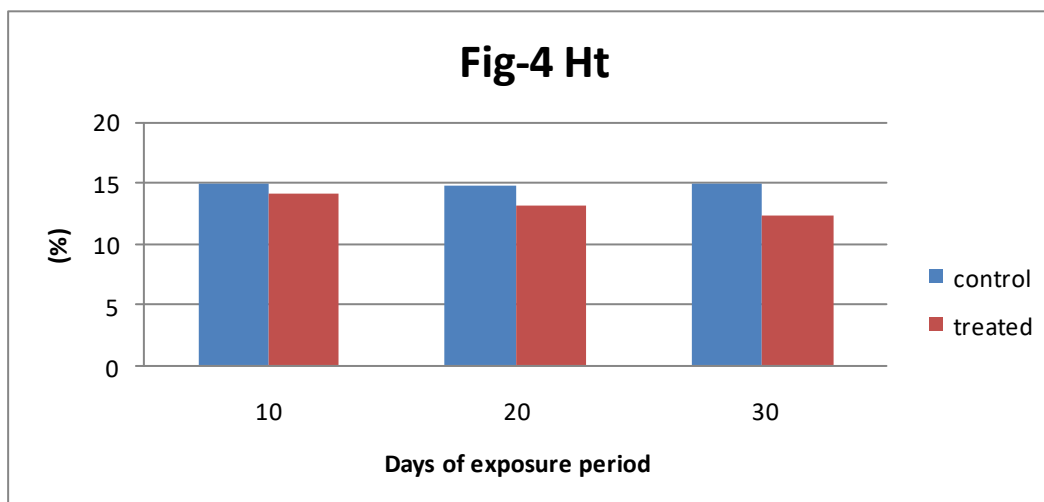
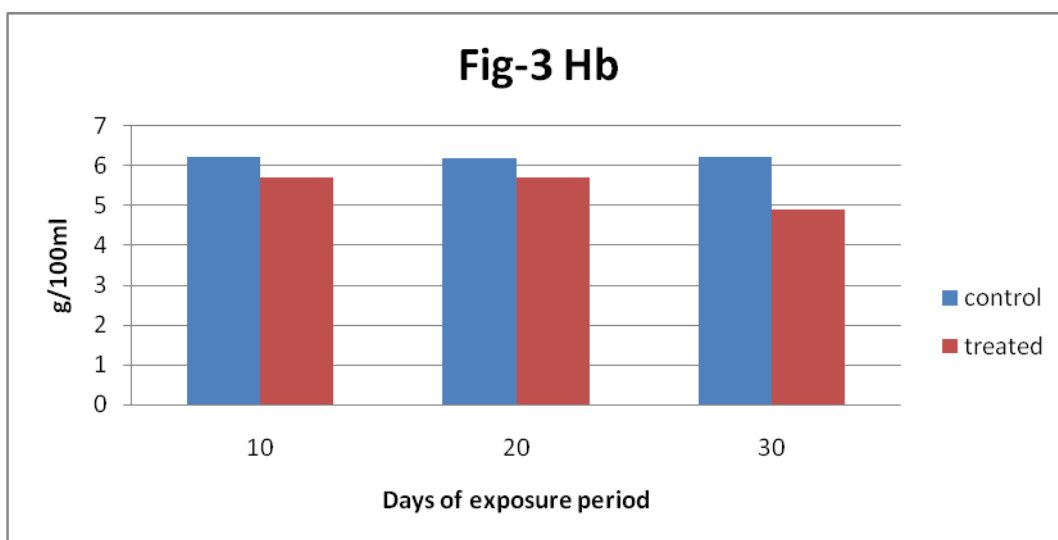
C-Control

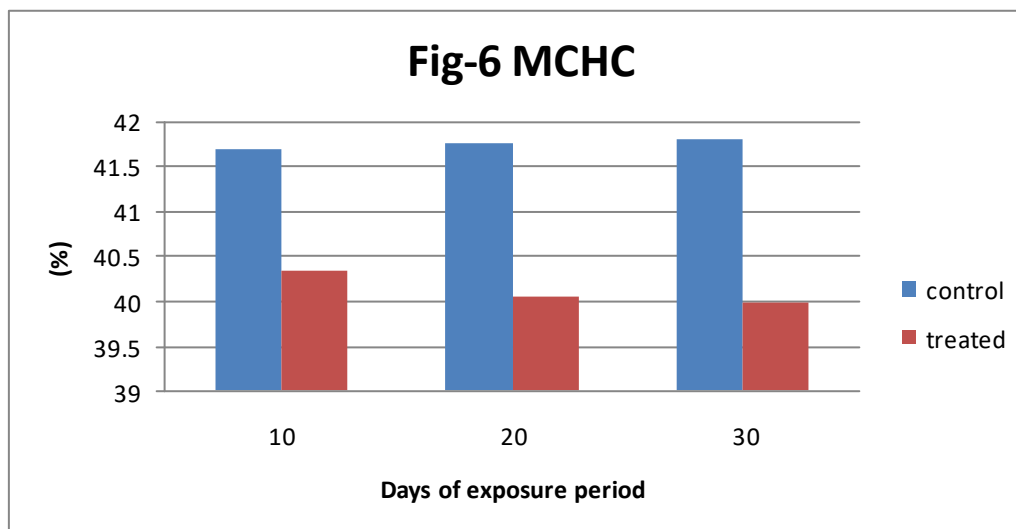
SL- Sublethal concentration

Mean \pm S.E indicates the mean of six Individual observations (+/-) indicates the per cent increase/ decrease over control.

(*) Indicates significant at 5% level of 't' test







4. DISCUSSION

In the present study *Oreochromis mossambicus* treated with sublethal concentration of lead acetate exhibit a significant decrease in the Red Blood Corpuscle (RBC), Haemoglobin (Hb), Haematocrit(Ht), Mean Cell Haemoglobin(MCH), Mean Cell Haemoglobin Concentration (MCHC) where as the White Blood Corpuscles increased at 10,20 and 30 days of exposure. Several investigation have been reported the effect of different pollutants on the blood of fishes (Rao and Hymavathi 2000; Preetha Bala Thakkar and Bais 2000). Shanthi Jeyarathi (2005) has made a study to assess the effect of Chlorpyrifos at sublethal concentration on blood parameters of *Cyprinus carpio*.

The RBC, MCH, MCHC, Ht and Hb Percentage were decreased with the increase in exposure period and also a drastic depletion in the number of Red Blood Cell was noticed with the increasing exposure periods. The decrease in RBC count and haemoglobin percentage indicates the occurrence of acute anaemia (Prasanta Nanda, 1977). Similar observation was made by Sachar and Gupta. A significant decrease in erythrocyte counts, Haemoglobin, Packed cell volume, Mean corpuscular haemoglobin, Mean corpuscular haemoglobin concentration and an increase of White blood corpuscles were observed in arsenic induced *Labeo rohita* (Phazanisamy 2002); Yaddav and Akila,(1993) have reported that a decrease in the haemoglobin and total erythrocyte counts in aldrin treated *Clarius batrachus* might be due to anaemia or disturbance in the haemopoietic organs or because of iron deficiency under toxic stress. Anaemia is due to the rate of production or to an increase in the destruction of red blood cells (Nilson, 1970). In the present investigation a significant decrease observed in the total RBC count, Haemoglobin content and haematocrit value exhibits anaemic conditions in treated fish. The decrease in erythrocyte count could be due to the indication of anaemia resulting in the volume of erythrocyte production Anand Kumar *et al.*, 2001).

In the present study the significant increase in the WBC count during sublethal treatment may be due to leucocytosis which is an adaption to meet stressful condition of lead by the fish. Similar observations were also made by Nelson and Rani, 1992; Sen *et al.*, (1994) have reported that Leucocytosis has been considered as an adaptation to meet stressful condition by the animal. The findings of the present investigation revealed a similar increasing trend in the WBC counts suggesting the leucocyte count during lead intoxicification. Fresh water fishes exposed to lead showed decrease in synthesis of haemoglobin (Schmitt *et al.*, 1993). Increase in the total leucocyte count has been attributed to several factors like increase in thrombocytes or sequencing of WBC in peripheral blood (Agarwal and Srivastava., 1980). A decrease in haemoglobin and haematocrit content in *Labeo rohita* exposed to sublethal concentration of arsenic have been reported Pazhanisamy., (2002).

Mean cell haemoglobin and (MCH) and Mean corpuscular haemoglobin concentration (MCHC) exhibited a decreasing trend suggesting anaemic condition of the fish. Similar observation were made by (Vijayamohan *et al.*, 2000); Indra (1995), Shakeori *et al.*, (1996). The decreased level of MCH and MCHC observed may be attributed to the higher percentage decrease of Haemoglobin (Hb) as compared to erythrocyte count and Packed cell volume (Ramanujan and Mohanty., 1997). Verma and Punigrahi (1998) have observed the decrease of RBC, Hb and MCH in the fish *Oreochromis mossambicus* exposed to agrofens. Similar trend has been reported in the fish *Oreochromis mossambicus* when exposed to sublethal dose of Ekalux (Sampath *et al.*, 1993). From the present investigation it is evident that the lead caused haemotoxic in fish. So haematological parameters can be used as a tool for toxicity studies.

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