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EFFECT OF HEXAVALENT CHROMIUM ON THE HAEMATOLOGICAL BIOLOGY OF *MYSTUS SEENGHALA*

Amita Sarkar* and Madhulika Verma

Department of Zoology, Agra College, Agra - 282 001, India.
*e-mail : amieeta@gmail.com

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ABSTRACT : An attempt has been made in the present investigation to determine the acute toxicity of chromium and its effect on haematological parameters of *Mystus seenghala*. Toxicity test were performed at the time intervals of 24 hrs, 48 hrs, 72 hrs, 96 hrs and one week at different concentration. LC(50) at 96 hrs was found 39.402 mg /ltr. Under the treatment of toxicant, blood shows a significant decrease in the blood values like TEC, Hb percent and PCV values.

Key words : *Mystus seenghala*, haematology, chromium.

INTRODUCTION

Fish survive and forms a significant proportion of aquatic life, this is because they are adapted to their surroundings and a certain balance is maintained between them and their environment.

The fish populations are however subjected to sudden and large scale mortalities. They suffer a lot due to the ever larger loads of pollutions, which makes their way in to the river (Vtukuru, 2005). Their edible importance decreases as well as, their body show several diseases. As chromium is highly poisonous compound all emissions from the plants should be closely monitored. Chromium causes adverse health effects following inhalation, indigestion or irritation on dermal exposure (Vincent and Ambrose, 1994). Chromium is unstable in the body and is reduced by intra cellular way, providing a very reactional form which can alter DNA as well as the blood components.

MATERIALS AND METHODS

Pollution intensity was estimated for May (2008) and September (2008). Samples of river water was collected from Mantola Agra. Chemical analysis of the samples proved the presence of hexavalent chromium. The live fish which shows active movements were collected from dealers and were used for the test and were placed in 1% $KMnO_4$ for 15 min. to avoid dermal infection.

Six aquarium of 40 litre capacity were arranged and marked as I, II, III, IV, V, VI. Effects of toxicants and percentage of mortality were observed after exposure to the pollutants at 24 hrs, 48 hrs, 72 hrs, 96hrs, and one week. The LC_{50} value is 39.402 mg/lt calculated by log conc. Probit regression line method. To evaluate the toxic effect of chromium blood was taken from the caudal region. The caudal vein standard hematological methods as described by Dacie and Lewis (1969) were are adopted to study.

(a) Total erythrocyte count (TEC) was done by Nauber's chambers haemocytometer with two counting chambers (CC_1 and CC_2). RBC pipette with 3 graduations was used. Two graduations 0.5 and 1 were present on the stem of the pipette and the third mark 101, was placed just above the bulb. The bulb of the pipette in so constructed that it holds exactly 100 times the volume of fluid contained in the item of the pipette upto mark 1.

Dilution fluid for R.B.C. used : (a) Sodium Chloride 0.6g, Sodium citrate 1 g, formalin 1ml, distilled water 100 ml. (b) **Hayem's Solution**- Sodium chloride 1g, Sodium sulphate 5 g, corrosive sublimate 0.5g, distilled water 200 ml.

(b) Hb content was studied by Haemometer.

(c) Packed cell Volume/Haematocrit (PCV)

For the haematocrit value of blood, 5 ml oxalate blood of fish in a graduated centrifuge tube is taken and centrifuge the blood for about 5 mins at 4000 rotations per minute.

The rapidly rotating centrifuge drives the heavier elements *i.e.* the blood cells, to the outer (lower) part of the tilted test tube. The upper lighter half is the liquid portion of the blood, the blood plasma which in pale yellow, somewhat viscous and sticky.

1. Vol. of blood taken = 5 ml.
2. Vol. of plasma in tube = x ml
3. Vol. of Corpuscles in tube = y ml.

$$\text{(haemotocrit) \% of blood cells} = \frac{y}{5(\text{blood vol. taken})} \times 100$$

PCV reading

$$\% \text{ of plasma} = \frac{x}{5(\text{blood vol. taken})} \times 100$$

Statistical analysis

The statistical test which are used to determine the significance is ANOVA test. To test the differences between more than two samples, the most appropriate technique is ANOVA (Analysis of Variation).

Formula's used

$$\text{Mean} = \frac{\sum x}{N}$$

$$\text{Standard deviation} = \sqrt{\sum x^2 / N}$$

$$SE_M = \sigma / \sqrt{N}$$

$$F = \frac{\text{Variance between samples}}{\text{Variance within samples}}$$

RESULTS AND DISCUSSION

Blood parameters showed decrease in their values after exposed to the chemicals. In *Mystus seenghala* the Hb% reduced from 9.51 ± 0.11 to 6.17 ± 0.22 in the month of May (2008) (Table 1). From 12.01 ± 0.12 to 9.14 ± 0.22 in the month of September (2008), when exposed to different concentrations of Chromium sulphate (Table 2). TEC and PCV values also reduced (Tables 1 and 2).

Toxicants initiating a physiological stress impose qualitative and quantitative changes in various components of body like blood biochemical constituents, sex steroids, enzymes and it causes the production of stress hormones. Due to the effects of these stress hormones, various necessary component, useful for the proper functioning and growth of the body are disturbed.

Workers like Banerjee (1996), Pradhan (1961), Quayyum and Nassem (1967), Siddiqui Khan and Naseem (1970), Dey and Upadhyaya (1972), Subbarao and Behera (1973), Raizada and Maheswari (1977), Raizada and Singh (1980, 1982) have worked on different constituents of blood of some Indian fishes. Present study shows cumulative effects of the chemicals on the blood parameters.

It is well known that blood in the primary target of pollutant action, it has been proved by Kennedy *et al* (1970, 1998). Investigations were carried out to see the effects of different chemicals on the blood of fishes.

Blood parameters of fishes are sensitive indicator of stress, water pollutants and toxicants. Due to discharge of industrial wastes, such as Cd, Cr, Cu, Hg, Zn and other heavy metals changes in blood parameters of fishes have been reported by Agarwal and Srivastava (2003) and Gill and Pant (1981).

Haematological indices are very important parameters for the evaluation of fish physiological status under metallic stress. The changes in the blood indices and their peculiarities depends on the concentrations of heavy metals and duration of exposure of the fish to them. A significant decrease in the haemoglobin percent and total erythrocyte count and in the haematocrit value of both the fishes are seen in the performed experiments.

Haemoglobin concentrations reflects the supply of an organism with oxygen and the oxygen itself tries to maintain them as much stable as possible as also explained by Ambrose *et al* (1994) in their work on the haematological and biochemical response of *Cyprinus carpio* to the toxicity of tannery effluents and the metal induced changes in some of the blood and biochemical parameters of cat fish. Short term exposures to the low

Table 1 : Blood parameters in *Mystus seenghala* at different time intervals (May, 2008).

Parameters	Control	24 hrs	48 hrs	72hrs	96hrs	One week	Significance
Hb %	10.12 ± 0.22	9.51 ± 0.11	8.11 ± 0.12	7.43 ± 0.17	7.38 ± 0.13	6.17 ± 0.22	P<0.05
TEC	2.17 ± 0.17	1.97 ± 0.13	1.88 ± 0.22	1.44 ± 0.17	1.15 ± 0.21	1.07 ± 0.34	P<0.05
PCV %	36.17 ± 0.12	35.17 ± 0.32	29.43 ± 0.16	27.84 ± 0.22	24.13 ± 0.41	21.13 ± 0.32	P<0.05

Table 2 : Blood parameters in *Mystus seenghala* at different time intervals (Sep., 2008).

Parameters	Control	24 hrs	48 hrs	72hrs	96hrs	One week	Significance
Hb %	12.22 ± 0.13	12.01 ± 0.12	10.84 ± 0.22	10.17 ± 0.32	9.75 ± 0.13	9.14 ± 0.22	P<0.05
TEC	2.18 ± 0.32	2.04 ± 0.32	1.96 ± 0.22	1.88 ± 0.17	1.68 ± 0.21	1.54 ± 0.34	P<0.05
PCV %	41.18 ± 0.36	40.11 ± 0.11	39.46 ± 0.32	38.44 ± 0.32	36.17 ± 0.41	32.17 ± 0.32	P<0.05

concentrations of heavy metals mostly increase the above parameters but the long term exposure of 24 hours to one week showed a significant decrease in the above mentioned blood parameters.

The T.E.C. values of control and treated fishes have shown significant differences at the end of the experiment in *Mystus seenghala* but a slight increase was seen in the beginning but afterward it decreases till the end of the experiment. The decrease in the blood parameters TEC, Hb, PCV% may be due to many factors such as haemolysis of erythrocytes, decreased iron uptake in intestine due to the damage of intestinal villi and mucosa resulting in the defective intestinal absorption of iron and other substances essential for erythropoeisis leading to its decreased rate.

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