The Effect of Lead on Haemocyte Count of the Freshwater Teleost *Catla Catla*

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Abstract: In the present work, the effect of heavy metal like lead in aquatic system on freshwater teleost *Catla catla*. The experimental group of fish was exposed to a sublethal concentration of 0.02, 0.04, 0.06, 0.08 and 0.10 ppm of lead for 10, 20 and 30 days. During above treatment period the haemocyte count decreased in the lead treated fish.

Key words: lead, total haemocyte, *Catla catla*

I. INTRODUCTION

The indiscriminate discharge of metals from industrial effluents and other sources into aquatic media affect non-target organisms such as fishes and aquatic organisms which are great economic importance to man. The metals are of special concern because of their diversified effect and the range of concentration stimulated toxic ill effect to aquatic life forms. Aquatic systems are exposed to a number of pollutants that are mainly released from effluents discharged from industries, sewage treatment plants and drainage from urban and agricultural areas. The metals are of special concern because of their diversified effect and the range of concentration stimulated toxic ill effect to the aquatic life forms. Industrial wastes constitute the major source of metal pollution in natural water [1]. These pollutants cause serious damage to aquatic life [2, 3].

The river systems may be excessively contaminated with heavy metals released from domestic, industrial, mining and agricultural effluents [4]. The blood parameters of diagnostic importance are erythrocyte and leucocytes counts, haemoglobin, haematocrit and leucocyte differential counts would readily respond to incidental factor such as physical stress and environmental stress due to water contaminants [5].

There exist many published reports on the toxic effects of metals on growth [6], respiratory metabolism [7] and haematology [8] in fish. Lead is a common environmental pollutant used in many industries, and enters aquatic environments with effluents from mines, smelters, and chemical factories manufacturing pigments, paints, plastics, etc. [9].

Lead has an extremely high affinity for erythrocytes and is a known inhibitor of dehydrogenase of delta aminolevulinic acid (ALA-D), an enzyme participating in heme synthesis [10]. Lead may cause deformities of fish erythrocyte [11], membrane disruption [12] and often induces anemia in fish [13]. Lead also is a known immunotoxicant. Immunitoxic effects of lead may result in immunosuppression, rendering an organism more susceptible to infectious diseases. On the other hand, lead may cause inappropriate enhancement of immune response, leading to allergies or autoimmune diseases.

Blood parameters are considered pathological indicators of the whole body and therefore are important in diagnosing the structural and functional status of fish exposed to toxicants [14]. It was reported that the blood parameters of diagnostic importance are erythrocyte and leucocytes counts, haemoglobin, haematocrit and leucocyte differential counts would readily respond to incidental factor such as physical stress and environment stress due to water contaminants [15]. Some authors [16,17] have reported a decrease in hematocrit, hemoglobin and red blood cells values of some fish after their exposure to insecticides. Hence, the present work was undertaken to study the sublethal effects of lead on total haemocyte count in *Catla catla*.

II. MATERIALS AND METHODS

Active specimens of *Catla catla* (10.50 ± 0.10 in length and 16.85 ± 1.040 gms in weight) of both sexes were used for the experiments. All fish used were procured from local aqua agri farm. The fishes were maintained in large glass aquaria at 28.40 ± 1.50°C under diurnal lighting conditions and acclimatized to laboratory conditions. During this period acclimatization the fish were fed with commercial fish food *ad libitum*.

After determining lethal concentration of 96hr value of five sublethal concentrations of lead were taken and 10 fishes were introduced in each concentrations. For each sublethal concentration 5 replicated were maintained. *Catla catla* was exposed to 0.02, 0.04, 0.08 and 0.10 ppm of lead for 10, 20 and 30 days. After 10,
20 and 30 days the blood from the control and lead treated fishes was obtained by severance of caudal peduncle and collected in Eppendorf tubes with EDTA anticoagulant [18]. These treated and control blood samples were used to estimate the total haemocyte count. The total red blood cells were counted by Neubaur haemocytometer. The blood was diluted 1:200 with Hayem’s fluid. The total haemocyte counted in the haemocytometer chamber.

III. RESULTS AND DISCUSSION

The lead is found to affect total haemocytes in the experimental fishes as revealed by table. The valued for reduction of total haemocytes under the sublethal concentration of the lead. On day 10, the total haemocyte count on control fish was estimated to be 1.82, which is reduced to 1.78, 1.69, 1.53, 1.41 and 1.34 in various sublethal concentration of the lead. On the other hand, the total haemocyte count was found to decrease to 1.77, 1.64, 1.50, 1.42 and 1.30 in different sublethal concentration of lead on 20th day. The values for reduction of RBC count on day 30 were ranging from 1.88 to 1.29 on 30th day.

Table 1: The total count of RBC (10⁶/µl) in control and lead treated fish of Catla catla on various exposure periods. (Each value is the mean ± SD of 5 observations; *Significant at P < 0.05)

<table>
<thead>
<tr>
<th>Concentration of the lead (%)</th>
<th>10</th>
<th>20</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>1.82 ± 0.020</td>
<td>1.85 ± 0.019</td>
<td>1.88 ± 0.023</td>
</tr>
<tr>
<td>0.02</td>
<td>1.78 ± 0.018*</td>
<td>1.77 ± 0.016*</td>
<td>1.82 ± 0.024*</td>
</tr>
<tr>
<td>0.04</td>
<td>1.69 ± 0.015*</td>
<td>1.64 ± 0.022*</td>
<td>1.60 ± 0.021*</td>
</tr>
<tr>
<td>0.06</td>
<td>1.53 ± 0.017*</td>
<td>1.50 ± 0.018*</td>
<td>1.52 ± 0.013*</td>
</tr>
<tr>
<td>0.08</td>
<td>1.41 ± 0.013*</td>
<td>1.42 ± 0.016*</td>
<td>1.37 ± 0.012*</td>
</tr>
<tr>
<td>0.10</td>
<td>1.34 ± 0.018*</td>
<td>1.30 ± 0.008*</td>
<td>1.29 ± 0.007*</td>
</tr>
</tbody>
</table>

Blood is a patho-physiological reflector of the whole body and therefore, blood parameters are important in diagnosing the structural and functional status of the animal exposed to toxicants. The exposure of Catla catla to sublethal levels of lead resulted in time-and concentrations dependent significant decrease in the RBC count.

A reduction in haematological values, indicated anemia in the lead exposed fish may be due erythropoiesis, haemosynthesis and osmoregulatory dysfunction or due to an increase in the rate of erythrocyte destructin in haematopoietic organs [19]. The lead shows a high affinity for erythrocytes [20]. Reduction of Hb and RBC accompanied by a compensatory response (increased hematopoietic rate) in lead-intoxicated rainbow trout was reported [21]. Another effect of lead upon fish erythrocytes is structural damage. Membrane disruption and increased frequency of mitoses were reported in Salvelinus alpinus from a lead-polluted Alpine lake [22].

The reductions of haemoglobin percentage and red blood cell count of the fish Anabas scandens treated with mercury [23]. Heavy metals such as cadmium, chromium, Nickel and lead might alter the properties of hemoglobin by decreasing their affinity towards oxygen binding capacity rendering the erythrocytes more fragile and permeable, which probably results in cell swelling deformation and damage [24].

The results are in good agreement with earlier works that reported a significant decrease in RBC’s hemoglobin and packed cell volume of fresh water fish exposed to heavy metals [25]. Our results are supported by previous research work that various heavy metals and toxins enter into the aquatic system exerted a specific toxic effect on fish blood and tissues [26, 27].

REFERENCES


