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## Effect of the Detergent Powder on the Haematological Parameters of Common Carp *Cyprinus carpio* (Linnaeus, 1758)

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**Abstract:** Detergents are one of the common pollutants which create pollution in fresh water medium and would affect the fish and other aquatic organisms. The LC<sub>50</sub> values of detergent powder treated common carp (*Cyprinus carpio*) for 24, 48, 72 and 96 h were determined. The changes in the haematological parameters were studied. The RBC count of common carp was decreased and the WBC count was increased. The Haemoglobin value, MCV, MCH, MCHC levels considerably decreased as compared to the control. The decrease of Haemoglobin, Red Blood Corpuscles and Packed Cell Volume of common carp is due to haemolysis. The decrease of Red Blood Corpuscles and Haemoglobin concentration indicate that the fish is anemic. The Mean Corpuscular Volume (MCV) values showed various values due to endosmosis process in common carp. These results were tested statistically by One Way ANOVA and most of the values were found to be statistically significant at 5% level.

**Keywords:** Haematological parameters, Common carp, Detergent, LC<sub>50</sub>, Red Blood Corpuscles, White Blood Corpuscles, Haemoglobin

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### Introduction

The fresh water fish common carp (*Cyprinus carpio*) is very important fish which live in all fresh water medium and can tolerate environmental stresses. Finding out Haematological parameters is an important aspect in fish biology and to know the health condition of fishes (Grant, 2015). The uses of detergent and toilet

soaps have become an essential and long term practice also throughout the world. However, the elaborate use of detergent ultimately leads to contamination of fresh water aquatic environment and would affect the fishes and other flora and fauna present in fresh water medium. These detergents act as pollutant and create some

changes in biological characteristics of Common carp. Oost *et al.* (2003) studied haematological parameters on Common carp, because blood is an important body fluid. Majority of domestic drainage consists of detergent and toilet soaps which are organic pollutants and is mingling in fresh water medium elaborately. Most of the detergents are xenobiotic components which affect the blood components and the fresh water fishes are very susceptible to physical and chemical changes (Roy, 1988). According to Wachap *et al.* (2019) detergent cause haematological disturbances to the fishes. Further they have reported that the detergent contamination in water medium would cause biological and physical alterations in fish. Smulders and Krings (1990) suggested that the detergents are common domestic waste which enters the aquatic environment and is considered as non-biodegradable chemical substances. Fishes are easily affected by detergent solution contaminating the fresh water medium quickly. Several investigators studied the toxicity effect and haematological changes of detergents in fish fauna (Akinrothimi *et al.*, 2007; Gabriel *et al.*, 2007; Chindah *et al.*, 2008).

A general haematological analysis consists of blood cell counts, biochemical indices and plasma compounds. Apart from this, erythrocyte count, haemoglobin concentration, mean corpuscular volume, mean corpuscular haemoglobin and mean corpuscular concentration are blood parameters (Wachap *et al.*, 2019). The White blood parameter consists of leukocyte count, lymphocytes, monocytes, eosinophils and basophils (Grant, 2015). In fishes the main route of entry for any detergent is through the gills and then it is transported to other parts of the fish body. In fishes decrease in the blood parameters has been reported by Benarjee *et al.* (2009). Generally detergents damage fresh water fish's gills and remove protective mucus from gills and skin. Detergents have been discovered to induce poisonous effects such as xenobiotic compounds, hence it is known to be one of the most common terrestrial and aquatic contaminants.

The present investigation was carried out to determine the effects of sub lethal doses of detergent for a period of 20 days on the haematological changes in fingerlings of common carp *Cyprinus carpio*.

## Materials and Methods

### *Fish care:*

The healthy common carp (*Cyprinus carpio*) fingerlings (12±0.5 cm; 25±0.6 g) were obtained from local fish farm from Porayar town in Mayiladuthurai district, Tamil Nadu, India. The fish were brought to the laboratory, stocked and acclimatized for 2 weeks by keeping them in plastic tubs. The fish were disinfected with Potassium permanganate (0.05%) and maintained at room temperature. The fish were fed with the commercial feed daily. The food and excreta were siphoned out after feeding to prevent fungal growth and contamination of water medium. The water in the plastic trough was changed daily to keep the plastic troughs clean. The experiment was carried out at the PG and Research Department of Zoology, T.B.M.L College, Porayar.

### *Selection of Detergent:*

Commercially available detergent powder was used as a toxicant for the present investigation and was purchased from Porayar market. It consists of Alkyl sulfate, Borax, hydrogen peroxide, Mannanase, Sodium polyacrylate and Benzoic Acid.

### *Experimental design:*

5 g of detergent powder was mixed with 1000 ml of distilled water and used as stock solution. Various concentrations of detergent (1 ml, 2 ml, 3 ml, 4 ml and 5 ml) were prepared and 15 fishes were introduced in each concentration. A control group of 15 fishes was also maintained without adding detergent solution. The mortality of fish was noted at 24, 48, 72, 96 and 120 h. The median lethal concentration LC<sub>50</sub> was calculated by using Probit analysis (SPSS version 25). Food was not given two days before the commencement

of the experiment to get stable condition of metabolic needs.

#### *Determination of Median Lethal Concentration (LC<sub>50</sub>):*

To determine wide range of concentration 1-10 g of detergent powder was used and the stock solution was prepared. Five fish were used in each experiment group. Number of dead fish in each group was recorded. The water quality assessment was also performed periodically. Narrow range concentration of 1-5 g of detergent powder solution was used with minimum of five fish for test every 24 h up to 72 h. Thereafter, the Probit analysis method (Finney 1971) was used to calculate the per cent mortality.

In the present investigation, the changes in haematological parameters were studied on common carp after exposure to sub lethal concentration of detergent powder.

#### *Haemoglobin (Hb) determination:*

Haemoglobin (Hb) was estimated by Haematin method as suggested by Sahli (1962). The blood samples were taken by piercing with 2 mm needle and syringe through the dorsal aorta and the blood was collected in Ethylenediaminetetraacetic acid (EDTA) treated tubes to prevent coagulation.

#### *Red Blood Corpuscles (RBC) Count:*

The Red Blood Corpuscles (RBC) was estimated by using the Neubaur Haemocytometer as suggested by NWQL (1975). The total number of erythrocytes is expressed as  $10^6/\text{mm}^3$ .

#### *White Blood Corpuscles (WBC) Count:*

The White Blood corpuscles (WBC) were counted by using the Neubaur Haemocytometer.

#### *Estimation of Packed Cell Volume (PCV):*

In the present study the blood of common carp was sucked by Heparinized haematocrit capillary tube. The tube was centrifuged at 6000 rpm for 5 min. The volume of blood taken and cell volume after centrifugation was used to estimate the PCV percentage by the method of Sandhu (1990).

#### *Mean Corpuscular Volume (MCV) calculation:*

The Mean Corpuscular Volume (MCV) was calculated by using values of PCV% and the Red Blood Corpuscles count. The value is expressed in terms of  $\mu\text{m}^3$ .

### **Results and Discussion**

The LC<sub>50</sub> values of detergent powder treated common carp (*Cyprinus carpio*) for 24, 48, 72 and 96 h were determined. After that the fish were exposed to sublethal concentration of detergent for 20 days to assess haematological changes.

It was recorded that the mortality rate due to detergent exposed increased with higher concentration over a short period of time and diminishes with decreasing concentration during the subsequent hours of treatment. In the toxicity curve asymptote was attained at 120 h. In the present investigation the toxicity effect of detergent on common carp in different hours viz., 24, 48 and 72 were taken into account to avoid bias. Other hours were omitted as they showed almost similar mortality rates.

#### *Haematological Parameters:*

In the present investigation, the changes in the haematological parameters were studied after exposure to sub lethal concentration. The changes caused by the detergent powder exposure in different blood parameters are depicted in Table 1 and Figure 1. The commercial detergent powder had expressed considerable effect on the blood parameters of common carp. In the present investigation the RBC count of common carp was decreased. On the contrary, the WBC count was increased. The haemoglobin value decreased. The MCV, MCH, MCHC levels considerably decreased as compared to the control. Any changes in the haematological parameters are good indicators of physiological changes in common carp.

The result revealed that there was decrease in RBC (millions/cu.mm) at 24 h ( $2.15 \pm 0.35$ ) and 96 h ( $1.52 \pm 0.07$ ). The WBC (Cells/ $\text{mm}^3$ ) was increased at 24 h ( $3.7 \pm 0.05$ ) and at 96 h

Table 1: Haematological parameters of common carp *Cyprinus carpio* exposed to sub lethal concentration of detergent powder

| Parameters                   | Control    | 24 h       | 48 h       | 72 h       | 96 h       | CD (5%) |
|------------------------------|------------|------------|------------|------------|------------|---------|
| RBC (millions/cu.mm)         | 2.72±0.05  | 2.15±0.35  | 1.85±0.18  | 1.70±0.10  | 1.52±0.07  | 0.58    |
| WBC (Cells/mm <sup>3</sup> ) | 3.3±0.08   | 3.7±0.05   | 4.3±0.02   | 4.9±0.14   | 5.5±0.30   | 0.243   |
| Haemoglobin (g/dl)           | 5.52±0.18  | 4.65±0.09  | 4.10±0.45  | 3.25±0.16  | 2.80±0.05  | 0.692   |
| MCV (μm <sup>3</sup> )       | 60.18±0.50 | 52.40±1.55 | 42.15±0.90 | 33.81±0.16 | 25.10±1.12 | 2.306   |
| MCH (pg)                     | 20.2±0.42  | 18.2±0.15  | 16.5±0.38  | 15.1±0.94  | 14.0±0.12  | 0.257   |
| PCV (%)                      | 8.12±0.42  | 7.55±0.02  | 6.42±0.16  | 5.15±0.82  | 4.08±0.75  | 0.253   |

Each value represents mean ± SD (n=3)

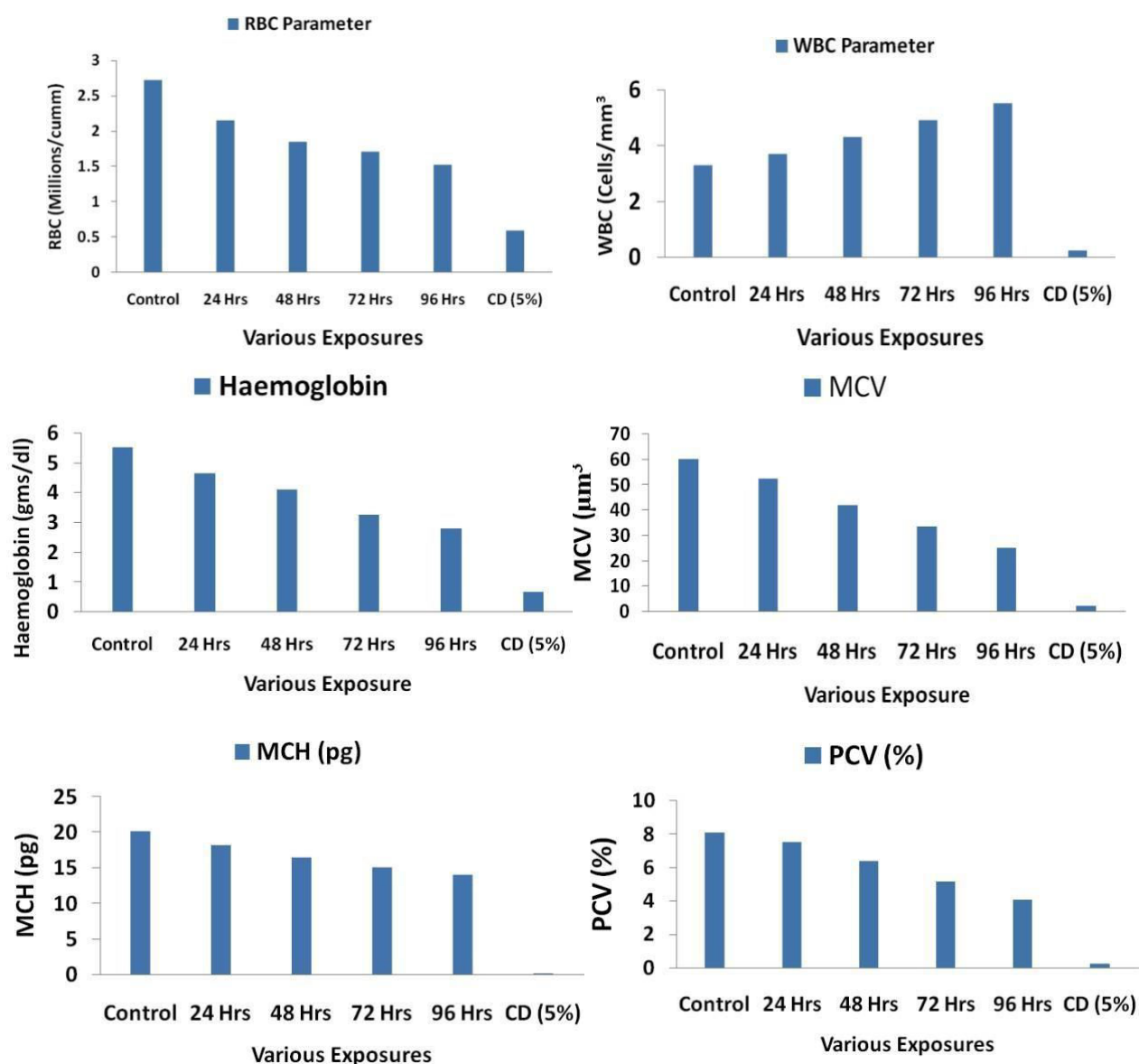


Fig. 1: Haematological parameters of common carp *Cyprinus carpio* exposed to sub lethal concentration of detergent powder.



( $5.5 \pm 0.30$ ). The haemoglobin content (g/dl) was  $4.65 \pm 0.09$  at 24 h and  $2.80 \pm 0.05$  at 96 h. Similarly, the MCV ( $\mu\text{m}^3$ ) was decreased at 24 h ( $52.40 \pm 1.55$ ) and at 96 h ( $25.10 \pm 1.12$ ) as compared to control ( $60.18 \pm 0.50$ ). The MCH (pg) was decreased at 24 h ( $18.2 \pm 0.15$ ) and at 96 h ( $14.0 \pm 0.12$ ) as compared to control ( $20.2 \pm 0.42$ ). The PCV (%) was decreased at 24 h ( $7.55 \pm 0.02$ ) and at 96 h ( $4.08 \pm 0.75$ ) as compared to control ( $8.12 \pm 0.42$ ) (Table 1; Fig. 1).

The decrease noticed in haemoglobin, Red Blood Corpuscles and Packed Cell Volume in common carp after exposure to detergent is due to haemolysis. According to Johanson and Larsson (1978) in the case of fresh water fishes, the reduction of Leukocyte is associated with external disturbances or stress and leucopenia. In this situation the corticosteroids increased in fishes. On the other hand, the decrease of Red Blood Corpuscles and haemoglobin concentration shows that the fish is anemic. In the present study, the Mean Corpuscular Volume (MCV) showed various values due to endosmosis process in common carp. These results were tested statistically by One Way ANOVA and most of the values were found to be statistically significant at ( $P < 0.05$ ) at different concentration ( $F = 45.120$ ;  $P = 0.003$ ). The maximum count of White Blood Corpuscles (WBC) was recorded most probably due to invasion of pollutant Rin powder in various parts of fish. Obiezue *et al.* (2014) mentioned that the chemically treated fishes showed reduction in haemoglobin level in blood, as well as the lowering of RBC and PCV leads to anemia in fishes.

The results of the present investigation are in accordance with the previous research work on fishes carried out by Blahova *et al.* (2014). The authors reported a decrease in RBC count, haemoglobin content and platelet count of fresh water fishes exposed to various toxicants including detergent powder. The effect of detergent powder on common carp results in the loss of viability of the cells. The decrease in the haemoglobin values and other blood parameters in the present investigation is correlated with the

results of other workers on *C. punctatus* carried out by Rahaman *et al.* (2002). In the present research work the increased number of WBC could be correlated with an increase in antibody production for survival and recovery of the fish exposed to sub lethal concentrations of toxicant like detergent powder (Joshi and Tsai, 2002).

## Conclusion

The blood parameters of fishes are often measured to know the fish physiology and to determine sub lethal effects of any pollutants. The study of haematological parameters (RBC, WBC, haemoglobin, MCV, MCH, PCV) reflects a physiological response to a contaminated aquatic environment. In the present investigation, the changes in the haematological parameters of the fish revealed effect of detergent powder. In the present study few haematological parameters decreased from the control. However, the WBC count was increased at all exposure duration. It is concluded that the fresh water ecosystem is being affected by many ways, and it is interpreted that the fresh water fishes are much affected by the detergents.

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