

RESEARCH ARTICLE

Hematological profile of common carp (*Cyprinus carpio*) under sublethal effect of trivalent chromium

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Manuscript Details

Received : 27.11.2017

Accepted: 27.12.2017

Published: 31.12.2017

ISSN: 2322-0015

Editor: Dr. Arvind Chavhan

Cite this article as:

Bansode Manisha Uttamrao, Jaiswal NR and Kadam MS. Hematological profile of common carp (*Cyprinus carpio*) under sublethal effect of trivalent chromium. *Int. Res. Journal of Science & Engineering*, 2017, 5 (6): 104-108.

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ABSTRACT

In aquaculture fishes are often exposed to chromium waste and demonstrate cumulative detritus effect to our knowledge, there are less studies concerning the effects of trivalent Cr on *C. carpio* hematology. The aim of the present study to determine hematological parameters of common carp, *Cyprinus carpio* affected by sublethal concentration of trivalent chromium. The experimental group of fish was exposed to sublethal chromium chloride concentration of 2mgL^{-1} for the period of 28 days and hematological parameters were examined. The exposure period of chromium significantly reduces the amount of Hct, Hb, RBC, WBC, MCH and MCHC. The study shows that hematological indices of fish, caused by chromium toxicity to *C. carpio* can be secondary responses to toxicants.

Keywords: Chromium, Common carp, *Cyprinus carpio*, Hematology.

INTRODUCTION

Over the few last decades, the smudging of invigorating fresh water with heavy metals has become a matter of concern, due to their dissemination mainly through fabricated activities [3,6,7,14,16, 17] which leads overwhelmed alternations on the ecological balance of surrounding environment and aquatic diversity. Chromium is a biologically important essential nutrient due to its important role in metabolic pathways of lipid and glucose [4]. Among the heavy metals, chromium is a deterious pollutants from industrials effluents and induces an aquatic ecosystem imbalance [9].

The heavy metal chromium, exists primarily in Cr [III] and Cr [IV] oxidation states, is considered as more toxic in the environment due

to its higher solubility and mobility. Chromium is a compound of biological interest, probably having a role in a glucose and lipid metabolism as an essential nutrient. among the heavy metals chromium is an important pollutant from industrial effluents and induces deleterious effects on non- target aquatic organisms resulting in imbalance of an ecosystem [9]. On chronic exposures of hexavalent chromium compounds also cause renal failure leading to the loss of osmoregulatory ability and respiration in fish [5]. Sublethal effect of chromium in fish were directly related to the inhibition of various metabolic processes [14]. It also induces the depletion in profiles of liver glycogen, total protein and total lipid has been reported [7,15].

According to the objective of this study is to investigate the effects of sublethal concentrations of Cr on hematological parameters as sensitive indices for the evaluation of fish physiology under metallic stress in the economically important common carp, *Cyprinus carpio*, following 28 days of Cr (III) exposure.

MATERIAL AND METHODS

The common carp *Cyprinus carpio*, (11.68±1.92 cm and 25.92 ± 6.3 g) were sampled from Bhategaon dam, prior to toxicity testing, the fish were acclimatized for one week under laboratory conditions (25± 10 C, 12 hr light/ 12 hrs dark). Water quality parameters (TDS 600 ppm, Ph =6.75, ES= 1 ds/m) were measured during experiment. During acclimation and toxicity test, the fish were not feed. The heavy metal chromium in the form of Chromium chloride (CrCl₃.6H₂O, APLICAM) was used in the present study.

Fish were divided into two groups, with the first group serving as control and the other as experimental group each with three replicates located at glass aquaria (average volume 100 L). The fish in the experimental aquaria were exposed to a sublethal Cr concentration of 2mg L⁻¹, which was prepared as a stock solution and added depending on the volume of each aquarium to obtain the required concentration, for a period of 28 days. This concentration was taken from our earlier determination of Cr LC50-96hr value for this species. After the exposure period, blood samples (1ml) were immediately taken from the caudal vein of 10 fish at each aquarium using heparinised syringes for hematological analysis. Blood then poured into

heparinised plastic tubes for determination of blood factors. red and white blood cells (RBCs and WBCs) were counted by Neubauer's chamber hemocytometer using a special kit by diluting fluid (3g sodium citrate, 99ml distilled water and 1ml formalin), counting the four corners and the center fields.

Hemoglobin (Hb) was determined spectrophotometrically at 540nm absorbance (cyanmethemoglobin method) by the use of Pars Azmoon kit. Hematocrit (Hct) was determined by slanted microhematocrit method and expressed in percentages. Erythrocytes indices [Mean corpuscular hemoglobin (MCH), mean corpuscular volume (MCV)] were calculated accordingly to the method applied by. Differential leukocyte counting was performed with blood smears stained. The smears were by light microscopy under oil immersion at 100X magnification.

RESULTS AND DISCUSSIONS

Table-1 presents hematological parameters in the blood of *Cyprinus carpio* exposed to sub- acute concentrations of chromium for 28 days. The amount of Hct, Hb, RBC, WBC, MCH and MCHC significantly decreased (P< 0.05) as a result of chronic chromium exposure, other blood factors monocytes, eosinophils, and myelocytes, were not observed in the examined blood samples.

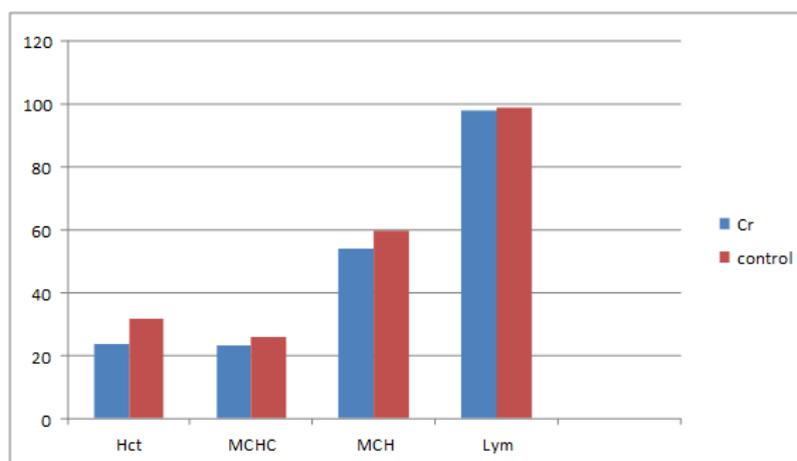
The present study demonstrated that common carp *Cyprinus carpio*, exposed to sub-lethal concentration of trivalent chromium for 28days shows decreased level of hemoglobin. Similarly, chronic exposure of *Tilapia sparrmannii* and the cat fish, *S. fossilis*, (after 28 days) to 0.098 and 3.2mg of hexavalent chromium, respectively lead to significant decreases in hemoglobin concentration [18]. Likewise, blood hemoglobin decreased in the Indian carps, *L. rohita* and *catla catla*, treated by sub-acute Cr and Cd exposures, respectively within 96hrs and for 28days. Vutukuru its consequent decreased utilization for Hb synthesis [17]. The decreased hematocrit of common carp in the current study is in lined with those found in *T. sparrmannii* and the cat fish, *S. fossilis* chronically examined by hexavalent chromium [18]. Our findings also agree with the fact that long term exposure of fish to sub-lethal concentrations of heavy metals usually decreases the above-mentioned indices such as Hb and Hct. the Cr treated common carp in this study had reduced number of RBC and WBC,

Table 1 : Monthly variations in the percentage of protein content in Liver of male and female *G.biocellatus* (%)

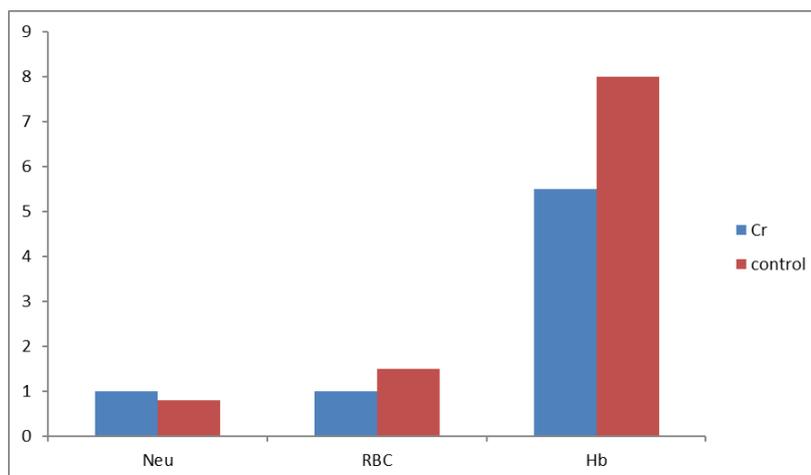
Blood parameters	chromium	control	p-value
Hct (%)	24.89±1.36	32.8±2.16	P < 0.05
Hb (g/dl)	5.96±5.7	8.76±0.68	P < 0.05
RBC(10 ³ mm ³)	1.10±0.08	1.42±0.05	P < 0.05
WBC(10 ⁶ .MI)	4955.56±1542	6700±1063	P < 0.05
Lymphocytes (%)	98.78±1.48	99.20±0.83	P > 0.05
Neutrophils (%)	1.22±1.48	0.80±0.83	P > 0.05
MCV (fl)	198.457±15.39	230.860±8.77	P > 0.05
MCH (pg)	54.34±4.74	61.7±4.63	P < 0.05
MCHC (g/dl)	23.933±1.38	26.780±2.33	P < 0.05

Hct : hematocrit ; MCHC: men corpuscular hemoglobin concentration ; MCH: mean corpuscular haemoglobin:

Lym: lymphocytes ; Neu : neutrophyles ; RBC : red blood cells; Hb : hemoglobin ; MCV: mean corpuscular volume .

**Fig.1 :** Blood factors of *C. carpio* exposed to sub-acute concentration of trivalent chromium for 28 days.

Hct : hematocrit (%); MCHC : mean corpuscular hemoglobin concentration (%) ; MCH: mean corpuscular hemoglobin (pg) ; lym : lymphocyte

**Fig.2 :** Hematology and blood biochemistry of *C. carpio* exposed to sub acute concentration of trivalent chromium for 28dys.

Neu : neutrophyles (%); Red blood cells (10³mm³) ; Hb :hemoglobin (g/dl)

while discernible augmentation of WBC and RBC numbers were observed in the Indian carp catla catla and common carp subjected to Cd and Cr, respectively [2].

In this present study, MCH and MCHC significantly decreased due to Cr toxicity to *C. carpio* MCH and MCHC have been attributed to direct or feedback responses of structural damage to RBC membranes resulting in hemolysis and impairment in hemoglobin synthesis.

Overall, chromium toxicity to aquatic biota is significantly influenced by abiotic variables, such as water hardness, pH and metal form. Our findings mostly agree with the general report that the toxic mechanism of action differs for hexavalent versus trivalent chromium, fresh water fish can regulate chromium over a wide range of ambient concentrations.

CONCLUSION

Water born metals may alter the physiological and biochemical parameters in fish blood and tissue. The reaction and survival of aquatic animals depend not only on the biological state of the animal but also on the toxicity, type and time of exposure to the toxicant. indices of fish, as emanated from chromium toxicity to common carp can be secondary responses to irritants, including exposure to low concentration of heavy metals that mostly induced fluctuations in these parameters reflecting the launch of stress reaction in the affected fish. These findings are very important in monitoring fish health and risk assessment during periods of fluctuating levels of pollutants in both natural and farm environments.

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