



Effect of Toxic Heavy Metal Cadmium on the Hematological Parameters in the Common Carp (*Labeo Rohita*)

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Abstract

Heavy metals are persistent contaminants in the environment that come to the forefront of dangerous substances such as cadmium, lead, mercury, copper and zinc. It causes serious health hazards to human, animals and environments. For the past twenty years considerable attention has been focused on the heavy metals and their derivatives in the aquatic environment. These metals are containing highly toxicant stable substances which play on vital role in the environmental pollution. The industrial process involving fossil fuel combustion, cement production, electroplating, tanneries and dying units. Cadmium is an extremely toxic metal commonly found in industrial workplaces. Cadmium is used extensively in electroplating although the nature of the operation does not generally lead to over exposures. Cadmium is also found in some industrial paints and many represent a hazard when sprayed. Cadmium is also presents in the manufacturing of some types of batteries. It does not degrade by breaking down to a less toxic form. Metals are non-biodegradable and are considered as major environmental pollutants causing cytotoxic mutagenic and carcinogenic effects in animals. Haematological parameters and physiological profiles can be useful indicators of the physiological disturbances in animals and so can be crucial in providing vital information on the general well-being of fish and considered evaluation of blood cells, blood biochemistry as useful for the diagnosis of diseases. Blood cell indices (RBC, WBC and DLC counts) are good indicators of systemic response to external stimulus and any changes are therefore reflected in their morphology and distribution in the blood.

Keywords: Heavy metals, toxicity, Indian major carps, haematological parameters

Introduction

In the recent year's man's activities on the environment increasingly intensified due to population growth, industrialization and advancements in new technology. Pollutants like pesticides, heavy metals, hydrocarbons and radionuclides are discharged in to the surroundings due to man activities (Pandey 2001) ^[12]. This region has also high agriculture potential and the river has been exposed agriculture activities densely in almost seasons. So, it is thought to be affected from the pollution. Changes in physico-chemicals parameters may be reflected haematological parameters of the fishes. The values of haematological parameters depend on season and slow or active movement of fishes reported that haematological parameters are influenced by microbial infection of fish and toxicants. Haematological parameters and physiological profiles can be useful indicators of the physiological disturbances in animals and so can be crucial in providing vital information on the general well-being of fish and considered evaluation of blood cells, blood biochemistry as useful for the diagnosis of diseases. Blood cell indices (RBC, WBC and DLC counts) are good indicators of systemic response to external stimulus and any changes are therefore reflected in their morphology and distribution in the blood.

Haematology is a reliable indicator of the physiological condition of the fish. This has been the incentive to the scientific interest and development of fish haematology as chemical tool in monitoring fish health programmers (Gill *et al.*, 1993) ^[8]. These also review background effects of water pollution and toxicity studies. A wide array of factors, both within and without the organisms affects the peripheral haematological make up of fishes (Nasser *et al.*, 2015) ^[11]. Metals are non-biodegradable and are considered as major environmental pollutants causing cytotoxic mutagenic and carcinogenic effects in animals. Aquatic organisms have the ability to accumulate heavy metals (Pandey, 2001) ^[12]. It increase turbidity and may cause discoloration of water of with possible adverse effects on fisheries and recreational activities. Some type of particulate matter may damage gill surfaces of fishes and vertebrate (Mohamed *et al.*, 2014) ^[10]. *Labeo rohita*, commonly known as rohu has been selected the present study by considering its commercial value. Being an economically important and available fish in the rivers and ponds the present work will be of greater use to the people depending on this fish as their food. Moreover, in our country since the percentage of people living under poverty line is more the percentage of people depending upon this locally available fish is also more. Rohu is an Indian major carp, rohu is a fresh water bony fish and it lives in river. It is indigenous

fish more than 24 species, having spindle shape body. Body is bluish or grayish color and the lateral sides are silvery appearance and mouth is sub terminal. Fishes are the simple and reliable biomarker of copper pollution of aquatic bodies. The metallic ion present in water enters the fish body and gets accumulated in various organs like liver and kidney (Al-Mohanna, 1994; Shukla *et al.*, 2007) [2]. So far so many works have been carried out on *Labeo rohita* in many instances the body size along with sex and season which are important factors are bring about changes in blood parameters. According to Das *et al.*, (2002) [7] hematological parameters may closely related to the response of the animal to the environment. Further the environmental pollutants, disease attack and starvation also alter the blood chemistry.

Materials and Methods

A live freshwater fish (rohu) were collected from the fish landing center of Anaikarai Cauvery delta in Thanjavur district. Anaikarai is a village panchayat under Thiruvudaimaruthur Taluk in Thanjavur district, Tamil Nadu. Anaikarai is connected with two major bridges nearly 1 kilometer long on both side, it is island in the basin of cauvery river. Nearly 2000 families live in Anaikari with the main occupation of agriculture and fishing, they are well known of river fishes. Cauvery river commonly called collidam in Anaikari people. The fishes were brought to the laboratory and weighted to select median size group for acclimatization. Fish wear cleaned and maintained in the habitats water for a couple of days in order to acclimatize to the laboratory conditions. The stock preparation is generally 1g of toxic substance dissolved in 1 liter of distilled water. The 1ml of this solution contain 1g of toxic substance so these preparation varies between the toxic substance defined up on the combined molecules. Now prepare the stock solution for cadmium chloride. We want to calculate the amount of cadmium present in the cadmium chloride (Cdcl₂). The molecular weight of cadmium is 183.32gm. The molecular

weight of cadmium is 12.40gm and two chloride is 70.9 (35.45x2). Therefore 1gm of cadmium contain 183.32/112.40=1.63. Therefore the 1.63gm of cadmium dissolved in 1 liter of distilled water for stock.

Collection of Blood

This is a method which can be used to repeatedly to take blood sample from large fish (generally more than 10 cm long). The blood samples were collected from individual fishes by cardiac puncture using 21 gauge hypodermic needle in collection bottle containing EDTA. Attach the needle to the syringe; hold the fish with the ventral side on top, insert the needle vertically midway between the anterior bases of the pectoral fins. Apply negative pressure on the plunger until blood enters the syringe slowly withdraw the syringe completely from the fish.

The standard haematological procedure described by Blaxhall and Diasley 1973 were employed in the assessment of the various blood parameters. The data were analysed statistically. The red and white blood corpuscles (RBC and WBC) were counted using the Spencer's haemocytometer. Absolute blood parameters such as haemoglobin count (Hb), packed cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular haemoglobin concentration (MCHC) were determined by the method given (Welchselbam, T.E., American j.clin path 1946.16:40).

Results

The observation on the variation in the study of hematological parameter and correlation coefficient in the parameters are shown in the table. The Hematological parameters of fish *Labeo rohita* were collected from Anaikarai and exposed to various concentrations to the fish and the study included the RBC, WBC, Hb, PCV, MCV, MCH, MCHC. From the data, it is clearly showed that the hematological parameters showed significant fluctuation between different concentrations.

Table 1: Showing the Hematological parameters of Control and different concentrations

Sl. No	conc.	Hematological Parameters						
		RBC (million cells/cu.mm)	WBC (thousand cells/km.mm.)	Hb (g/dl)	PCV (%/dl)	MCV (µm ³)	MCH (pg)	MCHC (%mg/dl)
1.	Normal Values	3.9-4.2	4.5-11.0	10-16	40-54	78-94	27-32	30-40
2.	Control	3.99	5.8	9.8	37	92.73	24.56	26.48
3.	1 ppm	3.20	5.6	7.5	29	90.62	23.43	25.85
4.	2 ppm	3.00	5.4	6.4	25	83.33	21.33	25.59
5.	3 ppm	2.42	5.4	5	20	82.64	20.66	25.00
6.	4 ppm	2.21	5.2	4.0	18	81.44	18.09	22.21
7.	5 ppm	2.10	5.1	3.5	17	80.95	16.66	20.58

In the present study of RBC (million cell/cu.mm) level was well marked. The quantitative variations of hematological parameters are including the RBC's. The normal values of RBC was noted that 3.9-4.2 million cell/cu.mm. The different value of blood RBC level was observed by five concentrations including the control and experimented. The observed value of blood RBC levels were 3.99, 3.20, 3.00, 2.42, 2.21 and 2.10 million cell/cu.mm respectively their concentrations. The RBC have the positive correlation with the other hematological parameters viz, 0.843, 0.636, 0.699, 0.565, 0.817, 0.645. The same observation was done by Umamaheshwari *et al.*, 2013 [16]; Mohapatra *et al.*, 2016; Kandeepan, 2014 [9] and R. Vinodhini *et al.*, 2009 [17].

The present study of WBC (thousand cells/km.mm) level was well marked. The normal values of WBC was mentioned as 4.5-11.0 (thousand cells/km.mm). The different value of blood WBC level was observed as 5.8, 5.6, 5.4, 5.4, 5.2 and 5.1. The RBC have the positive correlation with the other hematological parameters viz, 0.843, 0.427, 0.494, 0.447, 0.613, 0.484.

The haemoglobin (Hb) (g/dl) level was well marked. The quantitative variations of haematological parameters are including the Hb. The normal values of Hb was 10-16 (g/dl). The different value of blood Hb level was observed in both control and experimented fishes. The observed value of blood Hb level was 9.8, 7.5, 6.4, 5.0, 4.0, 3.5, (g/dl) respectively in

the concentrations. The Hb have the positive correlation with the other haematological parameters viz, 0.636, 0.427, 0.992, 0.945, 0.932, 0.861. The remarkable values are observed by the following authors in their studies Mohamed El-Said El-Boshy *et al.*, 2014^[10]; Adhikari *et al.*, 2004^[1] and Nasser. A. Al-Asgah *et al.*, 2015^[11]. In the PCV%/dl level was well differentiated. The quantitative variations of haematological parameters are including the Packed Cell Value. The normal values of PCV were 40-56%/dl. The different value of blood PCV level was observed. The observed value of blood PCV level in 37, 29, 25, 20, 18, 17%/dl respectively the control and experimented. The PCV have the positive correlation with the other haematological parameters viz, 0.699, 0.494, 0.992, 0.941, 0.946, 0.866. The result similar to Ateeq. B., *et al.*, 2002^[3]; Chekrabarthi P *et al.*, 1988^[6].

The study of Mean Corpuscular Value Level (MCV) (μm^3) level was well marked. The quantitative variations of haematological parameters are including the MCV. The normal values of MCV 78-94 μm^3 the different value of blood MCV level were observed in control and experimental fishes. The observed value of blood MCV level in fishes 92.73, 90.62, 83.33, 82.64, 81.44, 80.95 μm^3 respectively. The MCV have the positive correlation with the other haematological parameters viz, 0.565, 0.447, 0.945, 0.941, 0.871, 0.952. The Mean of Corpuscular Haemoglobin Level MCH (Pg) level was well noted. The quantitative variations of haematological parameters were including the MCH. The normal values of MCH 27-32 Pg The different value of blood MCH level were observed by five months in cultural and natural fish. The observed value of blood MCH level in both control and experimental fishes 24.56, 23.43, 21.33, 20.66, 18.09, 16.66 Pg respectively, The MCH have the positive correlation with the other haematological parameters viz, 0.817, 0.613, 0.931, 0.946, 0.821, 0.952. In the present study of Mean Corpuscular Haemoglobin Concentration MCHC (% mg/dl) level was well marked. The quantitative variations of haematological parameters were including the MCHC. The normal values of MCHC 30-40% mg/dl. The different value of blood MCHC level were observed as 26.48, 25.85, 25.59, 25.00, 22.21, 20.58%mg/dl. The MCHC have the positive correlation with the other haematological parameters viz, 0.645, 0.484, 0.865, 0.866, 0.681, 0.952. The results are similar to Benerjee V 1988^[6]; Srivastava S. *et al.*, 2010^[14]; Taylor *et al.*, 2002^[15] and Sripriya *et al.*, 2012^[13].

Table 2: Showing the co-relation coefficient between the haematological parameters

Parameters	RBC	WBC	Hb	PCV	MCV	MCH	MCHC
RBC	1.000						
WBC	0.843	1.000					
Hb	0.636	0.427	1.000				
PCV	0.699	0.494	0.992	1.000			
MCV	0.565	0.447	0.945	0.941	1.000		
MCH	0.817	0.613	0.932	0.946	0.821	1.000	
MCHC	0.645	0.484	0.861	0.866	0.681	0.952	1.000

Conclusion

Freshwater fishes are maintained by control and experimental both are acclimatized their habitation, because they are free floated throughout the entire Natural reservoir. Application of haematological examinations to investigating clinical episodes of infectious and non-infectious diseases of fish must be viewed with some degree of caution. There are few "normal" values because of the responsiveness of the blood

vascular system to external stimuli. The most appropriate approach is to establish the baseline data for the fish in a specific situation and monitor the population for changes in the hemogram. If good techniques are applied and interpretations are guarded, hematological methods have value in fish health management. The study is very useful tool to all the concerns to compare the quality of fishes. In natural environment the heavy metals are enter through excess usages of chemicals. So the study is very useful to aware of the percentage of heavy metals are present the survival area in around the nature. Finally the study concluded the very meager amount of heavy metals also produced the mortality of the animals.

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