

Comparative Haemato-Biochemical Studies on *Cirrhinus mrigala* and *Cirrhinus reba*

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Abstract

The present investigation is an attempt to study the comparative haemato-biochemical parameters of *Cirrhinus mrigala* and *Cirrhinus reba*. Alive freshwater fishes were collected from a freshwater pond of Kausalyaganga, Bhubaneswar and Odisha. Blood samples were then taken from the caudal vein of fishes. Haematological parameters such as haemoglobin (Hb), total erythrocyte count (TEC), total leucocyte count (TLC), packed cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), and mean corpuscular haemoglobin concentration (MCHC) and the serum biochemical parameters like protein, albumin, globulin, glucose and cholesterol were thoroughly studied and each parameter was expressed as mean \pm SE. All the haemato-biochemical parameters showed slight fluctuation between the species. The results showed that RBC count, haemoglobin, WBC count and MCHC showed higher value in *C. mrigala*. PCV, MCV and MCH were found to be an elevated level in *C. reba* than *C. mrigala*. Except MCV none of the haematological parameters differ significantly between the *Cirrhinus* species. All biochemical parameters showed higher value in *C. reba* than *C. mrigala* but are not significantly different except albumin and cholesterol. The findings of the present study used as a reference value as well as a valuable tool in monitoring fish health.

Keywords: Haemato-Biochemical Parameters; Freshwater; *Cirrhinus mrigala*; *Cirrhinus reba*.

Introduction

The haematological characteristics can be used as an effective tool to monitor physiological and pathological changes in animals. Normal ranges for various blood parameters in fish have been established by different investigators in fish physiology and pathology [4, 24]. Haematological and biochemical parameters are being used as indicators in the measurement of health conditions and toxicological symptoms of organisms [18]. These parameters provide information about the health status of organisms, also indicates the abnormal environmental conditions [6]. Information about the existence, status and degree of possible sickness in organisms can be rapidly obtained by haematological and biochemical parameters. One of the difficulties in assessing the state of health of natural fish population has been the lack of reliable references of the normal condition [10, 24]. Although fish haematology is an effective tool but normal range for blood parameters are inadequate and literature in this area is often incomplete [24]. Despite advances in fish medicine in recent years, interpretation of fish haematology is often troubled by a lack of meaningful

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reference values [2]. Only a few normal values for a small number of haematological parameters have been established for some teleosts, but these values vary widely due to the lack of standardized collecting and measuring techniques. Number of factors cause normal and abnormal variations in haematological data [2] such as species and strain [11], temperature [11, 14], age [26], season [7], stress [3], photoperiod [12], nutritional state [26, 13], the cycle of sexual maturity, health condition [20] and water quality. The present paper deals with the comparison of important blood parameters of *Cirrhinus mrigala* and *Cirrhinus reba*.

Materials and Methods

The samples were collected from a freshwater pond of Kausalyaganga, Bhubaneswar, Odisha

during August 2014 to December 2014. 30 alive fishes of each species (irrespective of sex and almost of medium size group) were taken and brought to the laboratory. Blood samples were drawn from caudal vein into two different vials, one containing EDTA (ethylenediaminetetra acetic acid) for haematological studies and the other without EDTA allowing to clot and serum to separate for studying some biochemical constituents. The blood samples were processed for haemoglobin (Hb), totalerythrocyte count (TEC/RBC), total leukocyte count (TLC/WBC) and packed cell volume (PCV) as follow.

Haemoglobin concentration (Hb) was measured by Sahli's acid haematin method [22]. RBC and WBC were determined using a Neubauer haemocytometer. Haematocrit/PCV value was determined by the standard microhematocrit method [16] and expressed in percentage. The following erythrocyte indices such as mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) and were calculated as per following formula.

$$\text{MCV (fl)} = \text{PCV} / \text{RBC} \times 10$$

$$\text{MCH (pg)} = \text{Hb} / \text{RBC} \times 10$$

$$\text{MCHC (\%)} = \text{Hb} / \text{PCV} \times 100$$

Biochemical parameters of Blood were determined by using standard kits (Crest biosystems, Alto Santacruz Bambolim complex, Goa-403 202, India).

Statistical Analysis

The results are presented as mean \pm SE. Difference in parameters between *C.mrigala* and *C.reba* was analyzed using t-test.

Result and Discussion

The haematological parameters of *C.mrigala* and *C.reba* are discussed in detail (Table-1)

Haematological analyses of fish are important as these are linked to fish health. Fish are exposed to

Table 1: The haematological parameters of *Cirrhinus mrigala* and *Cirrhinus reba*

Haematological parameters	<i>Cirrhinus mrigala</i> (30)	<i>Cirrhinus reba</i> (30)
RBC(millions/mm ³)	1.83 \pm 0.04	1.75 \pm 0.05
Hb(gm/dl)	6.26 \pm 0.26	6.21 \pm 0.23
WBC(thousands/mm ³)	5 \pm 0.26	4.56 \pm 0.24
PCV(%)	20.4 \pm 0.79	21.8 \pm 0.76
MCV (fl)	112.41 \pm 4.65*	126.61 \pm 4.92*
MCH (pg)	34.33 \pm 1.42	36.32 \pm 1.72
MCHC(%)	30.8 \pm 0.63	28.79 \pm 0.89

(Figures in parentheses indicate number of observations, *significant at $p < 0.05$).

different factors in natural habitat such as pollution, water quality, microorganisms for which they adapt some what to these adverse conditions by changing their physiological activities. Findings of reference value for fish species will help to establish and identify the causes of disease in fish which presents challenge for the ichthyologists. The RBC of fish determines the dissolved oxygen carrying capacity. The result of the RBC count of this work for *C.mrigala* and *C.reba* are 1.83 \pm 0.04 to 1.75 \pm 0.05 millions/mm³ respectively. This finding is similar with the corroboration [5] for control group of *C.mrigala*. The result of Hb obtained of this work for *C.mrigala* and *C.reba* are 6.26 \pm 0.26 to 6.21 \pm 0.23 g/dl respectively. There is a slight fluctuation in haemoglobin level which may be due to different species but the level of haemoglobin is higher when compared to other carps such as *Catla* and

Labeo rohita (4.0 \pm 0.08 and 4.0 \pm 0.05) respectively [9]. Further the result of PCV of this study is 20.4 \pm 0.79 to 21.8 \pm 0.76 % for *C.mrigala* and *C.reba* respectively. The value of WBC is slightly higher in *C.mrigala* than *C.reba* but does not vary significantly. In fishes, the significance of WBC and their biological function are not clearly understood. The number of WBC in some species of fish varies greatly with age, season and maturation [17]. The MCV value reflects the size of red blood cells by expressing the volume occupied by a single red blood cell. The present study shows significantly higher value of MCV in *C.reba* than *C.mrigala*. The value of MCH is found higher in *C.reba* than *C.mrigala* but does not vary significantly. The MCHC is observed to be higher in *C.mrigala* than *C.reba*. The high level of MCHC indicates more Hb in a unit of RBC [21].

Serum biochemistry can be influenced by many biotic and abiotic factors such as temperature of water, seasonal pattern, food, age and sex of the fish [8]. In this study, the results of biochemical

parameters (Table 2) showed higher value in *C.reba* than *C.mrigala* but are not significantly different except albumin and cholesterol.

Table 2: The biochemical parameters of *Cirrhinus mrigala* and *Cirrhinus reba*

Biochemical parameters	<i>Cirrhinus mrigala</i> (30)	<i>Cirrhinus reba</i> (30)
Protein(g/dl)	5.68 ± 0.42	6.61±0.42
Albumin(g/dl)	2.78 ± 0.18*	3.31± 0.2*
Globulin(g/dl)	2.9 ±0.41	3.29 ± 0.42
Glucose(mg/dl)	106.3 ± 3.43	106.46 ±3.34
Cholesterol(mg/dl)	186.19 ± 7.91*	210.07±7.61*

(Figures in parentheses indicate number of observations, *significant at $p < 0.05$).

Among all the organisms, the highest level of protein is found in fishes. The level of protein found in our study for *C.mrigala* and *C.reba* are 5.68 ± 0.42 and 6.61 ± 0.42 g/dl respectively. This value is higher in comparison to *Catla catla* and *Labeo rohita* which is 4.1 ± 0.23 and 3.9 ± 0.3 respectively. The Serum albumins accomplish important functions in the vertebrates, participating in the filtration of tissue fluid, in the transport of biomolecules and in the plastic metabolism [1]. In the present study, significantly higher level of albumin is recorded in *C.reba* than *C.mrigala*. Globulin found in *C.mrigala* and *C.reba* is 2.9 ± 0.41 and 3.29 ± 0.42 g/dl respectively. Blood glucose has been shown to be a sensitive biochemical indicator of environmental stress [25, 27]. The blood sugar level represents a dynamic balance between the rate at which the sugar is entering the blood from the liver and the rate at which it is being removed by the body tissue from the blood [23]. In this study, the level of glucose is found insignificantly higher in *C.reba*. The elevated blood glucose level reflects an increase in the rate of transportation of glucose probably from the liver to muscle where high energy demand was met due to brisk and erratic movements [19]. The cholesterol concentration in this study was 186.19 ± 7.91 and 210.07 ± 7.61 mg/dl for *C.mrigala* and *C.reba* respectively. Cholesterol concentration varies both among and within fish species because of variation in diet activity and sexual development [27].

Conclusion

The results of this study provide the knowledge of the characteristics of haematological and biochemical parameters of *C.mrigala* and *C.reba*. This investigation may be helpful as a tool to monitor the health status of this and other related fish species. The evaluation of hematological parameters will grant early

detection of clinical pathology as well as the presence of disturbance in the environment.

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