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COMPARATIVE STUDY OF HAEMATOLOGICAL PARAMETERS IN FISHES FROM THE NATURAL HABITAT, MADURAI REGION

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Haemoglobin

Labeo rohita

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ABSTRACT

The heamatological profile of two freshwater fishes *Labeo rohita* (Rohu) and *Channa striatus* (Murrel) with a relationship to the sex and the water quality under natural habitat was analyzed. The freshwater fishes were collected from the pond located in Thodaneri, Vadipatti taluk, Madurai district, Tamil Nadu, India. In heamatology studies, no significant variation was observed in Heamoglobin content and found almost the same in both the fish irrespective of the sex and also falls in the range of control value. In differential Leucocyte count (DLC) the following blood components Lymphocyte, Eosinophil, and Monocyte count were significantly higher than the control values and the values are found maximum in Rohu when compared to Murrel.RBC (Erythrocyte) count was almost the same in both the fish and the value falls between the range of control value Packed Cell Volume (PCV) count was almost the same in both the fish and the value falls between the range of control value. The values of Hb and PCV were found higher in male fish as compared to female fish. The leucocyte count is also higher in the males when compared to the females of both Rohu and Murrel. These may be also influenced by physiological activity, feeding habits, infectious agents, water quality parameters, and the environmental stress on the organism.

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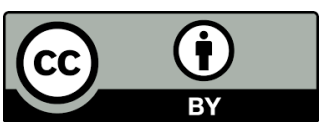

1 Introduction

The growing demands of urbanization cause a decrease in the amount of forest and, wetlands. This deplenishing green cover leads to variation in impervious-pervious which affect the quality of the storm water run-off, leading to poor watershed systems due to loads of pollutants carried by the storm water (Morisawa & La Flure, 1979). In addition to this, the pollutants that are released from the industries are also carried to the riverine system. The overall environment of the aqua system gets affected indefinitely based on the effects of the pollutants, and they directly or indirectly affect the organisms that habitat the wetlands. Fishes are considered valuable resources since they are an important source of food in the world. Fishes as a unit play an important role in maintaining the balance in the ecosystem.

Fishes in the pond are afflicted by the water quality parameters such as pH value, alkalinity, availability of oxygen, level of environmental stress, and hardness which eventually pose a great threat to fish health (Southamani et al., 2015). Rohu (*Labeo rohita*) is the predominant species used in carp polyculture systems. Rohu is a fast-growing species and thrives above 14 ℃ temperature. Spawning happens in the shallow water and the spawning season of Rohu generally coincides with the south-west monsoon. *Channa striatus* (Ng & Lim, 1990) generally lives in estuaries and can withstand the drought. It can breathe in an anaerobic way and can survive in the dry season (Qin & Fast, 1996; Pradhan et al., 2012). The Murrel involve in reproduction all-round the year (Ali, 1999), and suitable breeding habitat for this fish is the paddy field. Both these fishes are available in almost all seasons and hence chosen for the study.

The heamatology is considered an important indicator to oversee the physiological and pathological changes in the fishes. The total body weight of fish constitutes 1.3–7% of blood which exchanges gas between organism and environment. Studies of haematological parameters are based on health status, age, aquatic biotope, and fish species (Patriche et al., 2011; Kumar et al., 2019). It is greatly influenced by physiological stress, diseases, and the introduction of toxic pollutants in the aqua system. This study aimed to compare the haematological profiles of two freshwater fish in Rohu (*Labeo rohita*) and Murrel (*Channa striatus*) collected from the native environment.

2 Materials and Methods

The heamatological profile of the two freshwater fishes *L. rohita* and *C. striatus* in relationship with the sex and the water quality in a natural habitat is analyzed in this work. Ten healthy and disease-free male and female of each *L. rohita* and *C. striatus* species were collected for sampling from the pond located near Thodaneri, Vadipatti Taluk, Madurai, Tamil Nadu, India subjected to heamatological studies (Figure 1). Ten male and female fish of *L. rohita* and *C. striatus* served as a control. The studies include physicochemical parameters of the pond water and heamatology profile of the two selected fishes. The parameters taken for comparison are haematology and sex discrimination factors.

Figure 1 Satellite Map showing the catchment area where fish were collected from Thodaneri pond, Vadipatti Taluk, Madurai district

2.1 Water quality analysis

Pond water from the catchment area was collected in a sterilized PET bottle by immersing it completely in the middle of the pond and screw-capped tightly under the water without lifting the water bottle and it was transported immediately to the laboratory for physicochemical examination of water parameters as described by the standard protocols (APHA, 1989). The sampling was done between 10 am to 2 pm. Water samples in triplicates were collected at different intervals of time for the study. On-site analysis was done for pH and turbidity using a pH meter and turbidity meter. Other physicochemical parameters like dissolved solids, pH, total hardness, and bound minerals were carried out within 24 hrs of sample collection. It was preserved at 4○C. The water quality was analyzed by methods given in APHA (1989) and Trivedy & Goel (1986).

2.2 Collection of Blood

Blood was collected from the punctured caudal vein with the aid of 20 G×1.5 syringes and collected blood samples in falcon tubes containing EDTA from both the sexes of Rohu and Murrel separately. The experiment was repeated twice with ten samples of males and ten samples of the female of each fish. In haematological profile, the differential Leucocyte counts was determined with the help of a Neubauer hemocytometer. Nelson & Morris (1989) method was used to estimate hemoglobin concentrations and hematocrit. Packed cell volume was estimated by adopting the procedure of Wintrobe (1934). Further, erythrocyte indices such as MCV, MCH, and MCHC were calculated as mentioned below: MCH = hemoglobin x 10/erythrocyte count, MCV = PCV x 100/erythrocyte count and MCHC = hemoglobin x 100/PCV.

Sex was also determined for the hematological parameters.

2.3. Statistical analysis

Statistical analysis of hematological parameters in terms of Mean±SD in both sexes of fishes was employing ANOVA.

3 Results

The results are presented as comparative analyses between the species and sexes of Rohu (*Labeo rohita*) and Murrel (*Channa striatus*) the freshwater fish collected from the pond with that of the control.

In the physicochemical examination of water, total dissolved solids were very minimum (211mg/l) when compared to the acceptable limit, the electrical conductivity was 302µS/cm. The pH of the water was 7.10, which is falling under the recommended range.

In a chemical examination of water analysis through total hardness parameter was showing maximum (700 mg/l) the individual chemical components were found minimum when compared to an acceptable limit. Other physio-chemical parameters like calcium, magnesium, iron, ammonia, nitrate, chloride, fluoride, sulphate, and phosphates are below the recommended range (Table 1).

Table 1 Physico-chemical examination of pond water

S.No.	Physical examination	Acceptable limit	Pond Water (Sample)	Control water
1.	Colour	5	Clear &colourless	Clear &transparent
2.	Total Dissolved Solid (mg/l)	500	211	150
	Chemical Examination			
3.	P^H	6.5−8.5	7.10	6.70
4.	Total hardness (mg/l)	200	700	650
5.	Calcium (mg/l)	75	88	80
6.	Magnesium (mg/l)	30	35	33
7.	Iron (mg/l)	0.3	0	0.1
8.	Ammonia (mg/l)	0.5	0.5	0.1
9.	Nitrate (mg/l)	45	1	0.5
10.	Chloride (mg/l)	250	40	30
11.	Fluoride (mg/l)	1.0	0	0.5
12.	Sulphate(mg/l)	200	15	10
13.	Phosphate (mg/l)	0	0.5	0.1

Haematological profiles were compared between the sex of Rohu and Murrel (Table 2). No significant variation was observed in Hb content and found almost the same in both the fish (11±0.5) and also fell in the range of control value in Rohu female.

Mean corpuscular volume (MCV) were found significantly maximum (188±17) in Rohu male when compared with control range. Mean Corpuscular Heamoglobin (MCH) count was found significantly maximum (47±0.0) in Rohu males when compared to the control range.

In differential leucocytes count the following blood components Lymphocyte (87.0±3), Eosinophil (3.50±0.5) and Monocyte (1.75±1.5) count in Rohu male were significantly higher than the control values. Eosinophil(0.34−0.40) and Monocyte (0.14) and the values were found maximum in Rohu when compared to Murrel. Lymphocyte count was found maximum in both the sex of Rohu and Murrel when compared with control. RBC count was almost same for the both the fish and the value found minimum when compared to the range of control value. PCV count was almost the same in both the fish (40±1) and the value was found between the range of control value.

Table 2 Haematological Profiles of Rohu and Murrel Fish

S. No	Haematology parameters	Rohu		Murrel		Rohu (Control)		Murrel (Control	
		Male	Female	Male	Female	Male	Female	Male	Female
1.	HB	11±0.5	11.5±1	12±1	11±0.5	11±1	11±0.5	12±1	11±0.5
2.	PCV	40±1	38.5±0.5	41±1	38±1	42±1	40±0.5	43±1	41±2
3.	RBC	2.8±0.1	2.4±0.1	3±0	2.0±2	4±0.1	3.8±0.1	3.9±0	3.7±2
4.	MCV	188±17	122±2	158±12	156±3	93±3	85±2	94±1	81±2
5.	MCH	47±0.0	33±0.2	35±0.3	34±0.2	31±1	29±0.2	33±0.1	30±1
6.	MCHC	30±0.3	32±0.1	31±0.4	30±1.5	37±2	32±0.1	39±1	35±2.5
	Differential Leucocyte Count								
8.	Neutrophil	9.5±0.5	6.50±0.5	10±1	9±0.5	16±0.5	11±0.5	15±1	12±0.5
10.	Monocyte	1.75±1.5	1.00±0	1.00±1	1.00±1	0.13±0.5	0.1±0	0.13±0.01	0.11±0.1
11.	Eosinophil	3.50±0.5	2.00±0.5	1.5±0.5	1.75±0.5	0.3±0.1	0.2±0.2	0.4±0.1	0.1±0.2
12	Lymphocyte	87±2.5	82.5±3	86±2	81±2.5	79±2	78±1	78±1	77±1.5

The given values are Mean± SD

4 Discussion

Haematological results are presented as comparative analyses between Rohu *(L. rohita)* and Murrel *(C. striatus)* freshwater fish. The physico-chemical parameters taken for the study of pond water were above the control range except for iron content. The pH of the water is influenced by the dissolved minerals in the aquatic system, the pH of water influences the solubility of substances thus the presence of these substances influence the aquatic system. Furthermore, pH is additionally emphatically corresponded with electrical conductance and absolute alkalinity (Sahiti et al., 2018; Sarkar et al., 2020). The pH in the present study is alkaline and is also under the optimal range. Huq & Alam (2005) stated that electrical conductivity typically is shown for the dissolved concentration of free radicals in water. The total dissolved solids also influence the electrical conductivity of the water (McNeely et al., 1979).

The amount of chloride was below the optimal level. High Chloride level is an indicator of polluted water (Munawar, 1970). Phosphate was found 0.5 mg/l in the pond water. Phosphates are taken up by plants and are not found in high amounts in water. Phosphates in high quantities indicate pollution in water (WHO, 1993). Presently nitrate level was found to be influenced by the nitrification and denitrification process which is carried out by micro-organisms (Trivedy & Goel, 1986). The sulphates in water determine their use for public and industrial purposes, the sulphate content was 15 mg/l.

According to Svobodova (1994), stream hydrology and capacity are reliant on five significant factors viz., atmosphere, geography, soils, land use, and vegetation. These factors straightforwardly influence the elements of release and silt load, which thus affect the hydrology and morphology of the stream. Additionally, the pesticide and other chemicals leaches out and, in the end, influences the water quality, which thus impacts the miniature atmosphere of the lake and the life form which lives in it.

According to Southamani et al. (2015) the climate of the environment affects the hematology of fish. The specific distinction is seen in the hematological profile of both the species and also concerning the sex. Changes in the environment can induce changes in the hematological profile of fishes as they are very sensitive to their environment (Ahmed et al., 2020).

The values of Hb and PCV have been seen maximum in male fish which is due to the physiologically activeness of male fish. The variation in the erythropoietin is the indicator of higher hematological values in male fish influenced by the water quality of the pond. The leucocyte count is also higher in the males when compared to the females of both Rohu and Murrel. Leukocyte levels in the blood may also fluctuate according to environmental quality, nutritional status, and presence of infectious agents (Sunomonu & Oyelola, 2008).