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Comparative Study of Haematological Parameters of *Etroplussuratensis* (Bloch) From Veli Lake and Vellayani Lake

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ABSTRACT

Haematological studies of fishes are useful in the diagnosis of many abnormalities as well as diseases. Haematological parameters act as efficient tool to examine health status, physiological and pathological changes occurring in various fishes, as well as the nature of aquatic habitat. Blood is a mirror image of all the vital processes taking place inside the organism. So the blood parameters are used for understanding the biological process taking place in the fish species. Fishes show abnormal effects due to food, habitat, temperature, P^H and many other elements of environment. Comparative study of two fishes of the same species from two different habitats provide relationship between the environmental pollution as well as the effect of pollutants on the health of the animals.

KEYWORDS: Haematology, Etroplus, Hb, PCV,Hct, Histology

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INTRODUCTION

Haematology is concerned with the study,diagnosis, treatment and prevention of diseases related to the blood. It involvestreating diseases that affect the production of blood and its components,such as blood cells, haemoglobin,blood proteins and the mechanism of coagulation. Haematological indices are important parameters for the evaluation of fish physiological status.Their changes depend on the fish species,age,the cycle of sexual maturity and health (Hrubec*et al*., 2001)[1].The blood comprises 1.3-7% of the total body weight of fish and it represents one of the most active components.The bone marrow, the source of RBCcontributes to metabolic process by ensuring gas exchange between the organism and the environment. For this reason,blood parameters are increasingly used as indicators of the physiological condition or sub –lethal stress response in fish to endogenous or exogenous changes(Belanger *et al*., 2001)[2].Haematological parameters have been recognized as valuable tools for monitoring fish health.Its changes would be sign of fish physiological responses against environmental stresses such as heavy metals in water pollution (Vosyliene,1996)[3] or bacterial infections (Austin,1987)[4].Therefore haematological changes would occur subsequently in response to the invading pathogens.

Haematological Components and Their Functions

Blood which is a vital fluid formed of cells such as RBC, WBC and platelets. A reduced RBC count implies a reduction in the level of oxygen that would be carried to the tissues as well as the level of carbon dioxide returned to the lungs. WBC and its differentials are essential to defend the body exposed animals to toxicant and other conditions. As reported by Isaac *et al*.,(2013)[5] animals with good blood composition are likely to show good performance in health. Blood platelets are implicated in blood clotting. Low level which prolongs the clotting time and leads loss of blood in the case of injury.

Jawad*et al*., (2004)[6] found that values of RBC, Hct and Hgb increased with increasing fish size. It should be noted that the differences recorded in blood parameters between fish of various sizes according to Raizada*et a*l., (1983)[7]are genetically determined, but Chaudhuri*et al*., (1986)[8]suggest that the differences might be due to the higher metabolic rate of bigger fish compared to smaller ones. Moreover Svobodova*et al*., (2008)[9] reported that active species displayed higher values of haematological parameters compared to less active forms.

The inverse relationship between WBCs and RBCs was found by Satheeshkumar*et al*.,(2010)[10]on seven different teleost fish including *M. cephalus*.. Fish thrombocytes represent a link between innate and adaptive immunity (Passantino*et al*., 2005)[11].Haematological studies contribute to an

understanding of the relationship between blood characteristics and the habitat and the adaptability of the species to the environment, so there is a need for establishing normal haematological values in different species of fish.

Changes in haematological parameters depend upon the aquatic biotope. Intense activity in industrial and agricultural sectors has inevitably increased the levels of aquatic pollution.Pollution of water resources adversely affect the plants and animal life. The advent of agricultural and industrial revolution, most of the water sources are becoming contaminated (Khare and Singh,2002)[12]. Aquatic organisms accumulate pollutants directly from contaminated water and indirectly through the food chain. Fish are useful bio-indicators to evidence the environmental degradation (Fausch*et al.*, 1990)[13]. Rapid progress made in industrialization without adequate environmental safety results in lake of good quality of water both for irrigation and drinking.

Industrial effluents have been regarded as sources of pollution because of the lack of efficient treatment and disposal. Freshwater lakes and brackish water lakes are now in the grip of pollution and it has become a matter of concern over the last few decades.

The present project was intended to study the haematological parameters of *Etroplussuratensis* living in two different habitats. The work has been completed on the following headings such as Estimation of total RBC count, Estimation of total WBC count, Estimation of Hb, Estimation of Packed Cell Volume (PCV), Mean corpuscular Haemoglobin (MCH), Estimation of clotting time, Estimation of Serum protein, Estimation of Blood glucose and Morphological Alterations.

MATERIALS AND METHODS

The species used in this study were the *Etroplussuratensis*. Systematic position of the experimental animal is the shown below.

Classification

Kingdom : Animalia
Phylum : Vertebrata
Super class : Glnathostomata
Class : Teleostei
Sub class : Actinopterygii
Order : Perciformes
Family : Cichlidae
Genus : Etroplus
Species : *suratensis*(Bloch)

The green chromide (*Etroplussuratensis*) is a species of cichlid fish from fresh water and brackish water in Southern India and Sri Lanka. It is also known as the pearlspot. In India, it is found throughout Kerala, especially in Kerala backwaters. The fish, known locally in Kerala as *Karimeen*. It commonly reaches 20 centimeters (7.9 in) in length and the maximum length is twice that.

Body is laterally compressed, mouth small and terminal with a small cleft.Snout is spout – like, eyes large and lateral, lips thin and jaws equal.Teeth villiform, present on both jaws. Dorsal fin is inserted above the pectoral fin base; caudal fin is emarginated while pelvic fin is characterized with one spine. Body is light greenish with eight yellowish oblique bands, the first passing through the occipital part of the head and last across base of the caudal. Scales above lateral line have a central pearly spot; and possess some triangular black spots on the abdomen. Anal fin possesses 12-13 spines and 11 or 12 soft rays. The fish were collected from Vellayani Lake &VeliLake.

Vellayani Lake

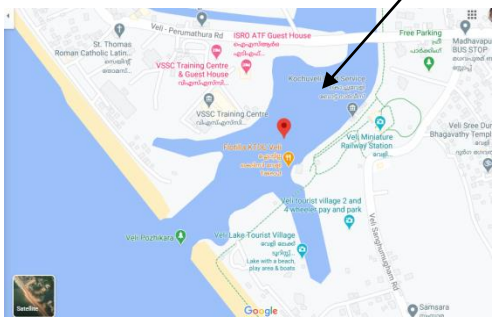
VellayaniLake, one of the three major fresh water lakes in Kerala is located between North latitude 8 degree 24”09”- 8 degree26”30” and East latitude 76 degree 59”08”- 76 degree 59”47” in the suburb near the capital city of Thiruvananthapuram. The lake has rich fish fauna and great potentially for developing its fishery resource.

Veli Lake

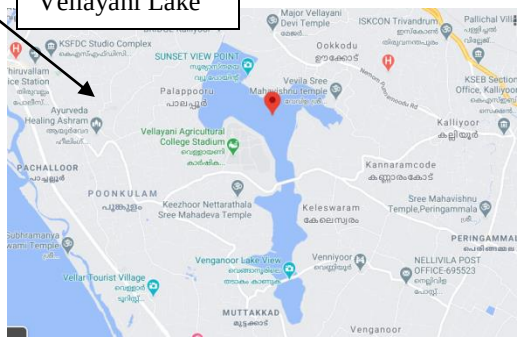
Veli Lake is a relatively small water body situated 5 km North West of Thiruvananthapuram city. The lake is 1 km long and 0.3 km with an average depth of only 2 meters. During the south west monsoon, the lake opens for a few days to the sea through a narrow outlet. Seawater exchange takes place only during these days. Seasonal variation of benthic fauna and the zooplankton (Arunachalam*et al* .,1982)[14].Studied in detail. Even though no attempt has neither to been made to access the stock up on which the fishery is based.

Fish Collection

Veli Lake



Vellayani Lake



Fish were collected from both Vellayani Lake and Veli Lake using gillnet. Captured fish taken in a container with sufficient and aeration and brought to laboratory. Blood was collected from the caudal peduncle using sharp knife. After discarding the first drop of blood, the freely oozing blood was collected in a small watch glass containing a sufficient quantity of anticoagulant EDTA. Samples for analysis were prepared immediately after collecting blood. Various procedures were adapted for estimation of various blood parameters (Mukherjee,1988)[15]and (Sahli, 1962).[16]

OBSERVATION AND RESULTS

1. ***Size***: The fish from the Vellayani Lake was found to be big size as compared to the fish collected from Veli Lake which was observed to be thinner, and paler in appearance. (Table 1)
2. ***RBC &WBC Count:*** The RBC and WBC Count were more in males than females. Similarly the count was greater in fishes of Vellayani Lake than the fishes of Veli Lake. (Table 2)
3. ***Conc. Hb:*** The result of Hb in male fish was 9.8g/dl but in female it was 9.6g/dl. The level was slightly lower in fishes of Veli Lake. Higher Hb concentration found in males compared to females may be due to sex differences or males are more active and aggressive than the females. (Fig. 1)
4. ***PCV:*** The result of PCV for male and female were 30.5±0.89% and 29.3±1.04 %respectively. Males have higher value of PCV than females which is perhaps because of relatively higher RBC counts in males. (Fig. 2)
5. ***Conc. Glucose:*** In both cases the glucose concentration show higher values in females than males. (Fig. 3)
6. ***Conc. Protein:*** In both cases the protein concentration show higher values in females than males. (Fig. 4)
7. ***Conc. Cholesterol:*** In both cases the cholesterol concentration show higher values in females than males. (Fig. 5)
8. ***Histology***: Structural alterations were observed in the liver of fish collected from Veli Lake. The main variations noted in the Liver were congestion of blood vessels and severe degeneration or necrosis of hepatic cells. Commendable structural variations were not observed in the liver of Etroplus collected from Vellayani Lake. (Fig. 6& 7).

Table 1. "Description of fish"

Sl. No	Source	Species	Length (cm)	Breadth (cm)
1	**Veli Lake**	***Etroplussuratensis***	**12**	**5.6**
2	**Vellayani Lake**	***Etroplussuratensis***	**16**	**7.5**

Table 2."RBC & WBC Count"

Sl.No	Source	Sex	RBC(10^6mm-^{3})	WBC(10^3 mm-^{3})
1	Vellayani Lake	Female	2.41±0.06	8.59±0.27**
		Male	2.89±0.08*	9.71±0.43**
2	Veli Lake	Female	2.24±0.07	7.9±0.27**
		Male	2.32±0.08*	8.01±0.43**

*Shows significance (p<0.01)

**Shows significance (p<0.05)

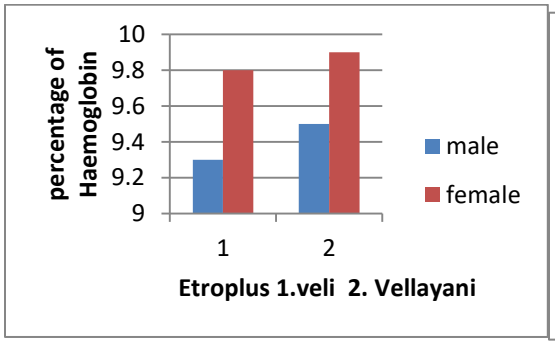


Fig. 1 "Concentration of haemoglobin"

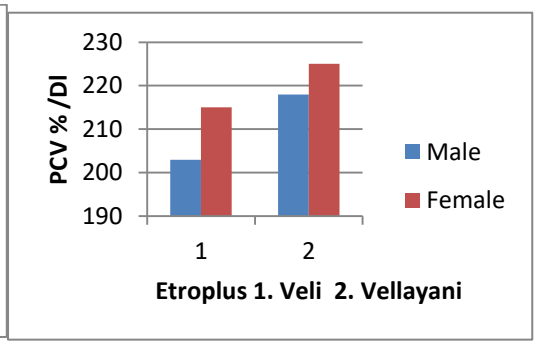


Fig. 2"Packed Cell Volume"

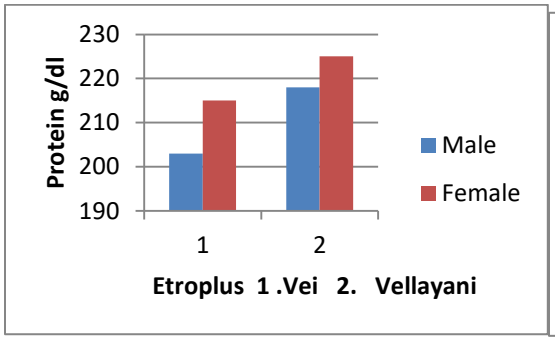


Fig. 3 "Concentration of Protein"

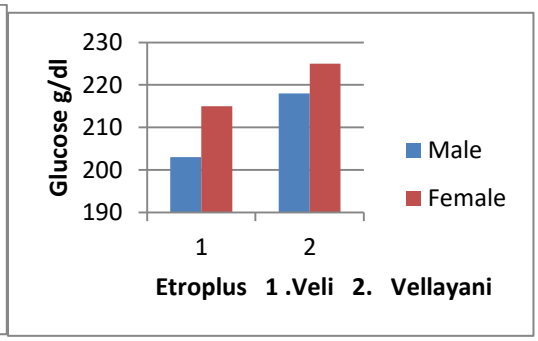


Fig. 4 "Concentration of Glucose"

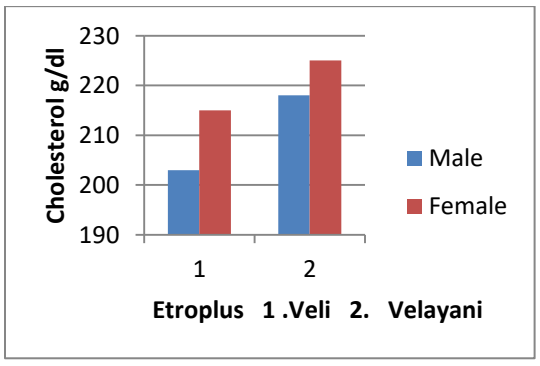


Fig. 5"Concentration of Cholesterol"

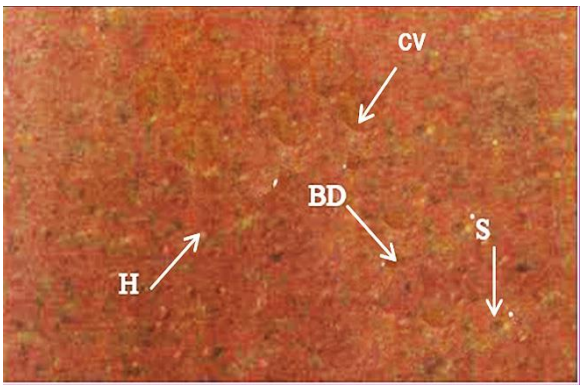


Fig. 6"Histology of liver of *Etroplussuratensis* (15 X) CV-central vein S-sinusoid H-hepatocyte, BD-bile duct

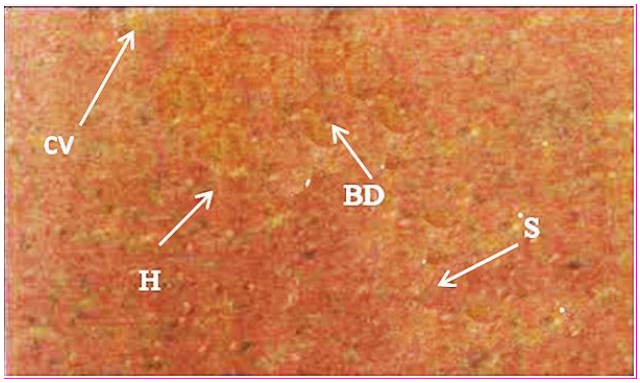


Fig. 7 "Histology of liver of *Etroplussuratensis* – Veli Lake"Vellayani Lake" (15 X) CV-central vein S-sinusoid H-hepatocyte, BD-bile duct

DISCUSSION AND CONCLUSION

There is a leading interest in the study of haematologicalparameters and features of fish blood cells regarded as important for aquaculture purposes. Blood is a mirror image of all the vital processes taking place inside the organism.So the blood parameters are used for understanding the biological process taking place in the fish species.Fishes show abnormal effects due to food, habitat, temperature, $P^H$and many other elements of environment. Fish blood is being studied in toxicological research and environmental monitoring as a possible indicator of physiological and pathological change in fishery management.

RBC of an organism determines the carrying capacity of dissolved oxygen.The high RBC number was associated with fast movement, predaceous nature and high activity,within stream lined body (Rambhasker and Srinivasa Rao, 1986)[17].The elevated erythrocytecounts &Hb concentration are response to the higher metabolic demand and have no impact on erythrocyte volume.

Increased RBC number indices oxygen demand in tropical region to meet the higher oxygen requirement at higher metabolic rates (Engel and Davis, 1964)[18].Hb value in the present study was within the range low haemoglobin value is associated with the low active fishes. Similar results were already reported by (Rambhasker and Srinivasa Rao 1986)[17]. RBC andHb concentration tend to increase with length and age of the fishes (Das, 1965). There is an inverse relationship betweenWBC and RBC count. High RBC count perhaps lessens the requirement for large number of WBC (Xiaoyn*et al.*, 2009)[19] .Biochemical parameters in the blood shows significant variations ($p<0.01$) were observed for

the concentrations of glucose,protein and cholesterol. The ranges of serum biochemistry vary from species to species and can be influenced by many biotic and abiotic factors such as water ,temperature,seasonal pattern,food,age,and sex of the fish(Jawad*et al*.,2004)[6].An increased blood glucose and protein level was recorded in Etroplus.This may probably be due to an increased depletion of liver glycogen(Ojolick*etal*., 1995)[20]. Blood glucose level may vary according to season and water temperature, and age and size of fish (Coz-Rakovac*etal*., 2005)[21].

Blood is a very sensitive tissue that is affected by environmental changes so, by the current comparative research related to the haematological and biochemical profile of the blood serum of fish, the evaluation of environmental pollution in these two different lakes has been carried out. In this relation, the comparative studies of different fishes have shown that these parameters are good indicators for assessing the quality of water, respectively water pollution with heavy metals (Kopp *et al*., 2013)[22]. Water contamination with heavy metals can cause changes in haematological parameters and this is noted in the current research. This difference in the RBCs may be due to chronic exposure to heavy metals. The effect of Cd in reduction of RBCs has been noted also in the work of Al-Asgah*et al*., (2015)[23]and Gill andEpple,(1993)[24] who found significant reduction of RBCs in fish exposed to Cd. Other blood parameters such as MCV, MCH and MCHC are important in diagnosing animal anaemia (Coles, 1986)[25]. The increasing values of these indicators appear in the case of various anaemia, though one of the first indications of metal poisoning might be anaemia. Increase of these values can be attributed to the reduction of RBCs caused by heavy metals toxicity. These results are in agreement with the results of Al-Asgah et al. (2015)[23], who reported that exposure of carp with Pb and Cd causes significant increase in MCV (mean corpuscular volume), MCH mean corpuscular haemoglobin) and MCHC (mean corpuscular haemoglobin concentration). All these findings are confirmed by the fact that Veli Lake is more polluted than Vellayani Lake and this is the reason for the ill health of the local fish.

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