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Haematological indices of Indian major carps cultured in West Godavari region of Andhra Pradesh

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Abstract
Haematological parameters are repeatedly used as an essential tool to assess the health condition of fish. Although fish haematology continues to offer the potential of a valuable tool, progress in establishing normal range valves for blood parameters has been slow and literature in this area is isolated, old and often incomplete. The purpose of this study was to assess the reference values of some haematological parameters of three Indian major carps *Labeo rohita, Catla catla, Cirrhinus mrigala* which are mostly cultured collected from different freshwater ponds in West Godavari district of Andhra Pradesh from August 2014 to July 2015. Variation in haematological parameters such as erythrocyte count, total leucocytes count, haemoglobin, hematocrit, mean corpuscular volume (MCV) and mean corpuscular haemoglobin concentration (MCHC) of fish were observed when compared to the earlier reference values. So a continuous assessment is essential for establishing the reference values in the field of haematological research basing on the area of the study and time durations.

Keywords: Haematological parameters, *Labeo rohita, Catla catla, Cirrhinus mrigala*

Introduction
Aquaculture represents one of the fastest growing food producing sectors. Fish diseases constitute one of the most important problems and challenges fish culturists. Haematological parameters are frequently used as an essential diagnostic tool to assess the health condition of lower vertebrates due to the increasing emphasis on pisciculture and greater awareness of population of natural water resources (Bhaskar and Rao, 1985) [4]. The regular monitoring of fish blood serves as the diagnostic purpose in establishing the health status of fish. By analyzing blood cell characteristics some clues for diagnosis and prognosis of the disease state may be found (Anderson, 2004) [3]. There are several publications, reports on haematological aspects of the vertebrate species in order to correlate their physiology and evolution, but a break through knowledge of fish physiology is becoming more imperative due to diagnostic evolution, economic importance and comparative study of fish. In recent years, blood parameters have been commonly used to observe and follow the quality of fish (Bhaskar and Rao, 1985) [4]. One of the difficulties in assessing the state of propagation has been the paucity of reliable references under natural habitat. In pursuant to this objective, many fish physiologists have concentrated to haematological studies probably because it has proved a valuable diagnostic tool in evaluating fish quality. (Hesser, 1960; Anderson and Klontz, 1965; Kori-Siakpre *et al*., 2005; Oluyemi *et al.,* 2008) [8, 2, 11, 12].
Haematological parameters can be used as base for the indicators of disease or stress in the fish and its pathological state. With this, an effective health management programme can be covered at all levels of aquaculture activity, from the production unit, farm, district/local or zone levels, to the national and regional/international level. Haematological studies offer the easiest, cheapest and most reliable methodology to diagnose the status of fish health and treatment of diseases. By addressing the health questions, both the economic and socio-economic conditions of the aqua farmer may be improved. By studying the fish haematological conditions in the pond, the environmental status in that particular area can be estimated and necessary precautions can be taken without further demand to the other organisms. Study of haematological parameters in fish species make useful in assessing the whole aquatic environment of the area. For this reason, there is few data on normal haematological values, including these on carps, some of which was described long ago (Blaxhall and Daisley, 1973) [5].

Some studies were made for the fish inhabiting natural and artificial lakes (Orun *et al.*, 2003; Gabriel *et al*., 2004; Svobodova *et al*., 2006; Zexia Gao *et al*., 2007) [13, 7, 19, 21].

Aquaculture in West Godavari District of Andhra Pradesh has brought many changes in land usage, occupational shifts and in the living conditions. Thousands of acres of paddy fields are turning into fish ponds in the delta region, especially the mandals located on the border of West Godavari district. According to estimates, fish farming is being taken up in more than one lakh acres but the officials records say that fish farming is done in 75,000 acres and shrimp farming in 5,000 acres. A multitude of factors has contributed to the health problems currently faced by aquaculture. Over the past three decades, aquaculture has expanded, intensified and diversified, based heavily on movements of animals and animal products such as brood stock, seed, and feed. Such movements are now clearly recognized as having played a pivotal role in the introduction and spread of pathogens and disease into aquaculture systems. Haematology the fishes lags behind that of other classes of vertebrates, but analysis of blood still can of be informative about disease processes in fishes. Although robust interpretation of fish hemograms often is hampered by a lack of reference values, this knowledge deficit represents an opportunity for expansion of clinical pathology studies among fishes. The blood constituents in fishes are influenced by factors like temperature ecological habitat, food selection and mode of life. Therefore, it is difficult to establish any normal values for the class as a whole. But, if data are collected for different species as well as within species under different conditions some normal ranges of values can be arrived at, which can form a valuable diagnostic aid in fisheries. Any deviation from this normal may be a clue to the physiological and pathological states of the animal. Although fish haematology continues to offer the potential of a valuable tool, progress in establishing normal range valves for blood parameters has been slow and literature in this area is isolated, old and often incomplete. So the present study is taken up to analyse the haematological parameters of Indian major carps *Labeo rohita, Catla catla* and *Cirrhinus mrigala* which are mostly cultured in West Godavari district region.

Materials and Methods

Study area and sample collection

Data of the different types of fish cultured in the 46 mandals of West Godavari district was collected and of the different freshwater fish, the most widely cultured fish such as *Labeo rohita, Catla catla* and *Cirrhinus mrigala* were selected irrespective of the sex and from the different areas in the selected mandals. Ten samples from each fish weighing between 460-590 gms and their total length between 21-33 cm were collected for the present study.

Blood sample collection

Blood sample was collected from caudal peduncle and heart by cardiac puncture using disposable plastic syringes fitted with 26-gage needle which was already moisturized with heparin and expelled into separate heparinised vials and stored in refrigerator for further analysis.

Haematological examination

Total RBCs count and WBCs count were determined by using Improved Neubauer haemocytometer. (Hesser, 1960) [8], Haemoglobin (Hb) concentration was estimated by cyanmethemoglobi (Blaxhall & Daisley, 1973) [5] and hematocrit value (Hct) was determined by micro hematocrite capillary tube (Wintrobe, 1967) [20]. Differential leukocyte count was done by using giemas's staining method (Abdul wahid shah *et al.,* 2009) [1]. Mean cell haemoglobin concentration (MCHC), mean cell haemoglobin (MCH), and Mean cell volume (MCV) were calculated using the formulae mentioned by Dacie and Lewis (2001) [16].

Statistical analysis

Haematological data results were subjected to one-way analysis of variance (ANOVA) by using the SPSS 17 for windows. Differences between means was determined by Duncan multiple range test ($p<0.05$). The correlation between haematological variables was analyzed by Pearson coefficient for linear correlation (r) at $p<0.05$.

Results and Discussions

Hematological indexes are an important tool for assaying physiological and pathological changes, and they are used by fish biologists in many parts of the world. Since hematological analysis supplies valuable knowledge for effectively controlling the condition of both wild and cultured fishes, studies of blood parameters have been carried out to determine the systematic relationship among certain species and to obtain knowledge of their physiology and health status under adverse conditions. Great attention has been paid recently to blood biochemical parameters as indexes of the physiological state of the internal milieu. The hematological features of fish blood could be useful for monitoring and assessing the physiological status and health condition of fish at a superlative level. Evaluating blood parameters involves determining total erythrocyte count (RBC), total leucocyte count (WBC), hematocrit (PCV), Haemoglobin concentration (Hb), and erythrocyte indexes (MCV, MCH, MCHC), differential leucocyte count such as thrombocytes, monocytes, large lymphocytes, small lymphocytes, neutrophils, eosinophils, basophils. The hematological parameters of the Indian major carps are noted in the Tab1

Earlier studies on haematological parameters in *Labeo rohita* include the works of Khan *et al*., (1969) [10] and Siddiqui and Naseem (1978) [17]. The works of Siddiqui and Naseem reported that the haemoglobin percentage was 9.8% and the erythrocyte count 2.11 x 10^6/cmm, while the total leucocyte count was 5470 /cmm. Qayyam *et al*., (1969) [15] studied the differential leucocyte in *Labeo rohita* from the University fish farm, Aligarh Muslim University, Aligarh and reported thrombocytes 60.2%, lymphocytes 34.5%, neutrophils 3.5%, and eosinophils 1.7%. In the present study differential leucocytes count in *Labeo rohita* was recorded to be thrombocytes 59.2%; monocytes 2.2%; lymphocytes 30.4%; neutrophils 3%; eosinophils 1.6%; basophils 1.8%.

Sudha Summarwar and Santosh Verma (2012) [18] observed that RBC in *Labeo rohita* 2 x 10^6 /mm^3 and Kandeepan (2014) [9] reported haematological parameters in Labeo rohita as RBC 1.5 x 10^6/mm^3, WBC 4.5 x 10^4/mm^3, Lymphocyte 44%, Polymorphonucleocyte 50%, Eosinophil 1.10%, Thrombocyte 1 x 10^4/mm^3, Haemoglobin 4%, MCH 10 pg, MCV 42.71 µl x 10^{-9}, MCHC 4.88%, Hematocrit 82%, ESR 5 mm/h, Blood Glucose 60 ± 0.05 mg/100ml. The values of haemoglobin 8.64% and the total erythrocytes 1.43 x 10^6/ mm^3 in the present study are slightly lower, while the leucocyte count is higher 11,782/cmm compared to Siddiqui and Naseem (1978) [17].

Earlier studies on the haematological parameters of *Catla catla* include the studies of Khan *et al*., (1969) [10] and Rao and Behra (1973) [16]. Rao and Behra (1973) [16] reported that the erythrocyte count in the samples of *Catla catla* studied by them range between 1.76 and 2.89 millions/mm^3 (x = 2.28); leucocyte count varied between 7,400 and 11,500/cmm (x = 9,241); haemoglobin range between 7.5 and 11% (x = 9.14). Qayyum *et al*., (1969) [15] recorded the differential leucocyte count in *Catla catla*. The differential leucocyte count reported by them was; thrombocytes 63.2%, neutrophils 3.8%, lymphocytes 0.6%, eosinophils 1.2%. Rao and Behra (1973) [16] also studied the differential leucocyte in catla and reported; thrombocytes 30%, lymphocytes 32%, neutrophils 18% and eosinophils 16%. The differential leucocyte count recorded in *Catla catla* in the present study was; thrombocytes 60.4%, monocytes 2.6%, lymphocytes 30%, neutrophils 3.2%, eosinophils 2% and basophils 1.6% were in accordance with the finding of the earlier authors.

According to Binod Bihari Patra *et al*., (2014) hematological factors of *Catla catla* were found to be influenced by seasonal variations. The total number of erythrocyte ranged from 1.644 x 10^6 and 1.44 x $10^6/mm^3$, total leukocyte count varied between 3.754 x 10^3 and 4.124 x $10^3/mm^3$ of blood, hematocrit (PCV) varied from 24.24% to 29.39%, MCV value of male fish ranged between 172.10 and 179.90 fl and for female fish 169.80 and 179.00fl, MCH varied between 53.00 and 55.31 ρg in male fish and for female fish it was between 53.01 and 57.00 pg, MCHC value ranged from 30% to 31.80% in male fish where as for female fish it was varied between 31.10% and 32.20%. The data collected during the present study on *Catla catla* show that the range of total erythrocyte count in the present sample is lower (0.96 – 1.92; x =1.42) while total leucocyte count is slightly higher (10,850 – 12,645; x =11,772) in comparison with the earlier studies. Haemoglobin percentage is almost equivalent (7.5 – 9.20; x = 9.08).

Earlier Qayyum and Naseem (1967) [14] studied the haematology of *Cirrhinus mrigala.* The total erythrocyte count was lower (1.48 x $10^6/mm^3$) when as compared to the earlier study (2.21 x $10^6/mm^3$) whereas the total leucocyte count of the earlier report was lower (7260/cmm) compared to the present study (11,386/cmm). The present value of packed cell volume was lower (22.50%) when compared to the earlier value (38.92%). The haemoglobin percentage is almost similar 9.58% to the earlier value 9.1%. Qayyam and Naseem, (1969) [15] recorded the percentage differential leucocyte count to be; thrombocytes 64.7%; leucocytes 29.5%; neutrophils 4%; and eosinophils 1.6%. In the presence study the differential leucocyte was recorded to be; thrombocytes 60.2%; lymphocytes 29.6%; monocytes 2.4%; neutrophils 2.8%; eosinophils 2.2%; basophils 2.2%. A comparison shows that the percentage of thrombocytes and neutrophils in the present samples studied were lower while the eosinophils were slightly higher compared to Quyyam and Naseem (1969) [15].

Table 1: Haematological parameters of Indian major carps

	Labeo rohita		***Catla catla***		***Cirrhinus mrigala***	
Parameter	Range	Mean ± SD	Range	Mean ± SD	Range	Mean ± SD
TEC x $10^6/mm^3$	1.29 - 1.58	1.43 ± 0.20	0.96 - 1.92	1.40 ± 0.03	1.08 - 1.69	1.48 ± 0.28
TLC (/cmm)	11,103 - 12,860	11,782.6 ± 428.1	10,850 - 12,645	11,772± 639.3	10,851 - 12,501	11,386.4± 446.3
Hb (%)	8.2 - 9.1	8.64 ± 0.41	7.5 - 9.2	9.08 ± 0.42	7.8 - 10.1	9.68 ± 0.91
PCV (%)	21.50 - 25.6	23.46 ± 1.21	30.25 - 31.00	30.49 ± 0.25	22.50 - 23.45	23.02 ± 0.38
MCH (pg)	57.5 - 63.5	60.62 ± 2.41	42.7 - 8.12	57.6 ± 9.78	46.31 - 72.20	56.34 ± 11.16
MCHC (%)	35.53 - 38.13	36.85 ± 1.22	43.77 - 48.53	45.88 ± 1.56	34.21 -38.26	35.30 ± 2.01
MCV (μm^3)	214.24 - 245.61	234.98±41.47	162.5 - 166.4	164.8±1.24	162.9 - 166.4	165.9 ± 1.41
Glucose mg/dl	58.59 - 61.33	59.83 ± 0.23	66.51 - 69.16	67.75 ± 0.89	45.61 - 48.15	46.90 ± 1.28
ESR mm/h	2.19 - 2.95	2.43 ± 0.01	2.0 - 2.3	2.1 ± 0.2	2.8 - 3.5	3.1 ± 0.4
Thrombocytes %	54 - 62	59.2 ± 2.78	59 - 64	62.4 ± 1.49	50 - 67	60.2 ± 5.6
Monocytes %	2 - 3	2.2 ± 0.4	2 - 3	2.6 ± 0.48	1 - 4	2.4 ± 1.01
Large Lymphocytes %	2 - 5	3 ± 1.09	1 - 3	2 ± 0.89	3 - 7	5.2 ± 1.32
Small Lymphocytes %	25 - 30	27.4 ± 2.05	26 - 29	28 ± 1.4	20 - 34	24.4 ± 5.71
Neutrophils %	2 - 5	3 ± 1.09	2 - 5	3.1 ± 1.16	1 - 4	2.8 ± 1.16
Eosinophils %	1 - 3	1.6 ± 0.8	1- 3	2 ± 0.6	1 - 4	2.2 ± 0.97
Basophils %	1 - 3	1.8 ± 0.74	1 - 2	1.6 ± 0.48	1 - 3	2.2 ± 0.97

*Values are mean ± S.D. of five individual observations.

Conclusion

The haematological values studies in the present research provide a contribution of knowledge to standardize the haematological parameters in the fish cultured in the West Godavari region of Andhra Pradesh and once the standardized values are obtained, they may be used for immediate reference and necessary precautions may be taken to prevent the disease spread or for the therapy in this area.

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References

1. Abdul Wahid Shah, Muni praveen, Sajad hussain Mir, Sarwar SG, Yousuf AR. Imapact of Helminth Parasitism on fish Haematology of Anchar Lake, Kashmir. pak. jourl of nutrition. 2009; 8(1):42-45.
2. Anderson D, Klontz GW. Basic hematology for the fish culturist, Ann North Fish cul Conf. 1965; 16:38-41.
3. Anderson DP. Diseases of fishes Narendra publishing House Delhi: 2004, 22-73.
4. Bhaskar BR, Rao KS. Some hematological parameters of tarpon, *Megalops cyprinoils* (Broussenet) from Visakhapatnam harbor, Masty. 1985; 11:63-69.
5. Blaxhall PC, Daisley KW. Routine Haematological Methods for use Fish with Blood, J Fish Biol. 1973; 5:771-781.

6. Dacie JV, Lewis SM. Practical haematology, 9th edition. Churchill Livingstone, London. 2001, 663.
7. Gabriel UU, Ezeri GNO, Opabunmi OO. Influence of sex, source, health status and acclimation on the haematology of *Clarias gariepinus* (Burch, 11822). Afr. J Biotechnol. 2004; 3:463-467.
8. Hesser EF. Methods for routine on fish hematology. Prog Fish cult. 1960; 22:164-171.
9. Kandeepan C. Haematological and biochemical parameters on few fresh water South Indian teleosts. Int. J Curr. Microbiol. App. Sci. 2014; 3(9):1015-1022.
10. Khan, Saghir H, Qayyum, Siddiqui A. Differentila blood cell counts of four species of freshwater air-breathing fishes. Proc Indian Acad sci., Sect B, 1969; 69(1):29-35.
11. Kori-Siakpere O, Ake JEG, Idoge E. Hematological characteristicof the African Snakehead, Prachannaabscura. AFJ Biot. 2005; 4(6):527-530.
12. Oluyemi KG, Adecprusi EA, Olanrewage J. Basic hematological parameters in African cat fish, *Clarias gariepinus*(Burchell, 1822) FED ascribe acid supplemented diets Res J Ani Sci. 2008; 2(1):17-21.
13. Orun, Doruca M, Yazlak H. Hematological parameters of three Cyprinid fish species; Onl J Biol. Sc. 2003; 3(3):320-328.
14. Qayyum A, Nassem SM. A haematological study on mrigal *Cirrhiria mrigala* (Hamilton), Curr Sci. 1967; 36(16):435-6.
15. Qayyum Siddique A, Khan SH. Differential Blood cell count counts in three species of Major carps. Curr. Sci. 1969; 1970(4):86-87.
16. Rao MVS, Behera MK. Hematological study on freshwater teleost, *Catla catla* Current Science. 1973; 42(17):612-613.
17. Siddiqui AQ, Naseem SM. The haematology of Rohu, *Labeo rohita*. J Fish. Biol. 1978; 14:67-71.
18. Sudha summarwar, Santosh verma. Study of selected haematological indices of freshwater fish from bisalpur reservoir; Indian journal of fundamental and applied life sciences (online). 2012; 2(2):51-54.
19. Svobodova Z, Kroupova H, Modra H, Flajshans M, Randak T, Savina L. *et al*. Haematological profile of common carp spawners of various breeds. Research Institute of Fish Culture and Hydrobiology, Vodnany, Czech Republic, 2006.
20. Wintrobe M. Clinical hematology, 4th edition. Lea and febiger, Philadelphia, 1967.
21. Zexia Gao, Weimin Wang, Khalid Abbas, Xiaoyun Zhou, Yi Yang, Diana James S *et al*. Haematological characterization of loach *Misgurnus anguillicaudatus*: comparison among diploid, triploid and tetraploid specimens. Comparative biochemistry and physiology. Part A, Molecular & integrative physiology. 2007; 147(4):1001-1008.