Sex Differences in the Haematological Parameters in the Fresh Water Fish, *Notopterus notopterus* (Pallas)

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Received: 27th August 2016
Accepted: 29th October 2016

**Abstract:** Various haematological parameters are significantly influenced by the physiological factors and sex of the fish. In the assessment of the blood parameters it was revealed that the sex may exert some degrees of influence on some of the haematological characteristics and hence there is a need to assess before reporting the haematological indices of the fish species. The present study has been undertaken to know the difference between male and female haematological parameters of the fish, *Notopterus notopterus*.

The haematological measurements such as erythrocytes (RBC), hemoglobin (Hb), hematocrit (Hct), mean cell volume (MCV), mean cell hemoglobin (MCH) and mean cell hemoglobin concentration (MCHC) were compared with regard to sex and the effect of sex on quantitative changes in fish blood was studied. The results of haematological parameters between the sexes indicated that male fishes consistently had higher level than the female fishes and this study may be a proposal as means of sexing fish. This indicates that the male fish is biochemically and nutritionally richer than the female; in female fish it is probable that much of metabolites and nutrients are continuously being exhausted in the development of gonads (ovary). The results of this study could be used for monitoring the health and studying the physiological condition of the fish, *Notopterus notopterus* in a particular aquatic body.

**Key words:** Haematology, fresh water male and female fish, *Notopterus notopterus*

**Introduction**

Blood chemistry and hematological measurements can provide valuable tools for monitoring the health and condition of both wild and cultured fish. Physiological indices can offer critical feedback on rearing conditions and nutritional status and can aid in the diagnosis of disease. Some authors reported quantitative difference between the blood parameters of male and female fishes (Van Vuren and Hatting, 1978). The values of different haematological parameters are significantly influenced by the physiological factors and sex of the fish.

In the assessment of the blood parameters it was revealed that the sex and period of acclimation may exert some degrees of influence on some of the haematological characteristics of *Clarias gariepinus* (Gabriel *et al.*, 2004) and hence, the need to reckon with these factors in the assessment and reporting of the haematological indices of fish species.

The present study was undertaken to know the differences in haematological parameters between male and female fish, *Notopterus notopterus*. 
Material and methods
Live specimens of fresh water fish, *Notopterus notopterus* were collected from Bheema River near Gulbarga and transported in aerated containers to the laboratory. The blood samples from fish were obtained from the caudal circulation with the aid of a disposable plastic syringe and a 21 gauge disposable hypodermic needle. After collecting blood sample, fish were sacrificed and dissected to know the sex and accordingly the test tubes were marked as ‘M’ for male and ‘F’ for female.

Hemoglobin was measured using the standard cyanmethemoglobin method described by Baker and Silverton, (1976). Erythrocyte (RBC) count was determined using Neubaur’s haemocytometer according to Dacie and Lewis (1984). Haematocrit value was determined by standard Wintrobe method, and expressed in percentage. Mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC) and mean corpuscular volume (MCV) was calculated.

Observation
The haematological parameters (erythrocyte count (RBC), hematocrit, hemoglobin contents, MCV, MCH, and MCHC) of the both sexes of fish, *Notopterus notopterus* are presented in the Table - 1. The numbers of erythrocytes (RBC) in the fish *N. notopterus* indicate that males had higher concentrations than females. The males have higher levels of hemoglobin and hematocrit than females. With respect to haematological indices the values of MCV in males are having higher values than the females. MCH and MCHC in males are found to have higher values than the females.

<table>
<thead>
<tr>
<th>Haematological parameters/Sex of fish</th>
<th>Male</th>
<th>Female</th>
</tr>
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<tbody>
<tr>
<td>Erythrocytes (RBC)</td>
<td>1.51 ± 0.07</td>
<td>1.28 ± 0.14</td>
</tr>
<tr>
<td>Haemoglobin (Hb)</td>
<td>7.74 ± 1.25</td>
<td>6.60 ± 1.14</td>
</tr>
<tr>
<td>Haematocrit (Hct)</td>
<td>22.83 ± 3.55</td>
<td>18.72 ± 2.99</td>
</tr>
<tr>
<td>Mean cell volume (MCV)</td>
<td>141.86 ± 63.92</td>
<td>139.33 ± 12.78</td>
</tr>
<tr>
<td>Mean cell haemoglobin (MCH)</td>
<td>55.94 ± 6.52</td>
<td>46.22 ± 4.15</td>
</tr>
<tr>
<td>Mean cell haemoglobin concentration</td>
<td>36.94 ± 1.45</td>
<td>33.87 ± 2.67</td>
</tr>
</tbody>
</table>

Erythrocytes count in (millions /µL), Haemoglobin in (gr/dl) Haematocrit in (%), Mean cell volume in (fl), Mean cell haemoglobin in (pg), Mean cell haemoglobin concentration in (%) Each value expressed as Mean ±SD, N = 6

Discussion
Hematological parameters of fish are closely related to the response of fish to environmental and biological factors (Fernandes and Mazon, 2003). For example, in response to ecological and physiological conditions, major changes occur in the fish blood composition, such as fluctuations in the levels of red blood cells (RBC), hematocrit (HCT), hemoglobin (HB) concentration and other basic components. Therefore, analysis of blood indices is a valuable guide for assessing the condition of fish, as it provides a reliable index of their physiological condition, a set of data that is especially important in fish aquaculture (Alyakrinskyaya and Dolgova, 1984). Gabriel *et al.* (2004) revealed that the source of fish (wild or pond) and sex, may exert some
degrees of influence on some haematological characteristics of fish Clarias gariepinus. Erythrocytes are the dominant cell type in the blood of a vast majority of fish species and high erythrocyte number was associated with fast movement, predaceous nature and high activity with streamlined body (Rambhaskar and Srinivasa Rao, 1986). The fish N. notopterus exhibits fast movement, predaceous nature and is very active with streamlined body and the erythrocyte count was found to be more as their exists difference between the sex. The mean erythrocyte counts for males have higher concentrations of cells than the females. Such variation of erythrocytes counts between sex have been reported for Prochilodus lineatus (Parma De Croux, 1994) and African snakehead Paranchana obscura (Kori-Siakpere et al. 2005). The values reported for N. notopterus are within the range found for other fish species. The haemoglobin is crucial to the survival of the fish as its role is directly related to the oxygen binding capacity of blood. The haemoglobin concentration in the fish N. notopterus was found to be within the range reported for other fishes like Paranchana obscura and Labeo rohita, (Seddiqui and Naseem, 1979). Haematocrit provides a measurement of red blood cells (erythrocytes) count in whole blood, while the hemoglobin within these erythrocytes. Studies on sexually matured gold fish (Carassius auratus) (Summerfelt, 1967), brook trout (Salvelinus fontinalis) and brown trout (Salmo gairdneri) showed that males consistently had higher haematocrite values than the females and this has been proposed as means of sexing fish. In the present study, males exhibited higher haematocrit and haemoglobin levels than females. Lane (1979) also observed significantly higher haematocrit and haemoglobin levels in male versus female in the fish rainbow trout. These differences in hematology with regard to males and females may be related to differential oxygen demand by sex, which in turn may be related to reproductive activity. With respect to haematological indices the values for mean cell volume (MCV) were similar to the findings of Terry et al. (2000), Nilza et al. (2003) and Gabriel et al. (2004). The haematological indices such as MCH and MCHC in the fish Prochilodus lineatus in males was higher than females reported by Parma De Croux (1994) and also in the fish Salminus maxillosus (Rainza – Paiva et al., 2000). In the present study for fish, N. notopterus, the MCH and MCHC in males have higher values than the females, indicating sex difference. In the assessment of blood parameters of goldfish, Carassius auratus, Summerfelt, (1967) observed that males consistently had significantly higher haematological values than the females and suggested the need to separate blood component data on the basis of sex to avoid attributing sex differences to other factors. The results found in the fish N. notopterus, suggests that males are having higher haematological indices than females.

Conclusions

The haematological parameters studied between the sexes of the fresh water fish, Notopterus notopterus indicated that male fish consistently had higher level of haematological parameters than the female fish and this may be because of physiological activity and it may be a proposal as means of sexing fish. This indicates also that the male fish is biochemically and nutritionally richer than the female. However, in female fish it is possible that much of metabolites and nutrients are continuously being exhausted in the development of gonads (ovary). The results of this study could be used for monitoring the health and studying the physiological condition of the fish, Notopterus notopterus in a particular aquatic body.
Acknowledgement
The author is grateful to University Grants Commission, New Delhi for Emeritus fellowship No. F-6-6/2014-15/EMERITUS-2014-15-GEN-3514 (SA-II). Thanks are also extended to Prof Vijaykumar, Chairman of the Department and to Gulbarga University for providing facilities to carry out this work.

References


