BIOSCIENCES BIOTECHNOLOGY RESEARCH ASIA, June 2012. Vol. **9**(1), 437-440

Age and Size Related Variations in the Haematological Parameters of *L. boga* and *L. bata*

Kadambri Gupta, Sheetu Raina*, Anupriya Sachar and Krishma Gupta

Department of Zoology, University of Jammu, Jammu, J & K - 180 006, India.

(Received: 15 February 2012; accepted: 09 April 2012)

Studies made on two minor carps, *L. boga* and *L. bata* of varying length groups depicted that certain haematological parameters viz., Total erythrocyte count (TEC), Total leucocyte count (TLC), Haemoglobin (Hb), Haematocrit (Hct) and Mean corpuscular haemoglobin concentration (MCHC) rise with their increasing age and size while Mean corpuscular haemoglobin (MCH) and Mean corpuscular volume (MCV) values declined in higher age and size groups. In the differential leucocyte count (DLC), agranulocytes (monocytes and lymphocytes) and granulocytes viz., neutrophils, eosinophils and basophils increased with increasing age and size of both the fish species.

Key words: Haematological Parameters, *L. boga* and *L. bata*.

Blood is the most accessible tissue of the fish body which can be frequently examined to assess the physiological status of fish. The analysis of blood parameters has been used as a relevant tool in detecting the diseases (diagnosis and prognosis) that afflict fishes (Tavares-Dias and Maraes 2004) as well as it indirectly also assists in monitoring the aquatic ecosystems (Kori-Siakpere *et al*., 2005). Therefore, the use of blood parameters in diagnosing the health condition of fish is acquiring acceptance world wide, as a valuable tool in the management of fish farms (Blaxhall and Daisley, 1973). The variations in haematological parameters tend to vary depending on age (Lysaya, 1951 and Ostrumova, 1960), sex (Callazos *et al*., 1998), season (Jamalzadeh and Ghomi, 2009) and size of the fish (Sharma and Joshi, 1985). Inspite of the vast number of reports on the haematological parameters of different fish species, only a few studies have investigated the relationship between the haematological parameters and aspects of fish biology such as body size, age, season, sex etc.

Against this scenario, presently an attempt has been made to evaluate the variations in the haematological parameters of two fish species viz., *L. boga* and *L. bata* in relation to their body size and age.

MATERIAL AND METHODS

The fishes for the present studies were procured from the Nagrota stream of River Tawi with the help of cast net for a period of two years (Nov.2008-Oct.2010). After acclimatization, the fishes of different size and age were subjected to clinical observations for various blood parameters viz., TEC, Hb, Hct, MCH, MCHC, MCV, TLC and DLC following standard techniques and formulae.

* To whom all correspondence should be addressed.

TEC and TLC were counted with the help of improved Neubauer haemocytometer (Maule and schreck, 1990). Hct was determined by centrifugation method (Wintrobe, 1967). Hb was estimated using Sahli's haemoglobinometer (Dethloff *et al*., 1999). DLC was carried out by Leishman-Geimsa stain (Anderson, 2003). Age was determined by counting the growth rings on the scales (Johal and Tondon, 1985). Results were differentially pooled in groups according to age and size range of fishes. *Labeo boga* were categorized into Group I, II and III and *L. bata* into Group I and II (Table). The results obtained were analyzed statistically by two-way analysis of variance by SPSS software.

RESULTS AND DISCUSSION

Observed haematological indices

The mean values of the observed haematological parameters viz., TEC, Hb, Hct and TLC of two fish species (Table 1 and 2) clearly reveals a rising trend in their values with increasing size and age of both the fishes. The TEC dependent parameters viz., RBC and Hb represents the oxygen carrying capacity of the fish. Therefore these

Table 1. Age-Size related variations in the haematological parameters of the fish *Labeo boga* (Mean±S.D.)

Parameters Mean±S.D.	Group I		Group II		Group III	
Age	1+(9.9-12.5cm)		2+(13.0-19.7cm)		3+(21.0-25.4cm	
Length	(7.87-17.22gms)		(18.17-72.42gms)		0(83.99-170.75gms)	
Weight						
Year	N0v08 -Oct09	Nov09 -Oct10	N0v08 -Oct09	Nov09 -Oct10	N0v08 -Oct09	Nov09 -Oct10
TEC	3.21±0.53	3.18±0.66	3.81±0.54	4.25±0.40	4.02±0.48	4.41±0.34
Hb.	6.64±0.54	6.74±0.83	7.5±0.99	8.35±1.04	7.86±0.96	8.38±1.13
Hct.	26.84±2.29	27.91±4.08	29.49±3.26	30.91±4.19	30.57±1.91	30.8±2.54
MCV	27.67±8.51	29.56±9.43	21.07±5.05	17.14±1.09	19.44±3.77	15.85±0.97
MCH	2.10±0.25	2.16±0.23	1.97±0.09	1.96±0.07	1.96±0.07	1.89±0.12
MCHC	24.77±0.97	24.26±1.20	25.40±1.47	27.07±0.97	25.64±1.72	26.77±1.19
TLC	12.35±2.30	12.67±3.06	14.47±3.17	17.63±2.29	15.69±3.11	18.85±2.79

Table 2. Age-Size related variations in the haematological parameters of the fish *Labeo bata*. (Mean±S.D.)

Parameters Mean±S.D.	Group I		Group II	
AgeLength	1+(9.5-14.2cm)		2+(15.9-22.7cm)	
Weight	(10.31-23.7gms)		(85.15-142.0gms)	
Year	N0v08 -Oct09	Nov09 -Oct10	N0v08 -Oct09	Nov09 -Oct10
TEC	3.29±0.86	3.93±0.70	3.90±0.70	3.87±0.86
Hb.	7.92±1.56	9.01±0.85	8.36±1.26	12.51±13.48
Hct.	28.33±3.73	31.37±2.74	30.88±4.90	31.12±5.60
MCV	29.78±11.68	21.70±6.88	22.07±7.15	22.47±7.70
MCH	2.44±0.21	2.33±0.24	2.15±0.09	2.24±0.12
MCHC	27.75±2.27	25.47±9.22	27.13±1.31	28.21±2.65
TLC	15.51±3.89	18.67±2.21	16.08±3.25	16.11±3.58

haematological parameters serve as indicators of the aerobic capabilities of the fish (Tavares-Dias *et al*., 2008). Presently, as the size and age of the fishes advances, both RBC and Hb have been observed to manifest significant increase ($p<0.01$). Increase of RBC and Hb simply suggests that it help to meet the increasing metabolic demands of the growing fish species. The present findings corroborates the work of Dombrowski (1953), Murachi (1959), Preston (1960) and Das (1965) as they also stated that RBC and Hb values tend to increase with advancing size and age of the fishes. They attributed such age related increase to meet the metabolic demands of the growing fishes. Contrary to present findings, Joshi and Tandon (1977) too reported that with increase in length and weight in *Clarias batrachus*, there is a corresponding increase in the blood values (RBC and Hb) also but only upto certain age till they attain their peaks. They further added that thereafter these values tend to either fall or may almost become constant. Elaborating it further, they stated that as fishes grow older they become less active and their metabolic rate decreases and so does their blood values. In present case as at none of the point during the studied period a fall in blood values could be observed, it therefore implies that these fishes are still growing and that in these fishes the age at which senility sets in has still not reached and hence increase in blood values in *L. boga* and *L. bata* get explained.

Similar to RBC and Hb, Hct another TEC dependent parameter too observed significant increase ($p<0.01$) with the increase in size and age of both the fish species (Table 1 and 2). Increase in RBC and Hb in growing fishes is just to meet their ever increasing oxygen demand. Their size and age related increase gets clearly authenticated by increase in the Hct values also. It means that as RBC increases, Hb increases and so does the Hct i.e. the packed cell volume of the growing fishes (Table 1 and 2). Present author also relates the increase in Hct values with the reproductive potential of the growing fishes. As the fish becomes sexually mature (1+ in *L. boga* and 2+ in *L. bata*), the energy requirement now gets diversified towards the reproductive preparation of these fish species. In this context, the observations of Jawad *et al*. (2004) that rise in Hct values with the advancement of size and age of the fish is due to physiological factor evoked by high energy demand during the breeding period of fish simply supports the present viewpoint.

TLC in tune with TEC has also been found to exhibit significant increase ($P<0.01$) in both the fish species with the advancing age and size (Table 1 and 2). Increase in leucocytes in growing fish means the strengthening of immune system and preparing them to cope up or resist the various stressors (both natural as well as anthropogenic) which they may encounter in their natural environment. Joshi and Tandon (1977) however, stated that increasing length and weight of fish *Clarias batrachus* is correlated with corresponding increase in WBC counts upto a certain age after which the values become constant or tend to fall. Such fall presently could not be observed which simply means that age and size when these parameters become constant has not been achieved in presently studied fishes. Explaining it they held they held that the fishes become less active and their metabolic rate is retarded as it grows older. However, according to present authors, TLC is directly related to the immune functioning of fish. Thus as the fishes grow older, TLC increases to make their immune system strong enough for the better survival of the growing fishes in the extreme environmental conditions.

Calculated Haematological indices

Among the calculated indices, MCV and MCH has been observed to exhibit significant decline ($P<0.05$) with increase in age and size of both the fish species (Table 1 and 2). Decline in MCV finds a direct relation with increase in TEC values of both the fish species as TEC and MCV have an inverse relationship. MCH in both the fishes has been observed to exhibit decline which should have actually depicted increase because the overall Hb content is increasing. The declining trend of MCH in both the fishes, present author proposes may indicate that these fishes may be suffering from some sort of hypochromic microcytic anaemia in their natural habitat. It simply implies that the fishes may be under the stress of either anthropogenic or natural stressors like temperature, starvation, xenobiotics etc. in their aquatic habitat. Such stress by causing disproportionate reduction of red blood haemoglobin may then seemingly be possible causation of decline in MCH of both the

fish species. Wintrobe (1967) also observed declining trend in MCH as the fish grows older but he attributed it to iron deficiency due to increasing demands of growing fish.

MCHC on the contrary exhibited significant increase ($P<0.05$) in its values which finds association with increasing Hb concentration in both the fish species with the advancing size and age.

From the above discussion, it can be concluded that increase in haematological parameters (both observed and calculated) have been observed in *L. boga* and *L. bata* with their increasing size and age just to meet the increasing energy demands of the growing fishes. However, presently, no such size and age still appear to have been caught where these parameters could become constant or decline. So it can be inferred that present studies were carried upto 3+ age group in *L. boga* and 2+ age group in *L. bata* will advance to still high age and size group so that particular age and size may be detected at which constancy is achieved.

REFERENCES

1. Anderson, D.P. Text book of Fish Immunology, Narendra Publishing House (2003).
2. Blaxhall, P.C. and Daisley, K.W. Routine haematological methods for use with fish blood. *J. Fish. Biol*., **5**: 771-781 (1973).
3. Collazos, M.E., Ortego, E., Barriga, C. and Rodriguez, A.B. Seasonal variation in haematological parameters in male and female *Tinca tinca*. *Molecular and Cellular Biochemistry*, **183** (1-2): 165-168 (1998).
4. Das, B.C. Age related trends in the blood chemistry and haematology of the Indian carp (*Catla catla). Gerontologia*, **10**: 47-64 (1965).
5. Dethloff, G.M., Schlenk, D., Khan, S., Bailey, H.C. The effects of copper on blood and biochemical parameters of rainbow trout (*Oncorhynchus mykiss*). *Arch. Environ. Contam. Toxicol*., **36**: 415-423 (1999).
6. Dombrowski, H. Intersicjingem ibr dos Karpfens (*Cyprinus carpio)* und einigeranderer sussawasser fischarten. *Biol, Zbl. Ed.*, **72**: 182-195 (1953).
7. Jamalzadeh, H.R. and Ghomi, M.R. Haematological parameters of Caspian salmon, *Salmo trutta caspius* associatedwith age and season. *Marine and Freshwater Behavior and Physiology*, **42** (1): 81-87 (2009).
8. Jawad, L.A., Al-Mukhtar, M.A. and Ahmed, H.K. The relationship between haematocrit and some biological parameters of the Indian shad, *Tenualosa ilisha* (Family Clupeidae). *Animal Biodiversity and Conservation*, **27** (2): 47-52 (2004).
9. Johal, M.S. and Tandon, K.K. Use of growth parameters in *Labeo rohita* (Pisces, Cyprinidae). Vestnik Ceskoslovenske sploenscnosti. *Zoologicke*, **49**: 101-107 (1985).
10. Joshi, B.D. and Tandon, R.S. Seasonal variations in haematologic values of freash water fishes, *Hetropneustes fossilis* and *Mystus vittaus. Comp. Physiol. Ecol*., **2** (1): 22-26 (1977).
11. Kori-Siakpere, O., Ake, J.E.G. and Idoge, E. Haematological characteristics of the African snakehead, *Parachanna obscura. African Journal of Biotechnology*, **4** (6): 527-530 (2005).
12. Lysaya, N.M. Cahnges in the blood composition of *Salmo* during the spawning migration. *Izy. Tikhvokeassk. Nauch. Issled. Inst. Rybn. Khoz. Okeanogr*., **35**: 47-60 (1951).
13. Maule, A.G., Schreck, C.B. Changes in number of leucocytes in immune organs of juvenile Coho salmon after acute stress on cortisol treatment. *J. Aquat. Anim. Health*., **2**: 298-304 (1990).
14. Murachi, S. Haemoglobin contents, erythrocyte sedimentation rate and haematocrit of the blood in young of the carp *(Cyprinus carpio). J. Fac. Anim. Husb*. Horoshima Univ., **2**: 241-247 (1959).
15. Ostumova, I.N. A physiological evaluation, on the basis of blood indices of *Salmon* fry cultivated under various conditions. *Rybn. Khoz. Moscow*., 112-121 (1960).
16. Preston, A. Red blood value in the Plaice. *J. Mar. Biol. Assn. U.K*., **39**: 681-687 (1960).
17. Sharma, T. and Joshi, B.D. Effect of seasonal variation on some haematological values of hillstream fish *Tor putitora*. *J. Adv.Zool.*, **6** (1):39-45 (1985).
18. Tavares-Dias, M. and Mores, F.R. Hematologia de peixes teleosteos. *Ribeirao Preto, Sao Paulo*, **144** (2004).
19. Tavares-Dias, M., Moraes, F.R. and Imoto, M.E. Haematological parameters in wo neotropical freshwater teleost, *Leporinus macrocephalus* (Anostomidae) and *Prochilodus lineatus* (Prochilodontidae). *Bioscience Journal*, **24**: 96-101 (2008).
20. Wintrobe, M.M., Clinical Haematology "VI ED., Philadelphia, Lea and Febiger, 236-243 (1967).