



SEASONAL, SEX AND SIZE VARIATION IN SOME BLOOD PARAMETERS OF SNAKEHEAD FISH (*PARACHANNA OBSCURA*, GUNTHER 1861) IN OSE RIVER, SOUTHWEST - NIGERIA

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Abstract

Samples from a natural population of snakehead fish (*Parachanna obscura*) from Ose River were used in a 24-month study to verify seasonal, sex and size variation in packed cell volume, haemoglobin and total plasma protein. Blood characteristics were better during wet season for both sexes and size - groups. There were no significant difference in blood characteristics between the males and females while the juveniles had better blood characteristics than the adults. Since lower values of blood characteristics were obtained during the dry season, management methods in this season should be improved, aimed at preventing reduction in blood value of *P. obscura*.

Keywords: Season, Size, Blood parameter, *Parachanna obscura*, Ose River.

Introduction

Blood is a very good medium of assessing health status of animals (Taiwo and Awosa, 1995). The use of haematological techniques is gaining importance for toxicological research, environmental monitoring and assessment of fish health conditions (Shah and Altindag, 2004). Blood composition is usually altered during disease or malnutrition condition (Kelly, 1979). The knowledge of haematological profile of a fish also indicates its dietary sufficiency and physiological response to environmental stress (Ezzat *et al*; 1974; Fagbenro *et al*; 2000). The application of haematological techniques has proved valuable in monitoring stress responses (Sovio and Oikari, 1976). Haematological variables have been used to detect stress condition such as exposure to pollution, hypoxia and acclimation (Akinrotimi *et al.*, 2009). Fish are closely associated with the aquatic environment and the blood will reveal conditions within the body of the fish long before there is any visible sign of disease (Fernades and Mazon, 2003). The use of haematological parameter as a tool in diagnosing the health condition of fish in the management of fish farms is essential. Change in exogenous factor such as poor water quality, starvation, overstocking and harsh weather are indices of the health of cultivated fish (Basia and Arago, 1988; Adedeji *et al*; 2000). Evaluation of blood analyses will enhance the culture of fish by facilitating early detection of diseases and identification of sub-lethal condition affecting production performance (Yavuscan *et al*; 2005). Gabriel *et al.* (2011) reported that sex and size have some degree of influence on the blood characteristics of *O. niloticus*. One of the commercial fish species of Ose River is *P. obscura*. As one of the tropical rivers, Ose River recedes greatly, breaking into pools during the dry season. There is dearth of information on the changes in the blood characteristics of *P. obscura* in the wild as the weather changes. For this reason, the objective of this study was to assess the effect of seasons, sexes and size- groups on blood characteristics of the species.

Materials and Methods

A total of 174 *Parachanna obscura* comprising 71 juveniles and 103 adults were obtained from Ose River (Figure 1) during the wet and dry seasons, 80 were males and 94 females.

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Insert Fig. 1 Here
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On site, Total length (cm) and weight (g) of fish were measured using a standard fish measuring board and Ohaus triple balance, respectively. Two sets of blood samples (2ml) respectively were collected per fish by puncturing the caudal blood vessels as described by (AQUALEX, 2004), using 2mL plastic syringe with 22 gauge hypodermic needle (Schmitt *et al.*, 2007). The samples were brought in a ice pack to the Department of Environmental Biology and Fisheries' laboratory, Adekunle Ajasin University, Akungba- Akoko, Ondo State, Nigeria, for blood analysis. First set of 2 ml blood was transferred into a tube containing ethylene-diamine-tetra-acetic acid (EDTA), an anticoagulant and stored at 4⁰C in a refrigerator prior to haematological analyses for packed cell volume (PCV) and haemoglobin (Hb) concentration as described by Svobodova *et al.* (1994). The second set of 2 ml blood sample was transferred into a tube containing lithium heparin, (anticoagulant) and centrifuged immediately at 12,000 r.p.m. for 5 minutes in a refrigerated centrifuge. The plasma was collected and stored at 4⁰C prior to analysis for total plasma protein by Golgberg refractometer method (Kohn and Allen, 1995).

Meteorological data during the study period were collated from the Agro- climatological Unit, Ministry of Agriculture and Rural Development, Akure, Ondo State, Nigeria.

Statistical Analysis

All data obtained were subjected to statistical analysis using student's t-test and Pearson's correlation for equality of variance SAS (1988). A probability value of $P < 0.05$ was considered as significant for the two seasons, sexes and size- groups.

Results

Meteorological parameters during the study period indicated that lower water temperature ($24 \pm 0.16^\circ\text{C}$) was recorded in wet season, while higher rainfall and dissolved oxygen $10.97 \pm 0.90\text{mm}$ and $6.90 \pm 0.82\text{mg/L}$, respectively were recorded during the wet season (Table 1).

Table 1: Meteorological Data and Ose River parameters (Mean \pm SD) during the study period (March, 2009 – April, 2011).

Parameters		Dry Season		Wet Season	
		Mean \pm SD	Range	Mean \pm SD	Range
Temperature (%)	Ambient	28.29 ± 0.79	27.31-29.31	24.42 ± 0.89	23.75-25.80
	Water	25.35 ± 1.08	24.10-26.70	24.00 ± 0.16	23.80-24.20
Rainfall (mm)		0.86 ± 0.67	0.05- 1.77	10.97 ± 0.90	10.39 - 12.09
Relative humidity (%)		82.67 ± 0.84	81.91-83.96	88.18 ± 0.70	88.11- 88.27
Transparency (cm)		42.66 ± 0.88	41.50 -44.00	10.00 ± 0.79	9.00 - 11.00
Dissolved oxygen(mg/L)		5.40 ± 0.27	5.00 - 5.80	6.90 ± 0.82	6.00- 8.00
pH		6.20 ± 0.27	5.80 -6.60	6.65 ± 0.30	6.20 - 7.10
Alkalinity(mEq/L)		4.65 ± 0.13	4.50 -4.80	5.12 ± 0.38	4.70 -5.80
Ammonia (mg/L)		< 0.02	< 0.02	< 0.02	< 0.02

Data collated from Agro- climatological Unit, Ministry of Agriculture and Rural Development, Akure, Ondo State, Nigeria.

The results showed that the PCV, Hb and TPP mean values obtained for the juvenile *P. obscura* were significantly ($p < 0.05$) higher than the values for the adult fish (Table 2).

Table 2: Packed Cell Volume (PCV), Haemoglobin (Hb) and Total Plasma Protein (TPP) for Juvenile and Adult *Parachanna obscura* from Ose River.

Parameters	Juvenile (< 100.0g)	Adult (\geq 100.0g)
PCV (%)	25.33 ± 3.51^a	24.87 ± 2.35^a
Hb (g/dl)	11.30 ± 1.18^a	10.43 ± 1.07^a
TPP (g/L)	71.24 ± 10.67^b	62.05 ± 6.00^a

Mean \pm SD: Based on triplicate observations and mean values with different superscripts along the row are significantly different at 5 % probability level.

Where PCV = Packed Cells Volume, Hb = Haemoglobin, TPP = Total Plasma Protein.

The PCV, Hb and TPP obtained during wet season were significantly ($P < 0.05$) higher than values obtained during the dry season (Table 3), while the PCV, Hb and TPP values of the male *P. obscura* were similar ($P > 0.05$) to those of their female counterparts during the wet season. However, in the dry season these values for the female were insignificantly ($P > 0.05$) higher than those of the male (Table 3).

Table 3: Seasonal and Sex variations in Packed Cell Volume, Haemoglobin and Total Plasma Protein of *Parachanna obscura* from Ose River.

Sex	Wet Season			Dry season		
	PCV (%)	Hb (g/dl)	TPP (g/l)	PCV (%)	Hb (g/dl)	TPP (g/l)
Male	$26.79 \pm 3.41^{b*}$	$11.21 \pm 1.19^{b*}$	$66.64 \pm 8.99^{b*}$	$23.81 \pm 2.23^{a*}$	$10.13 \pm 1.15^{a*}$	$63.61 \pm 8.35^{a*}$
Female	$25.57 \pm 2.86^{b*}$	$11.30 \pm 1.33^{a*}$	$63.52 \pm 9.46^{a*}$	$24.05 \pm 1.32^{a*}$	$10.67 \pm 1.15^{a*}$	$64.86 \pm 7.97^{b*}$
Combined	$26.18 \pm 3.18^{b*}$	$11.27 \pm 1.26^{a*}$	$65.08 \pm 9.23^{a*}$	$23.93 \pm 1.78^{a*}$	$10.40 \pm 1.15^{a*}$	$64.24 \pm 8.16^{a*}$

Mean \pm SD: Based on triplicate observations and mean values along the same row with different superscript alphabets are significantly different at 5% probability level.

Mean value along the same column with different superscript asterisk are significantly different at 5% probability level.

Where PCV = Packed Cells Volume, Hb = Haemoglobin, TPP = Total Plasma Protein.

Discussion

Variations from normal values of blood parameters do exist in fish and could be attributed to some internal and external factors (Ighwela *et al.*, 2012). The PCV, Hb and TPP values in *P.obscura* in the study were lower during the dry season than the wet season, this could be due to low level of nutrition, especially protein deficiency, which occurs mostly during the draught. It is known that *P.obscura* are highly predacious, many preferring other fishes, crustaceans, frogs, and smaller reptiles as food in the water column (Odedeyi, 2007; Lee and Ng, 1994, Hsu and Wu, 1979). Such scarcity may be partly responsible for the comparatively low values of PCV, Hb and TPP obtained during the dry season when River Ose recedes and with less vegetal land covered by water. The fact that less vegetal land was covered by water implied that there was less breeding grounds for the prey fish and arthropods for *P.obscura* to feed on. The data obtained in the study demonstrated that the dry season of the year, characterized by higher water temperature, reduced rainfall and lower dissolved oxygen was a stressful period for this fish in the River as indicated by the blood parameters.

The mean haemoglobin concentration for *P. obscura* in the two seasons, sexes and size-groups were high. This was a reflection of high carrying capacity of the blood which is consistent with the correlation of haemoglobin concentration and fish activity. The study agreed with the report of Fagbenro *et al.* (2000) who reported high erythrocyte count and haemoglobin concentration for *Heterotis niloticus*. Lenfant and Johanson (1972) also reported that haemoglobin concentration is higher in fishes capable of aerial respiration. Thus the high haemoglobin concentration value in *P. obscura* is indicative of its air-breathing character.

The packed cell volume and haemoglobin values in *P. obscura* which are indices of oxygen carrying capacity of a vertebrate decreased with increase in size of the fish which agreed with the report of Lagler *et al.* (1977) who reported that oxygen carrying capacity of fishes vary with life history stage, habits and environmental conditions. Summerfelt (1967) reported increased packed cell volume for male fishes prior to the time of spawning but the mean packed cell volume and haemoglobin concentration values for both males and females *P.obscura* were similar, which indicated that there were no differences in the environment and diet of the sexes. The total plasma protein values for combined sexes of *P.obscura* in wet and dry seasons were similar to that of Fagbenro *et al.* (2000) who reported 50-83g/L for *Heterotis niloticus*. Lenhandt (1992) however, reported that the serum protein concentration in pike *Esox lucius* ranged from 21.3-51.0 g/L which was slightly lower than that of *P.obscura* in this study.

Conclusion

It can be concluded that the packed cell volume and haemoglobin concentration parameters of *P. obscura* were influenced by size and season of the year. Blood parameters were better during wet season for both sexes and size-groups. The blood characteristics between the males and females were not significantly different while the juveniles have better blood characteristics. The data presented in this study on blood characteristics of *P. obscura* will contribute to the comparative studies on fish haematology and physiology.

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Annexure

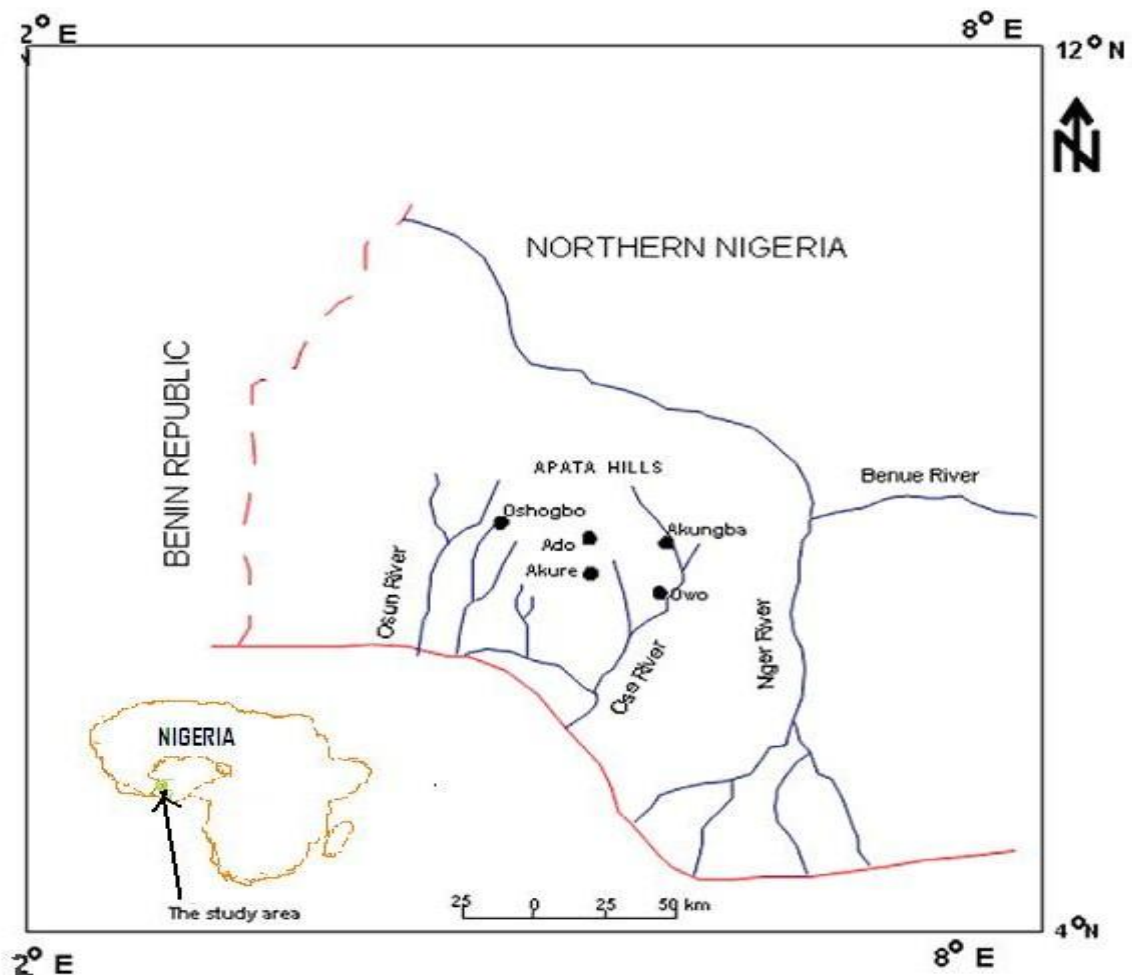


Figure1: Location of Ose River