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Full Length Research Paper

Haematological characteristics of the African snakehead, *Parachanna obscura*

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The haematological characteristics of the African snakehead *Parachanna obscura* includes mean blood haemoglobin concentration of 5.70g/dl, mean haematocrit of 19.20%, mean red blood cell count of 1.67 x 10 ^{12}/L, mean total white blood cell count of 19.07 x 10^{3} mm^{-3}, mean erythrocytic haemoglobin concentration of 29.08%, mean erythrocytic haemoglobin of 39.86 ρg, mean erythrocytic volume of 132.84 μ^{3}, mean total plasma protein of 4.45 g/dl and mean plasma glucose of 67.42 mg/dl. Correlations were found with certain blood parameters as function of the length, weight and condition factor.

Key words : African snakehead, *Parachanna obscura*; haematology, protein, glucose, Nigeria.

INTRODUCTION

One of the difficulties in assessing the state of health of natural fish population has been the paucity of reliable references of the normal condition. In pursuant to this goal, many fish physiologists have turned to studies of hematology, probably because it has proved a valuable diagnostic tool in evaluating human health. 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 and often incomplete (Mawdesley-Thomas, 1971). Only a few normal values for a small number of hematological parameters have been established for some teleosts, but these valves range widely due to the lack of standardized collecting and measuring techniques (Blaxhall, 1972). Perhaps further confounding these data are variables such as age, sex, dietary state, and stress, all of which may alter blood values (Barnhart 1969; McCarthy et al., 1973).

Haematological studies on fishes have assumed greater significance due to the increasing emphasis on pisciculture and greater awareness of the pollution of natural freshwater resources in the tropics. Such studies have generally been used as an effective and sensitive index to monitor physiological and pathological changes in fishes (Iwama et al., 1976;Chekrabarty and Banerjee, 1988). This present study was undertaken to establish a "normal", haematological profile of the African snakehead, *Parachanna obscura* which is lacking and provide a basis for future comparative surveys.

MATERIALS AND METHODS

Fish samples

Live specimens of the African snakehead *P. obscura* were obtained from a local fish market in Warri, Delta State, Nigeria and transported in aerated containers to the laboratory. They were given a minimum period of 2 weeks to acclimatize to laboratory conditions during which time they were provided with artificial (commercial) feed and ground shrimps obtained locally to avoid the possible effect of starvation on any of the hematological parameters. The size of the fish varied from 24.0 to 30.0 cm length and 300.0 to 550.0 g in weight. All sexes were used without discrimination.

Blood collection

The fish were caught individually in a small hand net from the containers. After the preliminary investigation of the length and weight, the condition factor (K) was calculated thus:

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$K = (W/L^3) \times 10^2$

Where W = Weight and L = length.

The fish were then placed belly upwards and blood samples obtained from the caudal circulation with the aid of a heparinised 2 cm^3 disposable plastic syringe and a 21 gauge disposable hypodermic needle. The use of plastic syringe is a necessary precaution with fish blood because contact with glass results in decreased coagulation time (Smith et al., 1952). The site chosen for puncture (about 3 to 4cm from the genital opening) was wiped dry with tissue paper to aid contamination with mucus. The needle was inserted at right angle to the vertebral column of the fish and was gently aspirated during penetration. It was then pushed gently down until blood started to enter as the needle punctured a caudal blood vessel. Blood was taken under gentle aspiration until about 1 cm^3 has been obtained. Thereafter the needle was withdrawn and the blood gently transferred into heparinized plastic containers. The samples were then mixed gently but thoroughly. Some blood samples were used for the measurement of haematocrit, haemoglobin concentration, red blood cell count and white blood cell count (total and differential). Plasma was obtained from blood samples by centrifugation and then drawn into a 1 cm^3 plastic syringe transferred into a universal bottle and stored in a refrigerator and later used for the determination of total plasma protein and plasma glucose. All determinations were carried out in duplicates for each sample.

Blood analysis

The haemoglobin concentration of the blood samples was determined in duplicate by the cyanmethaemoglobin method (Larsen and Snieszko, 1961). The microhaematocrit method of Snieszko (1960) was used to determine the haematocrit. The red blood cells were enumerated in an improved Neubaeur haemocytometer, using Hendricks (1952) diluting fluid. The total white blood cell counts were similarly enumerated in an improved Neubaeur haemocytometer using Shaw's diluting fluid. The haematological indices: mean erythrocytic haemoglobin concentration (MEHC), mean erythrocytic hemoglobin (MEH) and mean erythrocytic volume (MEV) were calculated from the equations given by Anderson and Klontz (1965).

$$\text{MEHC (\%)} = \frac{\text{Haemoglobin (g\%)} \times 100}{\text{Haematocrit (\%)}}$$

$$\text{MEH (}\rho\text{g)} = \frac{\text{Haemoglobin (g\%)} \times 10}{\text{Erythrocyte count (per/L)}}$$

$$\text{MEV (}\mu^3\text{)} = \frac{\text{Haematocrit (\%)} \times 10}{\text{Erythrocyte count (per/L)}}$$

The total plasma protein was determined by the Biuret method using a commercial kit. Plasma glucose was quantitatively determined by semi micro method using a commercial kit.

Linear regression analysis was carried out between the different blood parameters of 25 experimental fish. The coefficient of regression was then analyzed for statistical significance by the student's t-test at 0.01 and 0.05 levels of significance.

RESULTS AND DISCUSSION

The range and mean of each blood parameter is shown in Table 1, together with the standard deviation and standard error of each mean. All individual results for each (variables) were taken in duplicates. Table 2 lists the intraspecies relationship for the various haematological parameters as indicated by their correlation coefficients (r).

The haematological characteristic observed in the present study showed marginal differences when compared with that of *C. isheriensis* (Kori–Siakpere, 1985) and *C. buthupogon* (Kori–Siakpere and Egor, 1997). Consideration of the intraspecies relationship between blood parameter as indicated by the correlation coefficient (r) in Table 2 and the intraspecies variations as indicated by the wide range of some of the parameters in this study have been attributed to any of the many factors such as season, spawning, migration, sex and genetic variation that affect the blood picture of fish.

Stress factors due to capture, handing and sampling procedures of which capture is most important are factors which can cause intra-species haematological variation (Bouck and Ball, 1960). Stress of handling has been shown to produce a haemoconcentration. It has also been shown that the haemoglobin concentration and haematocrit of fish blood decreases after the stress of capture and transportation (Hattingh and Van pletzer, 1974). Stress due to capture, handling and sampling procedure also affect the plasma proteins in fish blood (Bouck and Ball, 1960). Such a stress situation is probably associated with an increased secretion of catecholamine.

Correlation between haematocrit, haemoglobin and red cell count used in the computation of the haematological indices, have been demonstrated for several species (Eisler, 1965; Summerfelt et al., 1967; Houston and Dewilde, 1968). Haemoglobin estimation has been widely used in fish studies, but with such a variety of methods, it has been difficult to correlate the results. Using the cyanmethaemoglobin method on pike (*Essox lucius* (L)) Mulchahy (1970) gave a range of 5.6 to 15.0 g/ dl with a mean 8.8 g/dl. The values obtained using the cyanmethaemoglobin methods was slightly different from those obtained in this study which may be expected possibly due to age and nutritional state of the fish. The mean value for haemoglobin concentration of *P. obscura* was 5.70 g/dl. This value falls within the range reported for other fishes like *Labeo rohita*, 6.0 g/dl for males and 6.3 g/dl for females (Seddiqui and Naseem, 1979) and *Hypophthalmichthys molitrix*, 6.11 g/dl (Pieterse et al., 1981). In fish blood, oxygen is carried in physical solution and also in combination with haemoglobin. So physiologically, haemoglobin is crucial to the survival of the fish as its role is directly related to the oxygen binding capacity of blood. Despite this importance,

Table 1. Summary of haematological parameters of 25 apparently healthy specimen of *P. obscura*.

Parameter(Unit)	Mean	Standard Deviation	Standard Error	Range
Standard length (cm)	27.48	±2.60	±0.52	24.00 – 30.00
Weight (g)	414.00	±76.83	±15.37	300.00 – 550.00
Condition Factor ($K=W/L^3 \times 10^2$)	21.92	±3.73	±0.75	17.17 – 28.93
Haemoglobin (g/dl)	5.70	±1.24	±0.25	3.90 – 8.30
Haematocrit (%)	19.28	±3.80	±0.76	14.00 – 28.00
Red blood cell count ($x10^{12}$/L)	1.67	±7.08	±0.14	0.60 – 2.95
Total white blood cell count ($x10^3$ mm^{-3})	19.07	±7.34	±1.47	4.70 – 33.30
Mean erythrocytic haemoglobin concentration (%)	29.08	±5.90	±1.18	10.00 – 42.10
Mean erythrocytic haemoglobin (ρg)	39.89	±17.36	±3.47	20.40 – 96.70
Mean erythrocytic volume (μ^3)	132.84	±5.56	±11.11	65.40 – 316.70
Total Plasma Protein (g/dl)	4.45	±1.00	±0.20	2.80 – 6.42
Plasma Glucose (mg/dl)	67.42	±23.99	±4.80	30.80 – 103.00

Table 2. Intraspecies haematological relationship in *P. obscura*.

	Length	Weight	K	Hgb	Hct	RBCC	TWBCC	MEHC	MEH	MEV	Protein
Length											
Weight	0.68										
K	-0.53	0.24									
Hgb	-0.42	-0.25	0.22								
Hct	-0.36	-0.25	0.27	0.77							
RBCC	-0.15	-0.03	0.22	0.64	0.74						
TWBCC	-.020	-0.10	0.08	0.47	0.49	0.49					
MEHC	-0.30	-0.07	0.25	0.52	-0.02	0.09	0.20				
MEH	-0.14	-0.25	-0.14	-0.11	-0.29	-0.75	-0.06	0.19			
MEV	-0.30	-0.19	-0.15	-0.25	-0.27	-0.77	5.60^{-03}	-0.04	0.17		
Protein	-0.42	-0.36	0.18	0.15	0.37	0.11	6.62^{-03}	-0.20	-0.04	-0.02	
Glucose	-0.30	0.31	0.29	0.39	0.60	-0.18	0.36	-0.05	-0.47	-0.34	0.03

Chaenocephalus aceratus has been reported as having no haemoglobin (Rund, 1954) indicating that in such species, oxygen is transported by blood in physical solution only.

Baxhall and Daisely (1973) have reported the possibility of using haematocrit as a tool in aquaculture and fishery management for checking anaemic condition. Reported values for fish haematocrit are usually between 20-35% and scarcely attain values greater than 50% (Clark et al., 1976). The mean haematocrit values in this work are almost within this range 14 - 28%. This is possibly due to stress of capture and transportation.

Das (1965) stated that both the red cell number and haemoglobin concentration tend to increase with length and age. Increase haematocrit have been observed for male fishes approaching spawning, but this increase seems to be of a limited and transient nature (Poston, 1966; Summerfelt, 1967).

Weinreb (1958) used leukocyte count changes as a means of assessing the systematic response of the rainbow trout, *Salmo gairdneri* (R), to various injections. Leucocyte counts seem to have wide range of variation 2000 to 63000/mm^3 for brown trout *S. trutta* (L). In the present work, the range of leucocyte counts is 4.70-33.30 x $10^3/mm^3$. There is variation between these results and those obtained by some other workers. However, the variation has no statistical significance.

The results of the present study could be summarized thus: the mean length of *P. obscura* used in this study was 27.48 cm with a means weight of 414.00 g, mean condition factor (K) was 21.92, mean haemoglobin concentration of the blood was 5.70g/dl, mean haematocrit, 19.20%, mean red blood cell count 1.67 x 10^{12}/L, mean total white blood cell count of 19.07 x 10^3 mm^{-3}, mean erythrocytic haemoglobin concentration of 29.08%, mean erythrocytic haemoglobin of 39.86 ρg, mean erythrocytic volume of 132.84 μ^3, mean total plasma protein of 4.45 g/dl and mean plasma glucose of 67.42 mg/dl.

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