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Research Article
Seasonal Changes in Haematological Values of Male and Female African Snakehead *Parachanna obscura* from Eleyele Reservoir, Ibadan, Nigeria

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Abstract

Background and Objective: Haematological parameters remained an effective and sensitive index for monitoring physiological changes in fishes. This has been established to change with sex, seasons, environment and space within and between fish species. Therefore, a study on haematological indices of *Parachanna obscura* in the Eleyele reservoir was carried out to document its changes in sex and seasons. **Materials and Methods:** A total of 13 blood parameters were studied in 72 healthy fish (382.42±59.41 g) collected over a period covering a wet and a dry season. After biometry, blood samples were taken from the caudal vein for haematological and biochemical measurements using standard methods. Data were analyzed using descriptive statistics and t-test at ($p<0.05$) for sex and season variations. **Results:** White blood cells (26.13±1.01 10^3 μL^{-1}), monocyte (3.54±0.21%), neutrophils (35.79±1.59%) and platelets (27.45±14.33 10^3 μL^{-1}) were significantly higher ($p<0.05$) in females, while lymphocytes (71.45±2.04%) was markedly higher in males. Haematological values were not significantly different ($p>0.05$) between seasons, however, white blood cell (26.13±1.01 10^3 μL^{-1}), lymphocyte (58.39±1.80%), neutrophils (35.79±1.59%), monocytes (3.54±0.21%), platelets (27.45±14.33 10^3 μL^{-1}) and mean corpuscular haemoglobin (35.97±1.11 pg) were marginally higher ($p<0.05$) in dry season samples. **Conclusion:** From this study, it was suggested that biochemical parameters of *P. obscura* are more influenced by sexual differences than seasonal changes.

Key words: African snakehead, *Parachanna obscura*, haematology, fish health, Eleyele reservoir

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Parachanna obscura is a demersal fish, which inhabits marginal vegetation and muddy bottoms around rivers and lakes in West Africa. It belongs to the family Channidae and orders Perciformes. It is a popular table fish high in protein and other essential nutrients required by the body and command good commercial value[1]. Fishing is mostly carried out by artisanal fishers using different types of traditional fishing gears such as conical trap, square lift net, gill net and cast net. The fish has been documented to be cultured under the extensive farming system in Nigeria, Cameroon, Ivory Coast, Gabon and the Democratic Republic of Congo[2]. According to Atanasova *et al.*[3], the good health status of fish is the main element for their welfare, thus it is of great significance to research the haematological status of this species in their natural habitat.

Blood is the most important fluid in the body and its composition often reflects the total physiological condition of an organism[4]. Blood analysis has therefore become essential as an indicator of physiological or pathological changes in fisheries management and disease investigations. Fish live in water and they are extremely dependent upon it, any changes in the environment would affect their physiology. This situation then poses a great concern to the safety of inland fishery resources from environmental contamination or pollution.

According to Fagbenro *et al.*[5], the knowledge of the haematological profile of a fish could provide information on dietary sufficiency and physiological response to environmental stress. It also gives the haematological picture of species in their natural environment so that values of each species could be standardized for subsequent verification of factor inducing changes[6]. These changes depend on fish species, age, the cycle of the sexual maturity of spawners and diseases[7]. Haematological analyses provide a clue on haemoglobin, red cells, white cells, haematocrit, platelet count and erythrocyte sedimentation rate[8]. Haemoglobin is decreased by anaemia or increased by prolonged physical stress. The packed cell volume indicates red cell concentration in a sample of blood. It is usually reduced in anaemic conditions or after a major haemorrhage.

The haematological profile of *Parachanna obscura*[9-11] has been reported. However, sex and seasonal variations in blood parameters of this species have not been succinctly documented. Therefore, this study investigated seasonal variation in haematological values of male and female *Parachanna obscura* from Eleyele reservoir.

MATERIALS AND METHODS

Study area: Eleyele reservoir is located in South-Western part of Nigeria on latitude 7°25'0''-7°26'15''N and longitude 3°50'45''-3°52'15''E. The present study was carried out from April 2015 to March, 2016, which is 12 months. Dry season samples covered November-April, while rainy seasons covered May-October[12].

Collection of experimental fishes: A total of 72 male and female *Parachanna obscura* (382.42±59.41 g) were collected from the fish landing site at Eleyele Lake. Experimental fishes were collected from the fish landing sites at Eleyele reservoir. Seventy-two healthy males and females (382.42±59.41 g) were collected and used for the study. Fish samples were transported to the laboratory within one hour after collection. The sex of each specimen was determined by examination of the genitals for testis or ovaries.

Blood collection: Two millilitre blood samples were collected by vein puncture from each of the samples using a 2 mL syringe fitted to a 22-gauge hypodermic needle[13]. The blood was dispensed into Ethylenediaminetetraacetic acid (EDTA). Samples were analyzed immediately after collection in the Physiology laboratory of the Animal Science Department, University of Ibadan, Nigeria.

Haematological techniques: Red Blood Cell (RBC), White Blood Cell Count (WBC), Packed Cell Volume (PCV), Haemoglobin Concentration (Hb), lymphocytes, monocytes, neutrophils, eosinophils, basophils and platelets were measured and analyzed following the routine methodology of fish hematology[14,15]. Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC) were calculated according to Feldman *et al.*[16].

Statistical analysis: Results were analyzed by descriptive statistics and t-test, at a 5% of confidence level.

RESULTS

The haematological values of male and female *P. obscura* are presented in Table 1. It is evident that, no significant difference ($p>0.05$) exists in the red blood cell, packed cell volume, haemoglobin, eosinophils, basophils, Mean Corpuscular Volume (MCV) and Mean Corpuscular Haemoglobin Concentration (MCHC) between sexes. White

Table 1: Sex variation in mean values of haematological parameters of *P. obscura* (n = 36 per sex)

	Male		Female		
Haematological parameters	Range	Mean±SE	Range	Mean±SE	Significant values
RBC (10^6 µL^{-1})	1.98-4.13	3.29±0.07	2.21-4.38	3.43±0.08	0.19
WBC (10^3 µL^{-1})	17.41-37.18	23.02±0.68	16.12-41.25	26.13±1.01	0.01*
PCV (%)	19.88-43.78	32.05±1.07	20.62-42.88	30.46±1.13	0.31
Haemoglobin (g dL^{-1})	7.95-15.21	11.70 ±0.29	8.46-13.38	11.09±1.17	0.09
Lymphocytes (%)	39.52-88.63	71.45±2.04	36.56-78.23	58.39±1.80	0.00*
Monocytes (%)	1.47-5.31	2.85±0.16	1.26-6.52	3.54±0.21	0.01*
Neutrophils (%)	12.37-53.55	25.40±1.44	15.73-52.36	35.79±1.59	0.00*
Eosinophils (%)	3.45-8.81	5.36±0.21	3.53-8.42	5.35±0.18	0.98
Basophils (%)	0.00-0.24	0.09±0.01	0.00-0.23	0.08±0.00	0.50
Platelets (10^3 µL^{-1})	12.15-35.41	21.39±11.31	10.367-43.82	27.45±14.33	0.00*
MCV (fl)	54.46-199.54	100.80±4.86	47.07-138.81	90.85±4.30	0.13
MCH (pg)	25.78-56.46	35.97±1.11	25.45-44.07	32.82±0.81	0.02*
MCHC (g dL^{-1})	20.33-65.54	38.10±1.67	19.75-59.94	38.32±1.66	0.92

RBC: Red blood cell, WBC: White blood cell, PCV: Packed cell volume, MCV: Mean corpuscular volume, MCH: Mean corpuscular haemoglobin, MCHC: Mean corpuscular haemoglobin concentration and *Significant at 5% level (p<0.05)

Table 2: Seasonal variation in mean values of haematological parameters of *P. obscura*

	Dry season		Wet season		
Haematological parameters	Range	Mean ±SE	Range	Mean ±SE	p-value
RBC (10^6 µL^{-1})	1.98-4.24	3.26±0.08	2.21-4.38	3.46±0.08	0.69
WBC (10^3 µL^{-1})	16.82-41.25	25.18±0.96	16.12-35.57	23.97±0.82	0.34
PCV (%)	19.88-42.88	30.57±1.21	20.62-43.78	31.94±0.99	0.39
Haemoglobin (g dL^{-1})	7.95-15.21	11.28±0.30	9.49-14.98	11.52±0.19	0.51
Lymphocytes (%)	36.56-88.63	67.41±2.23	36.76-82.21	62.43±2.13	0.11
Monocytes (%)	1.47-6.52	3.27±0.22	1.26-6.43	3.12±0.17	0.59
Neutrophils	14.79-53.55	32.53±1.81	12.37-50.32	28.67±1.62	0.12
Eosinophils	3.45-8.81	5.13±0.22	3.53-7.36	5.59±0.18	0.11
Basophils (%)	0.00-0.24	0.07±0.01	0.00-0.21	0.09±0.01	0.14
Platelets (10^3 µL^{-1})	13.51-41.13	25.32±13.06	10.36-43.82	23.52±14.50	0.36
MCV (fl)	53.00-199.54	97.40±5.26	47.07-138.98	94.25±3.98	0.64
MCH (pg)	25.54-56.46	35.15±1.23	25.45-44.07	33.64±0.71	0.29
MCHC (g dL^{-1})	19.75-65.54	39.25±2.01	25.57-54.07	37.17±1.21	0.38

RBC: Red blood cell, WBC: White blood cell, PCV: Packed cell volume, MCV: Mean corpuscular volume, MCH: Mean corpuscular haemoglobin, MCHC: Mean corpuscular haemoglobin concentration and *Significant at 5% level (p<0.05)

blood cells (26.13±1.01 10^3 µL^{-1}), Monocytes (3.54±0.21%), Neutrophils (35.79±1.59%) and Platelets (27.45±14.33) were significantly (p<0.05) higher in females than their male counterparts. Similarly, the haematological results showed non-significant differences in values (p>0.05) between seasons in Table 2. However, red blood cell (3.46±0.08 10^6 µL^{-1}), packed cell volume (31.94±0.99%), haemoglobin (11.52±0.19 g dL^{-1}), eosinophils (5.59±0.18%) and basophils (0.09±0.01%) were slightly higher in the wet season.

DISCUSSION

The haematological values observed in this study were consistent with the previous reports on some freshwater teleost[11,17-19]. White blood cells, monocyte and neutrophil were found to be notably higher in female *P. obscura*. This could be due to an increase in reproductive activity and defence mechanisms of female fish. However, marked differences in lymphocyte count were observed in favour of males. This observation is following the findings of Ejraei *et al*.[20,21]. Also, several authors including[18,22] reported higher values of packed cell volume and haemoglobin count in males than female fish. This may be as a result of the higher physiological activity of males than the female fish. Also, Frank and Solomon[23] observed higher packed cell volume in male *Clarias gariepinus* than in females. Whereas, Jan *et al*.[24] report significantly (p<0.05) higher values of Hb content (11.18 g dL^{-1}) and PCV (36.15%) in male *Schizothorax labiatus* than females, which may be primarily due to its being biochemically and nutritionally richer than the female.

Contrastingly, the study revealed slight seasonal changes in the haematological values of *P. obscura*. The red blood cell, packed cell volume, haemoglobin, eosinophils and basophils

were higher in the wet season. A similar observation was made for packed cell volume and haemoglobin in *P. obscura* from Ose River[9]. Also, higher white blood cells, lymphocytes, monocytes and neutrophils were recorded in summer and autumn for *Alburnoides eichwaldii*[21]. Season related haematological changes have also been reported earlier[6,25].

This study could however be more eclectic if covers different sizes and ages of *P. obscura*, which will provide a more comprehensive reference value. This lacuna, therefore, emphasizes the need for more extensive study in all of these areas within and between fish species of the tropics.

CONCLUSION

The current study revealed marked sex variation on white blood cells, lymphocytes, monocyte, neutrophils and platelets, while seasonal influence was marginally observed. Therefore, the study indicates that haematological values of *P. obscura* were more affected by sex than the season.

SIGNIFICANCE STATEMENT

This study succinctly documented the haematological profile of male and female *Parachanna obscura* from Eleyele Reservoir, Nigeria. It also revealed sex and seasonal variations in this species, which is significant for both conservation and aquaculture programmes of the species.

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