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ORIGINAL ARTICLES

Comparative Haematological Parameters of the Bagrid Catfish (*Chrysichthys Nigrodigitatus)* and the African Catfish (*Clarias Gariepinus*) from Asejire Dam in Southwestern Nigeria

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ABSTRACT

The aim of the present study was to investigate and establish reference ranges for haematological values for Bagrid catfish (*Chrysichthys nigrodigitatus*) from Asejire Dam in Southwestern Nigeria and compared it with that of the African catfish (*Clarias gariepinus*) from the same dam. In the present work hematologic indices (RBC, WBC, Ht, Hb, MCV, MCH, MCHC), were determined using standard methods. The mean ± SEM and range were established. RBC, Hb, lymphocyte and MCV differs significantly between the Bagrid catfish and the African catfish.

Key words: Haematology, Bagrid catfish, Asejire Dam.

Introduction

The African Catfish (*Clarias gariepinus*) culture is widely practiced in many tropical and subtropical regions of the world and constitutes one of the largest groups of farmed freshwater fish. Much of the rapid increase in aquaculture production in recent years in Nigeria has come from the increasing of existing systems. A lot of studies have been conducted on its basic physiology and lot of literatures have been published on its haematology (Adedeji *et al* 2000). On the other hand there is drift of information about the haematological features of Bagrid catfish (*Chrysichthys nigrodigitatus*) which also belong to the order Siluriformes like the African catfish *(Clarias gariepinus)* morphologically (plate I and II).

Thus, the main objective of this study was to establish baseline haematological parameters for the Bagrid catfish (Siluriformes) which can be used as reference point in comparative studies; with other catfish (Siluriformes) , monitoring of health and diseases status, reproduction and ecotoxicological studies.

Materials and methods

Chrysichthys nigrodigitatus 25 in number (males and females) and 30 *Clarias gariepinus* (males and females) were obtained from Asejire reservoir (to rule out environmental effect on the study) located on latitude 7^0 22'N, and longitude 4^0 08'E in Southwestern Nigeria. The fishes (*Chrysichthys nigrodigitatus)* had a mean weight of 150g ± 5g and mean total length of 13 ± 2.0cm while (*Clarias gariepinus*) had a mean weight of 200g ± 5g and mean total length of 15 ± 2.0cm. The fish were transported to the laboratory in water obtained from the Asejire dam. They were acclimatized in the laboratory facilities at the department of Veterinary Public Health and Preventive Medicine for 48 hours to rule out the effect of stress on the hematological parameters. During the acclimation time, the fish were fed with commercial feed at 5% body weight. No treatment was carried out during this period. Mortality was 0% during the acclimation.

Examination of red blood cell and total white blood cell profile was carried out on 20 *Clarias gariepinus* and 20 Chrysichthys nigrodigitatus. For blood collection 0.2mg benzocaine dissolved in 5ml acetone in 4 liters of water was used as an anesthetic agent.

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Blood was drawn from the posterior caudal vein according to Schmitt *el al* (1999) with a 22 G hypodermic needle and 2ml was decanted into plastic tubes containing the sodium salt of ethylene diamine tetra acetic acid (Na-EDTA) as an anticoagulant. Whole blood (50µl) was stained for enumeration of red blood cells Shaw (1930). Blood smears were air dried for 5 min, fixed in absolute methanol, and stained for 60 seconds in giemsa stain.

Haematological Analysis:

Red blood cell (RBC), total white blood cell (WBC) and platelet counts were done using the Neubauer haemocytometer. The haematocrit or packed cell volume (PCV) and haemoglobin (Hb) concentration values were determined by the microhaematocrit capillary tube and cyanomethaemoglobin methods Hesser (1960), respectively. The mean corpuscular volume haemoglobin (MCV), mean corpuscular haemoglobin (MCH) and mean haemoglobin concentration (MCHC) were calculated from the data using standard formulae: Blood smears made and stained with Giemsa, were used to determine WBC, platelets count and differential WBC counts. WBC and platelet were counted until 200 WBC were enumerated on blood smears, and the percentage of each WBC type and of platelet were multiplied by the total WBC and platelet count to obtain absolute differential cell counts.

This method of manually determining total WBC and differential count has been recommended for avian Zinkl (1986) and fish Stoskopf (1993) blood, because nucleated RBC prevent accurate enumeration using automated analysis Huffman *et al* (1997). The majority of blood values determined for fishes have been reported as mean ± SEM Hrubec *et al*. (2000), the data generated in this study are thus presented as mean ± SEM

Statistical Analysis:

The data obtained from this study were subjected to various statistical tools. The differences in the means between 2 species were assessed using students t-test and Pearson's correlation for equality of variance SAS (1988). A probability value of $P<0.05$ was taken as significant.

Results:

The mean hematological values obtained for the two specie *Clarias gariepinus* and *Chrysichthys nigrodigitatus* from the study are as presented in Table 1. The Red Blood Cell counts in *Clarias gariepinus* has a range of 1.74-3.92 x 10^6mm^3 and a mean value of 3.02 x 10^6mm^3±0.17x10^6mm^3 while that of *Chrysichthys nigrodigitatus* ranges between 1.03 x 10^6mm^3 and a mean value of 2.31 x 106mm^3± 0.21 x 10^6mm^3 .

The Packed cell volume (PCV) for *Clarias gariepinus* ranges between 18-37% with a mean value of 30±1.09% while that of *Chrysichthys nigrodigitatus* ranges between 16 – 35% with a mean value of 26.95±1.41%. Heamoglobin concentration for *Clarias gariepinus* ranges between 8.6-11.7g/dl with a mean value of 9.28±0.42g/dl while *Chrysichthys nigrodigitatus* haemoglobin concentration ranges between 4.6 - 11.0g/dl with a mean value of 8.325±0.46g/dl. The White blood cells counts of *C. gariepinus* ranges between 9300 – 199000 mm^3 with an average value of 14692.5±536.7mm^3 its platelet ranges between 106000-458000 with average value of 172450±2508.6.

The WBC counts for *C. nigrodigitatus* ranges between 10,600 – 36,2000mm^3 with a mean value of 19385±1132.8mm^3 its platelet range between 106000 – 36200 with a mean value of 173000±1866.8. Microscopic examination of blood smears revealed the presence of erythrocytes, neutrophils, lymphocytes, and monocytes.

The Lymphocyte count ranges between 37 – 72% with mean value of 63.45±1.93% in *C. gariepinus* while *C. nigrodigitatus* lymphocyte ranges between 34 – 78% with a mean value of 52.35±3.01%.The Mean corpuscular volume ranges between 88 -160.90μ^3 with a mean value of 99.575±3.64μ^3 n *C. gariepinus* while that of *C. nigrodigitatus* ranges between 26.50 – 191.20μ^3 with a mean value of 116.1675±9.66μ^3 Mean corpuscular heamoglobin (MCH) in *C. gariepinus* ranges between 25.10-48.90pg with mean value of 31.345±1.20pg while *C. nigrodigitatus* has a range of 29.40 – 55.10pg with a mean value of 38.56±1.82pg. Mean corpuscular heamoglobin concentration in *Clarias gariepinus* range from 26 – 32 with a mean value of 30.7±0.41. *C. nigrodigitatus* Mean corpuscular haemoglobin concentration ranges between 27.05 – 33.00 with a mean value of 30.8±0.34.

Plate 1*:* Bagrid Catfish *(Chrysichthys nigrodigitatus).*

Plate 2: African Catfish (*Clarias gariepinus*).

Table 1: Mean Heamatological Values in Clarias Gariepinus and Chrysichthys Nigrodigitatus.

Parameter	Species	Mean	Standard Deviation	Standard Error
PCV (%)	Clarias gariepinu	30.00	4.877	1.091
	Chrysichthys nigrodigitatus	26.95	6.295	1.408
HB (g/dl)	Clarias gariepinu	9.280	1.8881	0.4222
	Chrysichthys nigrodigitatus	8.325	2.0761	0.4642
RBC x $10^6 mm^3$	Clarias gariepinu	3.0285	0.77156	0.17253
	Chrysichthys nigrodigitatus	2.3165	0.93847	0.20985
WBC mm^3	Clarias gariepinu	14692.50	2400.344	536.733
	Chrysichthys nigrodigitatus	19385.00	5065.962	1132.784
PT	Clarias gariepinu	172450.00	10661.745	2508.650
	Chrysichthys nigrodigitatus	173000.00	70958.846	1866.880
MCV μ^3	Clarias gariepinu	99.5750	16.29623	3.64395
	Chrysichthys nigrodigitatus	116.1675	43.19744	9.65924
MCH pg	Clarias gariepinu	31.3450	5.34282	1.19469
	Chrysichthys nigrodigitatus	38.5650	8.15088	1.82259
MCHC	Clarias gariepinu	30.7000	1.83332	0.40994
	Chrysichthys nigrodigitatus	30.8525	1.52747	0.34155
LYMPH%	Clarias gariepinu	63.45	8.624	1.928
	Chrysichthys nigrodigitatus	52.35	13.429	3.003

Discussion:

On the basis of haematological studies, it would be possible to predict the physiological state of fish in natural water bodies Moiseenko (1998). Blaxhall and Daisley (1973) reported the essence of using heamotocrit to detect aneamic condition in fishes. In this study, the mean heamotocrit value of *Clarias gariepinus* was 30± 4.8% while *Chrysichthys nigrodigitatus* was 26.95±6.3% which did not differ considerably from those found by Badawi and Said 1971 and Etim *et al* 1999.

There was no significant difference between the Packed Cell Volume of the two species of fish at P>0.05. The mean hemoglobin concentration of *Clarias gariepinus* was while 9.28±1.88g/dl C*hrysichthys nigrodigitatus* has 8.325±2.07g/dl. *Clarias gariepinus* is more active than C*hrysichthys nigrodigitatus* and have higher value of heamoglobin concentration. From statistical analysis, there was significant difference in the Hb between the two species at P>0.05. Eisler (1965) suggested that there was a correlation between heamoglobin concentration and activity of fish. The more active fishes tend to have higher heamoglobin values than the sedentary ones. Consequently, *Pleuronectes annectens* being a relatively quiet and sedentary species has a slightly lower heamoglobin concentration than more active African teleosts such as *Clarias buthupogon* whose heamoglobin is as high as 9.88g/dl Kori-Siakpero (1988). In this study, it was revealed that *Clarias gariepinus* has higher number of circulating erythrocyte (RBC) 3.02 x 10^6mm^3±0.77x10^6mm^3 and *Chrysichthys nigrodigitatus* has 2.31 x 10^6mm^3± 0.94 x 10^6mm^3 therefore transportation of oxygen and carbondioxide to the lung tissue will be more effective in *Clarias gariepinus* than *Chrysichthys nigrodigitatus*. There was a significant difference between the two species at P>0.05. This agrees with the findings of Adedeji *et al* (2000).White blood cell (WBC) and lymphocytes are the defensive cells of the body. According to Douglas and Jane 2010, their amount has implication in immune responses and the ability of the animal to fight infection. The species with higher value of WBC and lymphocytes will be able to fight infection more than the other species. In this study the mean value of circulating white blood cells in *Clarias gariepinus* is 14692.5±2400mm^3 while the mean value of *Chrysichthys nigrodigitatus* is 19385±5066mm^3 . In *Clarias gariepinus* the number of circulating lymphocyte was 63.45±8.62% and *Chrysichthys nigrodigitatus* was 52.35±13.43%. The species with higher value of circulating lymphocyte will be able to defend itself from invading pathogen both by cell-mediated and humoral - mediated responses Douglas and Jane 2010 , thus from this study *Clarias gariepinus* with higher value will be able to mount adequate immune responses better than *Chrysichthys nigrodigitatus*. There was a significant difference in circulating lymphocytes in the two species at P<0.05. In *Clarias gariepinus*, the platelet count is 172450±10661 and *Chrysichthys nigrodigitatus* is 173000±70958. The value of platelet in *Clarias gariepinus* is lower than *Chrysichthys nigrodigitatus* and has more ability to maintain heamostasis during blood lost Srivastava (1969) . There was no significant difference in the amount of platelet between the two species, P>0.05. In *Chrysichthys nigrodigitatus* the mean corpuscular volume (MCV) 116.17±43.20µ^3 is significantly higher than that of *Clarias gariepinus* which is 99.575±16.3µ^3. There was significant difference between the two species at P<0.05. (Srivastava (1969) and Adedeji *et al* (2000) while working on different fresh water species found out that there was correlation between the MCV and number of circulating Rbc (The higher the number the lower the size and vice versa). In *Chrysichthys nigrodigitatus* the mean corpuscular heamoglobin is significantly higher (P<0.05) than that of *Clarias gariepinus* these correlate with the fact that the MCH in *Chrysichthys nigrodigitatus* has higher values of 38.56±8.15pg than that of *Clarias gariepinus*, which is 31.345±5.34pg , thus *Chrysichthys nigrodigitatus* is able to carry more Hb than *Clarias gariepinus*. The Mean Corpuscular heamoglobin concentration (MCHC) in *Clarias gariepinus* is 30.70% which was lower than the value of *Chrysichthys nigrodigitatus* with 30.83%. There was no significant difference between the two species at P>0.05. From this study it is possible to differentiate with this specie based on haematological parameters.

Conclusion and Recommendation:

In recent times, there has been increased interest in aquaculture in and productive fish farming in the world and provision of wholesome fish protein for human consumption especially in Nigeria. This has necessitated the need for establishing normal haematological values in the different species of fish and the corresponding needs for the monitoring of health and production parameter which could be achieved by studying the haematological features of the various species. In conclusion, this study has provided valuable baseline data on the haematological features of Bagrid catfish (*Chrysichthys nigrodigitatus*) a freshwater fish species in Nigeria and has also been able to establish similarities and differences between this specie and the African Catfish, *Clarias geriepinus* which is widely farmed in the country.

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