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Studies on the hematological differences of pond and river African catfish (*Clarias gariepinus*) in Maiduguri, Borno State, Nigeria

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Abstract
The present study was designed to evaluate the haematological parameters of pond and river catfish (*Clarias gariepinus*) in Maiduguri, Borno state, Nigeria. Forty adult of *C. gariepinus,* twenty from pond and twenty from river were used for the present study. The haematological features have been used widely in vertebrate animals including man. The application of haematological procedures is very important for aquaculturist in assessing fish health as it monitors stress. The mean weight and length of fish from pond were 750 g and 46 cm, while that of river fish were 620 g and 43 cm respectively. There was no significant differences of the haematological parameters between the two groups. However there was significant difference in the erythrocyte sedimentation rate between the two groups with higher value in the pond fish than the river fish. This could be attributed to stocking density, humidity, water temperature and oxygen content of the water. There was also significant difference in the leucocyte count between the two groups with the pond fish having higher sizes of heterophils, monocytes, eosinophils and basophil while higher size of lymphocyte in river fish.

Keywords: Haematolgy, pond and river catfish, Maiduguri, Nigeria

1. Introduction
Substantial knowledge of the haematological parameters of fish, is an important tool that can be used as an effective and sensitive index to monitor physiological and pathological changes in fishes. Normal ranges for various blood parameters in fish have been established by different investigators in fish physiology and pathology [1, 2]. Studies on blood indices has proven to be a valuable criteria for assessing the health status of both cultured and wild fish, as these indices provide reliable information on metabolic disorders, deficiencies and chronic stress status before they manifest clinically [3]. Exogenous factors, such as management, diseases and stress, always induce marked significant changes in haematological parameters [4-6].
Studies of the haematological parameters have been carried out to determine the systematic relationships among certain species [7-11]. It is well known that blood comprises 1.3–7% of the total body weight of fish and it represents one of the most active components which, accompanied by haematopoietic organs, contributes to metabolic processes by ensuring gas exchange between the organism and the environment [12, 13]. For this reason, blood parameters are increasingly used as indicators of the physiological condition or sub-lethal stress response in fish to endogenous or exogenous changes [12, 13].
Red blood cell indices provide information about the haemoglobin content and size of red blood cells, abnormal values indicates presence of anemia and type of anemia [14]. These indices include the Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC). Fish Blood is one of the most readily accessible body fluid used for diagnostic purposes [15]. Haemogram is particularly recommended as a routine tests in fish hatcheries as a marker for health status in fish [16].
Fish erythrocytes is generally ellipsoidal with concentric, round or oval nucleus, with densely clumped nuclear chromatin with anucleated cells are sometimes observed, the basophilic cytoplasm is clear and about (7 X 12µm) in size [17]. Three forms of thrombocytes are normally found; rod, tear drop and spindle shape which are about (4 X 7.5 µm), (3.5 X 10 µm) and (3.5 X15 µm) in size respectively, although round cells could also be observed [17]. Monocytes are the largest among the leucocytes of catfish and ranges from 9 to 13 µm in diameter with pale

blue cytoplasm commonly filled various number of vacuoles, and nucleus that is round, although bean-shape could be observed.

The neutrophils are spherical, 9-10 µm in diameter, characterized by numerous fine dark purple granules scattered in the cytoplasm. Degranulated neutrophils are commonly seen in the adults with nucleus that is normally eccentric and round. Basophils are characterized by coarsed and dark stained granules, depending on the activities of the cells, and ranges between 9-10 µm in diameter. Eosinophils are characterized by coarse acidophilic and uniform oval shaped granule, about 7-8 µm in diameter.

The purpose of this present study was to obtain a baseline knowledge on the haematological variations of the pond and wild African catfish (*C. gariepinus*), Assesment on these haematological parameters will provide useful informations for further research, that can be used as a biomarker in association with stress conditions and as an available tool to diagnose and monitor disease conditions in fishes.

2. Methodology

2.1 Study area

The study was conducted in the Physiology Laboratory of the Department of Veterinary Physiology, Pharmacology and Biochemistry, University of Maiduguri, Nigeria. Maiduguri is located between latitude 11º and 50º north and longitude 13º and 36º east. The annual rainfall average 320mm, rainy season begins in June and last till October and dry season begins in November and last till May. The rainfall is monsoonal, generally been heaviest in August. The annual temperature average 35.4 ºC, the climate of Maiduguri can be divided into six zones: Guinea zone, sunado-Guinea zone, sunado-sahelian zone, sahelo-sudanian, sudanosaharan zone and Saharan zone [18].

2.2 Sources of fish

The total of forty adult catfish of both sexes were randomly used for this study. Twenty each of wild and farmed (pond) African catfish (*Clarias gariepinus*) were used. The mean weight of pond fish was found to be 750 g and mean length 46 cm, while that of wild fish was 620 g and mean length was 43 cm. The pond fish were bought from fish farmers in Maiduguri, while the wild ones were bought from fish retailers in Gamboru market in Maiduguri, Nigeria whose fish were from Lake Alau. The Lake is located 20 km south east of Maiduguri, Borno State and is situated at the semi-Arid north Eastern Zone of Nigeria (11˚40N to11˚45N and 13˚10′ E to 13˚20′ E). It is believed to be a remnant of former Mega Chad. It receives an annual delivery of water from Ngada and Yedzeram rivers system, but whiles these two rivers and their other tributaries dries up completely, Lake Alau retains water throughout the year [19].

2.3 Haematological procedures

The fish were transported alive in plastic trough containing chlorine free water to the Laboratory. The fish were allowed to acclimatize at water temperature range of 21 to 24 ºC for two weeks prior to the commencement of the study. The fish were fed twice on daily basis throughout acclimatization period, but was withheld 24hours prior to the commencement of the procedure. Blood was collected through caudal vein using a 2ml sterile plastic syringe. Plastic instead of glass syringe was used in order to prevent quick coagulation [20]. Determination of haemoglobin (Hb), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC) and leucocytes differential counts were all carried out according to this method [21]. The blood sample for haematocrit were collected in heparinized capillary tubes, the end of the tubes were sealed with plasticine and the tubes spun for 7 minutes in a micro hematocrit centrifuge at a speed of 12,900 pm. The haematocrits were measured with a micro capillary reader.

2.4 Leucocyte differential count

Leucocyte count were read on the slide with the aid of a microscope and a counter. Blood chart for blood components were prepared and used for identification of the different cell types. For the chart, aid was obtained from work done [22-24].

2.5 Statistical analysis

The results were expressed as mean± standard error of mean. Difference between the two groups was analyzed using student T-test and differences were considered significant at $P<0.05$ and not significant at $P>0.05$

3. Results

Table 1: Full blood count of Pound and River Catfish

Parameter	Pond catfish	River catfish
	X ± SD	
Hb (g/dl)	12.94 ± 0.87	12.12 ± 0.05
PCV (%)	33.70 ± 2.00	32.80 ± 1.93
RBC (x 10^6/ mm^3)	3.20 ± 0.13	3.21 ± 0.17
WBC (x 10^3/ mm^3)	4135 ± 260.39	4130 ± 78.88
ESR (mm)	^{a}2.05 ± 0.49	^{b}4.15 ± 0.47

Where Hb= Haemoglobin, PCV= Packed cell volume, RBC= Red blood cells, WBC= White blood cells & ESR= Erythrocyte sedimentation rate

Table 2: Hematological indices of Pound and River Catfish.

Parameter	Pond catfish	River catfish
	X ± SD	
MCV (fl)	10.53 ± 0.61	10.24 ± 0.75
MCH (pg)	40.56 ± 3.13	39.28 ± 2.68
MCHC (%)	38.48 ± 2.85	37.57 ± 3.01

Where MCV= Mean corpuscular volume, MCH= Mean corpuscular haemoglobin & MCHC= Mean corpuscular haemoglobin concentration

Table 3: Differential Leukocytes counts of Pound and River Catfish.

Parameter	Pond catfish	River catfish
	X ± SD	
HET (%)	32.40 ± 1.70	33.20 ± 2.35
MON (%)	10.30 ± 1.77	9.30 ± 1.57
EOS (%)	11.00 ± 1.49	10.60 ± 1.71
BAS (%)	2.70 ± 1.25	1.50 ± 0.85
LYM (%)	43.60 ± 3.20	45.90 ± 2.08

Where HET= Heterophil, MON= Monocyte, EOS= Eosinophil, BAS= Basophil, & LYM= Lymphocyte

Table 4: Comparative Cells Sizes of pond and river catfish

Parameter	Pond catfish	River catfish
	X ± SD	
HET (µm)	^{a}10.82 ± 0.39	^{b}9.08 ± 0.24
MON (µm)	^{a}6.65 ± 0.19	^{b}5.14 ± 0.35
EOS (µm)	^{a}12.64 ± 0.32	^{b}10.22 ± 0.18
BAS (µm)	^{b}7.49 ± 3.90	^{a}8.83 ± 0.18
LYM (µm)	^{b}8.26 ± 0.13	^{a}8.38 ± 0.34
RBC (µm)	8.91 ± 0.76	8.91 ± 0.97

Where HET= Heterophil, MON= Monocyte, EOS= Eosinophil, BAS= Basophil, LYM= Lymphocyte & RBC= Red blood cell

4. Discussion

The result of the haematological parameters of pond and river fish in the present study shows no significant difference between the Hb, PCV, RBC and WBC values this agrees with the report of Romeo *et al*. who reported a similar values in *Hoplias malabaricus* and *Geophagus brasiliensis* [15]. There was a significant difference between the erythrocyte sedimentation rate (ESR) of the two groups with the pond catfish having lower value as compared to the river catfish, this result is similar to that of Adakole [16] and lower to the work reported by Davis A K *et al.* [25], which shows variation in ESR of *Clarias gariepinus* at difference stocking densities, which suggest that stocking densities could affect the values of erythrocyte sedimentation rate in this specie. There was no significant difference in the values of MCV, MCH and MCHC between the pond and river catfish which also agrees to the report of Adedeji O B and Adegbile A F who reported similar findings in *Chrysichthys nigrodigitatus* and *Clarias gariepinus* [26], the values of MCV of the present study is similar to the report of G. Rey V′azquez and G.A. Guerrero [27] and MCHC lower to the report of Adedeji O B and Adegbile A F who reported a value less than that in the present study [26]. Differential leukocyte count, Heterophil, Eosinophil and lymphocyte were compared between the groups which agrees to the report of Yayi A J *et al.* where they reported similar value in fresh water fish *Oreochromis niloticus* [28] but monocyte and basophil were absent in his report but present in the report of Adedeji OB *et al*. [29] on catfish exposed to diazinon. There was a significant difference between the two groups in sizes of heterophils, monocytes, eosinophile, lymphocytes and basophil, with the pond catfish having higher cell sizes, Except for lymphocyte which are larger in the river catfish. This is in agreement with the work of Pisut M *et al.* [17]. The difference in the ratios of leucocytes can be attributed to stress associated with glucocorticoid release which can act to increase the number of heterophils to lymphocyte ratios [25]. The variation in size of monocyte among the pond and river catfish may be as a result of animal size [30]. Who reported that size of an animal is a factor that determines the range of hematological studies and limiting the quality of blood for analysis.

The size of eosinophil obtained here, is lower in values as compared to the works of Adakole J A [16], the difference among the group could be as a result of difference in age, season variation and sexual fluctuation [24]. The results of this research provide a contribution to the knowledge of the characteristics of blood cells and hematological parameters of the African catfish, *C. gariepinus*, under the normal conditions employed in this study. This investigation may be helpful as a tool to monitor the health status of this and other related fish species. The evaluation of hematological parameters will grant early detection of clinical pathology as well as the presence of disturbance in the environment.

5. References

1. Rambhaskar B, Srinivasa Rao K. Comparative haematology of ten species of marine fish from Visakhapatnam Coast. J Fish Biol. 1986; 30:59-66.
2. Xiaoyun Z, Mingyun L, Khalid A, Weinmin W. Comparative of haematology and serum biochemistry of cultured and wild Dojoloach *Misgurnus anguillicadatus.* Fish Physiol Biochem. 2009; 35:435-441.
3. Bahmani M, Kazemi R, Donskaya P. A comparative study of some hematological features in young reared sturgeons (*Acipenser persicus and Huso huso*). Fish Physiol Biochem. 2001; 24:135-140.
4. Svobodova Z, Kroupova H, Modra H, Flajshans M, Randak T, Savina LV *et al.* Haematological profile of common carp spawners of various breeds. J Appl Ichthyol. 2008; 24:55-59.
5. Chen YE, Jin S, Wang GL. Study on blood physiological and biochemical indices of *Vibrio alginolyticus* disease of Lateolabrax japonicas. J Ocean Tai Str. 2005; 24:104-108.
6. Cnaani A, Tinman S, Avidar Y, Ron M, Hulata G. Comparative study of biochemical parameters in response to stress in *O. aureus, O. mossambicus* and two strains of O. niloticus. Aquaculture Res. 2004; 35:1434-1440.
7. Cameron JN. The influence of environmental variables on the hematology of pinfish (Lagodon rhomboids) and stripped mullet (*Mugil cephalus*). Comp Biochem and Physiol. 1970; 32:175-192.
8. Larsson A, Johansson-Sjobeck ML, Fanger R. Comparative study of some haematological and bio-chemical blood parameters in the fishes from Skagerrak. J Fish Biol. 1976; 9:425-440.
9. Atkinson E, Judd FW. Comparative hematology of *Lepomis microlophus* and *Cichlasoma cyanoguttatum*. Copeia. 1978; 2:230-237.
10. Putnam RW, Freel RW. Hematological parameters of five species of marine fishes. Comp Biochem and Physiol. 1978; 61:585-588.
11. Filho DW, Elbe GJ, Cancer G, Caprario FX, Dafne AL, Ohira M. Comparative hematology in marine fish. Comp Biochem and Physiol. 1992; 102:311-321.
12. Cataldi E, Di Marco P, Mandich A, Cataudella S. Serum parameters of Adriatic Sturgeon *Acipenser naccarii* (Pisces: Acipenseriformes): Effects of temperature and stress. Comp Biochem and Physiol. 1998; 120:273-278.
13. Belanger JM, Son JH, Laugero KD, Moberg GP, Dorochov SI, Lankford SE *et al.* Effects of short-term management stress and ACTH injections on plasma cortisol levels in cultured white sturgeon, *Acipenser transmontanus*. Aquaculture. 2001; 203:165-176.
14. Stockham SL, Scott MA. Fundamentals of Veterinary Clinical Pathology. Ames, Iowa State University Press, 2002, 434-459.
15. Romeo S, Donatti L, Frietas OM, Telxecira J, Kusma J. Blood parameter analysis and Morphological alterations as biomarkers on the health of *Geophagus brasiliensis.* Braz Arch Biol Technol. 2006; 49(3):344-347.
16. Adakole JA. Acute toxicity of a metal-finishing company waste water to *Clarias gariepinus* fingerlings Nigeria. Afr. J Aquat Sc. 2005; 20(2):69-71.
17. Pisut M, Pairoji T. Blood parameters and structures of blood cell by light and electron microscope in giant catfish, Department of Zoology Faculty of science, Kasetsart University, Bangkok 10903 Thailand, 1990.
18. Ikusemoran Mayomi, Jimme Abba Mohammed. A Decade Assessments of Maiduguri Urban Expansion (2002-2012) Geospatial Approach, Int. J Human Soc Sci. 2014. ISSN: 2249-460x & ISSN: 0975-587x.
19. Bankole NO, Sule OD, Okwudu EC, Amadu M. Investigation on the Frame and Catch Assessment Survey of Alau Lake, Annual Report of NIFFRI, 1994, 28.
20. Smith RB, Finnergan JK, Larson DS, Sahyour PF, Dreyfuss ML, Haga HB. Toxicologic Studies on Zink and Disodium Ethylene Bisdithio Carbamates. J Pharmocol axp Ther. 1993; 33:319-330.

21. Babatunde MM, Balogun JK, Oladimeji AA. Some Haematological Response of O. niloticus to acute and sublethal concentrations of paraquat. Int. J Fish Aqua stud. 2014; (1):206-215.
22. Kiontz GW. Haematological techniques and the immune response in rain bow trout. in; Disease of fish (Ed. Mawdeskley-Thomas, L.E.)T 'Symposium of Zoological Society, London No 30 New York and London Academic Press, 1972.
23. Blaxhall PC, Daisely KW. Routine Haematological Methods for use with fish blood. J fish boil. 1973; 5:771-787.
24. Murad AA, Houston H, Samson L. Haematological Response to Reduced Oxygen carrying capacity increased temperature and Hypoxia in gold fish *Carassius auratus.* J fish Biol. 1990; 36:289-305.
25. Davis AK, Maney DL, Maerz JC. The use of leucocyte profile to measure stress in vertebrates: A review for ecologist, DB Warnell School of forestry and natural resources, University of Georgia, 2008.
26. Adedeji OB, Adegbile AF, Comparative haematological parameters of the Bagrid catfish (*Chrysichthys nigrodigitatus*) and African catfish (*Clarias gariepinus*) from Asejire Dam Southwestern Nig. J Appl Sci Res. 2011; 7(7):1042-1046.
27. G. Rey V´azquez, Guerrero GA. Characterization of blood cells and hematological parameters in *Cichlasoma dimerus* (Teleostei, Perciformes) J Tiss Cel. 2007; 39:151-160.
28. Yayi AJ, Auta J, Oniye SJ, Adakole JA, Solomon V. Effects of sub lethal concentrations of Cypermethrin and some haematological parameters of the fresh water fish *Oreochromis niloticus* in static Bioassay. Nig. J Fish 2012; 9(1):390-39.
29. Adedeji OB, Adeyemi DK, Agbede SA. Effect of diazinon on blood parameter in the African catfish (*Clarias gariepinus*), 2009. Msc Thesis
30. Homatowska A, Wojtaszek J, Adamowicz A. Hematologicalindices and circulating blood picture in sun bleak *Leucaspius delineatus*. Zoologica Poloniae. 2002; 47(3-4):57-68.