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Full Length Research

Hematological analysis of *Clarias garipinus and Oreochromis niloticus* from Gwagwalada Market, Abuja, Nigeria

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ABSTRACT: *Tilapia* (*Oreochromis niloticus*) and Catfish (*Clarias gariepinus*) are very common fish but little is known about their physiology. This study was carried out to determine the complete hematological profile of catfish *(Clarias gariepinus*) and *Tilapia (Oreochromis niloticus*) both of which were obtained from a local fish vendor in Gwagwalada market. They were anaesthesed and analysed and the values of the haematological parameters are as follows: for Clarias gariepinus, 124.19 (white blood cell count), 2.35 (Red blood cell count), 131.94fl (Mean corpuscular volume), 32.05% (Packed cell volume), 10.68g/dl (Haemoglobin), and 32.60 g/dl (Mean corpuscular haemoglobin) and24.16 (Mean corpuscular haemoglobin concentration) were calculated. For *Oreochromis niloticus*, 121.65 (White blood cell count), 2.24 (Red blood cell count), 132.21fl (Mean corpuscular volume), 30.07% (Packed cell volume), 10.23g/dl (Haemoglobin), 35.98g/dl (Mean corpuscular haemoglobin) and 30.48 (Mean corpuscular haemoglobin concentration) were calculated. Slight differences were observed in the values of both species with Mean corpuscular volume (MCV) and white blood cell count (WBC) having the highest mean values while red blood cell count and hemoglobin having the lowest value among both species.

Key words: Haematological parameters, haemoglobin, mean corpuscular haemoglobin concentration, red blood cell count.

INTRODUCTION

Fish is of great importance to man and it is one of the most readily available and value source of rich and high graded protein available to man (Heming et al., 2004). Of all source of protein fish is the easiest to digest, with the most of the specie showing protein digestibility of between 90 and 98% (Acton 1999). The prominence of fish as a source of food has been growing, with a rapid expansion in the food industry as a result of increasing population awareness and the demand for it. Currently, about 4.3 billon fingerlings of desirable fish species are required annually for stocking.

Fish live in very intimate contact with their environment and are therefore very susceptible to physical and chemical changes which may be reflected in their blood components (Zinkyl, 2002). In fish, exposure to chemical compounds can either increases or decrease in haematological levels (Arowowora et al., 2003). Blood tissues truly reflect physical and chemical changes occurring in organisms. Therefore, detailed information can be obtained on general metabolism and physiological status of fish indifferent groups of age and habitat. The study of physiological and haematological characteristics of cultured fish species is an important tool in the development of aquaculture system, particularly in regard to its use in detection of healthy from diseased or stressed fish (Olaosebikan et al., 2000). Early diagnosis is also possible, when evaluating haematological data, particularly blood parameters (Stoskopf, 1999). The health of fish has often been reported in terms of the relationship between the weight and length increase.

However, there is a need to understand the physiological concept of fish health in relation to blood and the quality of dietary protein fed. Any changes in the constituent component of blood sample, when compared to the normal values could be used to interpret the metabolic state of animal and state of health. Low haematological indices are indications of anaemic conditions.

Tilapia fish (*Oreochromis niloticus)*

Tilapia is the common name for nearly a hundred species of chchlid fish from the tilapiine cichlid tribe (Sayed, 2006). It has three different genera: Oreochromis, *Sarotheroden* and *Tilapia* (Olaosebikan et al., 2000). The members of the other two genera used to belong to the genus tilapia but have since split off into their own genera. However particular species within are still commonly called tilapia regardless of the change in their actual taxonomic nomenclature. Tilapia are mainly fresh water fishes inhabiting shallow streams, ponds, rivers, lakes, and less commonly found living in brackish water. Historically, they have been of major importance in the artisan fishing in Africa and are of increasing importance in aquaculture and aquaponics. *Tilapia* can become problematic invasive species in new warm water habitat (Baker, 2002) whether deliberately or accidentally introduced but generally not in temperate climate due to their inability to survive in water cooler than about 21°C (70°F).

Tilapia typically have laterally compressed deep bodies, their lower pharyngeal bines are fused into a single tooth bearing structure. A complex set of muscles allow the upper and lower pharyngeal bones to be used as second jaw for processing food (Moray 2000), allowing a division of labour between the true jaws (mandibles) and the pharyngeal jaw. This means they are efficient feeders that can capture and process a wide variety of food items. Typically, Tilapia have a long dorsal fin and a lateral line which often break towards the end if the dorsal fin and start again two or three rows of scale below. Other than their temperature sensitivity, Tilapia exists in or can adapt to a wide range of conditions

Tilapia has been used as biological control for certain aquatic plant problems. It has a preference for a floating plant, but also consumes some filamentous algae. In Kenya, tilapia were introduced to control mosquito which was causing malaria, because they feed on mosquito larva, consequently reducing the number of adult female, the vector of the disease. But these benefits are however frequently outweighed by the negative aspect of tilapia as an invasive species (Hussein 1996).

Catfish *(Clarias gariepinus)*

The African cat fish Clarias *gariepinus is* a specie of catfish family Claridae, the air breathing catfishes. African sharp tooth catfish was introduced all over the world in the early 1980s for aquaculture purposes, so is found in countries far outside its natural habitat, such as Brazil, Vietnam, Indonesia, and India. Description Jumping upstream in a branch of the Sabie River in Indonesia. Young African catfish caught in the sewers of Rishon Lezion in Israel. The African sharp tooth catfish is a large, eel-like fish, usually of dark grey or black coloration on the back, fading to a white belly. In Africa, this catfish has been reported as being second in size only to the vundu of the Zambesian waters. Although, Fish Base suggests the African sharptooth catfish surpasses that species in both maximum length and weight. *Clarias gariepinus* has an average adult length of 1 to 1.5 m. It reaches a maximum length of 1.7 m and can weigh up to 60 kg (130 lb). These fish have slender bodies, flat bony heads, notably flatter than in the genus *Silurus*, and broad, terminal mouths with four pairs of barbells. They also have large accessory breathing organs composed of modified gill arches. Also, only their pectoral fins have spines.

Haematology

Haematology is the science of studying the anatomical, physiological, and pathological aspects of blood. Blood is a fluid tissue contained within the cardiovascular system. The fluid element of blood is plasma and the formed elements of blood are the erythrocytes, leukocytes and thrombocytes. The primary functions of blood are: Oxygenation of tissues, nutrition of tissues, maintenance of acid-base balance; and removal of metabolic waste products from tissues. Thus, any dysfunctions of blood can have severe effects on the physiological activities of the entire body. Also, certain physiological dysfunctions in the body are reflected as alterations in blood constituents, which can be used as diagnostic indicators.

The history of applying haematological methods as diagnostic aids in episodes of non-infectious and infectious diseases in confined and free-living populations of fish is quite meagre. The major reason for the lack of utility, as compared with mammalian medicine, is the variability of data. The complete blood count is an important diagnostic tool, with laboratory protocols and reference ranges well established in both human medicine and in veterinary medicine of domestic animals. Advances in zoo medicine have included the application of comparable CBC techniques adapted for many exotic animal species, including birds and reptiles, providing the veterinarian with a valuable tool for health assessment of newly-acquired quarantine animals, routine physical examinations, and for clinically ill animals. As we continue to adapt these methods for fish species, we face challenges similar to those encountered with the early applications of CBC techniques for birds and reptiles.

Like their terrestrial non-mammalian counterparts, fish erythrocytes are nucleated, and a number of the leukocytes also show similar morphology on Romanowsky type stained blood films: thrombocytes, monocytes, lymphocytes, and basophils.

Haematopoiesis

Literature shows that interest in understanding the blood cells of fish dates back to the mid 1800s. Leydig described the lymphomyeloid structures in elasmobranchs as a source of granulocytopoiesis (organ of Leydig) in 1857. Fange (2004) further studied haematopoiesis in a wide variety of *elasmobranch* species and described the following tissues: the organ of Leydig, a white mass located in the dorsal and ventral wall of the oesophagus (abundant granulocytes and lymphocytes); the epigonal organ, associated with the gonads (abundant granulocytes and undistinguished blast-type cells); the spleen (white pulp primarily lymphocytes and red pulp primarily erythrocytes); and the thymus (lymphoid only).

In the more primitive holocephalans, the site of granulocy topoiesis is found in the tissues within the cranium. In teleosts, the anterior portion of the kidney, referred to as the head kidney, is a major organ of hematopoiesis, with minor sites including the spleen, liver, and thymus.

Description of Fish Blood Cell morphology

Red blood cell (RBC) count

Red blood cells count is an estimation of the number of red blood cells per litre of blood. The RBC carries oxygen from the lungs to the rest of the body and they also carry carbon dioxide back to the lungs to be exhaled. Very low amount of red blood cells may lead to anaemia as a result of blood loss, over-hydration and a few other factors. Abnormally high numbers of red blood cells may lead to the clumping of the red blood cells, and these blocks the capillaries and makes it hard for RBC to carry oxygen.

Packed cell volume (PCV)

This test is used in measuring the space or volume the red volume cells take up in the blood. The value is given as a percentage of the red blood cells in a volume of blood. The packed cell volume and haemoglobin are the two major test that show if anaemia or polycythemia is present

Haemoglobin (Hb)

Haemoglobin, also known as haematocrit, molecules fill up the red blood cells: it carries oxygen and gives the blood cell its distinctive red colour. The haemoglobin test measures the amount of haemoglobin in the blood and it's a good measure of the blood ability to carry out oxygen through the body it also shows if anaemia or polycythemia is present.

Mean corpuscular haemoglobin (MCH)

It is the average amount of haemoglobin per red blood cell, measured in pictograms. The MCH may be low in types of anaemia where the red blood cells are abnormally small, or very high in other types of anaemia where the red blood cells are enlarged.

Mean corpuscular volume (MCV)

It is the average volume of red cells. Its value determines the kind of anaemia that will be gotten. When MCV is above or below average, it is termed as microcytic or macrocytic respectively, and if the value is within the expected range, then the anaemia is classified as normocytic. it is measured in femtoliters.

Mean corpuscular haemoglobin concentration (MCHC)

This is the average concentration of haemoglobin in the cells. The MCHC value may be low in iron deficiency, blood loss and anaemia caused by chronic disease.

In the light of the above, this study was carried out to determine the complete hematological profile of catfish *(Clarias gariepinus*) and *Tilapia (Oreochromis niloticus*).

MATERIALS AND METHODS

Study area

The study was conducted at the University of Abuja main campus premises. The main campus is located in Gwagwalada area council of the Federal Capital Territory (FCT), Abuja, Nigeria. Gwagwalada is located about 55 kilometres from the Federal capital territory (FCT), Abuja. It lies between the Latitude 8° 55' and 9° 00' North and Longitude 7°and 3' to 7° 05' East. Its land mass covers a total of 65 square kilometres and located along Kaduna/Lokoja express road. Gwagwalada has two distinct seasons which are; the rainy season which begin around March and ends around October and the dry season that begins around October and ends around March. Gwagwalada has a mean temperature which ranges from 29°C to 33°C. According to Balogun (2002), Gwagwalada has its highest temperature during the dry season between the month of January and April, and it drops to its lowest during the rainy season in the month of August.

Table 1. Hematological analysis for *Clarias gariepinus.*

Parameters	WBC	RBC	Hb (g/dL)	PCV (%)	MCV (fL)	MCH (g/dL)	MCHC
Mean	124.19	2.35	7.73	32.05	131.94	32.60	24.16
Std. Error of Mean	1.673	0.066	0.24	0.97	2.027	.879	.666
Median	125.75	2.43	7.90	32.50	133.10	32.50	23.60
Mode	123.40	2.53	6.30	31.00	113.50	32.50	26.20
Std. Deviation	7.48	.298	1.10	4.34	9.06	3.93	2.98
Minimum	105.70	1.80	5.20	23.00	113.50	24.30	20.00
Maximum	131.40	2.80	9.20	39.00	147.90	40.10	30.20
Sum	2483.8	47.03	154.60	641.00	2638.8	652.10	483.30

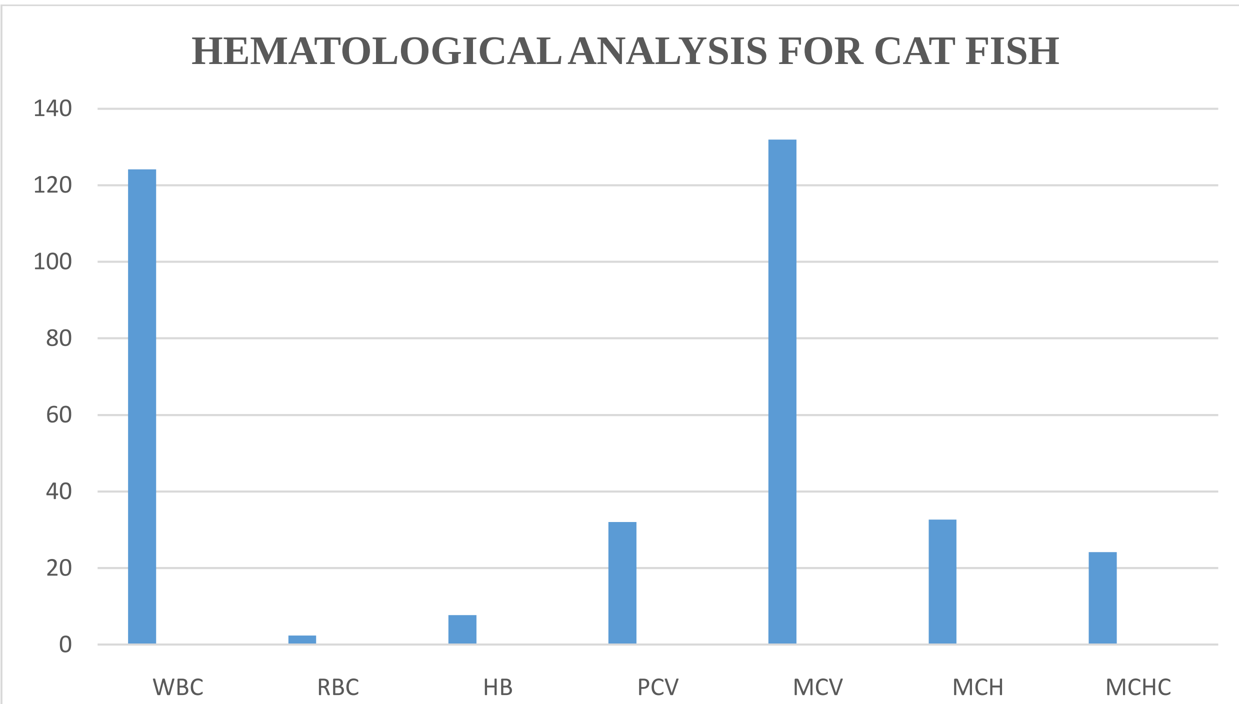

Figure 1. Graph of Haematological Value for Catfish (*Clarias gariepinus*) fish. Obtained from the mean (Table 1).

Method of sample collection

Tilapia (*Oreochromis niloticus* n=20) were obtained from Gwagwalada market and were bled at the market and samples were placed in EDTA bottles. *Clarias gariepinus* (n=20) were purchased from local fish vendor in Gwagwalada market. Their body weight and length were recorded and their blood samples were placed in EDTA bottles for hematologic purpose and refrigerated. The blood samples were analysed at the University of Abuja teaching hospital, using the Sysmex k-21N machine. This gave values of the white blood cells (WBC), red blood cells (RBC), haemoglobin (Hb), packed cell volume (PCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC).

RESULTS AND DISCUSSION

The mean value of the haematological parameters for catfish *(Clarias gariepinus*) was recorded. WBC had a mean value of 124, RBC had a mean value of 2.3515, HB had a mean value of 7.7300, PCV had a mean 32.0500, MCV had a mean of 131.9400, MCH 32.6050 and MCHC had a mean value of 24.1650.MCV had the highest value with a value 131.9400 while RBC has the lowest value with a value of 2.3515 (Table 1 and Figure 1). Figure 1 shows the graphical representation of the mean sample of haematological treatment on Tilapia fish. The graph shows that in RBC and HB the treatment is within range of 2-5-level which means it reduces. But it rises at MCV and WBC and then drops at PCV, MCH and MCHC. This shows that

Table 2. Hematological analysis for *Tilapia.*

Parameters	WBC	RBC	Hb (g/dL)	PCV (%)	MCV (%)	MCH (g/dL)	MCHC
Mean	121.65	2.24	10.23	30.70	132.21	35.98	30.48
Std. Error of Mean	1.43	0.113	0.33	1.054	2.63	0.70	0.586
Median	123.10	2.35	8.40	31.00	136.25	36.15	30.30
Mode	118.20	2.80	9.40	35.00	140.20	35.90	26.90
Std. Deviation	6.39	0.509	1.48	4.71	11.76	3.17	2.62
Minimum	101.80	1.40	4.70	20.00	110.10	30.20	26.30
Maximum	128.60	2.90	9.80	38.00	147.80	43.40	35.80
Sum	2433.0	44.80	161.20	614.00	2644.3	719.60	609.60

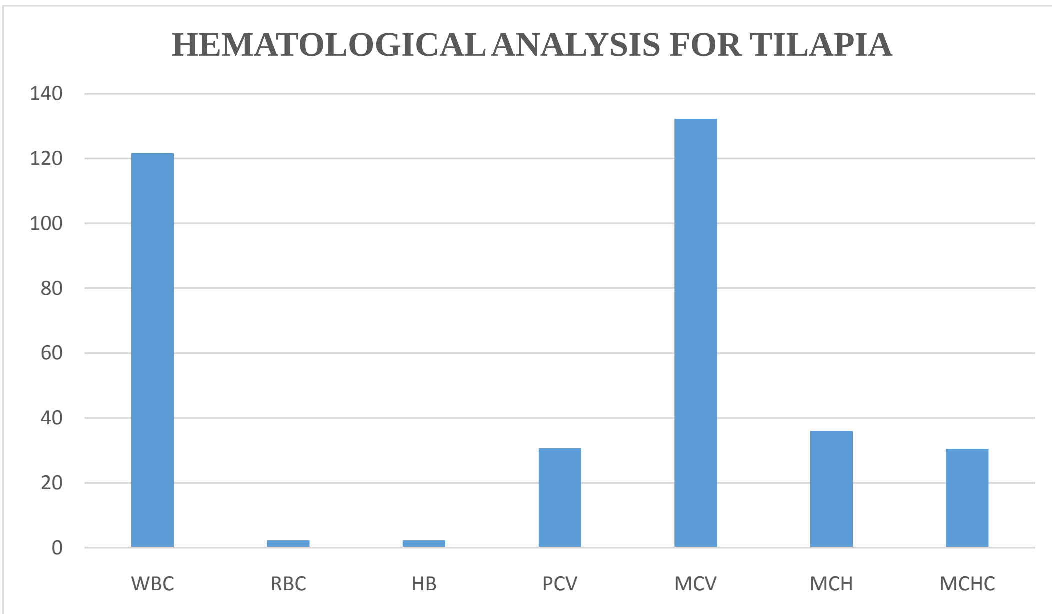

Figure 2. Graph of Haematological Value for *Tilapia* Fish (*Oreochromis niloticus)*. Obtained from the mean (Table 2).

as the treatment increases the sample also increases. It was then concluded that RBC, HB PCV, MCH and MCHC treatments were not effective but WBC and MCV treatments were effective.

The mean value of all the haematological parameter for tilapia was recorded. WBC had a mean value of 121.6500, RBC had a mean value of 2.2400, HB had a mean value of 2.2400, PCV had a mean value 30.7000, MCV had a mean value of 132.2150, MCH had a mean value of 35.9800 and MCHC had a mean value of 30,4800. MCV had the highest mean value among the parameters and RBC and HB had the same mean range (2.2400) and also had the lowest mean value among the parameters (Table 2 and Figure 2). Figure 2 shows the graphical representation of the mean sample of haematological treatment on tilapia (*Oreochromis niloticus*), the graph shows that in RBC and HB the treatment level was around the range of two (2) which means it reduces. But it rises in MCV, WBC and then drops in MCH, MCHC and PCV. And this shows that when the treatment is increasing the sample also increases. It was concluded that RBC, HB, MCH, MCHC, PCV treatments were not effective but WBC, MCV were effective.

When a comparison with previously reported on haematological value, the result obtained was similar for most of the analyses. Adeyemo (2007) noticed a slight difference between the packed cell volume (PCV) values of both species. The PCV value obtained for *Clarias gariepinus* was slightly higher (32.05) than that of Tilapia (30. 70) (Tables 1 and 2). Also the value of WBC of Catfish was slightly higher than in *Tilapia* (mean value of catfish being 124.1900 while that of *Tilapia* is 121.6500) (Tables 1 and 2). The value of MCV was higher in *Tilapia* (132.2150) than in catfish (131.9400). All the haematological values determined for both species was were reported as mean.

Conclusion

The differences obtained from the mean haematological values of both species were slightly apart. Therefore, there was no much significant differences between haematological values of *Clarias garipinus* and *Oreochromis niloticus*.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

REFERENCES

Acton, M. N., & Melissa A. S. (1999). Fish production and culturing. *American Journal of Fish Biology.*

Arowowora, N. O., Amina, H. O., & Burkitt, H. G. (2003). Effect of chemical contaminants on blood chemistry of teleostean fish. *Journal Of Fish Biology.*

Baker, J., & Frank, A. (2002). Culture of Hybrid Tilapia: University Of Florida, Institute of Food and Agricultural Science.

Balogun, M. O (2002). Temperature distribution in the Federal Capital Teritory, Abuja, Nigeria.

Fänge, R. (1968). The formation of eosinophilic granulocytes in the oesophageal lymphomyeloid tissue of the elasmobranchs. *Acta zoologica*, 49(1-2), 155-161.

Heming A. S., & Paleczny F. K. (2004). Comparative morphology and functions of blood cells in aquatic vertebrates. *Journal of Aquaculture.*

Hussein, S. Y., El-Nasser, M. A., & Ahmed, S. M. (1996). Comparative studies on the effects of herbicide atrazine on freshwater fish Oreochromis niloticus and Chrysichthyes auratus at Assiut, Egypt. *Bulletin of environmental contamination and toxicology*, 57(3), 503-510.

Moray B. N. (2000). Tilapia culture. Tilapia, *ITIS standard report.*

Olaosebikan, B. D., & Amina, Raji (2000). Nigeria Fresh Water Fishes. *African Journal of Aquaculture.*

Sayed, A. F. M. (2006). Tilapia Culture. Tilapia, *ITIS Standard Report.*

Stoskopf, M. K. (1999). Clinical pathology. Fish Medicine.

Zinkl, J.G. (2002). Avian hematology, Schalm's Vertinary Hematology.