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Studies on the Haematological Parameters of *Oreochromis niloticus* (Linnaeus, 1758) Cultured in Different Ponds

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Abstract: *The studies on the haematological parameters of Oreochromis niloticus from different culture facilities were investigated. Blood samples from Oreochromis niloticus reared in lined pond, earthen pond, concrete pond and plastic pond were collected and analysed for haematology, differential leukocyte count, low and high blood indices are analyse .The result of the study shows better haematological parameters in Oreochromis niloticus reared in earthen pond as 0.25, 8.70 and 6.50 for PCV, Hb and RBC while WBC was better in lined pond. The result of the differential leukocyte count, low and high blood indices were better in lined pond with NEU and LYM having the values of 34.00 and 77.00, while MCV, MCH and MCHC with values of 0.54, 18.1 and 33.18.Therefore, fish reared in earthen and lined pond can do better than those reared in concrete and plastic ponds.*

Keywords: *Haematological, Parameters, Cultured, Oreochromis niloticus Ponds*

Introduction

Fish represents at least 55% of the animals protein consumed in the diet of Nigeria With the demand outstripping the supply this has led pressures on the natural fisheries reserves, which have been subjected to gross over fishing for several yeas (Anyanwu *et al*, 2002). It is therefore imperative in order to achieve self-sufficiency for the country (Adesulu, 2001). The choice of species to culture and efficient management practices are very crucial to the overall success of any aquaculture ventures, according to Gabriel *et al.* (2007a). Effective handling procedures of species in the culture medium are key practical factors which determine the profitability and sustainability of aquaculture as an enterprise (Gabriel *et al*, 2007b). Effective management practice has been recognized as a key to profitable and sustainable fish farming in Nigeria, this has led to application of various manipulation strategies to maximize fish production in the culture environment (Akinrontimi *et al*., 2007). According to Akinrontimi *et al*. (2007), one of the production procedures commonly used in aquaculture is acclimation, which is preconditioning of fish before stocking in ponds and before use for experimental studies. Acclimation is, therefore, the modification of biological structures to minimize deviation from homeostasis, despite changes in environmental factors (Gabriel *et al*., 2007).

Haematological variables have been used as indices of fish health status in a number of fish species to detect physiological changes as a result of stress condition such as exposure to pollutants, hypoxia, transportation, anesthetic and acclimation (Akinrontimi *et al*., 2009). Hematological indices are therefore ready tools used by fish biologists and researchers in many parts of the world because, fish are associated with the aquatic environment and the blood will

reveal conditions within the body of the fish long before there is any visible sign of disease (Femades and Mazon, 2003).

Fish may be stressed when captured and when held in captivity. Effects of acclimation to captivity on haematological parameters of fish have been studied in a number of fish species, *Clarias gariepinus* (Ezeri *et al*., 2004; Gabriel *et al,* 2004), *Sarotherodon melanotheron* (Akinrontimi *et al.*, 2006; Gabriel *et al.*, 2007), Tilapia guineenis (Akinrontimi *et al*., 2010). There is limited information on the blood parameters of *Oreochromis niloticus*, which is a good experimental fish for studying the effect of environmental conditions on blood narameters (Omoregie and Oyebanji 2002).

Blood chemistry naematological measurement can provide valuable physiological indices that many offers critical feedback on transportation handiing stress in aquaculture as hematological measures have been reported (Bridges *et al*., 1976; Simpath *et al*., 1993). Moreover, it should be noted that haematological indices are of different sensitivity of various environmental factors and chemical (Lebedeva *et al*., 1998, Vosyliene, 1999). Previous hematological study of nutritional effects (Rehulka, 2000a), infectious diseases (Rehulka, 2000b), and pollutants (Rehulka, 2000c) brought knowledge that erythrocyte are the major reliable indicators of major source of hematological values of fishes are carried out for a variety of purpose; to establish a normal range of blood parameters (Etim *et al*., 1999). To investigate conditions that might lead to attraction of some condition or nutrition of fish (Clarks *et al*., 1979, Barham *et al.*, 1980). So many *Oreochromis niloticus* fish stocked in ponds or in many farms are dying as a result of infection. So there is need to carry out research in the area of fish health to be able to control the mortality.

Materials and Methods

Study area

This study was conducted at Department of Animal science laboratory, University Maiduguri, Bormo State, the climate is characterized by hot and dry season of March to June: temperature ranges between 27°C to 40°C. Raining season starts from June to October (annual rainfall) ranges from 200mm to 500mm and humidity is high from August (27% to 81%). Maiduguri is the capital and the largest city of Borno State. The city sits along the seasonal Ngadda River around Lake Chad located at longitude 11° 50'47 N and latitude 13° 9' 36 E.

Identification of fish species

Oreochromis niloticus were identified using the method of taxonomical identification by ldodoh, (2003) and the shape of their caudal fins, the number of dorsal and anal fins, spines and rays. Dorsal and anal fins count by counting the number of spines and anal rays in the dorsal or anal fins, *O. niloticus* has band in their bodies and in its caudal fins, and also the caudal fins has a round shape.

Sample collection

Sample of cultured Nile tilapia (*Oreochromis niloticus*) were obtained from Department of Fisheries University of Maiduguri and Garus fish farm. The blood Samples for the haematological study were collected right in the farms from 12 fish samples of *O. niloticus* between the periods 9-11am. The blood Samples was collected from the caudal vein (Adeyemo, 2004 and Stephen *et al* 2007).

Blood collection

Collection of the blood was done at the caudal vein using 5mls syringe and poured into an Di-potassium Ethylene diamine tetra acetic acid (EDTA bottle) containing anticoagulant to prevent the bloods from clotting (Whiteman, 2004). About 1ml of the blood was collected from each fish using 5mls of a plastic syringe, and a 21 gauge disposable hypodermic needle. The blood samples in the EDTA was placed in a cold box with ice and transported to Department of Animal Science laboratory, Faculty of Agriculture, for haematological analysis.

Haematological analysis

Haematological (H) or packed cell volume (PCV)

The micro haematocrit method was used in determining the hematocrit value by filling micro haematocrit capillary tubes up to 3/4 of its length with blood which has been mixed properly; seal one end with plaster seal, the sealed capillary tube were then placed on a micro haematocrit centrifuge with the sealed end outermost. Capillary tubes was placed in the haematocrit centrifuge for 5 minutes at 12,000rpm after spinning the blood divides into three(3) compartment which are the plasma, bufficoat and the red blood cell. Capillary tubes were taken out and the hematocrit values were recorded by placing the haematocrit tubes on the micro haematocrit reader. Using micro haematocrit reader (Hawker sky), the edge of the red blood cell was set at line 0 while the edge of the plasma was at the line 100 the readings was now taken from the bufficoat.

Haemoglobin (Hb)

Haemoglobin concentration was determined using Sahlis method. 0.1N hydrochloric acid was put inside haemoglobin tube to a yellow level mark 2; twenty micro miles (20u) of blood was mixed using stirrer, continual addition of distil water was added drop by drop until the color of the solution matches with the standard or test rode.

Red blood cell (RBC)

The red blood cells counts was carried out by diluting 20ul of blood in 380ul of red blood cells in formal citrate solution and then it was allowed to stay for 10minutes. Then a drop of the solution was added on the counting chamber and the red blood cells were counted under light microscope at 100 x magnification.

White blood cells (WBC)

The white blood cells count (complete blood count) was carried out by diluting 20ul of blood in 380ul of Turks solution which contain 1% of gelatic acetic acid and 99% of distilled water and then left for 10minutes.then a drop of the solution was added on the counting chamber, and the white blood cells were counted under the light microscope at 100 × magnification. The instruments used are automatic pipette,Turk's solution, microscope, slides (counting chamber) capillary tube and test tubes.

Differentials

The reverse side of the stained blood slides was cleaned with absolute alcohol and allowed to dry after a drop of olive oil is placed on the slide and was viewed under a light microscope at 10 x magnification to find out the percentage of neutrophils, lymphocytes, eosinophils, monocytes and basophiles.

Mean cell haemoglobin concentration (MCHC)

According to Wickham *et al*. (1990) mean cells haemoglobin concentration was estimated and as used by (Kori *et al*., 2008).

MCHC = haemoglobin (Hb) / Packed cell volume (PCV)gldl X100

Mean cell haemoglobin (MCH)

Mean cell haemoglobin was estimated according to wickham *et al*, (1990) formula as used by (Kori *et al*., 2008).

MCH = haemoglobin (Hb) /Red blood cell (RBC).pg X10

Mean cell volume (MCV)

Mean cell volume was estimated according to Wickham *et al*. (1990) formular as used by (Kori *et al*, 2008). Mean cell volume = packed cell volume × 10/red blood cells (MCV = PCV X 10/RBC) FI (femtomlitre).

Data analysis

Data obtained from the experiment were subjected to analysis of variance (ANOVA) and differences between means were Separated using LSD with statistic 8.0 for windows at 95% confidence level ($p<0.05$).

Results

Table 1 presents the haematological parameters of *Oreochromis niloticus* cultured from different culture facilities, higher value of 0.25 PCV was recorded in *Oreochromis niloticus* reared in an earthen pond followed by *Oreochromis* niloticus reared in concrete pond with the value of 0.24. The *Oreochromis* niloticus cultured in lined pond presented the value of 0.23 while *Oreochromis niloticus* reared in plastic tank show the value of 0.19 as the least value. *Oreochromis niloticus* reared in lined pond, concrete and eathen pond presented no significant differences ($P>0.05$) while *Oreochromis niloticus* cultured in plastic, pond shows significant variation ($P<0.05$) with those cultured in lined, concrete and earthen pond. Higher value of Hb was recorded as 8.30 in earthen pond followed by concrete pond with value of 7.95 while lined pond with a value of 7.80 and the least value recorded in plastic pond with the means of 6.30. The *Oreochromis niloticus* recorded in lined pond, concrete and earthen pond shows no significant differences but differ from the plastic pond ($P>0.05$) while those cultured in plastic tank shows significant differences ($P<0.05$). With *Oreochromis niloticus* reared in lined, concrete and earthen pond respectively. Highest value of WBC was recorded as 9.80 in lined pond followed by 9.40 at earthen pond, while 8.70 was observed in concrete tank with the least value of 7.10 in plastic tank. The *Oreochromis niloticus* culture in lined and earthen pond shows no significant differences ($P>0.05$) while the fish reared in concrete and the Plastic pond presented significant variation ($P< 0.05$). Red blood cell value was observed to be higher in fish raised in earthen pond with a value of 6.50 while fish obtained from concrete pond presented a value of 5.90. Fish collected in plastic pond produces a value of 5.25 and the least value of the RBC was in fish gotten from lined pond with the value of 4.30. *Oreochromis niloticus* cultured in concrete and plastic pond shows no significant differences ($P> 0.05$) but fish obtained from earthen and lined pond present significant variation ($P< 0.05$) among themselves.

Table 1**:** Haematological parameters *of Oreochromisniloticus* cultured from different pond

	Types of ponds				
Blood parameters	lined pond	concrete pond	plastic tank	earthen pond	SEM
PCV (%)	0.23[a]	0.24 [a]	0.19[b]	0.25[a]	0.01*
HB (g/dl)	7.80 [a]	7.95 [a]	6.30[b]	8.30[a]	0.41*
WBC (cell/l)	9.80 [a]	8.70[b]	7.10[c]	9.40[ab]	0.30*
RBC (cell/l)	4.30[c]	5.90[ab]	5.25[b]	6.50[a]	0.31*

Keys means follow by the same superscript within a treatment are not significantly different (P>0.05).
PVC = Packed cell volume
HB = hemoglobin
WBC = white blood cell × 10^3
RBC = red blood cell × 10^3
SEM = stranded arrow of mean

Table 2: presented the differential leukocytes counted in *Oreochromis niloticus* culture under different culture facilities. The highest value of 34.00 of NEU was in *Oreochromis niloticus*r eared in lined pond followed by *Oreochromis niloticus* culture in concrete and plastic tanks with the values of 31.50, 29.00 and 23.00 respectively. *Oreochromis niloticus* raised in the lined and concrete pond showes no significant differences (P>0.05) with *Oreochromis niloticus* reared in plastic and earthen pond. However, *Oreochromis niloticus* raise in concrete and earthen pond also show no significant differences (P>0.05) *Oreochromis niloticus* raised in plastic pond shows significant differences with the other *Oreochromis niloticus* raised in line, concrete and earthen pond. The highest value of LYM is recorded as 77.00 in plastic tank and then 71.00 in earthen pond. Then 68.58 presented in concrete pond. The least value of 66.00 was recorded in lined pond. The *Oreochromis niloticus* raised in all the different culture facilities presented the same value as 0.00 in terms of EOS, MON, and BAS which shows no significant differences (P> 0.05.) in all the treatment.

Table 2**:** differential leucocyte count of *Oriochromis niloticus* cultured under different pond

	Types of ponds				
Blood parameters	lined pond	concrete pond	plastic tank	earthen pond	SEM
Neutrophils	34.00[a]	31.50 [a]	23.00[c]	29.00[b]	1.27*
Eosinophils	0.00 [a]	0.00 [a]	0.00 [a]	0.00 [a]	0.00[ns]
Lymphocytes	66.00[c]	68.50[bc]	77.00 [a]	71.00[b]	1.27*
Monocytes	0.00[a]	0.00 [a]	0.00 [a]	0.00 [a]	0.00[ns]
Basophils	0.00 [a]	0.00 [a]	0.00 [a]	0.00 [a]	0.00 [ns]

Keys means follow by the same superscript within a treatment are not significantly different (P>0.05).

Table 3: shows the low and high blood indices of *Oreochromis niloticus* cultured in different pond. The highest value of MCV was found in *Oreochromis niloticus* culture in lined pond as 0.54 follow by *Oreochromis niloticus* raised in concrete pond with a value of 0.40. The *Oreochromis niloticus* reised in earthen, and plastic pond had the value of 0.38 and 0.36 respectively. Highest value of MCH was recorded as 18.10 in lined pond and the value of 13.45 was recorded in fish cultured in concrete pond followed by 12.75 in fish obtained in earthen pond, least value of 12.00 was presented in nile tilapia gotten from plastic tank

respectively. The fish sample collected from plastic and earthen pond shows no significant differences (P>0.05). While the fish produced in concrete and lined pond had significant differences p> 0.05. Value of MCHC was recorded in the sequence of earthen pond with the value of 33. 20, 33.18, 33.16 and 33.12 in fish reared in earthen, lined, plastic and concrete pond respectively. There is no significant differences (P>0.05) was seen in all the treatment in term of the MCHC values.

Table 4.3 low and high blood indices of *Oriochromisniloticus* culture in different pond

	Types of ponds				
Blood parameters	lined pond	concrete pond	plastic tank	earthen pond	SEM
MCV (FL)	0.54[a]	0.40 [b]	0.36c	0.38b[c]	0.01*
MCH (PG)	18.10 [a]	13.45 [b]	12.00[c]	12.75[bc]	0.39*
MCHC (pg)	33.18 [a]	33.12[a]	33.16[a]	33.20[a]	18.91[ns]

Key; means follow by the same superscript within a treatment are not significantly different (P<0.05).
MCV = means corpuscular volume
MCH = means corpuscular hemoglobin
MCHC = means corpuscular hemoglobin concentration

Discussions

The present study reveal higher value of haematological paramaters of *Oreochromis niloticus* cultured from different pond as 0.25, 8.3, 9.80 and 6.50 for PVC, Hb, WBC and RBC respectively. This higher value of haematological parameters obtained in this study were lower than the value obtained by Oluwabukola, (2014) who got the value of 22, 7.2, 42.6 and 37.0, The difference of haematological parameters could by as result of feed and also culture facilities. Similarly, Akinrontimi, (2010) reported the high value of PVC, RBC, WBC and Hb as 19.65, 3.52, 21.18 and 6.61. The higher value of differential leukocyte count obtained from this study in terms of NEU and LYM (34.00 and 77.00) were lower than the finding by Oluwabukola, (2014) who obtained the NEU of 38.0, while the high value of LYM as 77.00 is greater than the finding of Oluwabukola, (2014) who obtained the LYM of 70.0. *Oreochromis niloticus* cultured in all different culture facilities presented the same value of 0.00 in term of EOS, MON and BAS. The high value of low and high blood indices of *Oreochromis niloticus* cultured from different pond obtained from this study in term of MCV and MCHC (0.54 and 33.20) were all lower than the finding Oluwabukola (2014) who obtain the MCV and MCHC 7.69 and 33.33. The differences in the values of MCV and MCHC from the two research could be due to the differences in the cultured facilities. High value of low and high indices of *Oreochromis niloticus* cultured under different pond obtained from this study in term of MCH which is 18.10 were is greater than the finding of Esther (2014). Who got the value of 2.50.

Conclusion

It is concluded that the haematological parameters of *Oreocromis niloticus* was better in earthen pond for PCV, Hb and RBC while WBC is better in lined pond. Differential leucocyte count and low and high blood indices were all better in *Oreochromis niloticus* reared in lined pond. Therefore, fish reared in both earthen and lined pond are assumed to do well

Recommendation

It is recommended that the ertsarms should reared their fish in either lined or concrete pond. Further studies are to encourage on haematology of other fish species such as *clarias gariepinus*

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