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Research Paper

Comparison of haematological parameters between male and female catfish (*clarias gariepinus*) grown in cow dung earthen pond

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Haematological analysis of *Clarias gariepinus* was investigated with a view of establishing species specific baseline values for Haematologic parameters such as Red blood cell (RBC), White blood cell (WBC), Hemoglobin (HB), Mean cell haemaglobin (MCH), Packed cell volume (PCV) and Mean cell haematologic values did not differ significantly ($p<0.05$) on gender basis. Pearson's correlation coefficient indicated significant relationship for standard length with PVC; body weight with WBC, MCH, RBC and MCHC. The remaining parameters did not exhibit such relationship. The use of Hematological techniques to assess fish health is generally accepted.

Key words: Hematologic parameters, Hemoglobin and *Clarias gariepinus.*

INTRODUCTION

African cat fish known as *Clarias gariepinus* commonly called *Clarias* belonging to the family of *Clariidae* and the group of the prominent cultivable *Clarias* species found in Nigeria, is one of the most important tropical cat fish species for aquaculture practice (Rahman *et al.,* 1992). They are easily cultured with large economic gain because of their air-breathing and hardy nature, suitable reproductive strategy, nutritional efficiency and attainment of large size in a short time and in spite of its commanding presence in the wild. This might have been due to its high feed conversation rates including its high resistance to handling and stress (Olaifa *et al.,* 2003; Eyo and Ezechie, 2004, Akinsanya and Otubanjo, 2006; Ogundiran *et al.,* 2009). *Clarias gariepinus* is known to tolerate harsh aquatic conditions in terms of low dissolved oxygen concentration by utilizing both dissolved and atmospheric oxygen (Okechi, 2004), though *Clarias gariepinus* can endure long period of draughts, below 9-10°c (Peteri *et al.,* 1992) *Clarias gariepinus*, like any other aquatic organism, live in direct contact with the aquatic environment where some changes are rapidly reflected as measurable patho-physiological alterations in exposed fishes.

Haematology

Hematology is a branch of medicine concerning the study of blood, the blood forming organs and blood diseases. The word "Heme" comes from the Greek word for blood (Baker, 1985). Hematology is practiced by specialist in the field who deal with the diagnosis, treatment and over-

all management of people with blood dis-orders ranging from anemis to blood cancer. Some of the diseases treated by hematologist include (Fischbech, 1992).

(i) Iron deficiency anemia and other types of anemia such as sickle cell anemia or trauma
Related anemia.
(ii) Polythemia or excess production of red blood cell.
(iii) Myelofibrosis
(iv) Leukemia
(v) Platelet and bleeding disorders such as hemophilia, idiopathic thrombocytopenic
(vi) Hemoglobin pathies such as thalassemia and sickle cell diseases
(vii) Multiple myeloma
(viii) Malignant lymphomas
(xi) Blood transfusion
(x) Bone marrow stem cell trans plantation.

COMPONENTS OF BLOOD CELL

Blood is made up of liquid portion plus all the various blood cells. It functions to transport nutrient and oxygen to the cells waste and carbon dioxide to the organs responsible for their removal or breakdown, and also defend the body against bacteria, viruses, and other organism. The liquid portion of blood is referred to as plasma, if the blood was not allowed to cloth and serum, if it was (Henry, 2001). This liquid portion, without the cells, is generally as straw or light yellow color. Every drop of blood literally contains millions of blood cells. Although the sample drawn for a complete blood cell (CBC) may seems small (Ringsrud 1995), it contains such high numbers of cells that is an excellent and accurate portrayal of the total numbers of these cells found in the blood stream. The complete blood cell (CBC) is concerned with the quantities and types of red blood cells, white blood cells and platelets.

Red blood cells (RBC)

Red blood cells (RBC's) these are the tiny work horses that are responsible for carrying oxygen to the body's tissue. Red blood cells (RBC's) contain the molecule hemoglobin (Luzzatto and Lucio, 1981). Oxygen that is taken into our bodies attaches to the hemoglobin as the red blood cells (RBC's) pass through the lungs. The red blood cells (RBC's) then deliver the oxygen to all the other cell in the body and take the carbon dioxide back to the lungs (Linne and Ringsrud, 1999). (RBC's) are formed in the bone marrow the bone marrow constantly produces new RBC's, since the life span of an RBC's only 120 days. The body measures their numbers simply by evaluating the quantity of oxygen being supplied to its tissue. If not enough oxygen is available, then the body sees that as a need for more working RBC's. If more RBC's are needed quickly, then more immature cells (called reticulocytes) are released into the circulation from the bone marrow. However, if there are adequate cells present, it slows down the release of new ones.

Hematocrit (PCV)

In the complete blood cell, we determine the number of red blood cells in several different ways. The quickest and easiest is called the hematocrit also referred to as a packed cell volume (PCV). If the PCV is low (Raphael, 1983), there are fewer red cells in the body than we would expect, this condition is referred to as anemia PCV is determined as the percentage of the cellular portion relative to the total amount of blood in the tube, blood was collected.

White blood cells (WBC)

The other major types of blood cells are the white blood Cells are the blood cells (WBC's) which are also referred to as leukocytes. There are many more red blood cells than there are white blood cells for every leukocyte present in a sample there will normally be 600-700 red blood cells (Lewis et al., 2002). The major role of the white blood cells is to defend the body against invading organism such a bacteria, viruses and fungi. There are different types of leukocytes and a white blood count is a total of all the various kinds (Wintrobe, 1981). The number of white blood cells is typically elevated when the body is fighting a severe infection or stressed by metabolic toxins (acute kidney failure with waste products building up in its body would normally have an elevated white blood cells will be released into the blood and the levels will rise.

Platelets

The final component that we study when interpreting the CBC, are the platelets they serve a vital function in the formation of cloths. To recognize their importance, think of having a large cut and how it would be possible to bleed to death, if normal clothing did not occur. In actuality, we are bleeding all the time (Koepke and John, 1984). Microscopically small vessel often break within seconds and the amount of blood lost is significant. The platelets and the protein called fibrinogen are responsible for the repair of all damaged blood vessels. Even if there was never a cloth on the outside of the bodies, without platelets and fibrinogen working together we would bleed to death internally within a matter of days (Robinson, 1993). If the platelet numbers are decreased, it may mean that the available cells in cloth formation, or that

their risk, if bleeding should commence in the future.

Hemoglobin (HB)

A final way we can evaluate the red blood cells is by quantifying the amount of hemoglobin present. Hemoglobin transport oxygen from gill to inner organs in fish and this process is affected by temperature (Hoffbrand 1993). One of the major environment factors for fish. The hemoglobin gene clusters have been well studied in humans and several model fish species but remain largely unknown in cat fish.

Mean ceil volume (MCV)

A standard part of the complete blood count, the mean of the red blood cell (Hayhoe and Fleman, 1992). This is a calculated value derived from the hematocrit (packed cell volume) and the red cell count (the hematocrit is the ratio of the volume of the red blood cells to the volume of whole blood white the red cell count is the number of red blood cells in a volume of blood).

Mean corpuscular/cell hemoglobin (MCH)

Mean corpuscular hemoglobin or mean cell hemoglobin per red blood cell in a sample of blood (Hall and Malia,1984). It is reported as part of a standard complete blood count MCH value is diminished in hypochromic anomies. It is calculated by dividing the total mass of hemoglobin by the number of red blood cell in a volume of blood.

Mean corpuscular/cell hemoglobin concentration (MHCN)

The mean cell hemoglobin concentration of hemoglobin in a given volume of packed red blood cells (Cheesebrough, 2000). It is reported as part of a standard complete blood count. The MHCN is a calculated value derived from the measurement of hemoglobin and the hematocrit MHCN is a standard part of the complete blood count. Many research and test have been carried out on Clarias gariepinus in relationship to its haematology. Burchell in 1822 carried out an experiment on the effect of the probiotic lactobacillus acidophilus, on the growth performance, haematology parameters and immunoglobin concentration in African catfish (*Clarias gariepinus*, (Burchell, 1822) fingerling.Catfish constitute a unique and large group of commercially important freshwater fish that are widely distributed throughout the world. the African catfish Clarias gariepinus, is one of the most important cultured fish species in Malaysian waters and in other Asian countries and represent one of the most widely produced food fish in the world (Sutriana, 2007). It is well known that *Clarias gariepinus* grow very fast and needs to consume in lot of feed during it life circle. However, some diseases have an influence on the health and production of this fish during it culture, it has also be reported in the literature (Thune et al., 1993). treatment and control of this diseases under culture condition has commonly be performed using chemical control agent (Wellborn, 1994; Vijayakumaran and Radhakrishnan, 2003), some of which have been reported to disrupt the fish intestine (Stream and Ring, 1993) and pollute the environment (Ranjit and Singh, 2003), apart from increasing the production cost (Thune et al., 1993) therefore to minimize the use of chemical drugs for treatment of some of these fishes and to reduce their effect on the fish and the environment and also decrease the aquaculture research, 2009, 40, 1642- 1654 doi:10.1111/j.1365-2109. 2009.02265. 2009 University Sains Malaysia 1642 journal compilation 2009 Blackwell publishing Ltd production cost, cheaper and safer alternatives have become a vital necessity. In intensive larval culture, the large quantities of sterilizers and drugs used in culture practice often negatively affect the development of a protective gastrointestinal micrflora in fish (Austin and Al- Zahrami 1988; Stream and Ring, 1993). For this reason, reared larvae and fish are more at risk of stress because of exposure to intestinal Lora disruptions (FFV– Gil, Roque and Turnbull 2000). As a result of this, it is necessary to search for alternative method in aquaculture that could possibly maintain a microbiologically healthy environment in the animals and at the same time enhance production and economic profits.

One such method that has been proposed to improved growth performance without damage to intestinal lora is the probiotic method (Stream and Ring, 1993).

Most studies on probiotics in fish focus on the effect on response to the immune system, especially at the early stage of the fish life. Moreover, some of this have been reported the possibility of improving fish growth, health and food digestibility when probiotic are used. Generally, probiotic are associated with micro-organisms that produce bacteriocins and other compounds that have probiotic characteristics (Gildberg et al., 1997; Gatesoupe, (1999) declined probiotics as living microbial cells added as dietary supplements, which improve the health of human and terrestrial livestock. Speck, (1978) on the other hand reported consumer need probiotic bacteria in concentration above 105 – 106 cells gram – 1 of food consumed to effectively derive health-promoting benefits. Recently, in aquaculture, the use of probiotic bacteria to enhance the growth performance and to also improve the quality of water in which fish are cultured (usually need bioremediation or bio control when they act only in water) has received considerable attention

(Vershuere, Rombaut, Sorgeloos and Verstraete 2000). Lactic acid bacteria have probiotic properties and some beneficial advantages, as it enhances the digestive process and could therefore be useful for its beneficial effects on the health of its consumers.

The application techniques of lactobacillus acidophilus as a probiotic to enhance the growth performance and to improve the immune system of Clarias gariepinus is not common, even they documented report of similar studies conducted with other bacteria species. Information regarding the effect of probiotic on the growth performance of this candidate species is therefore scarce and its impact merit examination. This study was thus conducted to evaluate the effect of the probiotic lactobacillus on the growth performance, and immunoglubin concentration of African catfish *Clarias gariepinus* fingerling.

In the present studies better concentration of Hemoglobin, hematocrit, red blood cell, white blood cell, total serum protein serum glucose, Mg 21, Ca 21, Cl-and cholesterol were observed in *Clarias gariepinus* fingerling maintained on the diet supplemented with Lactobacillus acidophilus, showing significant differences ($P<0.05$) from the control. This observation probably indicate support for the suggestion that fish feed probiotic supplemented diet were healthier than the control due probably to the decreased cortisol levels in the blood plasma as reported by Carnevali *et al*. (2006) in sea bream (S. aurata). In our trial, the value of hematocrit agreed with that suggested by Clarks, white more Jr and Mc Mahon (1979) who reported that value of hematocrit in fish are generally between 20% and 35% and rarely exceed 50%. No similar studies were available with-which to compare the variation of haematology values in catfish *Clarias gariepinus* maintained on a probiotic diet obtained in the present study. However, the pattern was generally similar to that observed in other species (Benli and Yildiz 2004; Ranzani- Paiva, Ishikawa, das Eiras and da Silveira 2004) or similar to those fed with diet not supplemented with probiotics in the same species.

Another experiment was carried out by Farnandes and Mazon, (2003). On the influence of sex,source, health status and acclimation on the haematology of Clarias gariepinus (Burchell, 1822). According to Farnandes and Mazon, (2003), hematological parameters are closely related to the response of the animals to the environment, and indication that the environment where fish live could exert some influence on hematological characteristics (Kori-Siakpere, 1985). Sex of the fish may also influence the blood parameters. Studies on sexually matured gold fish. (*Carassius auratus*) *(Salvelinus fontinalis)* and brown trout *(Salmo gairdneri)* (Sniezsko, 1960) showed that males consistently had higher packed cell volume values than the females and this has been proposed as means of sexing fish changes in the blood characteristic *Clarias gariepinus* caused by stress because to exposure to environmental pollutants, diseases or attack by pathogens have been studied by a number of authors (Onusiriuka and Ufodike, 2000; Ezeri, 2001; Gabriel and Opabunmi, 2004) this indices has been employed in effectively monitoring the response of the fish to the stressors and thus it health status under such adverse condition. Report on the influence of sex, source and acclimation on the blood parameters of *Clarias gariepinus*, an important aquaculture species in many tropical and sub-tropical countries is non-existent; this study accessed the influence of these factors on the haematology of *Clarias gariepinus* with the hope of providing some useful information on this aspect of its biology.

The hematological characteristic of a number of cultivatable fish species have studied with the aim of establishing normal value ranges, and any deviation from its may indicate a disturbance in physiological processes. Several of these studies were attended to determine if significant variation from normal value of these parameters exists that could be attributable to some internal or external factor (Gabriel *et al.,* 2004). In the assessment of blood parameters of gold fish, *Carassius auratus,* Summerfelt (1967) observed that male constantly have significantly higher hematocrit values than the female and suggested the need to separate blood data on the basis of sex to avoid contributing sex difference to other factors. His observation is not consistent with the result obtained from this study, with regard to the source and health status of the fish. The observation in this study agree with that of Kori-Siakpere, (1985), who noted wide variation in the HB, PCV and RBC indices of *Clarias ishierensis* from the wild. Furthermore, we recorded variation in the value of the various blood parameters within the same sex. Similar observation has been made in other fish species and were attributed to intrinsic factors (Etim *et al.,* 1999). However, pooled data indicate that after acclimation, males constantly had higher values of WBC, neutrophils and monocytes than the females, but the reverse was the case with lymphocytes. It appears then that the males are more responsive to the stress of acclimation than the females. The source of fish (wild or cultured) may influence the state of health. This could be revealed by changes in the Gabriel *et al. (*2004*)* 465 hematological parameters due to variations in physico-chemical parameters of habitats, exposure to aetiological agents and environmental pollution among others (Das, 2003). Interaction between sex of C*larias gariepinus*, source (wild or cultured), acclimation and health status indicated that sources of fish had highly significant impacts on the health status. This is shown in the value of WBC neutrophils lymphocytes and monocytes and differential counts. Besides, fish from wild had higher ESR values after acclimation than cultured. The significant interaction recorded between source of fish and health status seems to suggest that the source of fish plays an important role in the health status when adjudged by changes in WBC

and differential counts. Changes in WBC and differential have been reported to play important roles in the assessment of the state of health of *Clarias gariepinus,* leucopaenia and leukocytosis have been also reported in the fish under exposure to pathogens, heavy metals and chemo-therapeutants (Van Vuren *et al.,* 1994).

Another experiment was also carried out on the haematology response of *Clarias gariepinus* to changes in acclimation temperature. Fish live in a very intimate contact with their environment, and are therefore very susceptible to physical and chemical changes which may be reflected in their blood components (Wilson and Taylor, 1993). Temperature of aquatic environment is important for ensuring survival, distribution and normal metabolism of fish, failure to adapt to temperature fluctuation is generally ascribed to the inability of fish to respond physiologically with resultant mortality, which is related to changes in the metabolic pathways. This result is a collapse in osmo-regulatory functions during temperature extremes (Gubbins *et al.,* 2000). The normal range of temperature in the tropics to which fish are adapted is 22-35ºC (Blaxhall and Daisley, 1973). In the salmonids studied by Rijzhkor, (1976) oxygen consumption fell at 20-25ºC or about 7oC above the acclimation temperature. Also Korovin, 1976, Wilson and Taylor, 1993 observed this phenomenon in common carp (*Cyprinus carpio*) at 28-32ºC. Acclimation is the sum total of the adjustment, which fish make to long-term changes in their environment. The changes are most frequently thought of in terms of seasonal or other temperature changes but can also occur in response in changes in oxygen level, salinity or other environmental factor. The changes are complex mixture of adjustment in hormones, metabolic pathways, enzymes and behaviors which occur in all functional level from the molecular and cellular to the whole organism and population. The temperature has a profound effect on chemical and biological processes. As chemical and biological reaction rates double for every 10ºC increase in temperature, the metabolic activity of aquatic organism also increases an animal uses twice as much oxygen (Howerton, 2001). The result of this investigation showed a decrease in hematocrit (PVC), Hemoglobin (HB) and total plasma protein (TPP) at 23+1ºC and 41+1ºC relative to control (29+1ºC). It is well known that a reduce quantity and quality of erythrocytes and a decreased Hemoglobin level lead to deteriorated oxygen supply. In addition to the transport of oxygen, erythrocytes have other functional tasks in the body, an insufficient quantity and quality of red cells would therefore consequently have several additional effects on metabolism beyond the simple oxygen supply for tissue metabolism, decrease in total plasma protein has also been reported to suggestive of malabsorption (Gross *et al,.* 1996). The highest blood glucose level however was observed at 23+1ºC and high blood glucose at low temperature is indicative of retarded metabolism, and is also an index of sub-lethal stress (Hattingh, 1976; Connors *et al,.* 1978, Best *et al., 2001*). The HCO_3 -, Na +, K+, Cl- and osmolality were temperature independent, this is an indication *Clarias gariepinus* seem to have the ability to conserve osmolality over a wide and/or higher temperature range. According to Smith *et al.,* (1981) osmolality values remained relatively stable in carp at all temperature, whereas in *S.mossambicus* a wide span was observed at 15ºC and at 25ºC in trout. There was no significant difference in HB, PVC and TPP at 35+1ºC the MCV, MCH, MCHC were temperature independent it can therefore be concluded that C*larias gariepinus* has a high adaptive ability. However, it should note that fish differs in their tolerance to extremes in temperature depending on the species involved, stage of development, environmental temperature dissolved oxygen (D.O), pollution, season and extent to which the environment is heated and that temperature fluctuations affect feeding rate spawning, D.O, uptake, pH level and other water quality parameters which would then affect the well-being of the fish. When water is highly heated, much energy, oxygen and vapor is released into the air leaving behind a high concentration of carbon dioxide, which makes the water acidic. Waste-water therefore has a high acidity (pH 1.6-1.8) and this renders it especially harmful to fish. The temperature of water had a direct influence on t6he toxicity of many pollutants and on the growth of microorganism. Temperature of inland water fluctuates with industrial use.

MATERIALS AND METHODS

This research work was conducted in university of Abuja teaching hospital (specialist) in Gwagwalada, one of the six area council of the F.C.T of Nigeria, Abuja. It lies between latitudes 80°55' north and 9°00' North and longitude 7°00' east and 7°05' east. It covers a total of 65 square kilometers with a temperature range of between 21 to 26.7°C and an annual rainfall of approximately 1,650 mm. Abuja.

Experimental fish

A sum of forty (40) catfish (*Clarias gariepinus)* with length ranging from 50-60 cm in length ranging from 150– 250 g, were bought from Agricultural Development Project. (A.D.P) Gwagwalada Abuja. The fish were divided into two groups with varying length and weight as well as their sexes. Group 1 contains 20 (twenty) cat fish ranging from 50– 55 cm in length and 150 – 200 g in weight , all females. Group 2 contains 20 (twenty) fish as well, 56–60 cm in length and 200– 250 g in weight all male fishes under experimentation were picked individually for the collections of its blood.

Collections of blood samples

Fish were caught individually in a small hand net from the

container. After the preliminary investigation of the length and weight. The fish were then placed belly upward and blood samples obtained from the caudal circulation with the aid of a heparinized 2 cm^3 disposable plastic syringes and a 21guage disposable hypodermic precaution with fish blood because contact with glass results in decreased coagulation time. The site chosen for puncture (about 3-4cm the genital opening) was wiped dry with tissue paper to avoid contamination with mucus. The needle was inserted perpendicularly to the vertebral column of the fish and gently aspirated during penetration. It was then pushed gently down until blood started to enter as the needle punctured a caudal blood vessel. Blood was taken under gentle aspiration until about 4ml has been obtained, then the needle was withdrawn and the blood gently transferred into lithium heparin anticoagulant tube in order for the blood not to cloth.

Centrifuging of blood sample

The blood in the anticoagulant tubes was placed on a centrifuge. A centrifuge is a heavy machine that spins test tubes at a high speed. This centrifuge force pulls particles to the bottom from the plasma as well as any substances. The blood was centrifuge for 10 min.

Haemotological test

The following hematological test were carried out to analyze the blood of *Clarias gariepinus* brought from agricultural development project (A.D.P) located in Abuja. All analysis was according to the reading in the mind ray machine.

Blood analysis

The below were analysis from the hematological test carried out; red blood cell (RBC), white blood cell (WBC), hematocrit or packed cell volume (PCV), hemoglobin (HB), mean cell volume (MCV) mean corpuscular hemoglobin (MCH),mean corpuscular hemoglobin concentration (MCHC) and platelets from each blood sample.

Statistical analysis

The data obtained were analyzed using one way analysis of variance (ANOVA) at a = 0.05.

RESULTS

The result of the hematological analysis for White blood cell (WBC), Red blood cell (RBC), Hematocrit (PVC), Hemoglobin (HB), Mean cell volume (MCV), Mean cell hemoglobin (MCH), Mean cell hemoglobin concentration (MCHC) and Platelet conducted on the blood samples of the fishes are shown in (Tables 1 and 2) respectively. Also the statistical analysis is shown in the (Appendix).
There is a significant difference between the female *Clarias gariepinus* and male *Clarias gariepinus*, the male are bigger in size as well as their White blood cell (WBC) and Pack cell volume values than the females and this has been proposed as a means of gender in fishes.

DISCUSSION

Results relating to the Hematological analysis (Tables 1 and 2) in the blood analysis of African Catfish (*Clarias gariepinus*) are presented as follows. It was observed that the packed cell volume White blood cell, Neutrophils, Monocytes values of the males are higher than that of the females, several factors affect Hematological values; these includes sex, age, size, environmental and physiological conditions. Moreover, it is difficult to ascertain that samples from which normal values may be constructed are completely healthy (Dacie and Lewis 1991) as observed from results cited in (Table 1) (all females). The Hematological characteristics observed in the present study showed marginal differences when compared with that of (Table 2) (all males). The differences observed for separate sexes resulted from larger sizes of the males and hormonal interactions of the females compared with the males, while Blaxhall and Daisley, (1973) was not categorically on the influence of sex on Haematology a factor attributed to sexual immaturity of the fish species used, Dacie and Lewis, (1991). Believed gender influences Haematology: Larson et al. (1976) included gender among factor influencing Haematology while Korisiakpere and Egor, (1997) observed differences in Haematology for different sexes of *Clarias gariepinus* although sex specific data were not cited (Blaxhall and Daisley, 1973). Dacie and Lewis, (1991) and Korisiakpere and Egor, (1997) agreed on the influence of size on Haematology which increases with size. A high Red blood cell and Haematology values for *Clarias gariepinus* in this study agreed with earlier works done by Korisiakpere and Egor, 1997; Annune and Ahuma,1998), inhabiting polluted water (Fange, 1992; Alkahem *et al.,* 1998). Similarly, the high White blood cell values agreed with Fange (1992) submission of remarkable richness of fish blood in Leucocytes, although it can be an indication of diseased conditions. Wepener *et al.* (1992), Alkahem *et al.* (1998) and Cole *et al.,* (2001). However, observed significant reduction in White blood cell from responses to chronic presence of environmental stressor. The derived variables of Mean cell volume (MVC), Packed cell volume (PVC or Haemocrit) and Mean corpuscular/cell Hemoglobin (MCH) excluding Mean corpuscular/cell Hemoglobin

Table 1. Haematological analysis obtain from *clarias gariepinus* bought in agricultural development project (adp) all females.

Length cm	Weight (g)	WBC	RBC	HB	PCV	MCV	MCH	MCHC	Platelets
26	156	121.9	2.7	10.7	46	174.1	40.8	23.1	58
30.5	194	129.1	2.7	10.4	46	152.1	30.8	22.6	118
24.5	115	123.3	2.7	10.8	41	155.8	40.8	22.2	125
27	170	126.9	2.6	9.6	45	174.3	37.4	21.4	129
27	170	102.4	2.1	10.0	43	144.8	39.1	22.2	113
29	173	106.1	2.3	9.3	33	141.6	39.9	28.2	75
25	154	116.6	2.3	9.1	39	164.5	38.9	23.6	83
27	171	128.3	2.7	10.3	46	167.0	37.7	22.6	103
28	170	126.3	2.9	10.7	47	160.6	36.6	22.8	112
29	195	103.5	2.4	9.5	43	141.6	40.0	24.2	75
29	172	113.3	2.5	10.6	40	154.4	40.2	22.2	122
28	175	20.5	2.5	10.3	43	154.1	40.0	22.1	50
24	180	114.8	2.1	10.6	38	139.8	36.1	23.4	112
22	119	103.3	2.4	10.0	40	154.3	23.0	23.0	83
29	119	125.8	2.8	10.0	46	164.3	36.4	22.0	112
29	172	127.1	2.5	10.4	35	135.7	36.2	22.6	116
27	190	21.9	2.7	10.7	46	163.3	39.2	23.1	141
29	189	113.5	2.1	10.5	45	154.3	32.2	23.4	112
30.5	194	126.9	2.6	9.6	38	139.8	36.1	20.4	118
22.5	116	114.6	2.1	10.6	45	174.2	37.4	21.7	125

Table 2. Haematological analysis obtain from *clarias gariepinus* bought in agricultural development project (adp). all males.

Length (cm)	Weight (g)	WBC	RBC	HB	PCV	MCV	MCH	MCHC	Platelet
32	210	125.7	2.4	9.3	34	143.4	39.6	27.6	154
31	209	125.5	2.6	9.5	42	165.0	37.0	22.4	147
30	175	122.7	2.4	10.8	41	136.6	34.1	23.1	155
31	210	127.9	2.6	9.7	39	147.0	36.7	25.0	154
33	214	216.1	2.7	9.9	43	166.8	38.4	22.5	140
33.5	212	124.7	2.0	9.1	36	159.3	39.2	21.8	141
31.5	209	123.8	2.4	10.6	43	133.8	34.4	22.7	149
35	229	105.4	2.5	10.7	47	166.4	37.2	23.0	150
32	210	105.9	2.4	7.5	43	147.2	40.0	24.1	128
33	215	113.3	2.5	10.6	40	154.4	40.2	26.6	134
36	228	100.2	2.0	9.5	42	155.0	36.0	22.3	140
30	175	123.5	2.4	9.9	42	134.6	33.1	22.5	150
34	220	125.1	2.7	9.4	39	155.8	37.4	24.0	135
35	229	127.9	2.6	9.6	45	147.0	34.4	20.4	154
33	221	126.9	2.7	10.4	43	172.3	37.3	22.6	125
30.5	194	127.9	2.3	10.4	43	150.1	39.9	28.2	192
33	216	116.5	2.2	9.1	43	145.5	20.6	20.6	125
33	215	123.5	2.4	10.0	40	154.3	23.0	23.0	125
32	210	114.8	2.1	10.6	46	133.1	35.2	23.4	182
30.5	194	123.5	2.4	10.3	45	155.4	39.4	20.7	140

concentration (MCHC) were observed to be lower than expected, the reason could be as a result of it being a cultivated fish or size of the fish used. Korisiakpere and Egor, (1997) and Annune and Ahuma, (1998) earlier observed of low packed cell volume (PVC) for *Clarias gariepinus.* It is therefore possible that the genus *Clarias* might have packed cell volume (PVC) value lower in it male species than its female species, the intra-specific relationship among Hematological parameters of *Clarias gariepinus* indicated that size related parameters had greatest influences and is more noticeable on non-derived parameters. A position that has been greatly supported by various authors. The influence of sex, method and period of acclimation of Hematological parameters was investigated that the values of Hemoglobin, Hematocrit, Leucocrit, White blood cells, Red blood count, Lymphocytes, Mean corpuscular Hemoglobin, Mean corpuscular volume, Neutrophils, Monocytes while Mean corpuscular Hemoglobin concentration were not significant, also was discovered that the male had higher value of blood parameters than the females (this is due to size). Results from this study suggest that sex, size, age, environmental and physiological conditions has some degree of influence

on the blood parameters.

Conclusion and recommendation

It could be concluded from this work that the blood parameters differ as a result of sex, which also differs in each samples of blood of *Clarias gariepinus* examined. It is therefore recommended that the age, size as well as the environmental and physiological condition of cultured fish must fit perfectly that of the wild (nature) for a better and richer value of blood analysis of *Clarias gariepinus*.

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APPENDIX

Table 1. All female catfish anova: single factor.

Groups	Count	Sum	Average	Variance
Length cm	20	543	27.15	6.08157895
Weight (g)	20	3294	164.7	721.8
WBC	20	2166.1	108.305	967.503658
RBC	20	49.7	2.485	0.06344737
HB	20	203.7	10.185	0.26976316
PCV	20	845	42.25	16.5131579
MCV	20	3110.6	155.53	148.960105
MCH	20	738.8	36.94	17.8625263
MCHC	20	456.8	22.84	2.312
Platelets	20	2082	104.1	614.2

ANOVA

Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	658155.521	9	73128.39	293.033261	2.4E-106	1.929424757
Within Groups	47415.7585	190	249.5566			
Total	705571.28	199				

There is a significant difference between the blood parameter and values of female catfish.

Table 2. All males catfish anova: single factor summary.

Groups	Count	Sum	Average	Variance
Length (cm)	20	649	32.45	2.944737
Weight (g)	20	4195	209.75	228.1974
WBC	20	2500.8	125.04	527.3436
RBC	20	48.3	2.415	0.045553
HB	20	196.9	9.845	0.612079
PCV	20	836	41.8	10.06316
MCV	20	3023	151.15	132.2953
MCH	20	713.1	35.655	27.23734
MCHC	20	466.5	23.325	4.540921
Platelet	20	2920	146	303.7895

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	961419.6	9	106824.4	863.5279	5.5E-149	1.929425
Within Groups	23504.32	190	123.7069			
Total	984923.9	199				

There is a significant difference between the blood parameter and values of male catfish.

Table 1. The means (Averages) of the male and female parameters *Clarias gariepinus.*

Groups	Length (cm)	Weight (g)	WBC	RBC	HB	PCV	MCV	MCH	MCHC	Platelet
Average of all males	32.45	209.75	125.04	2.415	9.845	41.8	151.15	35.655	23.325	146
Average of all female	27.15	164.7	108.305	2.485	10.185	42.25	155.53	36.94	22.84	104.1

Table 2. Two-factor without replication.

SUMMARY	Count	Sum	Average	Variance
Average of all males	10	777.43	77.743	5341.22
Average of all females	10	674.485	67.4485	3656.42
Length (cm)	2	59.6	29.8	14.045
Weight (g)	2	374.45	187.225	1014.751
WBC	2	233.345	116.6725	140.0301
RBC	2	4.9	2.45	0.00245
HB	2	20.03	10.015	0.0578
PCV	2	84.05	42.025	0.10125
MCV	2	306.68	153.34	9.5922
MCH	2	72.595	36.2975	0.825613
MCHC	2	46.165	23.0825	0.117613
Platelet	2	250.1	125.05	877.805

Anova

Source of Variation	SS	df	MS	F	P-value	F crit
Rows	529.8836512	1	529.8837	3.122177	0.111036	5.117355
Columns	79451.31093	9	8827.923	52.01584	1.09E-06	3.178893
Error	1527.444636	9	169.7161			
Total	81508.63921	19				