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HAEMATOLOGICAL PARAMETERS OF DIFFERENT GROUPS IN THREE POPULATION OF *Clarias gariepinus*

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Abstract

Three populations (farm) of table size Clarias gariepinus were used for this research. The study was conducted to assess and compare the haematological parameters of different size groups in three different populations. Weight and length of the different size groups were measured and their blood samples were collected and analyse for haemtological parameter such as Packed Cell Volume (PCV), Haemoglobin (HB), Red Blood Cell (RBC), Platelet (PLAT), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular HaemoglobinConcerntration (MCHC), Mean Corpuscular Volume (MCV), White Blood Cell (WBC), Heterophils (HET), Lymphocyte (LYM), Monocyte (MON) and Eosinophil (EOS). The data obtained were subjected to one-way analysis of variance (ANOVA). There were no significant ($p>0.05$) differences in haematological parameters among the different size groups of the three population studied. Also, no significant ($p>0.05$) difference was observed in the same sizes of the different populations.

Keywords: *Clarias gariepinus, different size, same size, Haematological parameters.*

Introduction

Depending on the sizes of fish, it has being documented that fish blood comprises 1.3–7% of the total body weight of fish, which represents one of the most active components which accompanied by haematopoietic organs also it helps in metabolic processes by ensuring gas exchange between the organism and the environment (Fazio *et al.,* 2013).Haematological studies enhance fish cultivation by facilitating early detection of situation ofstress and or disease that could affect production performance of fish species (Rehuika*et al*., 2004; Tavares-Dias, 2005). The assessment of haematological indexes is also important, since it allows the implementation of handling techniques which avoid losses related to illnesses, during certain times of the year (Figueredo *et al.,* 2014). According to Camargo *et al* in 2005, the reference populationis defined by the set of individuals that meet certain criteria, especially the absenceof disease. Different fish species have variations in the number, size and volume oferythrocytes, haemoglobin concentration and haematocrit percentage, that may be relatedto their different characteristics, such as eating habit, fish size,stress level (Martins *et al.,* 2011a) stage of gonadal development, sex, photoperiod,dissolved oxygen, pH, temperature (Martins *et al.,* 2011b) and infections (Silva *et al.,*2012).

Moreover, there is relationship between the weight and length increase of fish and their blood parameters. However, the understanding that the physiological concept of fish health in relation to blood and the quality of dietary protein fed is needed. Low hematological indices are indications of anaemic conditions (Haruna and Adikwu, 2001). The fish body always tries to maintain the count of the red bold cell using some physiological mechanism within the limits of certain physiological standards although the count of red blood cells is quite a stable index among haematological parameters.Van Vuren (1986) observed that when the water quality is affected by toxicants, many physiological changes will be reflected in values of one or more of the hematological parameters. Blood cells responses are important indicators of the changes in the internal and or external environment of animals. In fish, exposure to chemical pollutants can induce either increases or decreases in hematological levels. Their changes depend on fish species, ages, the cycle of the sexual maturity of spawners and disease (Luskova, 1997).

The African Catfish (*Clarias gariepinus*) culture is widely practiced in many tropical and subtropical regions of the world and constitutes one of the largest groups of farmed freshwater fish (Adedeji *et al*., 2000). This species is known for its resistance to diseases, high growth rate, resistance to handling stress, and its ability to tolerate a wide range of at 12,000rpm for 15 minutes. The packed cell was

environmental parameters and high stocking densities under culture conditions and high meat quality (Elnaggar*et al*., 2006;Rasowo*et al*., 2007; Wachirachaikarn*et al.,* 2009). Therefore, the purpose of this study is to provide information on blood parameters of table size of different groups of *Clarias gariepinus* from different fish farms.

Material and Methods

Experimental Site

The experiment was carried out at the microbiological and physiological laboratory of the college of Veterinary Medicine in Federal University of Agriculture, Abeokuta (FUNAAB).

Experimental Fish

Twelve (12) *Clarias gariepinus*were procured from each of the three fish farms (Farm A, B, and C).The stocks were sorted into groups of Big (1.5-2kg), Medium (0.7-1.2kg) and Small(0.3-0.6kg)with 3 fish (replicates) in each group. Theywere left for 14hours before the experiment to prevent the effect of stress on haematological parameter. The weight and length of each group were determined using CAMRY Spring Dial Mechanical Weighing Scale-20KGscale and measuring board respectively. Data on the Mean weights and mean standard lengths were collected and noted before the collection of blood samples from the groups.

Blood Collection

2ml of blood samples were collected from the caudal vein through the lateral line of the fish and was replicated four times by the use of needle and syringe into anti-coagulatant ethylenediamine tetra-acetic acid (EDTA) tube, the fish were not stressed as it may affect blood parameter and towel was used to clean the part where blood was extract to avoid mucus contamination. Blood sample were transferred to the laboratory immediately after collection from department of Aquaculture and Fisheries laboratory for analysing packed cell volume (PVC), Haemoglobin (HB), Red blood cell (RBC), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC) using standard formula, White blood cell (WBC), Monocyte, Lymphocyte, Eosinophil, Neutrophil.

Haematology Procedure

Packed Cell Volume (PCV)

PCV was determined using macrohaematocrit technique; plain capillary tube was filled with blood to about ¾ length and spun in heamatocrit centrifuge estimated using haematocrit reader.

Haemoglobin Concerntration(HB)

HB was obtained by measuring the amount of oxygen present in blood which can combine with haemoglosbin, using Van Slyke apparatus and applying Hufner's factor (1.36ml oxygen per 1g of Hb) for its calculation.

Haemoglobin (g/dl) =1g of Hb × value obtained ÷1.36ml Oxygen

Total Red Blood Cell Count (RBC)

Visual Red Cell counting method was used for RBC using formal citrate as diluents, where 0.38ml of the anticoagulated blood was thoroughly mixed with 200ml of diluents and counted by using Neubaer count chamber.

Total White Blood Cell Count (WBC) and Platelet

White blood cell was done by visual counting method. 0.1ml of the anti-coagulated blood was mixed with 1.9ml of 2% glacial acetic acid as diluents tinged with gentian violet. Total WBC count was estimated accordingly using Neubauer Count Chamber.

White Blood Differential Count

A drop of blood was spread on a clean glass slide and allowed to air dried; it was fixed with methanol and stained with Giemsa solution for 15minutes and then washed with water and allowed to dry. It was examined under a microscope using X100 oil immersion objective lens. Different white cells were analysed in percentage into Neutrophil, Lymphocyte, Eosinophil, Monocyte.

Haematological Indices

The haematological indices were calculated using standard formula given by Anderson and Klontz in 1965 which are given below.

Mean Corpuscular Volume (MCV)

This was calculated from haematocrit or packed cell volume value and the erythrocyte counts. It was expressed as femtoliters (fl).

MCV (fl) = PCV or Haematocrit /Erythrocyte count x10

Mean Corpuscular Heaemoglobin (MCH)

This was calculated from the value obtained from haemoglobin and erythrocyte count. It was expressed as pictogram (pg).

MCH (pg) =Haemoglobin/Erythrocyte count×10

Mean Corpuscular Haemoglobin Concentration (MCHC)

This was calculated from haemoglobin and packed cell volume. It was expressed as percentage (%).

MCHC= Haemoglobin/PVC×100.

Statistical Analysis

Data were subjected to Analysis of Variance (ANOVA) AND expressed as Mean ±Standard deviation in haematological parameters among the Big, Medium and small groups of *Clarias gariepinus* from different populations. Differences among the means were determined using Duncan's Multiple Ranged Test (DMRT) at 95% confidence level ($P<0.05$),using computer Statistical Package for Social Sciences (IBM SPSS version 20).

Result

Parameters of Different Sizes in the Three Populations

The haematology, weight and length parameters measured in first, second and third populationsare presented in Table1, Table 2 and Table 3 respectively.There were significant differences ($p<0.05$) in values of the weight and length among the three sizes in all the populations, with highest value for weight and length recorded in big size followed by medium size and lowest in small size. All the haematological parameters studies were not significantly differencein all the populations

Table 1 Haematological parameters of different sizes from first population

Parameters	Big Size	Medium Size	Small Size
Weight(kg)	1.85s±0.13^a	0.94±0.75^b	0.58±0.20^c
Length(cm)	58.43±3.58^a	49.53±3.27^b	43.30±5.90^c
PCV (%)	39.00±2.61^a	35.25±6.13^a	40.25±3.30^a
HB(g/dl)	12.95±0.83^a	11.70±2.03^a	13.63±1.16^a
RBC($X10^{12}$/L)	3.94±0.20^a	3.31±0.62^a	3.88±0.33^a
PLAT($X10^3$/uL)	390.00±8.98^a	390.75±42.01^a	391.75±26.60^a
MCH(pg)	34.61±0.47^a	35.42±0.49^a	35.23±0.05^a
MCHC(g/dL)	33.20±0.51^a	33.20±0.32^a	32.72±2.18^a
MCV(fl)	104.25±0.44^a	105.74±1.74^a	104.10±0.46^a
WBC($X10^3$/L	22.05±1.41^a	22.73±3.24^a	22.18±0.69^a
HET (%)	36.75±3.77^a	35.24±3.30^a	31.50±3.51^a
LYM (%)	59.00±4.24^a	60.75±2.87^a	63.75±2.99^a
MON (%)	1.00±0.00^a	1.00±0.00^a	1.25±0.50^a
EOS (%)	3.50± 0.58^a	3.50±0.58^a	3.75±0.96^a

Mean values with the same superscript in each row were not significantly different at $p>0.05$

PCV=Packed Cell Volume, Haemoglobin Concentration, RBC=Red Blood Cell, PLAT=Platelet, MCH=Mean Corpuscular Haemoglobin, MCHC=Mean Corpuscular Haemoglobin Concentration, WBC=White Blood Cell, HET=Heterophil, LYM=Lymphocyte, MON=Monocyte, EOS=Eosinophil

Table 2 Haematological parameters of different sizes from second population

Parameters	Big Size	Medium Size	Small Size
Weight(kg)	1.93±0.13[a]	1.00±0.82[b]	0.55±0.06[c]
Length(cm)	57.75±1.83[a]	49.78±1.00[b]	42.20±4.25[c]
PCV (%)	39.25±0.96[a]	36.25±7.54[a]	37.75±2.50[a]
HB(g/dl)	12.95±0.96[a]	12.23±2.36[a]	12.54±2.50[a]
RBC(X10^{12}/L)	3.77±0.16[a]	3.48±0.76[a]	3.67±0.19[a]
PLAT(X10 ^{3}/uL)	361.00±38.82[a]	373.00±55.40[a]	382.00±8.21[a]
MCH(pg)	34.41±3.33[a]	35.47±1.54[a]	34.25±1.61[a]
MCHC(g/dL)	32.72±2.58[a]	33.45±0.25[a]	33.18±1.26[a]
MCV(fl)	104.15±4.21[a]	104.44±2.01[a]	103.16±1.75[a]
WBC(X10^{3}/L	21.13±0.95[a]	22.93±2.16[a]	21.40±1.77[a]
HET (%)	36.25±2.63[a]	34.00±2.16[a]	31.75±3.50[a]
LYM (%)	59.75±1.71[a]	55.50±11.09[a]	62.25±3.59[a]
MON (%)	1.67±0.58[a]	1.00±0.00[a]	1.00±0.82[a]
EOS (%)	4.00±0.82[a]	3.50±0.58[a]	4.00±0.82[a]

Mean values with the same superscript in each row were not significantly different at p>0.05
PCV=Packed Cell Volume, Haemoglobin Concentration, RBC=Red Blood Cell, PLAT=Platelet, MCH=Mean Corpuscular Haemoglobin, MCHC=Mean Corpuscular Haemoglobin Concentration, WBC=White Blood Cell, HET=Heterophil, LYM=Lymphocyte, MON=Monocyte, EOS=Eosinophil

Table 3 Haematological parameters of different sizes from third population

Parameters	Big Sizes	Medium Size	Small Size
Weight(kg)	1.93±0.20[a]	0.89±0.85[b]	0.63±0.10[c]
Length(cm)	59.35±3.23[a]	50.13±0.59[b]	44.47±4.26[c]
PCV (%)	39.00±2.71[a]	34.50±5.92[a]	38.75±7.14[a]
HB(g/dl)	12.28±1.17[a]	11.18±1.61[a]	12.93±2.17[a]
RBC(X10^{12}/L)	3.71±0.47[a]	3.27±0.51[a]	3.66±0.74[a]
PLAT(X10 ^{3}/uL)	386.00±10.03[a]	359.25±39.10[a]	375.50±55.30[a]
MCH(pg)	33.55±5.44[a]	38.21±10.17[a]	35.52±1.69[a]
MCHC(g/dL)	31.58±3.48[a]	32.77±4.50[a]	33.47±1.41[a]
MCV(fl)	105.89±7.37[a]	103.90±0.38[a]	106.14±2.85[a]
WBC(X10^{3}/L	21.48±1.71[a]	21.53±1.74[a]	21.57±0.60[a]
HET (%)	38.00±3.65[a]	33.75±2.99[a]	32.00±4.76[a]
LYM (%)	60.00±3.65[a]	60.50±2.38[a]	60.75±1.71[a]
MON (%)	1.00±0.82[a]	0.75±0.96[a]	1.00±0.82[a]
EOS (%)	2.50±1.73[a]	3.50±0.58[a]	3.75±0.20[a]

EOS (%)2.50±1.73[a]3.50±0.58[a]3.75±0.20[a]Mean values with the same superscript in each row were not significantly different at p>0.05
PCV=Packed Cell Volume, Haemoglobin Concentration, RBC=Red Blood Cell, PLAT=Platelet, MCH=Mean Corpuscular Haemoglobin, MCHC=Mean Corpuscular Haemoglobin Concentration, WBC=White Blood Cell, HET=Heterophil, LYM=Lymphocyte, MON=Monocyte, EOS=Eosinophil

Parameters of the Same Sizes from Different Population

Table 4 shows the big sizes from different population in which all the parameters were insignificantly ($p>0.05$) different. The haematological parameters studies such as PCV, HB, RBC, PLAT ranged from (39.00-39.25), (12.28-12.95), (3.71-3.94), (361.00-390.00). The erythrocyte indices were in the range of MCH (33.55-34.61), MCHC (31.58-33.20) and MCV (104.15-105-89). WBC range was (21.13-22.05) and the differential count of white blood cell such as HET, LYM, MON and EOS had the range of (36.25-38.00)(59.00-60.00)(1.00-1.67)(2.50-4.00) respectively.

Table five (5) shows the haematological parameter of the medium sizes from different population which reported insignificantly ($p>0.05$) different in all the parameter among the three population. For all the haematological parameters, PCV ranged from (34.50-36.25), HB (11.18-12.23), RBC (3.27-3.48), PLAT (359.25-373.00). Erytrocyte indices such as MCH, MCHC and MCV had the following ranges of (35.42-38.21), (32.77-33.45), (103.90-105.74). WBC ranges from (21.53-22.93) and the differential count with the range of HET (33.75-35.24), LYM (55.50-60.75), MON (0.75-1.00) and EOS with mean value of (3.50).

Also, table Six (6) which represented the haematological parameters studied for the small sizes of the three population, reported insignificantly ($p>0.05$) different of the small sizes from different population in all the parameters. The haematological parameters studies such as PCV, HB, RBC and PLAT range from (37.75-40.25), (12.54-13.63), (3.66-3.88) and (375.50-391.75) respectively. The erythrocyte indices had the range of MCH (34.25-35.52), MCHC (32.72-33.47) and MCV (103.16-106.14). WBC ranges from (21.40-22.18) and the differential count of white blood cell such as HET, LYM, MON and EOS had the range of (31.50-32.00), (60.75-63.75), (1.00-1.25), (3.75-4.00) respectively.

Table 4 Haematological parameters of big sizes from different population

Parameters	First Population	Second Population	Third Population
Weight(kg)	1.85s±0.13^{a}	1.93±0.13^{a}	1.93±0.20^{a}
Length(cm)	58.43±3.58^{a}	57.75±1.83^{a}	59.35±3.23^{a}
PCV (%)	39.00±2.61^{a}	39.25±0.96^{a}	39.00±2.71^{a}
HB(g/dl)	12.95±0.83^{a}	12.95±0.96^{a}	12.28±1.17^{a}
RBC($X10^{12}$/L)	3.94±0.20^{a}	3.77±0.16^{a}	3.71±0.47^{a}
PLAT($X10^{3}$/uL)	390.00±8.98^{a}	361.00±38.82^{a}	386.00±10.03^{a}
MCH(pg)	34.61±0.47^{b}	34.41±3.33^{a}	33.55±5.44^{a}
MCHC(g/dL)	33.20±0.51^{a}	32.72±2.58^{a}	31.58±3.48^{a}
MCV(fl)	104.25±0.44^{a}	104.15±4.21^{a}	105.89±7.37^{a}
WBC($X10^{3}$/L	22.05±1.41^{a}	21.13±0.95^{a}	21.48±1.71^{a}
HET (%)	36.75±3.77^{a}	36.25±2.63^{a}	38.00±3.65^{a}
LYM (%)	59.00±4.24^{a}	59.75±1.71^{a}	60.00±3.65^{a}
MON (%)	1.00±0.00^{a}	1.67±0.58^{a}	1.00±0.82^{a}
EOS (%)	3.50± 0.58^{a}	4.00±0.82^{a}	2.50±1.73^{a}

Mean values with the same superscript in each row were not significantly different at $p>0.05$
PCV=Packed Cell Volume, Haemoglobin Concentration, RBC=Red Blood Cell, PLAT=Platelet, MCH=Mean Corpuscular Haemoglobin, MCHC=Mean Corpuscular Haemoglobin Concentration, WBC=White Blood Cell, HET=Heterophil, LYM=Lymphocyte, MON=Monocyte, EOS=Eosinophil

Table 5: Haematological parameters of medium sizes from different population

Parameters	First Population	Second Population	Third Population
Weight(kg)	0.94±0.75[a]	1.00±0.82[a]	0.89±0.85[a]
Length(cm)	49.53±3.27[a]	49.78±1.00[a]	50.13±0.59[a]
PCV (%)	35.25±6.13[a]	36.25±7.54[a]	34.50±5.92[a]
HB(g/dl)	11.70±2.03[a]	12.23±2.36[a]	11.18±1.61[a]
RBC($X10^{12}$/L)	3.31±0.62[a]	3.48±0.76[a]	3.27±0.51[a]
PLAT($X10^{3}$/uL)	362.75±42.01[a]	373.00±55.40[a]	359.25±39.10[a]
MCH(pg)	35.42±0.49[a]	35.47±1.54[a]	38.21±10.17[a]
MCHC(g/dL)	33.20±0.32[a]	33.45±0.25[a]	32.77±4.50[a]
MCV(fl)	105.74±1.74[a]	104.44±2.01[a]	103.90±0.38[a]
WBC($X10^{3}$/L	22.73±3.24[a]	22.93±2.16[a]	21.53±1.74[a]
HET (%)	35.24±3.30[a]	34.00±2.16[a]	33.75±2.99[a]
LYM (%)	60.75±2.87[a]	55.50±11.09[a]	60.50±2.38[a]
MON (%)	1.00±0.00[a]	1.00±0.00[a]	0.75±0.96[a]
EOS (%)	3.50±0.58[a]	3.50±0.58[a]	3.50±0.58[a]

Mean values with the same superscript in each row were not significantly different at p>0.05
PCV=Packed Cell Volume, Haemoglobin Concerntration, RBC=Red Blood Cell, PLAT=Platelet, MCH=Mean Corpuscular Haemoglobin, MCHC=Mean Corpuscular Haemoglobin Concerntration, WBC=White Blood Cell, HET=Heterophil, LYM=Lymphocyte, MON=Monocyte, EOS=Eosinophil

Table 6: Haematological parameters of small sizes from different population

Parameters	First Population	Second Population	Third Population
Weight(kg)	0.58±0.20[a]	0.55±0.06[a]	0.63±0.10[a]
Length(cm)	43.30±5.90[a]	42.20±4.25[a]	44.47±4.26[a]
PVC (%)	40.25±3.30[a]	37.75±2.50[a]	38.75±7.14[a]
HB(g/dl)	13.63±1.16[a]	12.54±2.50[a]	12.93±2.17[a]
RBC($X10^{12}$/L)	3.88±0.33[a]	3.67±0.19[a]	3.66±0.74[a]
PLAT($X10^{3}$/uL)	391.75±26.60[a]	382.00±8.21[a]	375.50±55.30[a]
MCH(pg)	35.23±0.05[a]	34.25±1.61[a]	35.52±1.69[a]
MCHC(g/dL)	32.72±2.18[a]	33.18±1.26[a]	33.47±1.41[a]
MCV(fl)	104.10±0.46[a]	103.16±1.75[a]	106.14±2.85[a]
WBC($X10^{3}$/L)	22.18±0.69[a]	21.40±1.77[a]	21.57±0.60[a]
HET (%)	31.50±3.51[a]	31.75±3.50[a]	32.00±4.76[a]
LYM (%)	63.75±2.99[a]	62.25±3.59[a]	60.75±1.71[a]
MON (%)	1.25±0.50[a]	1.00±0.82[a]	1.00±0.82[a]
EOS (%)	3.75±0.96[a]	4.00±0.82[a]	3.75±0.20[a]

Mean values with the same superscript in each row were not significantly different at p>0.05
PCV=Packed Cell Volume, Haemoglobin Concentration, RBC=Red Blood Cell, PLAT=Platelet, MCH=Mean Corpuscular Haemoglobin, MCHC=Mean Corpuscular Haemoglobin Concentration, WBC=White Blood Cell, HET=Heterophil, LYM=Lymphocyte, MON=Monocyte, EOS=Eosinophil

Discussion

According to Akinrotimi*et al*., (2009), size of fish is a very crucial factor in establishment of haematological parameters. The mean weight and length of the three sizes in this study reported that the bigger the fish,the higher the values of weight and length. These do not influence the blood parameters and agreed with similar work on *Clarias buthupogon* described by Kor-Siakpere and Egor, (1997).

The haematological parameters observe in all the sizes in this study vary among the different population. Blaxhall and Daisley, (1973) reported the essence of using packed cell volume or haematocrit to detect anaemic condition in fishes. This study provided PCV value range of 34.50-40.25% among the sizes in the different population and this was similar to the value reported for *Clarias gariepinus* and *Cichlasomadimerus* (Erhunmwunse and Ainerua, 2013; Vazquez and Guerrero, 2007) and rarely do values above 50% being reported (Clarks *et al.,* 1976; Etim*et al.,* 1999) which indicate that the fish species were not prone to aneamia disease.

Erythrocytes are the dominant cell type in the blood of the vast majority of fish species. It is widely accepted that fishes, like most other vertebrateshave a common leucocyte (white blood cell) pattern consisting of monocytes, lymphocytes (Erhunmwunse and Ainerua in 2013).A high RBC is one of the parameters ensuring a better oxygen supply to tissues, quicker metabolism and potentially a higher physical capacity. According to Jawad *et al*. (2004),the values of HB and RBC increase with increasing fish size which disagree with the value obtained in this study where the fish size does not determine the level of the blood parameters. However, (Chaudhuri *et al*., 1986) suggested that the difference might be due to the higher metabolic rate, of the bigger fish compared to smaller ones; it may also be due to other environmental factors.

The abundance of platelets in the fishes is an indication of a differential thrombocytosis which is an increase in the stimulation of platelets for good coagulation during injury (Etim*et al.,* 1999). In this study, the range obtained for platelet in all the sizes ranged from 359.25-391.75µL. Therefore, this indicates rapid coagulation of *Clarias gariepinus* blood after an injury which is highly visible.

The erythrocyte indices are used to define the size and haemaglobin content of the red blood cells (Ariweriokuma *et al*., 2016). Erythrocyte indices in this study of all the sizes of different population were within range of 31.58-35.42g/d for mean corpuscular haemaglobin concentration (MCHC), (33.55-38.20g/d) for mean corpuscular haemaglobin (MCH) and (103.16-106.14g/d) for mean corpuscular volume (MCV). MCHC agrees with MCHC value of 33.20-33.30g/d, MCV and MCH disagree with the value of MCV and MCH described by (Sowunmi, 2003). In comparing the erythrocyte indices of *Clarias gariepinus* with teleost species, the value of MCH is in agreement with value range of (24.48-45.4g/d) MCH of *C. dimerus, P. obscura*, *C. trutta*while the value obtained in MCV (110.27-149.71g/d) and MCH C (22.32-30.22g/d disagree with lower and higher values recorded by (Kori-siakpere*et al.,* 2005; Vazquez and Guerrero, 2007;(Orun and Erdemi, 2003) respectively. This corroborates with the findings of (Iversen *et al.,* 1998) that stress causes increase in value of MCV and a decrease in MCHC.

The white blood cells (WBC) are cells of the immune system involved in defending the body against both infectious diseases and foreign materials, also their levels have implications for immune responses and the ability of the animal to fight infection (Ariweriokuma *et al*., 2016).(Fanzio*et al*., 2013) recorded that WBC counts seem to have wide range of variation from 9.41-47.36 among teloest species and it agrees with studied sizes were the value of WBC ranges from 21.13-22.05 which also collaborate with the value recorded by (Kori-siakpere*et al.,* 2005) for *P. obscura* from all the sizes from different population indicating normal value of WBC and the ability to fight against infection.

The differential count as stated in the result such as Lymphocyte, Heterophils, Monocyte, Eosinophils were identified on basis of count present in all sizes of the fish species from different population. In fishes, the heterophils has been variably called neutrophils depending on the size of cytoplasmic granules. Among all these counts studied, lymphocyte shows the highest value and all value ranges from 55.50-63.75% followed by Heterophils of the values ranges of 31.50-38.00%, Eosinophils values ranges from 2.50-4.00% which is in agreement with the value of 4-60% recorded by (Ipinmoroti, 2015) while Monocyte disagree with its lowest value and it ranges from 0.00-0.75% in all sizes from different population. This also agree with (Ariweriokuma*et al.,* 2016) that lymphocytes are the most numerous cells comprising the leucocytes (white blood cell) which function in the production of antibiotics and chemical substances serving as defence against infection.

Conclusion and Recommendation

This study showed that there is a similarity among haematological parameters of all sizes from the different population. More so, the haematological parameters of *Clarias gariepinus* does not have influence on the different size group of the population. Therefore, molecular studies on its genome should further be investigated.

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