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Evaluation of Haematological Indices of Clarias Gariepinus from Enyigba, Ikwo-Ihie and Ekwe-Agbaja Fresh Water

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ABSTRACT*: Some haematological indices of Clarias gariepinus from Enyigba, Ikwo-Ihie and Ekwe-Agbaja fresh water was studied using standard analytical methods. Three of the rivers namely Enyigba, Ekwe-Agbaja and Ikwo-ihie are close to mining sites while the other river known as Onu-Ebonyi River (Control) is not close to mining sites. Sixty C. gariepinus were used for the study. Fifteen Clarias gariepinus each were collected from the four rivers by the use of fish net. White blood cell (WBC), neutrophil, lymphocyte, eosinophil, monocyte, and basophil counts, mean corpuscular volume (MCV), mean corpuscular haemoglobin concentration (MCHC) and levels of platelets were significantly ($p<0.05$) higher in C. gariepinus collected from rivers close to mining sites when compared with the control. Significant ($p<0.05$) decrease in red blood cell, haemoglobin, packed cell volume and mean corpuscular haemoglobin (MCH) were observed in C. gariepinus collected from rivers close to mining sites when compared with the control. The results of haematological indices indicate that fish from rivers close to mining sites are under stress which could be as a result of effect of heavy metal pollution from the mining sites.*

Keywords: *Clarias gariepinus, heamatological indices and heavy metals.*

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I. INTRODUCTION

Increasingly in the past decade, attention has been focused on continuous dumping of waste materials and run-off of polluted water into the estuarine, costal and oceanic ecosystems [1]. Population growth and technological development are putting serious stress on these areas and such stress foster conditions that diminish the harvest of marine animals [2]. The concern is not only for marine lives that are important to commercial and sport fisheries, but also for those species whose presence indicates a healthy and stable environment [3]. Drainage water from agricultural applications containing pesticides, fertilizers and effluents of industrial activities in addition to sewage effluents supply the water bodies and sediments with huge quantities of heavy metals and other chemicals [4]. The most anthropogenic sources of metals are industrial, petroleum contamination and sewage disposal [5].

There is an increasing concern in relation to human consumption of potentially toxic metal-contaminated products, namely, fishes [6]. Nowadays, industries (e.g. mining, steel, paint, or accumulator productions, fossil fuels), and agricultural technologies (e.g. phosphate fertilizers, sewage sludge, or town-refuse composts applications) are accountable for the largest discharge of heavy metals (e.g. Cd, Cr, Hg, Ni, Pb, As, Cu, Co, Se) into soil and water [7].

Fishes are considered as one of the important food sources for human beings because their flesh contains a high percentage of proteins, calcium and phosphorus. So, there is an increased attention given to fish farms and their diseases. Fish can serve as bioindicator of environmental pollution and therefore can be used for the assessment of the quality of aquatic environment. Since they are directly exposed to chemicals resulting from agricultural production through surface runoff of water or indirectly through the food chain of ecosystem [8].

Various studies have shown that hematological investigations among others could be used to evaluate the health status of an organism [9]. Some of the haematological parameters are, haemoglobin (Hb), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), neutrophils, lymphocytes, monocytes, eosinophils, basophils, packed cell volume (PCV), red blood cell count (RBC), white blood cell count and platelets. Haematological parameters as mentioned above can be used as indicators of toxicity and have a broad potential application in environmental and occupational monitoring [10]. Thus, a change in haematological parameters is a good procedure for assessment of the impacts of toxicant in fish from the aquatic environment, which is manifested in the blood [11]. Fish is sensitive to pollution-induced stress, and changes on the heamatological parameters, such as hemoglobin content, haematocrit and number of erythrocytes can be used to monitor stress caused by pollutants such as heavy metals [12].

A wide range of chemicals can contaminate our water, land or air which, in turn threatens or harm aquatic lives and make them unsafe for human consumption which can be consumed or absorbed by fish and some arthropods mainly consumed by human [13]. The African catfish, Clarias gariepinus was selected as the dominate test organisms in this study for its great value for aquaculture and commercial use in Nigeria. Clarias gariepinus is a benthopelagic (Bottom Feeder), ominivorous feeder that occasionally feeds at the surface.

II. MATERIALS AND METHODS

Sixty Clarias gariepinus were used for the analyses. The fish were conveyed to the laboratory in a white buckets containing water from the rivers for analyses. During this period, the fish were fed with pelleted diet containing crude protein twice daily. Also, the water in the glass aqua was changed once every day. At the expiration of 14 days the fish were carefully netted, avoiding stress as much as possible and immediately anaesthetized in a trough containing aerated water and 150 mg/l lignocaine. When inactivated, fish blood was collected into EDTA sample containers which, were used for determining hematological parameters.

Determination of Haematological Indices

Total white blood cell (TWBC), Neutrophils, lymphocytes, eosinophils, monocytes and basophils count with, haemoglobin level, percentage red blood cell (% RBC), packed cell volume (PCV) and erythrocyte indices (MCV, MCH and MCHC) were determined using mindray, (BC-3600) auto hematology analyzer.

Data Analysis: Data were treated by analysis of variance (ANOVA), and the level of significance was set at $P<0.05$.

III. RESULTS

Table 1. Measurements of haematological indices viz White Blood Cell count (WBC), Neutrophil (NEU), Lymphocytes and Eosinophil in Clarias gariepinus from Abakaliki fresh water.

Sites	WBC	NEU	LYM	Eosinophil
Enyigba	123.93 ± 6.76	46.83 ± 1.28	36.23 ± 0.40	13.23 ± 0.66
Ekwe-Agbaja	131.75 ± 9.80	42.13 ± 2.48	42.30 ± 3.11	12.03 ± 0.74
Ikwo-ihie	98.68 ± 14.05	59.60 ± 1.97	42.81 ± 3.65	14.76 ± 0.53
Control	69.88 ± 5.05	20.03 ± 0.22	6.33 ± 0.48	0.49 ± 0.12

Results are mean ±SD of four fish samples from Ekwe-Agbaja, Enyigba, Ikwo-Ihie and Onu-Ebonyi(control).

Table 2. Measurements of haematological indices viz Monocyte (MON), Basophil (BASO), Haemoglobin (HB), Red Blood Cells (RBCs) and Platelet (PLAT) in Clarias gariepinus from Abakaliki fresh water.

Sites	MON	BASO	HB	RBCs	PLAT
Enyigba	3.03 ± 0.56	0.70 ± 0.18	82.00 ± 10.43	1.88 ± 0.77	54.75±6.78
Ekwe-Agbaja	3.15 ± 0.60	0.75 ± 0.13	94.75 ± 14.06	2.10 ± 0.59	28.00±1.63
Ikwo-ihie	2.97 ± 0.33	0.49 ± 0.17	98.50 ± 5.45	1.08 ± 0.20	44.50±8.51
Control	0.54 ± 0.05	0.51 ± 0.05	104.88 ± 0.97	3.82 ± 0.40	14.00±0.82

Results are mean ±SD of four fish samples from Ekwe-Agbaja, Enyigba, Ikwo-Ihie and Onu-Ebonyi (control).

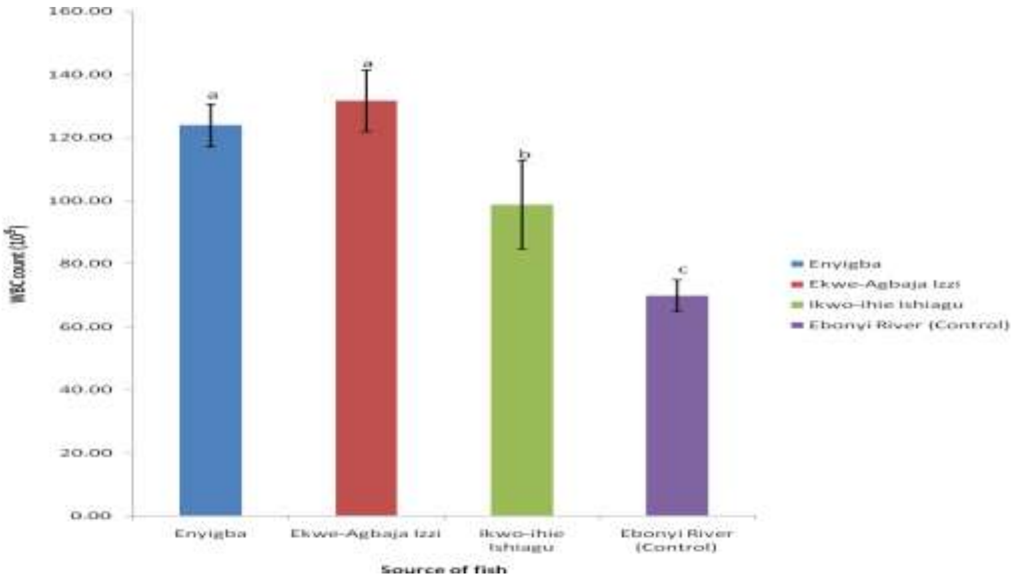
Table 3. Measurements of haematological indices viz Packed Cell Volume (PCV), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin Count (MCHC), and Mean Corpuscular Haemoglobin (MCH) in Clarias gariepinus from Abakaliki fresh water.

Sites	PCV	MCV	MCHC	MCH
Enyigba	36.13 ± 6.05	131.68 ± 8.48	274.00 ± 3.16	38.13 ± 1.11
Ekwe-Agbaja	38.20 ± 6.12	151.28 ± 7.78	263.75 ± 9.50	39.83 ± 0.56
Ikwo-ihie	27.40 ± 1.42	139.80 ± 6.81	365.75 ± 14.68	49.68 ± 4.37
Control	44 ± 2.63	112.20 ± 9.25	44.28 ± 2.45	50.43 ± 4.51

Results are mean ±SD of four fish samples from Ekwe-Agbaja, Enyigba, Ikwo-Ihie and Onu-Ebonyi(control).

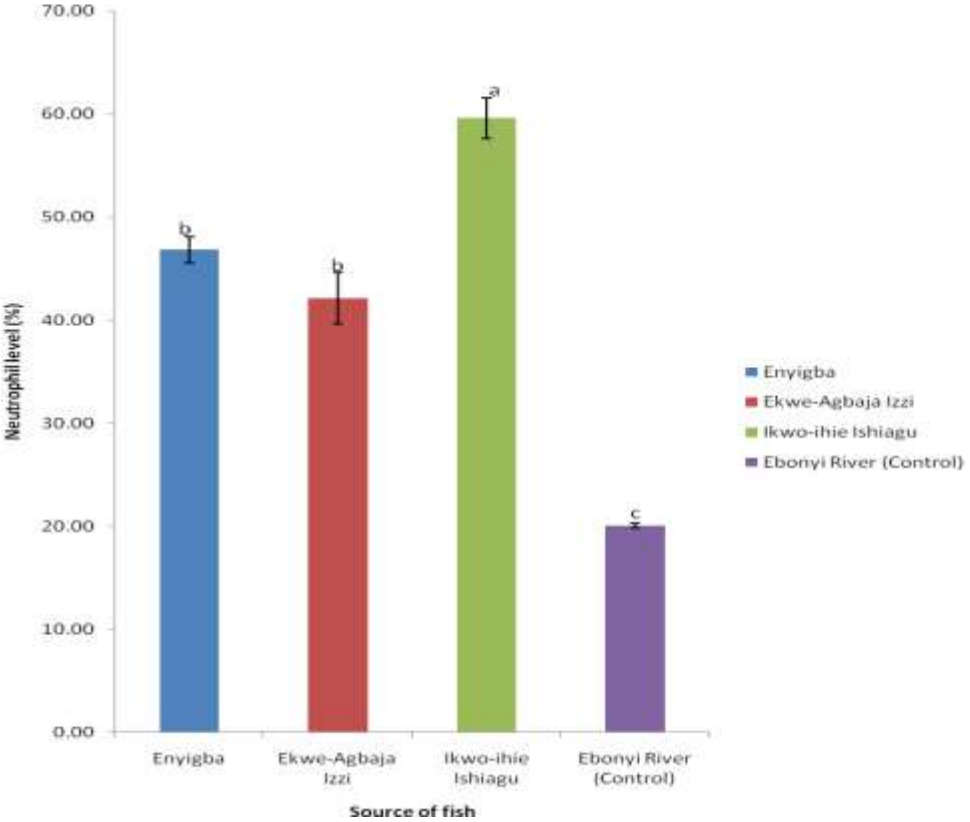
Charts

Figure 1: WBC count of C. gariepinus collected from four sites in Ebonyi State.



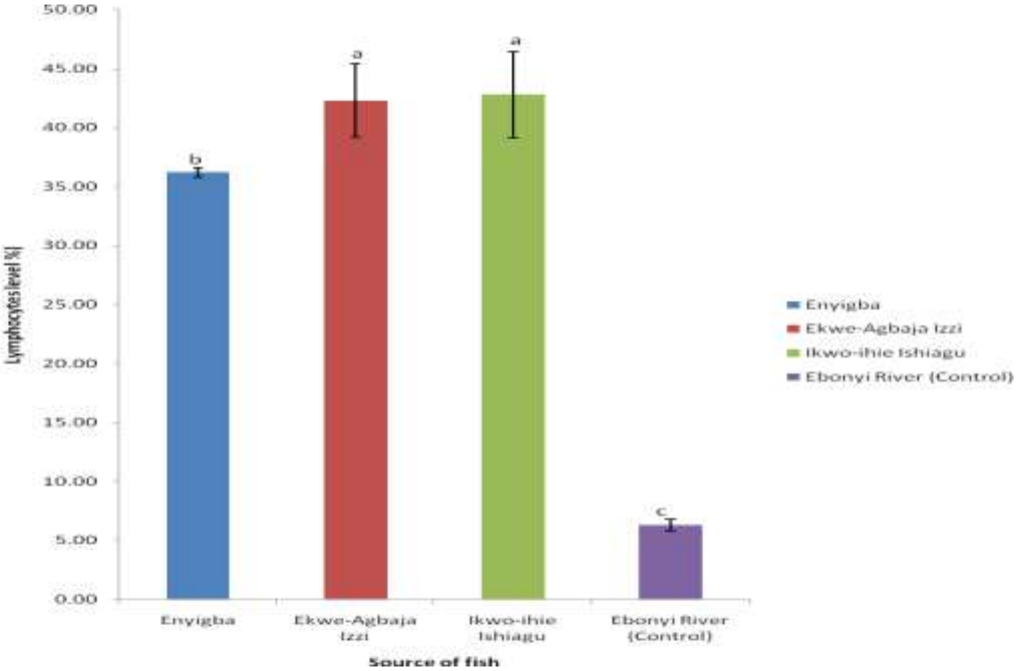
Data are shown as mean ± SD (n = 15). Bars with different letters differed significantly (P< 0.05).

Figure 2: Neutrophil count of C. gariepinus collected from four sites in Ebonyi State.



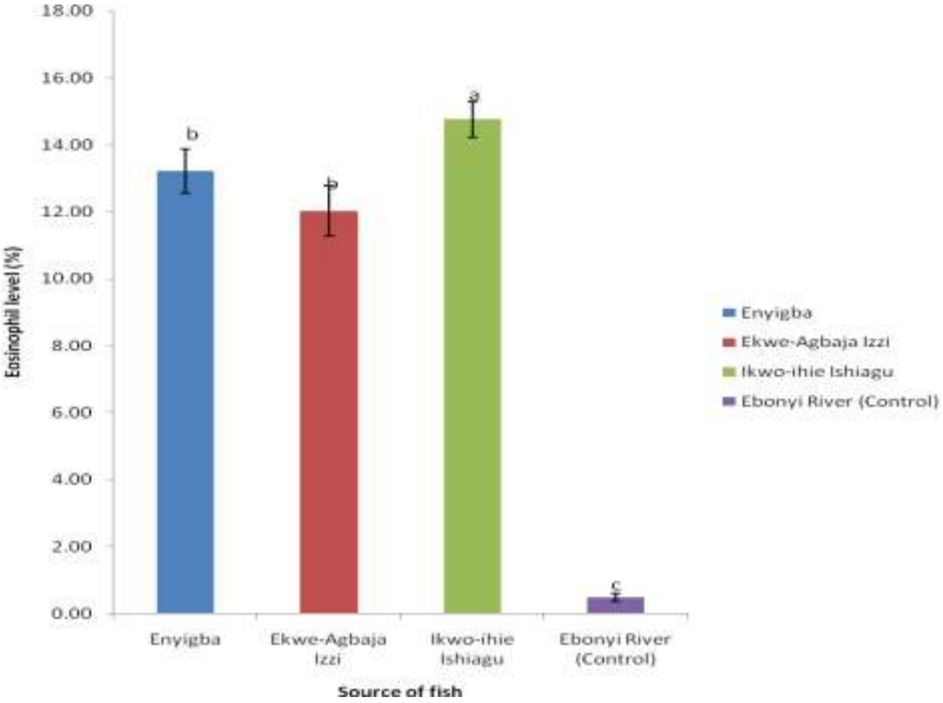
Data are shown as mean ± SD (n = 15). Bars with different letters differed significantly (P< 0.05).

Figure 3: Lymphocytes count of C. gariepinus collected from four sites in Ebonyi State.



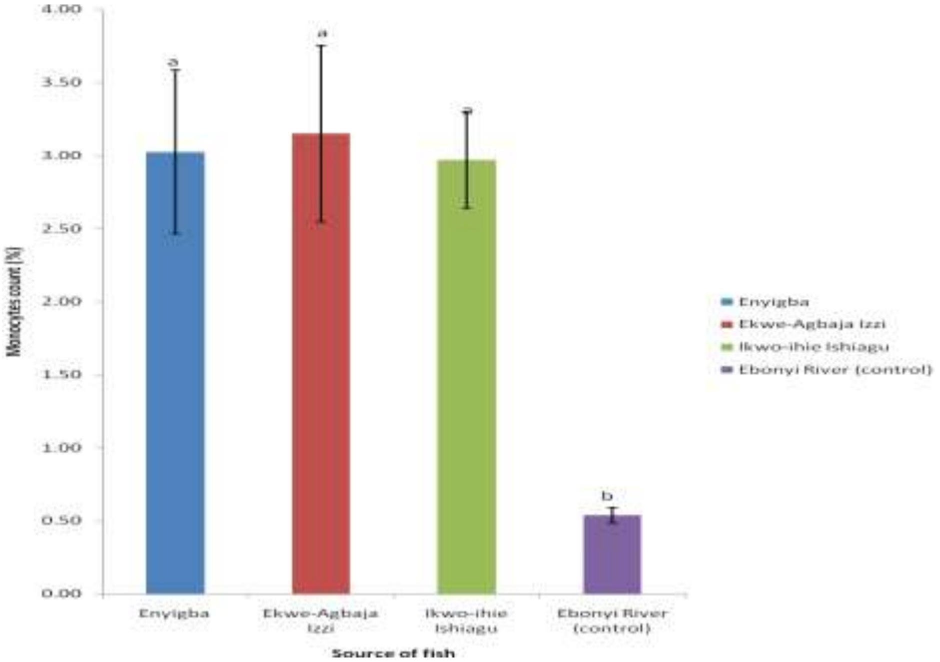
Data are shown as mean ± SD (n= 15). Bars with different letters differed significantly (P< 0.05).

Figure 4: Eosinophils count of C. gariepinus collected from four sites in Ebonyi State.



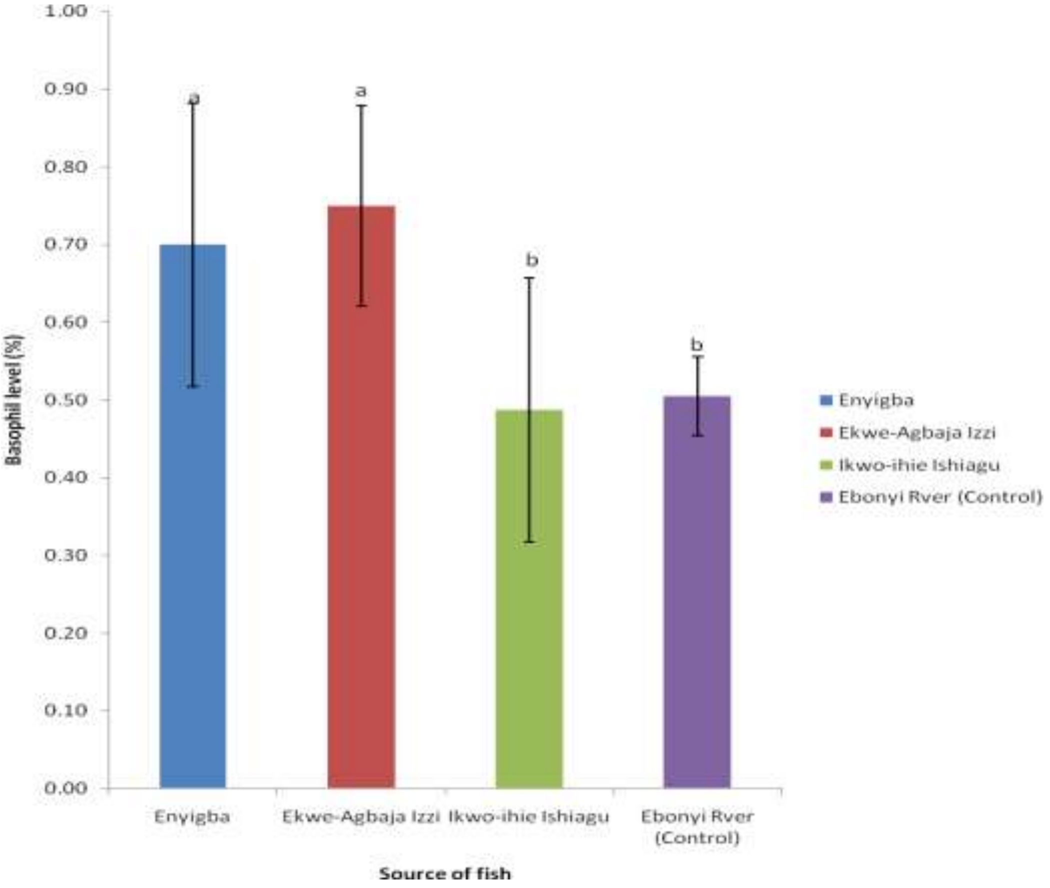
Data are shown as mean ± SD (n = 15). Bars with different letters differed significantly (P< 0.05).

Figure 5: Monocytes count of C. gariepinus collected from four sites in Ebonyi State.



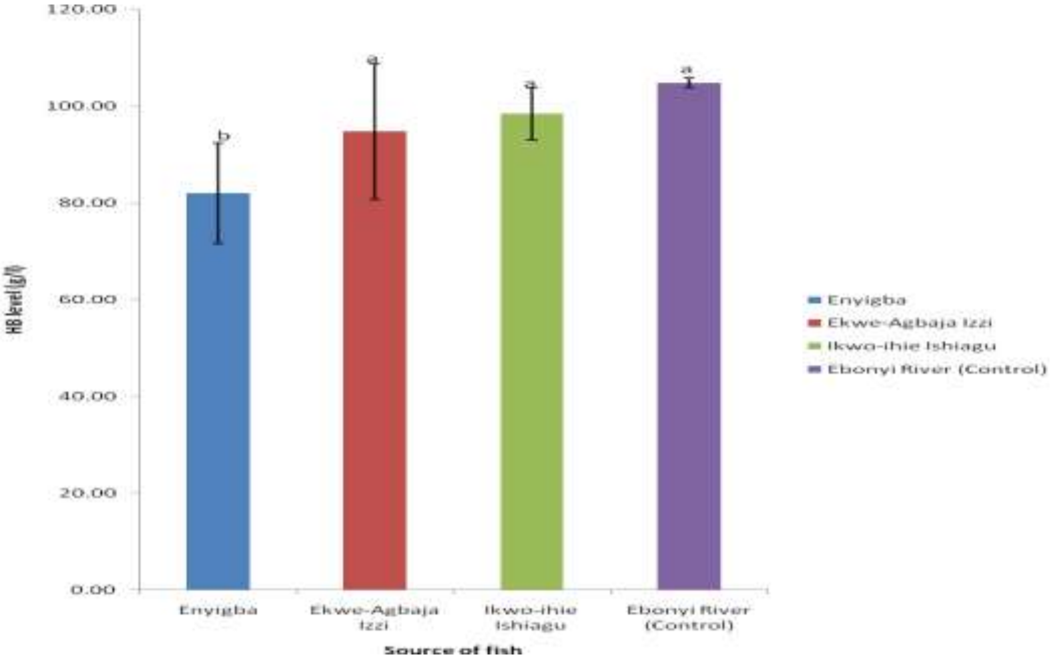
Data are shown as mean ± SD (n = 15). Bars with different letters differed significantly (P< 0.05).

Figure 6: Basophil count of C. gariepinus collected from four sites in Ebonyi State.



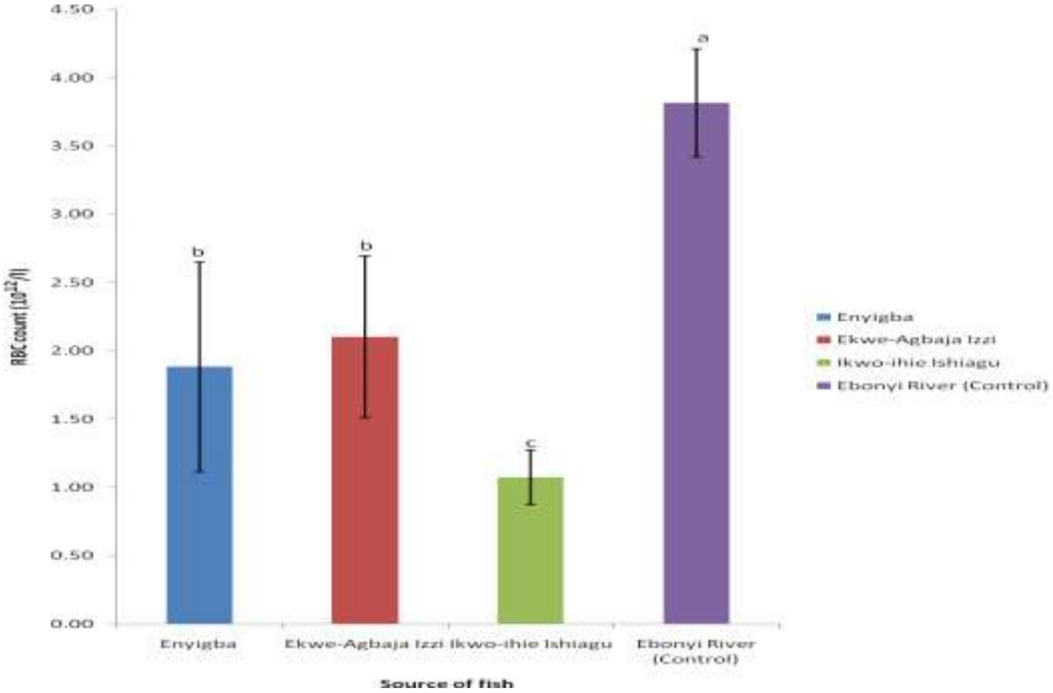
Data are shown as mean ± SD (n = 15). Bars with different letters differed significantly (P< 0.05).

Figure 7: Haemoglobin level of C. gariepinus collected from four sites in Ebonyi State.



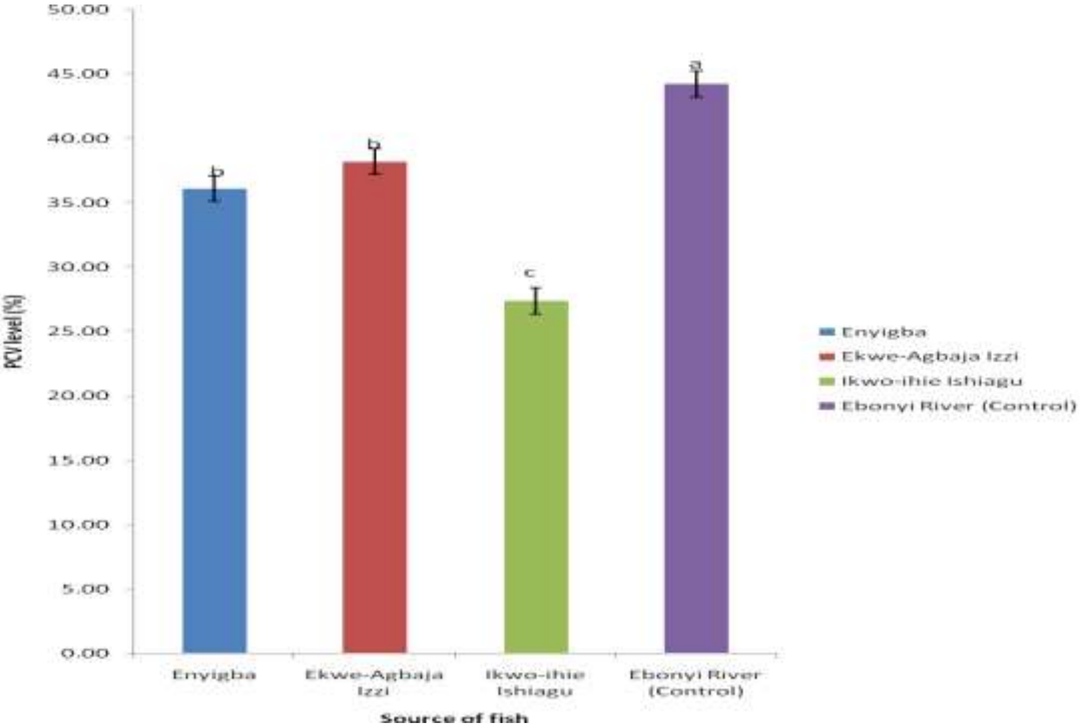
Data are shown as mean ± SD (n=15). Bars with different letters differed significantly (P< 0.05).

Figure 8: % RBC in C. gariepinus collected from four sites in Ebonyi State.



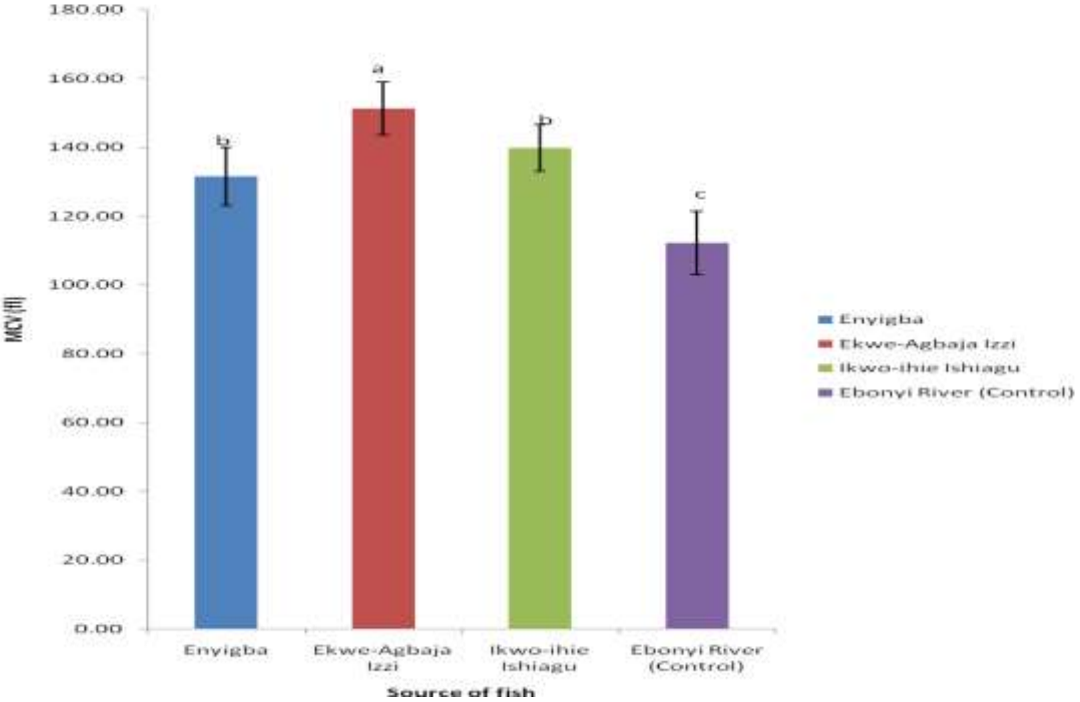
Data are shown as mean ± SD (n = 15). Bars with different letters differed significantly (P< 0.05).

Figure 9: PCV level of C. gariepinus collected from four sites in Ebonyi State.



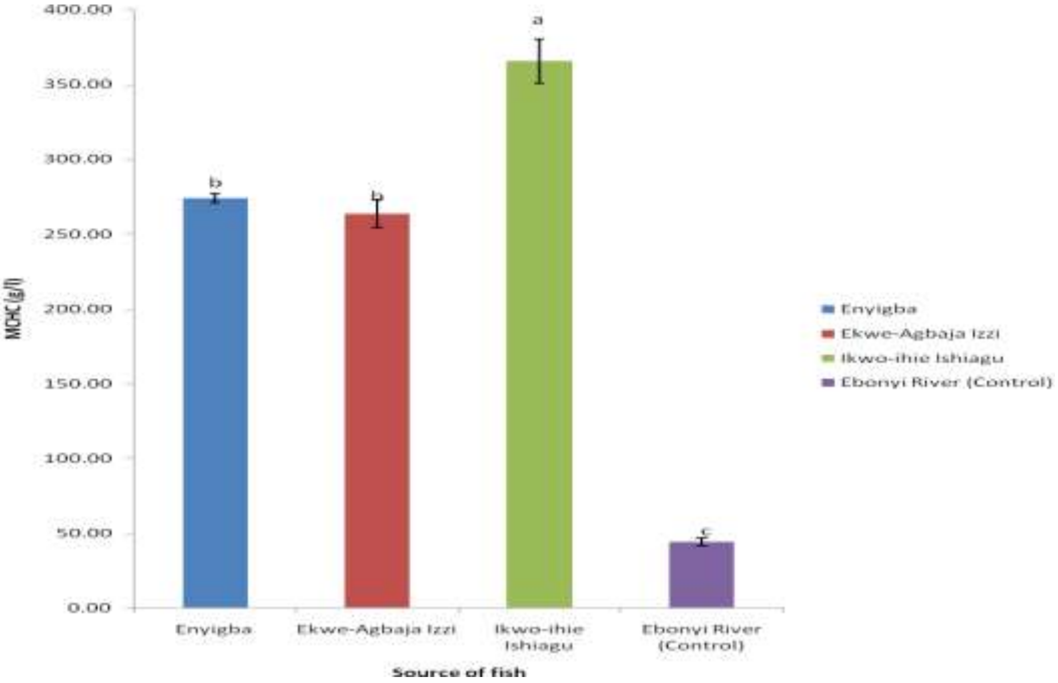
Data are shown as mean ± SD (n = 15). Bars with different letters differed significantly (P< 0.05).

Figure 10: MCV level of C. gariepinus collected from four sites in Ebonyi State.



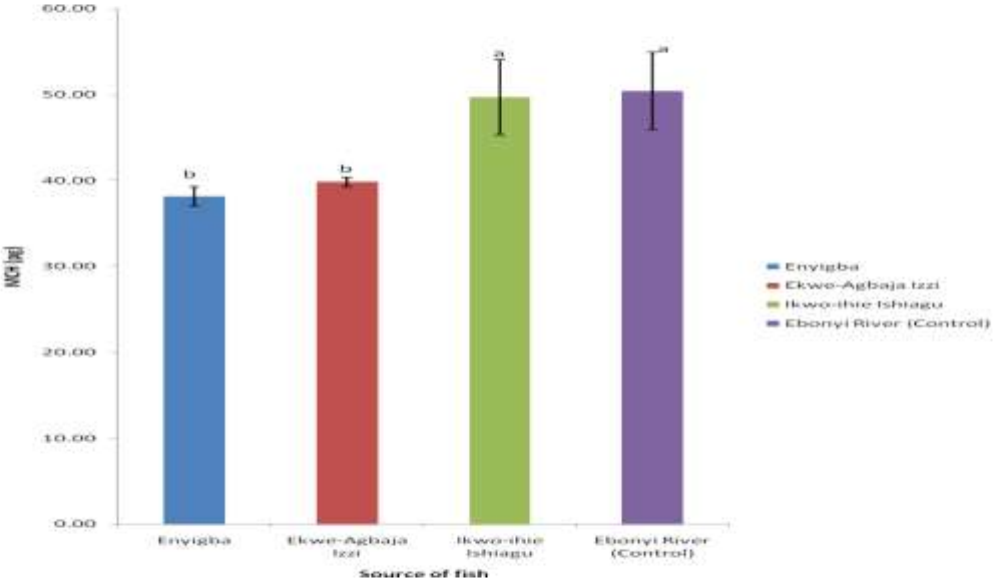
Data are shown as mean ± SD (n = 15). Bars with different letters differed significantly (P< 0.05).

Figure 11: MCHC level of C. gariepinus collected from four sites in Ebonyi State.



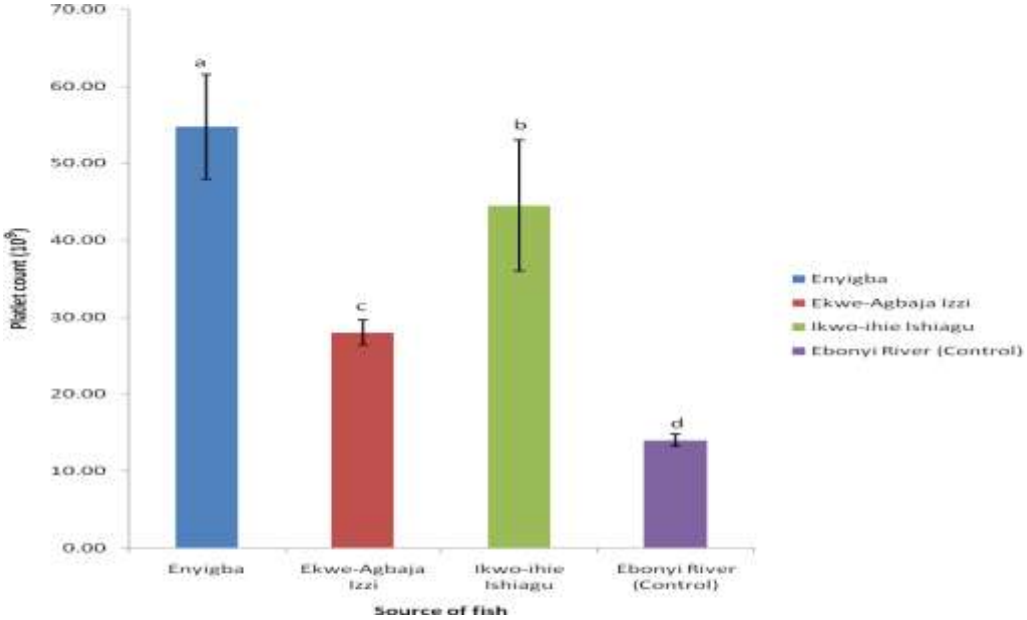
Data are shown as mean ± SD (n = 15). Bars with different letters differed significantly (P< 0.05).

Figure 12: MCH level of C. gariepinus collected from four sites in Ebonyi State.



Data are shown as mean ± SD (n = 15). Bars with different letters differed significantly (P< 0.05).

Figure 13: Platelet count of C. gariepinus collected from four sites in Ebonyi State.



Data are shown as mean ± SD (n = 15). Bars with different letters differed significantly ($P < 0.05$).

IV. DISCUSSION

In this study our results was significantly higher ($P<0.05$) in total white blood cell (TWBC) count, neutrophils, lymphocytes, eosinophils, monocytes, basophils, haemoglobin (Hb), packed cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular haemoglobin concentrations (MCHC), mean corpuscular haemoglobin (MCH), platelets and percentage red blood cell (RBC) was significantly lower ($p<0.05$) when compared to other haematological parameters of C. gariepinus collected from the three selected rivers close to mining sites in Ebonyi State. The elevation of these parameters could be attributed to the presence of toxic heavy metals found in the three selected rivers close to mining sites, which has strong influence on the haematological parameters of C. gariepinus. [14] reported similar findings in fish exposed to heavy metals.

The increase in total WBC count observed in C. gariepinus collected from three selected rivers close to mining sites may be a result of direct stimulation of immunological defense in fish due to presence of pollutants in their aquatic environment. The changes observed in differential WBC counts like neutrophils, lymphocytes and monocytes are indications that the fish is under stress. These observations are in agreement with the work of [15], which showed an elevated WBC count in fish exposed to sub-lethal cadmium. The lower RBC values can be attributed to the destructive action of pollutants released into the rivers, because decreased RBC are reported to be an indication of accelerated destruction of cells and hemolysis which occur in response to metal toxicity [16]. The industrial effluents discharged into the rivers at the mining sites would probably contain heavy metals which are possible contaminants responsible for the destructive activity on C. gariepinus RBC. Similar decreased RBC count in C. gariepinus exposed to metal fishing company effluents were reported by [17].

[18] reported a contrary finding of a significant increase in RBC count of C. gariepinus when subjected to Zn treatment. They attributed the red blood cell elevation to blood cell reserve combined with cell shrinkage as a result of osmotic alterations of blood by the action of the metal. Haematological variables remain veritable tools in determining the sub-lethal concentration of pollutants such as heavy metal in fish [19]. Fish haematological parameters are often determined as an index of their health status [16].

In conclusion, the fish collected from the three selected rivers close to mining sites in Ebonyi State were significantly higher ($P<0.05$) in white blood cell (WBC) count, neutrophils, lymphocytes, eosinophils, monocytes, basophils and haemoglobin (Hb) also a significantly ($P<0.05$) decrease was recorded in the concentration of RBCs with a percentage increase ($P<0.05$) in the PCV levels. Haematological variables remain veritable tools in determining the sub-lethal concentration of pollutants such as heavy metal in fish [13]. Fish haematological parameters are often determined as an index of their health status [12].

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