

## COMPARATIVE STUDY OF THE BIOCHEMICAL AND HEMATOLOGICAL PARAMETERS OF THE AFRICAN CATFISH *CLARIASGARIEPINUS* FED UNICAL AQUA FEED AND COPPENS FEED

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### Abstract

*A comparative study of the biochemical and hematological parameters of African catfish, Clariasgariepinus fed Unical Aqua feed and Coppens commercial feed was conducted in concrete tanks for six months. A total of 50 post fingerlings with a mean bulk weight of  $0.50 \pm 0.02$  kg were distributed in two triplicate groups and stocked in circular concrete tanks of area  $16.63 \text{ m}^2$  labeled A1, A2, A3, B1, B2 and B3. Fish in partition A1, A2 and A3 were fed Coppens feed while fish in partition B1, B2 and B3 were fed Unical Aqua feed at 3% of their body weight twice daily. Results obtained for hematological parameters revealed that there was no significant difference ( $p > 0.05$ ) in the blood parameters of male and female *C. gariepinus* including WBC, RBC, PCV, hemoglobin, MCV, MCH and MCHC for fish fed both Unical Aqua Feed and Coppens feed. Results obtained for biochemical parameters of male and female *C. gariepinus* revealed that there was no significant difference ( $p > 0.05$ ) in all the analyzed parameters including albumin, cholesterol, globulin, glucose, triglyceride, total protein, and urea. Based on the findings of this study, it is concluded that Unical Aqua feed can be used for farming *C. gariepinus* instead of Coppens without comprising their health status as indicated in the hematological and biochemical parameters. Therefore, based on affordability without compromising the health status of *C. gariepinus* Unical Aqua feed is recommended for farmers within Calabar and its environs.*

**KEYWORDS:** Biochemical; Hematological; *Clariasgariepinus*; Unical Aqua Feed, Coppens Feed.

### Introduction

In Africa, aquaculture production continues to grow with Egypt being the highest ranked country, followed by Nigeria with 1,169 tonnes of fish produced in 2018 which is projected by FAO (2020) at 1,275 tonnes and 9 % growth in 2030. Despite the increasing growth rate of aquaculture in Nigeria, high cost of quality feed is still a major challenge faced by fish farmers which hinders the developmental pace (Eyo *et al.*, 2014). With the outbreak of Coronavirus (Covid-19) pandemic in December 2019, the issue with **the availability of high quality imported aquafeed** has become worse as several countries placed restrictions and bans in almost all economic-related activities such transportation and importation of foreign goods such as fish feed. Because of this problem, several feed stores are out of feed stock and stores with old feed stock have increased the price of feed resulting in farmers not being able to buy feed for their farms. However, for fish to be farmed in the face of Covid-19 pandemic, farmers are now dependent on locally produced feed using locally available ingredients (Ekanem, *et al.*, 2012; Ekanem *et al.*, 2013). Unical Aqua feed is a product the University of Calabar fish feed mill produced with locally available ingredients. The feed mill was acquired and installed through the sponsorship of the Education Trust Fund (ETF). Hematological and biochemical parameters are indicating biological tools used in evaluating fish health conditions (Rao, 2006; Francesco *et al.*, 2012) and the health condition of the environment (Elahee and Bhagwant, 2007). To Francesco *et al.*, (2012), hematological and biochemical indices can provide information on the existence, intensity, and

status of possible diseases in fishes. Moreover, understanding these parameters is important since it can also be used to monitor the physiological and pathological changes in fishes (Eyo and Akanse, 2018). The objective of this study is to evaluate the health status of *C. gariepinus* fed Unical Aqua feed and Coppens feed using biochemical and hematological parameters.

## Materials And Methods

### Study Area

This study was carried out in the Institute of Oceanography Fish Farm Hatchery complex, University of Calabar, Cross River State, Nigeria.

### Experimental feed composition

Unical Aqua feed is an indigenous feed formulated at 42 % crude protein using Pearson square method. It is composed of corn powder, industrial fish meal (IFM), soybean meal (SBM), groundnut cake (GNC), lysine, methionine, bone meal, molasis, wheat flour, sodium chloride (NaCl) and vitamin premix as shown in table 1. Coppens feed (42%cp) is composed of conventional feed ingredients such as marine fish meal, phosphorus, lysine, calcium, methionine, selenium, copper sulphate (CuSO<sub>4</sub>), refined fish oil and several grains. Three sizes of Coppens feed including 2 mm, 4 mm and 6 mm were purchased from a fish feed vendor in Calabar, Cross River State, Nigeria.

**Table 1: Composition of Unical Aqua Feed in grams per kilogram**

Ingredients	Composition in grams per Kilogram
<b>Corn meal</b>	<b>206.80</b>
<b>Groundnut meal (GNM)</b>	<b>244.40</b>
<b>Industrial fishmeal (IFM)</b>	<b>244.40</b>
<b>Soybean meal (SBM)</b>	<b>244.40</b>
<b>Bone ash</b>	<b>5.00</b>
<b>Vitamin premix</b>	<b>10.00</b>
<b>Lysine</b>	<b>5.00</b>
<b>Sodium chloride (NaCl)</b>	<b>5.00</b>
<b>Molasis</b>	<b>20.00</b>
<b>Wheat flour</b>	<b>10.00</b>
<b>Palm oil</b>	<b>10.00</b>
<b>Methionine</b>	<b>5.00</b>
<b>Total</b>	<b>1000.00g</b>

### **Proximate analysis of experimental feed**

Proximate analysis of the dry matter of Unical Aqua feed and Coppens feed was performed according to AOAC (2000) at the Department of Biochemistry, University of Calabar.

### **Experimental design**

Three (3) ETF circular concrete tanks of area 16.63 m<sup>2</sup> were divided into two equal parts using hard wood and tarpaulin, giving a total of six experimental units (A1, A2, A3, B1, B2 and B3) to aid triplication of the experiment. Water volume in each experimental unit was 8.32 m<sup>3</sup>. A total of 300 post fingerlings of *C. gariepinus* with mean bulk weight of 0.50 ± 0.00 kg were collected from the University of Calabar fish farm and stocked in the six experimental units (50 per unit). After stocking, the fish were acclimated for seven days prior to the start of the experiment and were fed twice daily to satiation during the acclimation period. At the beginning of the feeding trial, the acclimated fish were starved for 24 hours, thereafter, the mean initial wet body weight of the fish in each experimental unit was measured using a METTLAR MT-5000D electronic balance to the nearest gram (Eyo and Ekanem 2011). The mean total length (TL – cm) was measured using a measuring board to the nearest 0.1cm. Fish in partition A1, A2 and A3 were fed with Coppens feed while fish in partition B1, B2 and B3 were fed Unical Aqua feed. The fishes were fed at 3% of their body weight twice daily by 9:00 am and 4:00 pm and it lasted for six months. At the end of the feeding trial, the biometrics measurements including total length (TL – cm) and total weight (TW – g) were taken for each sample before blood collection.

### **Collection of Blood Samples for Hematological and Biochemical Parameters**

Blood samples from fish fed Unical Aqua feed and Coppens feed were collected according to the method of Francesco *et al.*, (2012) by direct heart and caudal vein puncture using hypodermic needles and 2.5 mL sterile plastic syringe. Four (4) ml of blood was collected from each sample and transferred into two different blood sample bottle (2 ml per sample bottle). For hematological parameters, EDTA sample bottles were used in blood sample collection whereas sample bottles without EDTA were used in collecting blood sample for biochemical parameters.

### **Analysis of blood samples for Hematological and Biochemical Parameters**

The blood samples collected from *C. gariepinus* fed the two experimental diets were analyzed for hematological and biochemical parameters in the Hematology Laboratory, University of Calabar Teaching Hospital, Calabar. Hematological parameters were analyzed using an Automated Mindray Hematological Machine (Model BC- 2800). Biochemical parameters including triglycerides, globulin, glucose, total protein, cholesterol, and serum albumin were determined using bioanalytic test kits and a Shimadzu spectrophotometer.

### **Water Quality Measurement**

Water quality parameters of the experimental units including dissolved oxygen (mg/L), pH, water temperature (°C) and ammonia level (mg/l) were measured. Dissolved oxygen was measured using Portable Hanna dissolved oxygen meter Model HI9142, pH was measured with the aid of Portable waterproof pH/EC/TDS Hanna meter (high range) - HI991301, water temperature was measured with the aid of a mercury in glass thermometer and ammonia was measured with ammonia test kit.

## Statistical Analysis

Results obtained for hematological and biochemical parameters of *C. gariepinus* fed Unical Aqua feed and Coppens feed were subjected to T-test Analysis to test for significance at 0.05 probability level using Predictive Analytical Software Windows (PASW) version 18.0. Effects with a probability of  $p > 0.05$  was considered not significant.

## Results

### Hematological parameters of *C. gariepinus* fed Unical Aqua feed and Coppens feed

Results obtained for hematological parameters (Table 2) showed that in male *C. gariepinus* fed Unical Aqua feed, WBC was  $5.52 \pm 0.04 \text{ L}^{-1}$ , PCV ( $41.62 \pm 0.56 \%$ ), Hemoglobin ( $13.59 \pm 0.41 \text{ g/dl}$ ), RBC ( $5.98 \pm 0.32 \text{ L}^{-1}$ ), MCV ( $71.03 \pm 0.60 \text{ fem}$ ), MCH ( $22.38 \pm 0.52 \text{ Pg}$ ) and MCHC ( $33.75 \pm 0.31 \text{ g/dl}$ ). For female *C. gariepinus* fed Unical Aqua feed, WBC was  $5.56 \pm 0.09 \text{ L}^{-1}$ , PCV ( $41.48 \pm 1.03 \%$ ), Hemoglobin ( $13.68 \pm 0.42 \text{ g/dl}$ ), RBC ( $5.95 \pm 0.13 \text{ L}^{-1}$ ), MCV ( $70.85 \pm 0.75 \text{ fem}$ ), MCH ( $22.46 \pm 0.22 \text{ Pg}$ ) and MCHC ( $33.70 \pm 0.12 \text{ g/dl}$ ). For male *C. gariepinus* fed Coppens feed, WBC was  $5.57 \pm 0.02 \text{ L}^{-1}$ , PCV ( $41.54 \pm 0.46 \%$ ), Hemoglobin ( $13.65 \pm 0.34 \text{ g/dl}$ ), RBC ( $5.96 \pm 0.09 \text{ L}^{-1}$ ), MCV ( $70.62 \pm 1.04 \text{ fem}$ ), MCH ( $22.64 \pm 0.20 \text{ Pg}$ ) and MCHC ( $33.81 \pm 0.33 \text{ g/dl}$ ). For female *C. gariepinus* fed Coppens feed, WBC was  $5.53 \pm 0.06 \text{ L}^{-1}$ , PCV ( $41.57 \pm 0.43 \%$ ), Hemoglobin ( $13.62 \pm 0.22 \text{ g/dl}$ ), RBC ( $5.91 \pm 0.05 \text{ L}^{-1}$ ), MCV ( $70.58 \pm 0.91 \text{ fem}$ ), MCH ( $22.56 \pm 0.45 \text{ Pg}$ ) and MCHC ( $33.82 \pm 0.26 \text{ g/dl}$ ).

### Biochemical parameters of *C. gariepinus* fed Unical Aqua feed and Coppens feed

Results obtained for biochemical parameters (Table 3) showed that in male *C. gariepinus* fed Unical Aqua feed, albumin was  $30.05 \pm 0.13 \text{ g/L}$ , cholesterol ( $2.48 \pm 0.51 \text{ mmol/L}$ ), glucose ( $5.08 \pm 0.04 \text{ mmol/L}$ ), globulin ( $30.03 \pm 0.28 \text{ g/L}$ ), total protein ( $58.05 \pm 0.45 \text{ fem}$ ), triglyceride ( $1.20 \pm 0.05 \text{ mmol/L}$ ) and urea ( $1.85 \pm 0.10 \text{ mmol/L}$ ). For female *C. gariepinus* fed Unical Aqua feed, albumin was  $29.96 \pm 0.27 \text{ g/L}$ , cholesterol ( $2.45 \pm 0.21 \text{ mmol/L}$ ), glucose ( $5.06 \pm 0.64 \text{ mmol/L}$ ), globulin ( $30.09 \pm 0.31 \text{ g/L}$ ), total protein ( $58.10 \pm 0.20 \text{ fem}$ ), triglyceride ( $1.22 \pm 0.04 \text{ mmol/L}$ ) and urea ( $1.83 \pm 0.11 \text{ mmol/L}$ ). For male *C. gariepinus* fed Coppens feed, albumin was  $30.22 \pm 0.40 \text{ g/L}$ , cholesterol ( $2.47 \pm 0.12 \text{ mmol/L}$ ), glucose ( $5.05 \pm 0.05 \text{ mmol/L}$ ), globulin ( $30.10 \pm 0.25 \text{ g/L}$ ), total protein ( $58.36 \pm 0.34 \text{ fem}$ ), triglyceride ( $1.21 \pm 0.03 \text{ mmol/L}$ ) and urea ( $1.87 \pm 0.08 \text{ mmol/L}$ ). For female *C. gariepinus* fed Coppens feed, albumin was  $30.15 \pm 0.25 \text{ g/L}$ , cholesterol ( $2.49 \pm 0.18 \text{ mmol/L}$ ), glucose ( $5.04 \pm 0.06 \text{ mmol/L}$ ), globulin ( $30.50 \pm 0.14 \text{ g/L}$ ), total protein ( $58.62 \pm 0.28 \text{ fem}$ ), triglyceride ( $1.23 \pm 0.07 \text{ mmol/L}$ ) and urea ( $1.85 \pm 0.16 \text{ mmol/L}$ ).

**Table 2:**  
**Hematological parameters of *C. gariepinus* fed Unical Aqua feed and Coppens feed**

Hematological parameters	Unical Aqua Feed		Coppens Feed	
	Male (♂)	Female (♀)	Male (♂)	Female (♀)
White Blood Cell Count (L <sup>-1</sup> )	5.52 ± 0.04 <sup>a</sup>	5.56 ± 0.09 <sup>a</sup>	5.57 ± 0.02 <sup>a</sup>	5.53 ± 0.06 <sup>a</sup>
Pack Cell Volume (%)	41.62 ± 0.56 <sup>a</sup>	41.48 ± 1.03 <sup>a</sup>	41.54 ± 0.46 <sup>a</sup>	41.57 ± 0.43 <sup>a</sup>
Hemoglobin (g/dl)	13.59 ± 0.41 <sup>a</sup>	13.68 ± 0.42 <sup>a</sup>	13.65 ± 0.34 <sup>a</sup>	13.62 ± 0.22 <sup>a</sup>
Red Blood Cell Count (L <sup>-1</sup> )	5.98 ± 0.32 <sup>a</sup>	5.95 ± 0.13 <sup>a</sup>	5.96 ± 0.09 <sup>a</sup>	5.91 ± 0.05 <sup>a</sup>
MCV (fem)	71.03 ± 0.60 <sup>a</sup>	70.85 ± 0.75 <sup>a</sup>	70.62 ± 1.04 <sup>a</sup>	70.58 ± 0.91 <sup>a</sup>
MCH (Pg)	22.38 ± 0.52 <sup>a</sup>	22.46 ± 0.22 <sup>a</sup>	22.64 ± 0.20 <sup>a</sup>	22.56 ± 0.45 <sup>a</sup>
MCHC (g/dl)	33.75 ± 0.31 <sup>a</sup>	33.70 ± 0.12 <sup>a</sup>	33.81 ± 0.33 <sup>a</sup>	33.82 ± 0.26 <sup>a</sup>

Means with the same superscript are not significant (p > 0.05)

**Table 3:**  
**Biochemical parameters of *C. gariepinus* fed Unical Aqua feed and Coppens feed**

Biochemical parameters	Unical Aqua Feed		Coppens Feed	
	Male (♂)	Female (♀)	Male (♂)	Female (♀)
Albumin (g/L)	30.05 ± 0.13 <sup>a</sup>	29.96 ± 0.27 <sup>a</sup>	30.22 ± 0.40 <sup>a</sup>	30.15 ± 0.25 <sup>a</sup>
Cholesterol (mmol/L)	2.48 ± 0.16 <sup>a</sup>	2.45 ± 0.21 <sup>a</sup>	2.47 ± 0.12 <sup>a</sup>	2.49 ± 0.18 <sup>a</sup>
Glucose (mmol/L)	5.08 ± 0.04 <sup>a</sup>	5.06 ± 0.06 <sup>a</sup>	5.05 ± 0.05 <sup>a</sup>	5.04 ± 0.06 <sup>a</sup>
Globulin (g/L)	30.03 ± 0.28 <sup>a</sup>	30.09 ± 0.31 <sup>a</sup>	30.10 ± 0.25 <sup>a</sup>	30.05 ± 0.14 <sup>a</sup>
Total protein (g/L)	58.50 ± 0.45 <sup>a</sup>	58.10 ± 0.20 <sup>a</sup>	58.36 ± 0.34 <sup>a</sup>	58.62 ± 0.28 <sup>a</sup>
Triglyceride (mmol/L)	1.20 ± 0.05 <sup>a</sup>	1.22 ± 0.04 <sup>a</sup>	1.21 ± 0.03 <sup>a</sup>	1.23 ± 0.07 <sup>a</sup>
Urea (mmol/L)	1.85 ± 0.10 <sup>a</sup>	1.83 ± 0.11 <sup>a</sup>	1.87 ± 0.08 <sup>a</sup>	1.85 ± 0.16 <sup>a</sup>

Means with the same superscript are not significant (p > 0.05)

### Mean Proximate composition of Unical Aqua feed and Coppens feed

Mean proximate analysis of the dry matter (mg/100 g) of Unical Aqua feed and Coppens feed shows that in uncial Aqua feed, moisture content was  $9.53 \pm 0.15$  %, mean crude protein ( $43.30 \pm 0.23$  %), mean fat ( $12.03 \pm 0.02$  %), Mean crude fibre ( $3.34 \pm 0.10$  %), mean ash ( $9.03 \pm 0.20$  %) and Mean carbohydrate ( $22.77 \pm 1.27$  %). For Coppens feed, moisture was  $8.23 \pm 0.07$  %, mean crude protein ( $42.94 \pm 1.34$  %), mean fat ( $11.57 \pm 0.15$  %), Mean crude fibre ( $3.53 \pm 0.31$  %), mean ash ( $9.42 \pm 0.04$  %) and Mean carbohydrate ( $24.31 \pm 2.10$  %)

### Mean Water Quality Parameters

Results for measurement of water quality parameters (Table 4) showed that in concrete tanks fed Unical Aqua Feed, mean pH was  $6.99 \pm 0.06$ , mean dissolved oxygen ( $5.47 \pm 0.16$  mg/L), mean temperature ( $30.37 \pm 0.21$  °C) and mean ammonia ( $0.02 \pm 0.01$  mg/L). For concrete tanks fed Coppens Feed, mean pH was  $6.95 \pm 0.10$ , mean dissolved oxygen ( $5.36 \pm 0.24$  mg/L), mean temperature ( $30.28 \pm 0.33$  °C) and mean ammonia ( $0.01 \pm 0.01$  mg/L).

**Table 4: Mean Water Quality Parameters**

Parameters	Concrete tanks fed Unical Aqua Feed	Concrete tanks fed Coppens Feed
Ph	$6.99 \pm 0.06$	$6.95 \pm 0.10$
Dissolved oxygen (mg/L)	$5.47 \pm 0.16$	$5.36 \pm 0.24$
Temperature (°C)	$30.37 \pm 0.21$	$30.28 \pm 0.33$
Ammonia (mg/L)	$0.02 \pm 0.01$	$0.01 \pm 0.01$

### Discussion

Results obtained for hematological parameters revealed that there was no significant difference ( $p > 0.05$ ) in the blood parameters of male and female *C. gariepinus* including WBC, RBC, PCV, hemoglobin, MCV, MCH and MCHC for fish fed both Unical Aqua Feed and Coppens feed. Results of hematological and biochemical parameters in this study is within the range reported by several authors for *C. gariepinus* in good state of health (Omitoyin, 2006; Dienne and Olumuji, 2014). In fisheries science, hematological parameters are standardized accepted approach for examining the health status of fish. According to Fazio *et al.*, (2012), hematological parameters are very crucial in understanding the relationship of blood characteristics to fish adaptability to the environment and its habitat. Findings of this study also indicates that both Unical Aqua Feed and Coppens feed provided the required nutrients required by *C. gariepinus* for good health. This findings agrees with that of Ekanem *et al.*, (2012) who reported that Unical Aqua Feed and Coppens feed contained nutrients that promoted optimal growth and good health in *C. gariepinus*. Similar findings were reported by Eyo *et al.*, (2012), Ekanem *et al.*, (2013), Eyo *et al.*, (2014) on the effects of Unical Aqua Feed and Coppens feed on egg and sperm quality, fecundity, and gonad development, gonadosomatic index (GSI) and gonad gross morphology of *C. gariepinus*. Biochemical parameters also provide information on the existence, degree, and status of diseases in fishes. Health status of farmed fishes could be evaluated through biochemical parameters since they provide reliable data on stress status,

metabolic disorders, and several other deficiencies (Xiaoyun *et al.*, 2009; Bahmami *et al.*, 2001). Results obtained for biochemical parameters of male and female *C. gariepinus* revealed that there was no significant difference ( $p > 0.05$ ) in all the analyzed parameters including albumin, cholesterol, globulin, glucose, triglyceride, total protein, and urea. This also indicates that the two experimental diets supported optimal health of the experimental fishes. Water quality parameters of the concrete tanks fed Unical Aqua Feed and Coppens feed were within the recommended range for good health of freshwater fishes and did not pose any negative impact on the hematological and biochemical parameters of *C. gariepinus* in this study.

### Conclusion

Based on the findings of this study, it is concluded that Unical Aqua feed can be used for farming *C. gariepinus* instead of Coppens without comprising their health status as indicated in the hematological and biochemical parameters. Unical Aqua Feed which is a local feed utilizing locally available materials is a cheaper alternative for fish farmers than Coppens. Therefore, based on affordability without compromising the health status of *C. gariepinus* Unical Aqua feed is recommended for farmers within Calabar and its environs.

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