E-ISSN: 2347-5129
P-ISSN: 2394-0506
(ICV-Poland) Impact Value: 5.62
(GIF) Impact Factor: 0.549
IJFAS 2020; 8(5): 394-397
© 2020 IJFAS
www.fisheriesjournal.com
Received: 25-07-2020
Accepted: 30-08-2020

Wokeh Okechukwu Kenneth
Department of Animal and Environmental Biology, University of Port Harcourt, Rivers, Nigeria

Woke Godfrey Ngozi
Department of Animal and Environmental Biology, University of Port Harcourt, Rivers, Nigeria

Orose Ekinadose
Department of Animal and Environmental Biology, University of Port Harcourt, Rivers, Nigeria

Odioko Edafe
Department of Fisheries Engineering, Akdeniz University, Konyaalti, Antalya-Turkey

Corresponding Author:
Wokeh Okechukwu Kenneth
Department of Animal and Environmental Biology, University of Port Harcourt, Rivers, Nigeria

Comparison of growth performance of African catfish (*Clarias gariepinus*) fed with different standard feed

Wokeh Okechukwu Kenneth, Woke Godfrey Ngozi, Orose Ekinadose and Odioko Edafe

Abstract
This study aimed to compare the growth performance of African Catfish (*Clarias gariepinus*) on different standard feed. Post-fingerlings *Clarias gariepinus* with mean initial weight 5.50 ± 0.00 gram were fed with three commercial standard feeds which included T_1 (Coppens), T_2 (Vital) and T_3 (Multifeed). The experiment lasted for twelve weeks with 180 individuals used and evenly distributed among the three treatments, with three replicates. The experiment was a completely randomized design and plastic aquaria with dimensions of (0.5 x 0.38 x 0.30 m) were used for the experiment. The fish were fed 5% of their body weight daily, acclimatized for seven days before commencement of feeding trial on the eighth day. Statistical data were analyzed using one-way analysis of variance and Duncan's multiple range tests to compare growth (length and weight), survival rate and water parameters (pH, Temperature, and Dissolved Oxygen). Proximate analysis of the standard feeds used was conducted, which showed a significant difference ($P = 05$) in macronutrient's composition. The end of the experiment shows that fish fed with Coppens performed better in final body weight (78.43 ± 1.29 g), followed by Multifeed (73.47 ± 0.05 g) while Vital recorded the least (60.43 ± 0.20 g). The water parameters (pH, Temperature, and Dissolved Oxygen) showed no significant difference ($P \neq 05$) among the treatment groups. It is concluded that fish fed with Coppens recorded the overall best performance, followed by those fed with Multifeed while Vital recorded the least. This could be attributed to the nutritional composition of the various diet used.

Keywords: Standard feeds, comparison, performance, *Clarias gariepinus*

1. Introduction
In Nigeria today, despite the significant investment in commercial agriculture by the government, aid agencies, multilateral organizations and individuals, livestock production has not succeeded in meeting the protein demands in the country (Oluwatayo and Adedeji, 2019) [1]. The increasing human population in the country has indicated that the conventional forms of livestock production and artisanal fisheries which have been over-exploited will not be sufficient to solve the growing protein demand in Nigeria (Umaru *et al.*, 2016) [2]. There is an urgent need to evolve holistic and innovative strategies to address the lack of food security in the country, especially protein intake (Ubesie and Ibeziakor, 2012) [3]. This is where fish culture, particularly the culture of African Sharp tooth Catfish (*Clarias gariepinus)* holds much promise.

African Sharp tooth Catfish (*Clarias gariepinus*) is one of the most important cultured fish in developing countries like Nigeria, Cameroon, Democratic Republic of Congo, Tanzania, and Uganda (Limbu, 2019) [4]. The preference for this freshwater fish could be attributed to its fast growth rate, resistance to diseases, ability to withstand harsh environmental changes and good market value (Amisah *et al.*, 2009) [5] and (Farahiyah *et al.*, 2016) [6]. Unfortunately, the effective production of *Clarias gariepinus* in Nigeria has been hampered by the high cost of imported feed and the non-availability of affordable locally made high-quality fish feeds (Yakubu *et al*., 2015) [7]. Fish feeds in sustainable fish culture system account for 40 to 60% total production cost and need to be supplied in the right proportions with proper nutritional composition as it determines the effectiveness of fish growth and survival rate (Toutou *et al.*, 2018) [8] and (Dorothy *et al.*, 2018) [9].

The quest to provide adequate feed have been high and in an attempt to provide cheaper, affordable and available feed for *Clarias gariepinus* which will serve as an alternative to the

expensive imported commercial feeds, several local fish feeds have been formulated from different sources leading to the emergence and proliferation of many fish feeds industries in Nigeria (Mustapha *et al.*, 2014) [10]. As a result of this intensified efforts, the Nigerian markets are littered with an assortment of imported and locally manufactured catfish feed brands, thereby leaving fish farmers with different options (Agokei *et al.*, 2010) [11] (Mustapha *et al.*, 2014) [10]. Unfortunately, in terms of control over the feed components and quality, there is lack of legislation and regulations in Nigeria, and farmers are left with no option than to depend on labelled information provided by the feed manufacturers on feed composition and growth performance without any form of authentication since a very limited study on proximate composition of standard feed and its growth response on African Catfish has been reported in Nigeria despite the significant investment in aquaculture in the country (Ajayi *et al*., 2016) [12] and (Umaru *et al*., 2016) [2].

It is against this backdrop, that this study was carried out to evaluate the growth performance of African Catfish (*Clarias gariepinus*) fed with different standard feed. This study provides baseline information that will assist farmers, regulatory agencies, and other stakeholders in the fisheries industry.

2. Materials and Methods

2.1. Collection of experimental organism and test feeds

The study was conducted at the Animal house unit of the Department of Animal and Environmental Biology, University of Port Harcourt, Rivers State, Nigeria. The experimental fish used was *Clarias gariepinus.* A total of 220 post fingerlings of *Clarias gariepinus* with an initial body weight of 5.5 ± 0.0 grams were procured from the Africa Regional Aquaculture Centre (ARAC), Aluu Port Harcourt, Rivers State and transported to the experimental site in the early hours of the day in an open plastic bucket covered with nylon net. At the experimental site, they were immediately transferred into holding tanks. The experimental organisms were acclimatized for 14 days before the commencement of the experiment. The holding tanks were cleaned, and the water renewed once in three days (Odioko *et al*., 2016) [13].

Three standard commercial feeds namely Coppens, Vital, and Multifeed of 2 mm in size were procured from Animal Affairs Limited, a commercial feed dealer in Port Harcourt.

2.2. Experimental design

This experiment lasted for twelve weeks (3 months). A total number of one hundred and eighty (180) *Clarias gariepinus* were used and evenly distributed, twenty (20) per treatment (T1 for Coppens, T2 for Vital, and T3 for Multifeeds), with three replicates of each. Plastic Aquaria with a dimension of 0.50 x 0.38 x 30 m were used for the experiment. The test organisms were not fed for 24 hours before the commencement of the feeding trial. The initial mean weight and length were measured with the aid of a digital weighing balance and metre rule respectively. The test organisms in the different aquaria were fed twice daily between the hours of 9 am and 5 pm at 5% of their body weights. The water quality of the aquaria was maintained by siphoning fecal waste and leftover feds daily. The water in the plastic aquaria was replaced with clean water sourced from borehole every three days. The aquaria were covered with nets to prevent the test organisms from jumping out. This experimental design was completely randomized.

2.3 Measurement of growth parameters

The initial weight of the individual fish at the starting of the experiment and final body weight and length were determined with the aid of a digital weighing balance and metre rule. These body weight and length measurements were done every week to monitor the differences in weight gain and length increase. Generally, the growth performance of the fish was determined using the following mathematical expressions:

- **Weight gain (WG)**

$$= Wf - Wi$$

Where: Wf = Final body weight, Wi = Initial body weight

- **Average daily length gain (ADLG)**

$$= \frac{\text{Final length} - \text{Initial length}}{\text{Total number of days}}$$

- **Mortality rate**

$$= \frac{\text{Number of dead Fish at the end of the Expt.x 100}}{\text{Number of fish at the beginning of the Expt.}}$$

- **Survival percentage (%)**

$$= \frac{\text{Number of Fish that survived x 100}}{\text{Initial number of fish stocked}}$$

- **Specific growth rate (SGR)**

$$= \frac{\text{LnWf} - \text{LnWi x 100}}{\text{Number of days the Expt. Lasted}}$$

Where: Wf = Final Body Weight
Wi = Initial Body Weight
Ln = natural logarithm

- Feed Conversion Ration

$$= \frac{\text{Feed consumed}}{\text{Weight gained}}$$

(N.B: Feed consumed = 5% x body weight x number of days)

2.4. Water quality parameters

Water quality parameters were monitored for temperature, pH and Dissolved Oxygen (DO) on weekly basis at 8 am with the aid of mercury-in-glass thermometer for temperature in degree Celsius (°C) and pocket-sized pH metre (Milwaukee-pH 600 Tester Kit) was used in the determination of water pH, while Dissolved Oxygen (DO) present in the water was measured with the aid of portable Dissolved Oxygen meter (Milwaukee MW 600).

2.5. Proximate analysis and analytical procedure

The proximate analysis of the trail feeds was conducted at the Biotechnology Laboratory of Rivers State University, in an airtight environment. The analytical procedure used to analyze the nutritional composition of the different standard (commercial) feeds were based on the (A.O.A.C, 2000) [14]

standard procedure for proximate analysis to obtain an accurate result for Moisture, Crude protein, Ether Extract, Fibre and Ash.

2.6. Statistical analysis
All data were subjected to statistical analysis to determine the variation in the different parameters measured during this study. The one-way analysis of variance (ANOVA) was used to determine if there were significant differences (P = 05) from the data obtained from the different parameters. To determine the differences within means, Duncan's multiple range tests was used. All statistics were done using the Statistical Package for Social Sciences (SPSS) version 21.

3. Results
The results for the measured length revealed a significant difference (P = 05) in final length with T_1 recording the highest value (22.81 ± 0.05 cm), followed by T_3 (20.72 ± 0.28 cm) and T_2 (18.75 ± 0.49 cm). The analysis of final weight gained showed that T_1 recorded (83.93 ± 1.29 g), T_3 (78.8 ± 0.54 g) and T_2 (65.93 ± 0.20 g), the differences in weight was significant (P = 05). Feed conversion ratio (FCR) recorded were T_1 (18.74 ± 0.13), T_2 (19.18 ± 0.35) and T_3 (19.51 ± 0.73). The result for specific growth rate (SGR) showed that T_1 recorded (4.53 ± 0.02 g/day), T_3 (4.46 ± 0.01 g/day) and T_2 (4.28 ± 0.00 g/day). The result of mortality rate showed that T_1 recorded (4.00 ± 1.00), T_2 (6.00 ± 1.73) and T_3 (3.67 ± 1.53) and survival rate for T_1 (80.00 ± 5.00), T_2 (70.00 ± 8.66) while T_3 recorded (81.67 ± 7.66). There was no significant difference ($P \neq 05$) in the survival rate, mortality rate and feed conversion ratio across the treatment groups as shown in Table 1.

Table 1: Summary of mean growth performance and feed utilization of African catfish post fingerlings fed different standard feeds

Parameter (unit)	Treatment 1 (T_1)	Treatment 2 (T_2)	Treatment 3 (T_3)
Final Length (cm)	22.81 ± 0.05^a	18.75 ± 0.49^c	20.72 ± 0.28^b
Length Gain (cm)	15.61 ± 0.05^a	11.55 ± 0.49^c	14.38 ± 0.63^a
Initial Weight (g)	5.50 ± 0.00^a	5.50 ± 0.00^a	5.50 ± 0.00^a
Final Weight (g)	83.93 ± 1.29^a	65.93 ± 0.20^c	78.98 ± 0.54^b
Weight Gain (g)	78.43 ± 1.29^a	60.43 ± 0.20^c	73.47 ± 0.05^b
Total Feed Intake (TFI)	1503.95 ± 14.4^a	1179.15 ± 25.41^c	1376.9 ± 10.24^b
Feed Conversion Ratio (FCR)	18.74 ± 0.13^a	19.18 ± 0.35^a	19.51 ± 0.73^a
Specific Growth Rate (g/day)	4.53 ± 0.02^a	4.28 ± 0.00^c	4.46 ± 0.01^b
Survival Rate (SR)	16.00 ± 1.00^a	14.00 ± 1.73^a	16.33 ± 1.55^a
Mortality Rate (MR)	4.00 ± 1.00^a	6.00 ± 1.73^a	3.67 ± 1.53^a
Survival Percentage (%)	80.00 ± 5.00^a	70.00 ± 8.66^a	81.67 ± 7.64^a
Mortality Percentage (%)	20.00 ± 5.00^a	30.00 ± 8.66^a	18.33 ± 7.44^a

In each row, mean with a common subscript are not significantly different (P ≠ 05).

The results for the proximate composition of the standard feeds used are presented in Table 2. The mean proximate composition of the feed used as shown in Table 2, showed that Coppens (T_1) contained a higher crude protein with mean value 48.50 ± 1.02 than the other Treatments, T_3 (Multifeed) with 47.30 ± 0.29 and T_2 (Vital Feed) with the least value of 45.60 ± 0.29. The mean values of ether extract followed the same pattern, with T_1 having the highest value (12.50 ± 0.58), T_3 (8.00 ± 0.12) and T_2 (1.50 ± 0.58). The mean values of crude fibre showed that T_2 had the highest mean value (3.00 ± 0.12), followed by T_3 mean value (2.4 ± 0.17) and T_1 recorded the least value (1.5 ± 0.06). The mean values of moisture content showed that T_3 had (7.90 ± 0.17), followed by T_2 (7.70 ± 0.23), while T_1 (7.30 ± 0.23) recorded the least. The results of the mean proximate analysis for the three treatments showed there was a significant difference (P = 05) between the macronutrients composition of the different feeds.

Table 2: Proximate analysis of the different standard feeds used (%)

Parameters (%)	Treatment 1 (T_1)	Treatment 2 (T_2)	Treatment 3 (T_3)
Moisture	7.30 ± 0.23^a	7.70 ± 0.23^a	7.90 ± 0.17^a
Crude Protein	48.50 ± 1.02^a	45.60 ± 0.29^b	47.30 ± 0.29^{ab}
Ether Extract	12.50 ± 0.58^a	1.50 ± 0.58^c	8.00 ± 0.12^b
Ash	9.00 ± 0.32^a	8.00 ± 0.12^b	7.50 ± 0.12^b
Crude Fibre	1.50 ± 0.06^c	3.00 ± 0.12^a	2.40 ± 0.17^b
Nitrogen Free Extract	21.20 ± 0.71^c	34.20 ± 0.21^a	25.23 ± 1.29^b

In each row, mean with a common letter are not significantly different (P ≠ 05).

The results for the monitored water parameters are shown in Table 3. The analyzed results revealed that T_3 (Multifeed) recorded the highest mean value (24.84 ± 0.15 ^{o}C) in terms of water temperature, followed by T_2 (Vital Feed) with (24.65 ± 0.13^{o}C), while T_1 (Coppens) had the least value (24.59 ± 0.39^{o}C). The mean value of Dissolved Oxygen for T_3 was (2.73 ± 0.46) being the highest, followed by T_1 with (2.52 ± 0.60), T_2 recorded the least Dissolved Oxygen with 2.51 ± 0.45. Mean values for pH shows that T_1 had (7.53 ± 0.18), T_2 (7.39 ± 0.14) while T_3 (7.53 ± 0.33). The results in Table 3 showed there was no statistically significant difference ($P \neq$ 05) in all the physicochemical parameters of water monitored during the experiment.

Table 3: Mean of physicochemical parameters of treatments

Parameters	Treatment 1 (T1)	Treatment 2 (T2)	Treatment 3 (T3)
Temperature (^{o}C)	24.59 ± 0.39^a	24.65 ± 0.13^a	24.82 ± 0.15^a
Dissolved Oxygen (mg/L)	2.52 ± 0.60^a	2.51 ± 0.45^a	2.73 ± 0.46^a
pH	7.53 ± 0.18^a	7.39 ± 0.14^a	7.53 ± 0.33^a

In each row, mean with a common letter are not significantly different (P ≠ 05)

4. Discussion
Fish feed is one of the most vital agro-inputs used in fish culture, which has a direct effect on the growth performance and survival rate of fishes (Putra *et al.*, 2017) [15]. From the result of growth parameters of African catfish (*Clarias gariepinus*) fed with different standard feed, as shown in Table 1, fish fed with T_1 (Coppens), gave the best growth performance in terms of Weight Gain (WG), Length Gain (LG), Final Weight (FW), Final Length (FL), Feed Conversion Ratio (FCR) and Specific Growth Rate (SGR). This was followed by the group fed with T_3 (Multifeed), and the least performance was recorded among group fed T_2 (Vital feed). This finding was in consonant with the findings reported by Umaru *et al* (2016) [2] and Agokei *et al* (2010) [11] on feeding trial of *Clarias gariepinus*. The differences in growth performance amongst treatments could be attributed to the differences in the nutritional composition of the feed used (Mustapha *et al.*, 2014) [10]. The result of proximate analysis of the feed shown in Table 2, revealed that Coppens had more

of the macronutrients than Multifeed and Vital feed, and this nutrient availability particularly crude protein may have given corresponding growth response (Ajayi *et al*., 2016) [12]. Although, the value of Feed Conversion Ratio (FCR) was generally high in all the treatment groups which exceeded 2, recommended as the maximum value for FCR by Houlihan *et al.* (2001) [16] since feed conversion ratio serves as a parameter to predict the efficiency of the feed used in an experimental trial.

The physicochemical parameters obtained in this study as shown in Table 3, revealed that water temperature and pH were within the appropriate range required for efficient catfish growth under cultured system (Musiba *et al*., 2014) [17]. The values of Dissolved Oxygen (DO) across the treatments were generally low and fell below 5 mg/L suitable for fish proper development and maturation (Okey-Wokeh *et al*., 2020) [18]. This low concentration of Dissolved Oxygen (DO) may have caused the increase in FCR value and mortality recorded during the experimental trial (Yakubu *et al*., 2015) [7]. Low Dissolved Oxygen generally recorded, could be because the experimental trial was carried out in a closed environment which was not open for atmospheric air.

5. Conclusion

The study of growth performance of African catfish (*Clarias gariepinus*) fed different standard feeds revealed that fish fed with Coppens performed better in growth response than Multifeed and Vital feeds. This performance in growth was because of crude protein content as shown in the proximate analysis result. But due to the cost of importation of Coppens and Multifeed into the country as imported feeds, vital feed which is a locally made commercial feed could be used because of its availability, low cost and nutritional composition that also met the nutritional needs of *Clarias gariepinus.*

6. References

1. Oluwatayo IB, Adedeji TA. Comparative Analysis of Technical Efficiency of Catfish Farms Using Different Technologies in Lagos. State, Nigeria: A Data Envelopment Analysis (DEA) Approach. Agric and Food Security 2009;8(8):019-022. https://doi.org/10.1186/s40066-2.
2. Umaru J, Auta J, Onye SJ, Bolorunduro PI. Growth and Economic Performance of African Catfish, *Clarias gariepinus* (Burchell, 1822). Juveniles to imported and local feeds in floating bamboo cages. International Journal of Fisheries and Aquatic Studies 2016;4(2):221-226.
3. Ubesie AC, Ibeziakor NC. High burden of protein energy malnutrition in Nigeria: Beyond the health care setting. Annal of Medical Health Science Research 2012;2(1):66-69.
4. Limbu SM. The Effects of On-Farm Produced Feeds on Growth Survival, Yield and Feed Cost of Juvenile African Sharptooth Catfish (*Clarias gariepinus*). Aquaculture and Fisheries 2019;5(2):58-64.
5. Amisah S, Oteng MA, Ofori JK. Growth Performance of the African Catfish, *Clarias gariepinus*, Fed varying inclusion levels of *Leucaena leucocephala* leaf meal. Journal of Applied Science and Environmental Management 2019;13(1):21-26.
6. Farahiyah IJ, Zainal AAR, Ahmad A, Mardhati M, Thayalini K, Yong ST. Evaluation of Local Feed Ingredients Based Diets on Growth Performance of African Catfish, *Clarias gariepinus*. Malaysian. Journal of Animal Science 2016;19(2):39-46.
7. Yakubu AF, Nworgu NA, Olaji ED, Adams TE. Impact of Three Different Commercial Feeds on the Growth and Survival of *Clarias gariepinus* (Burchell, 1822) fry in Aquaria Glass Tanks. American Journal of Experimental Agriculture 2015;9(1):1-6.
8. Toutou MM, Soliman AA, Elokabu MA, Abel-Rahim MM. Impacts of Using Fresh Aquatic Plants as a Total Substitute for Formulated Feed on Performance, Health and Economic Efficiency of Grass Carp, *Ctenopharyngodon idella* (Valenciennes, 1844) Fingerlings. Aquaculture, Aquarium, Conservation and Legislation (AACL). International Journal of Bioflux Society 2018;11(6):1892-1907.
9. Dorothy MS, Raman S, Nautiyah V, Singh K, Yogananda T, Kamei M. Use of Potential Plant Leaves as Ingredient in Fish Feed – A Review. International Journal of Current Microbiology and Applied Sciences 2018;7(17):112-125.
10. Mustapha MK, Akinware BF, Faseyi CA, Alade AA. Comparative effect of local and foreign commercial feeds on growth and survival of *Clarias gariepinus* juveniles. Journal of Fisheries 2014;2(2):106-112.
11. Agokie EO, Oparah CA, Aranyo AA, Alozie-Chidi VC, Apapa UA. Growth of *Clarias gariepinus* Juveniles Fed Five Commercial Feed. Journal of Fisheries and Aquatic Studies 2010;5(3):1-5.
12. Ajayi OT, Ojo SO, Adeleke B, Oluyisola OO. The Growth Performance of African Catfish (*Clarias gariepinus*) Fed Commercially Prepared Imported Fish Feeds. International Journal of Agricultural Economies 2016;1(3):57-61.
13. Odioko E, Sikoki FD, Vincent-Akpu IF, Utibe DI. Acute Toxicity of Sponge Plant (*Luffa cylindrica*) Fruit Extract on African Catfish (*Clarias gariepinus*, Buchell 1822) Juveniles. International Journal of Life Sciences Research 2016;4(1):148-159.
14. Association of Official Analytical Chemists (A.O.A.C). Official Method of Analysis. 13th Edn, Washington DC, USA 2000, P56-132.
15. Putra I, Rusliadi R, Fauzi M, Tang UM, Muchlism ZA. Growth Performance and Feed Utilization of African Catfish *Clarias gariepinus* Fed a Commercial Diet and Reared in the Biofloc System Enhanced with Probiotic. [version 1; referees: 1 approved], F100 Research 2017;6:1545. doi: 10. 12688/F1000 research. 12438.1
16. Houlihan D, Bouiard T, Jobling M. Food Intake in Fish USA. IOWA State University Press. Blackwell Science Ltd 2001, P418.
17. Musiba MJ, Ngupala GW, Kashindye BB, Elison M, Shoko AP, Ndikumana J *et al*. Performance of Locally formulated feeds for rearing of African Catfish in Tanzania. African Crop Science Journal 2014;22(4):979-986.
18. Okey-Wokeh CG, Obunwo CC, Boisa N. Assessment of Physicochemical Characteristics of Mini-Ezi Stream in Elele-Alimini, Emohua Loca Government Area of Rivers State, Nigeria. International Journal of Advances in Scientific Research and Engineering 2020;6(1):196-202.