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A comparative study to evaluate the effect of two commercial diets (Aqualis and Topfeed) on the growth of African catfish *Clarias gariepinus*

Odeyemi O. M. and Awopetu T. S.*

Department of Aquaculture and Fisheries Management, University of Ibadan, Nigeria.

*Corresponding author. Email: awopetutope@yahoo.com

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ABSTRACT: The feed trial was carried out in African Inland Fish Farming Limited, Ibeju-lekki Lagos State, Nigeria to assess the growth of *Clarias gariepinus* fed with two commercial diets. Using a complete randomized design and six treatments separated into T1 and T2, the feed trial was carried out to assess the growth performance of two commercial fish feeds (Aqualis and Topfeed) on *Clarias gariepinus* for a period of 55 days using circular tarpaulin tanks with a capacity volume of 28.3 m^3 marked DS1, DS2, ES1, ES3, ES4, and FS1 stocked with 11,250/tank juveniles with an initial weight of 8.0 g were stocked in each tank. Fish in units ES3, ES4, and FS1 were fed Topfeed whereas fish in units DS1, DS2, and ES1 were fed Aqualis feed. Feeding was done twice daily. All physicochemical parameters were assessed using the Sera Aqua-Test Kit and the dry matter of the two commercial diets underwent chemical analysis. The growth performance parameters revealed that the final mean weight (g), mean weight gain (MWG) (g), specific growth rate (SGR), and survival rate were not significantly different between the two feeds ($p>0.05$). The results demonstrated that Topfeed outperformed Aqualis feed with a higher survival rate and a feed conversion ratio (FCR) value of ($p>0.05$). Also, the proximate composition revealed no significant differences ($p>0.05$) between the two feeds. Based on the findings, it can be said that Topfeed outperformed Aqualis feed for raising *C. gariepinus.*

Keywords: Growth, parameter, performance, *Clarias gariepinus.*

INTRODUCTION

In the aquaculture industry, the African catfish, *Clarias gariepinus*, a member of the Clariidae family, is one of the most sought-after freshwater food fish (Ekanem *et al.,* 2012). The aquaculture feed market has expanded significantly in recent years (Shefat and Karim, 2018) due to aquaculture activity, which has produced 89 per cent of the world's total in volume terms, over the previous 20 years and is the fastest-growing animal production industry in the world with an average annual rate of roughly 10.3 per cent since 2010 (FAO, 2020). In the aquaculture sector, fish feeds are particularly helpful for increasing productivity and maintaining a healthy profit, and in intensive fish culture, feed accounts for around 60% of the capital cost (Eyo and Ekanem, 2011). An important component in raising aquaculture's productivity and profitability is the intensification of production brought on by the expansion of the fish feed sector (Mogaji and Ibiyo, 2016). As a result, feed makes up a significant portion of the cost of producing aquaculture (Mogaji and Ibiyo, 2016; Ibiyo *et al*., 2018).

Meanwhile, there are a lot of tainted feeds on the market, which prevents fish from getting the right balanced meal they require for healthy and timely growth (Amisah *et al*., 2009). Fish farming is therefore impossible without the availability of sufficient fish feeds that provide a balanced diet essential for growth and development (Ayoola and Abdul, 2016). Reduced growth and health disorders may result from the excess or shortage of one or more nutrients in the diet (Oliva-Teles, 2012). A steady supply of nutritionally balanced feed with sufficient amounts of all

necessary components, such as protein, fat, carbohydrate, vitamins, and minerals, is vital for ensuring productive and sustainable aquaculture (Zafar and Khan, 2020). One of the most crucial economic characteristics of aquaculture is growth. If growth rates are improved, production costs might be decreased. The time it takes for farm-raised fish to reach market size could be shortened, and profits could increase (Abass *et al*., 2020). The lack of essential minerals and questionable quality found in African catfish may be due to inadequate nutrients in their diets (Sinyangwe *et al*., 2017). The management of African catfish farms is now plagued by a subpar farming method and inadequate fish feed quality. Aquaculture nutritionists are looking into different feed administration strategies to address these issues, such as including alternative sources of protein from plants and animals in the diet (Kari *et al*., 2021). The cornerstone of scientific feeding trials must now be the adequate knowledge of the quantitative needs of the fish for the nutrients and the relative value of feeds as sources of these nutrients, which has been acquired gradually through research and experience over many years (Fasakin *et al*., 2005).

Therefore, the experiment's specific goal is to compare the performance of *C. gariepinus* post fingerlings given two commercial diets, Aqualis and Topfeed, in terms of growth (g), survival rate (per cent), feed conversion ratio (FCR), and economic effectiveness. Despite the fact that in feeding tests, the value of one feed is contrasted with another whose efficacy is established. However, the purpose of this study is to assess how two diets affected the growth of African catfish at Africa Inland Fish Farm.

MATERIALS AND METHODS

Study area

The African Inland Fish farming Limited in Ibeju-Lekki, Lagos State, Nigeria, was the site of this study. Eti-Osa East Local Council Development Areas (LCDA) is to the west, Epe is to the east, and the Atlantic Ocean is to the north of the local government. Ibeju-Lekki occupies 646 km^2, or nearly 25% of Lagos state's total land area, and is around 75 km long and 20 km wide at its widest point.

Experimental design

The study design employed in this trial is a completely randomized design (CRD) with six tanks divided into two treatments (T1 and T2), each of which had three duplicates (Ekanem *et al*., 2012). The tanks had the labels DS1, DS2, ES1, ES3, ES4, and FS1. All of the fish in the T1 segment (DS1, DS2, and ES1) were fed Aqualis feed, and those in T2 (ES3, ES4, and FS1) were fed Topfeed. The study lasted for 55 days and 28.3 m^3 circular tarpaulin nursery tanks were used with intermittent water exchanges. Good aeration was provided by the paddle wheel aerator, and the tanks were covered with fine net to stop fish from jumping out. A dependable hatchery merchant supplied 67,500 post fingerlings, which were stocked at an average stocking rate of 11,250/tank with initial mean weights of 8.0 grams for T1 and T2. After acclimatizing to their new environment for seven (7) days in quarantine, the fish were transferred into the nursery tanks throughout the duration of the study. The tank water was replaced every other day to prevent the buildup of unused feed materials and fish metabolic waste. The fish were fed three times daily during the acclimatization period, following the benchmark of the feed chart. The acclimated fish were starved for 24 hours before the commencement of the feeding trial, and then, using a METLAR MT-5000D electronic scale, the average initial wet body weight of the fish in each experimental unit was calculated to the nearest gram (Eyo and Ekanem, 2011). They were fed at a rate of 3% of their body weight twice per day, at 9:00 am and 5:00 pm. Each experimental unit's fish body weight was measured at the end of every four weeks.

The physicochemical variables

Sera Aqua-Test Kit was used to determine the physicochemical water parameters which include water temperature, dissolved oxygen (DO), pH, ammonia (NH3), and nitrite, these were measured and monitored daily.

Collection and analysis of feed samples

Aqualis and Topfeed were removed from the packaged feed bags (2 mm and 3 mm in size). Eight (8) samples were sealed in an airtight bag, and transported to a laboratory by the name Remaben Scientific Services Ltd for chemical analysis following AOAC (2000).

Growth performance and feed utilization metrics

At the end of the 55-day trial, the growth performance of the experimental fish was calculated using Nwanna and Liebert (2016) formula. The average initial weights (grams) were recorded, and the following growth metrics and feed consumption indices were calculated: Specific Growth Rate (SGR) equals $100\ (ln\ (Wf) - ln\ (Wi)/T)$ for weight gain (number of days). The mean growth rate (MGR) was calculated according to Ekanem *et al*. (2012) using the formula $MGR = [(Wf - Wi)/0.5(Wf + Wi)\ t]\ 1000$. Where Wf = final weight, Wi = initial weight and t = Trial period. Feed conversion ratio (FCR) is the feed intake (g) divided by weight increase.

RESULTS

Proximate analysis of commercial feeds

This analysis was done to compare the manufacturer's listed nutrient content of the two feeds with the actual

Table 1. Chemical composition of experimental feeds.

Parameters	Aqualis feed		Top feed	
Diameter	3mm	2mm	3mm	2mm
Moisture (%)	9.1	6.4	5.9	6.9
Total Ash (%)	8.7	9.7	9.2	8.6
Sodium Chloride (Salt) %	0.6	1.1	1.1	0.87
pH	5.9	6.1	5.9	6.4
Crude Fat/Oil (%)	12.3	10.7	11.2	11.2
Crude Protein (%)	43.3	45.8	42.9	42.2
Carbohydrate (%)	26.6	27.4	30.7	30.9
Calcium (CaO) %	3.6	4.6	4.7	4.2
Available Phosphorous (P_2O_5)	1	1.1	1.2	1.1
Digestible Energy (Kcal/kg)	3547.1	3534.8	3586.5	3572.4
Crude Fiber (%)	1.3	1.2	1.7	2.4

Table 2. Chemical composition of manufactures feeds.

Parameters	Aqualis feed		Top feed	
Diameter	3mm	2mm	3mm	2mm
Moisture (%)	8	8	-	-
Total Ash (%)	14	8	7.0	7.0-
Sodium Chloride (Salt) %	0.3	0.3	-	-
pH	-	-	-	-
Crude Fat/Oil (%)	12	8	12	10
Crude Protein (%)	45	45	42	45
Carbohydrate (%)	-	-	-	-
Calcium (CaO) %	2.5	2.5	1.5	1.5
Available Phosphorous (P_2O_5)	1.1	1.1	1.1	1.1
Digestible Energy (Kcal/kg)	-	-	-	-
Crude Fiber (%)	4.5	2.0	3.5	3.0

proximate composition of fish feed. The chemical analysis (Table 1) revealed that the analyzed data on the crude protein was similar to the company's listed values (>40% crude protein), which is good for catfish production as advised by the manufacturers. However, 3 mm Aqualis differed slightly from what was stated by the manufacturer (43.3% as against 45%). In particular, the total ash, crude fibre, and fat contents of the feeds differ from company-declared nutrient values. Since they are a source of energy, lipids (fats and oil) are largely added to feed diets to enhance their ability to spare proteins. The measured lipid values were consistent with earlier research that showed 10–20% lipid in the majority of freshwater fish diets provided appropriate development rates without resulting in an excessively fatty carcass (Ayuba and Iorkohol, 2010). The majority of the feeds from the various commercial feed companies that were analyzed generally had crude protein contents that were within the acceptable range suggested for commercial fish, which is thought to be between 35 and 40 per cent, 25 and 35 per cent, and 28 to 32 per cent for fry, grow-out, and broodstock for tropical catfish, respectively. Even though there were discrepancies between manufacturers' claims and the findings of the present investigation, this research has shown that the nutrient contents of all the feeds are suitable for fish production.

Growth performance indices *Clarias gariepinus* fed Aqualis feed and Topfeed

Mean weight gain (kg), growth rate (GR), specific growth rate (SGR), and mean growth rate (MGR) were employed as indicators to assess the growth performance of *C. gariepinus* fed Aqualis feed and Topfeed (Table 3). Fish fed with Topfeed gained more weight (68.19 g) than Fish fed with Aqualis Feed (52.5 g). Additionally, fish fed Topfeed had a greater specific growth rate (SGR) than fish fed Aqualis feed (7.81±0.33 per cent/day vs. 7.4±0.39 per cent/day). Topfeed had a better percentage survival rate (74±112) compared to Aqualis feed (60±13). Compared to Topfeed (1.11±0.1), Aqualis feed has a higher feed conversion ratio (1.02±0.2).

Table 3. Growth and nutrient utilization of *Clarias gariepinus* fed commercial feed (Aqualis and Top feed).

Parameters	Aqualis feed	Top feed
Mean weight (g)	8.0	8.0
Final Mean Weight (g)	60.5±13.2	76.19±12.8
Mean Weight Gain (MWG)	52.5±13	68.19±11.5
Specific Growth Rate (SGR)	7.4±0.39	7.81±0.33
Survival Rate (%)	60±13	74±112
FCR	1.02±0.2	1.11±0.1

Table 4. Showing the mean water quality parameters.

Feeds	DO (mg/L)	T°C	NH_3 (mg/l)	pH
Aqualis feed	6.7±0.23	26.8±0.23	0.25±0.6	7.6±0.1
Top feed	6.4±0.7	25.9±0.01	0.22±0.04	7.5±0.6

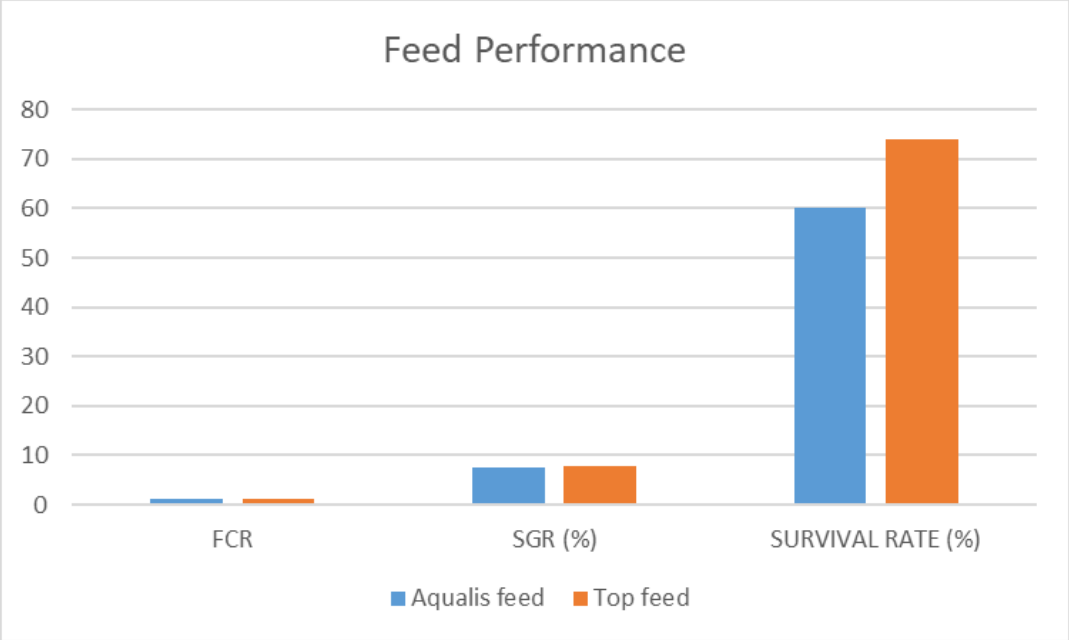

Figure 1. Showing the feed performance.

Water quality parameters

Figure 1 and Table 4 show the results obtained from daily monitoring of water quality parameters in the fish tank. It was observed that the mean temperature in tanks fed with Aqualis (26.8±0.23°C) was higher than Topfeed (25.92±0.01°C). Also, the dissolved oxygen (DO) in Aqualis (6.7±0.23 mg/l) was higher than Topfeed (6.4±0.7 mg/l). The ammonia NH_3 in Aqualis (0.25±0.6 mg/l) was higher compared to Topfeed (0.22±0.04 mg/l). The pH was higher in Aqualis feed (7.6±0.1) compared to Topfeed (7.5±0.6).

DISCUSSION

This study was performed to investigate the growth performance of two commercial feeds on *Clarias gariepinus.* One of the primary limitations facing the aquaculture business is feed costs (Dawood, 2021; Pati *et al*., 2016) because feed is a factor that drives up the price of sustainable fish farming, especially that of African catfish (Kari *et al*., 2021). The African catfish (*Clarias gariepinus*) requires adequate nourishment for growth and development (Kari *et al*., 2021). In this study, the experimental fish responded to Aqualis feed and Topfeed,

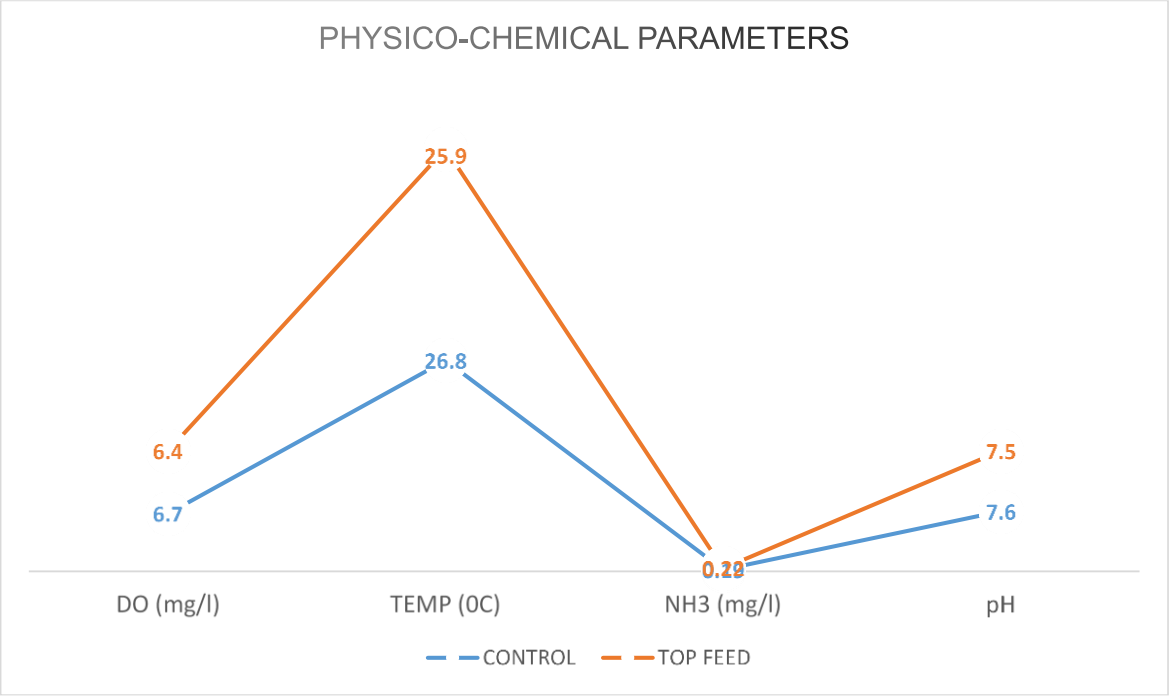

Figure 2. Daily mean water quality readings of tanks at 6:00am to 7:00am during experimental period.

as evidenced by their growth performance indicators (MWG, SGR, and FCR). These findings support Hung *et al*. (2001) and Dwyer *et al*. (2002) in that high-quality feed and the ideal feeding frequency can maximize diet utilization, resulting in rapid development. According to Ekanem *et al*. (2012), the growth performance of fish fed the two feeds is a sign that the two feeds have adequately satiated the nutritional needs of *C. gariepinus* in a culture system. The results have also demonstrated the nutrients from the two fish feeds are bio-available, according to Ekanem *et al. (*2012). This is significant because nutrients that can be adequately absorbed in a diet must be included in fish feed. According to the study, there is no significant difference between the diets in relation to their growth parameters ($p>0.05$). However, the average survival rate throughout the course of the trial was 60% for Aqualis feed and 74% for Topfeed, indicating that fish fed Topfeed fared better in terms of survival than those fed Aqualis feed. However, certain factors such as stocking density may be responsible for such performance (Akalu, 2021). Feed conversion ratio (FCR) is a reliable measure for assessing the quality and acceptability of feed for fish and determines how effective a feed is by measuring the amount of performance received from a feed (Jabeen *et al*., 2004). According to this study, the average final FCR during the experimental period for Aqualis and Topfeed was 1.02 and 1.11, respectively. This difference may be caused by environmental factors, fish activity levels, and fish sizes (Purcell *et al*., 2017). Using the stated FCR benchmark for the rearing of Catfish, 1.11 according to Ayoola and Abdul (2016), who acquired an FCR of 1.25, which is comparable, it can be concluded that both feeds performed well. Nevertheless, some elements can impact FCR and refute feed producers' assertions thereby performing below manufacturer recommendations which include fish size, stocking density and water temperature (Li *et al*., 2021). The FCR result obtained in this study is equally similar to Robinson and Li (2015) who stated that juvenile catfish convert feed at 1.0 to 1.2. Perhaps the single most crucial element in determining profitability is how effectively catfish convert feed to body mass (Robinson and Li, 2015). The physicochemical analysis in Table 4 and Figure 2 demonstrates that all the important parameters (dissolved oxygen, temperature, ammonia, and pH) are in a range that is acceptable for catfish (Fagbenro and Olurole, 2016).

Conclusion

Despite differences between the data obtained, this research has shown that both the Aqualis feed and Top feeds yielded good results. Also, the nutrient contents of all the feeds used, are suitable for catfish culture. However, as proved in this study, Aqualis may have yielded lesser results in comparison with Topfeed in terms of survival, FCR and weight gain.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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