Effect of three commercial floating fish feeds on survival and growth performance of juvenile African catfish (*Clarias gariepinus*)

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Abstract

There is paucity of information regarding efficiency and suitability of most imported floating feeds used for growing catfish in Nigeria. This study therefore determined proximate compositions of three commercial floating fish feeds (Vital Feed, Top Feed and Allier Aqua Feed) and their effects on growth parameters when fed to juvenile African catfish (*Clarias gariepinus*). 65 litre capacity rectangular plastic tanks were stocked with healthy juveniles catfish of similar average weight were fed with these feeds for a period of 56 days (8 weeks at the rate of 20 fish per tank. A triplicate trial was maintained for each feed, totalling nine tanks in all and 60 fish per feed. The tanks were labelled based on the type of feed. The rearing water quality parameters were monitored throughout the experiment. The results indicated that catfish fed with Top Feed had significantly ($p < 0.05$) higher weight gain, higher specific growth rates and lower feed conversion rates than those of the other groups, although catfish Allier Aqua had similar performances. High survival rates ($> 80\%$) were observed in all groups while water quality parameters were not affected due to the feed offered. The results of the proximate composition attested to the fact that feed with high protein and lipid contents results in better fish growth i.e. Top feeds with high protein (45.16 ± 2.73) and Allier Aqua with high (13.00 ± 2.11) content. Variations in growth parameters and estimated cost of feeding observed in the present study imply that catfish farmers should exercise great caution in selecting commercial floating feeds for their fish since these feeds produce different growth effects on fish.

Keywords: Floating feeds, survival, growth, *Clarias gariepinus*, juveniles

Introduction

Feed is invariably an important component of intensive food fish production, as it has been shown to influence growth rate, body composition and health status of the cultured fish, as well as economic viability of the operation (Bichi *et al.*, 2010). Commercial feeds available for fish farming in Nigeria are broadly classified based on their floatability in water as sinking pellets or floating feeds. Sinking feeds are made locally using conventional agricultural by-products (soya beans, groundnut cakes, maize, bone meal, etc.). Until recently, floating feeds in Nigeria are imported into the country and are more

costly than sinking pellets. Whether floating or sinking, a good feed should contain essential nutrients (protein, lipids, minerals, vitamins, etc.) in the right proportion with proper formulation that meet the nutritional requirements of cultured fish (Mustapha *et al.*, 2014). Feeds offered to fish should be fresh, durable in water until they are eaten, and must be attractive and palatable to fish at a reasonable cost that will yield profits to farmers (Diyaolu, 2012). Most of the available commercial sinking pellets in Nigeria do not meet these criteria, which explain why farmers prefer to use floating feeds rather than sinking pellets. Besides,

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floating feeds afford farmer the opportunity to view fish while feeding, while over-eating and wastage can be easily avoided (Nwokocha, 2005). However, these perceived advantages have not been translated into profits in many farms as the cost of feeding fish with floating feeds often lead to higher production costs. In addition, there is dearth of reliable published information on nutrient compositions of many of these commercial feeds. This makes farmers sometimes assume that all floating feeds produce the same growth effects on fish and are thus misled about efficiency of these feeds. The consequences may be grievous, leading to irreparable loss to the farmers.

Generally, selection of feed for aquaculture requires accurate information on the nutrient composition, growth efficiency and other important characteristics of the feed in relation to the nutritional requirement of the cultured (Diyaolu, 2012). Research on efficiency of commercial feeds till date mainly focuses on comparing growth responses of fish fed with locally made fish and imported feed (Ekanem, 2012; Mustapha *et al.*, 2014; Limbu, 2015). Reliable scientific evidences are lacking on most commercial floating feeds available in the country, despite that these feeds are being extensively used by farmers with varying results. This study was therefore aimed at examining proximate compositions of three commonly used commercial floating feeds in Nigeria and their effects on survival and growth performance of *Clarias gariepinus* juveniles in order to determine whether all floating feeds have similar growth effects on fish (Ali, 2012; Limbu, 2015).

Materials and methods

Healthy and similar sized of juvenile African catfish (*Clarias gariepinus*) were purchased from a reputable farm and

acclimatised for a week prior to the commencement of the experiment. They were stocked and maintained in large rectangular plastic tanks, and were fed to satiation using coppens feed of 3 mm diameter. Water in the tank was drained halfway and replaced with fresh water, and this was done twice in a day both in the morning and evening. The floating feeds (i.e. Vital Feed, Top Feed and Allier Aqua Feed) used in this experiment were procured from popular agro-feed store within Ado-Ekiti metropolis and kept in air-tight polythene material throughout the experiment. The proximate compositions of each feed were performed following the methods described by AOAC (2003).

At the start of the experiment, 65 litre capacity rectangular plastic tanks were stocked with fish at the rate of 20 fish per tank. A triplicate trial was maintained for each feed, totalling nine tanks in all and 60 fish per feed. The tanks were labelled based on the type of feed. The fish in all tanks were left without feeding throughout the first day, while active feeding commenced on the second day of the experiment. Feeds were offered twice in a day (8:00 am and 4:00 pm) at 5 % body weight throughout the experimental period of 56 days. The fish in each tank were batched-weighted at the end of every two weeks to determine the quantity of feed to be offered. Partial water exchange (half of the tank) was carried out as described for pre-experimental period before fish were fed, while water quality parameters (temperature, dissolved oxygen, total dissolved solids) were monitored before water exchange. The final weight of fish in each tank was determined at the end of the experiment. Other parameters such as number of fish survived, mean weight gain, specific growth rate, food conversation ratio, protein efficiency ratio and cost of using each feed in growing 1 kg of fish were calculated as described by other workers

(Ali, 2012; Limbu, 2015). The data obtained were recorded as mean $\pm$ standard deviation. All data in each parameter were subjected to one-way analysis of variance to determine if there was any significant difference due to the type of feed used. Duncan Multiple Range test was applied to separate means of significantly differed parameters. All statistical analysis were done using SPSS version 15.

Results and discussion

The results of the proximate analysis of the experimental feed are presented

in Table 1. Top feed was found to be significantly higher in crude protein (45.16 ± 2.73 %) and ash contents (10.14 ± 0.55 %). Allier Aqua Feed had highest crude fat content (13.00 ± 2.11), while nitrogen free extract was found to be highest in Vital Feed (35.81 ± 5.62). There were no significant differences ($P > 0.05$) in the moisture content of Vital feed (8.07 ± 0.51), Top feed (6.18 ± 0.09) and Allier Aqua Feed (8.47 ± 0.66), also crude fibre contents of Vital, Top and Allier Aqua Feed (3.61 ± 0.44 , 3.67 ± 0.08 and 3.63 ± 0.74), respectively among the three feeds.

Table 1: Proximate analysis of three commercial floating feeds used for feeding of *Clarias gariepinus* juveniles

Proximate Composition	Vital Feed	Top Feed	Allier Aqua Feed
Moisture content (%)	8.07 ± 0.51^a	6.18 ± 0.09^a	8.47 ± 0.66^a
Crude protein (%)	37.02 ± 2.87^a	45.16 ± 2.73^b	42.00 ± 4.79^b
Crude fibre (%)	3.61 ± 0.44^a	3.67 ± 0.08^a	3.63 ± 0.74^a
Crude fat (%)	7.30 ± 0.98^a	7.90 ± 1.02^a	13.00 ± 2.11^b
Ash (%)	8.19 ± 0.06^a	10.14 ± 0.55^b	8.49 ± 0.27^b
NFE (%)	35.81 ± 5.62^a	26.95 ± 2.73^b	24.41 ± 3.08^b
CHO: L	4.85 ± 0.16^a	3.40 ± 0.11^b	1.88 ± 0.02^c

Values with the same superscripts in a row are not significantly different ($p > 0.5$)

Table 2 showed the growth performance of the fish, the Initial weight of Vital feed was (5.19 ± 1.00), Top feed (5.12 ± 0.98) and Allier Aqua feed (5.79 ± 0.15). Fish fed with Top Feed recorded highest values in final weight (24.96 ± 0.29 g), weight gain (19.84 ± 0.52 g), and specific growth rate (0.028 ± 0.008 %/day), as well as lowest values in food conversion ratio (1.05 ± 0.02)

than those fed with Vital feed. Percentage survival for Vital, Top and Allier Aqua feeds were 85, 90 and 90, respectively. However, fish fed Allier Aqua feed had similar performances, as these parameters are found to be insignificantly ($P > 0.5$) different. Estimate cost of feeding was highest in fish fed Allier Aqua feed, with lowest values occurring in fish groups fed with Top feed.

Table 2: Growth performance, survival and cost of feeding of three commercial floating feeds to *Clarias gariepinus* juveniles

Parameters	Vital Feed	Top Feed	Allier Aqua Feed
Initial weight (g)	5.19 ± 1.00^a	5.12 ± 0.98^a	5.79 ± 0.15^a
Final weight (g)	15.48 ± 2.31^a	24.96 ± 0.29^b	22.14 ± 0.15^b
Mean weight gain	10.29 ± 1.95^a	19.84 ± 0.52^b	16.35 ± 0.23^b
Specific Growth Rate (%/day)	0.019 ± 0.005^a	0.028 ± 0.008^b	$0.024 \pm 0.001^{a,b}$
Feed Conversion Ratio	1.47 ± 0.58^a	1.50 ± 0.02^b	1.10 ± 0.09^b
Percentage survival (%)	85 ^a	90 ^a	90 ^a
Market price of feed (N)	600 ^a	615 ^a	665 ^b
Cost of feeding (N/kg)	702.00 ^a	645.75 ^b	731.50 ^c

Values with the same superscript in a row are not significantly different ($p > 0.5$)

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Table 3 showed the Water quality parameters during the experimental trials. Survival of fish fed each of these feeds and their measured water quality parameters (Table 3) were not significantly different ($P>0.05$).

Table 3: Water quality parameters during the experimental trials

Parameters	Vital Feed	Top Feed	Allier Aqua Feed
Dissolved Oxygen (mg/L)	4.42±0.61	4.29±0.33	4.26±0.57
Ph	6.23±0.55	6.41±0.18	6.30±0.72
Temperature (°C)	25.94±0.16	26.02±1.48	25.89±0.75

During the last decade, there has been a marked increase in the use of extruded floating feeds for feeding fish. These feeds have superior water stability, better floating properties and a higher energy than pelleted diets. Comparative performance in growth parameters of African catfish *Clarias gariepinus* fed three commercial floating feeds in this study revealed that different feeds produced varying effect on fish under culture. This is expected, since there are variations in the nutrient compositions of the feeds offered to the fish, as shown by their proximate analysis.

Ayuba (2012) had earlier reported variations in proximate composition of some commercial floating feeds used for feeding catfish in Nigeria. It should be pointed out that crude fibre and moisture content in these three feeds were different, and by consequence, may not be responsible for variations observed in fish growth. Protein, being the main component of African catfish feeds (Fagbenro, 1998) was found to be above 35% in all feeds used in this study and was within the ranges required for catfish grow-out (Ayinla, 2007). However, higher growth parameters were observed in diet containing 45% crude protein (Top Feed), indicating that catfish which are still young at the onset of the grow-out phase grow best at this protein level, as corroborated by Van Weerd (1995). Increased fish production and higher profitability has also been linked with higher protein level in fish feeds (Rouhani,

1993; Fagbenro, 2004). Lipids are well utilised by fish to meet their energy needs and spare protein for growth and body maintenance, and as a result, dietary lipid of 10 to 20 % are recommended in fish feeds (Ali, 2004; Mustapha, 2014). The lipid level was found to be highest in Allier Aqua feed, and this may be responsible for good growth observed in this study. According to Witson (2000) lipid level of more than 5% in the two other feeds is adequate for fish's optimum growth, provided protein and other nutrients in the feed are sufficient.

Pantazis (2005) had advocated greater use of carbohydrates during formulation of grow-out catfish diet in order to maximise the use of available dietary protein and reduce cost of feeding. Ali (2004) observed that CHO: L ratios ranging from 1.70 to 3.40 produced significant improved growth performance and feed utilization in *Clarias gariepinus*. This observation was supported by the present study, as good growth was observed in feeds with CHO: Lipid of 3.40±0.11 followed by 1.88±0.02. It should be noted that fish survival and water quality parameters observed in each feed group were not significant, implying that the use of these feed did not affect fish survival and water quality differently. Farmers should also be aware of the need to juxtapose growth performance efficiency with market price of feed before making any selection, since low feed prices do not necessarily translate

into low cost of feeding and high economic returns, as confirmed in this study.

Conclusions and recommendations

Variations in growth parameters and estimated cost of feeding observed in the present study imply that catfish farmers should exercise great caution in selecting commercial floating feeds for their fish since these feeds produce different growth effects on fish. Feed manufacturers in a bid to formulate a ration that give them high profits determine the types of ingredients used and consequently the nutrient compositions of commercial feeds. However, it is essential that every feed manufacturer formulate a nutritionally balanced ration that will produce optimum fish growth. Research-based evidence on efficiency of commercial feeds should also be provided by feed importers before they are certified by regulatory authorities. This becomes necessary in order to avert importation of all kinds of feeds with questionable nutrient compositions that can adversely affect local production of *Clarias gariepinus*.

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