Effect of three commercial feeds on the growth performance of Hybrid Catfish (*Heteroclarias*) juveniles

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Abstract

The growth of aquaculture depends on good quality feed which has led to the importation of commercial feeds into the country. However, these imported feeds are usually not affordable by the average Nigerian fish farmer. To solve this problem different locally produced commercial fish feeds have also been introduced to the Nigerian market giving rise to many brands of fish feed. This study seeks to determine the effect of an imported commercial feed (feed A) and two locally produced commercial feeds (feed B and C) on growth and survival of Hybrid Catfish (Heteroclarias) juveniles. A total of one hundred and thirty-five (135) Hybrid Catfish (Heteroclarias) juveniles with mean weight 7.29±1.30g were fed the three commercial diets for 56 days (eight weeks). Fifteen juveniles were batched weighed and stocked in each 60-litre capacity circular plastic tanks. A triplicate trial was maintained for each commercial feed, giving nine tanks in all and 45 fishes per feed. Water quality parameters were within standard limits. Temperature was between 25.3-25.6℃, pH was 6.05-6.16.and dissolved oxygen was between 2.3- 2.45mg/l, 25.3-25.6℃, respectively. Fish fed imported commercial feed (feed A) and locally produced commercial feed (feed B) showed significant difference (P<0.05) in final weight and mean weight gain when compared with fishes fed locally produced commercial feed (feed C). The specific growth rate, food conversion ratio and survival rate did not show significant difference (P≥0.05) in all the three treatments. Fish fed imported commercial feed (feed A) had the highest mean weight gain followed by locally produced commercial feed (feed B) and locally produced commercial feed (feed C) which had the least. The estimated cost for producing 1kilogramme of fish for feed A was N560.48 while feed B and C was N506.20 and N666.51 respectively. In terms of feed conversion ratio, feed intake, cost of feed and value of fish produced, locally produced commercial feed (feed B) gave the lowest cost of producing a kilogramme of fish. Therefore, locally produced commercial feed (feed B) can be used for Heteroclarias production in plastic tanks.

Keywords: Commercial feeds, *Heteroclarias*, growth performance.

Effet de trois aliments commerciaux sur les performances de croissance des juvéniles de poissons-chats hybrides (Heteroclarias)

Résumé

La croissance de l'aquaculture dépend d'aliments de bonne qualité, ce qui a conduit à l'importation d'aliments commerciaux dans le pays. Cependant, ces aliments importés ne sont généralement pas abordables pour le pisciculteur nigérian moyen. Pour résoudre ce problème, différents aliments commerciaux pour poissons produits localement ont également été introduits sur le marché nigérian, donnant naissance à de nombreuses marques d'aliments pour poissons. Cette étude vise à déterminer l'effet d'un aliment commercial importé (aliment A) et de deux aliments commerciaux produits localement (aliment B et C) sur la croissance et la survie des juvéniles de poisson-chat hybride (Heteroclarias). Au total, cent trente-cinq (135) juvéniles de poissons-chats hybrides (Heteroclarias) d'un poids moyen de 7,29 ± 1,30 g ont été nourris avec les trois régimes commerciaux pendant 56 jours (huit semaines). Quinze juvéniles ont été pesés et stockés dans des réservoirs circulaires en plastique d'une capacité de 60 litres chacun. Un essai en triple a été maintenu pour chaque aliment commercial, donnant neuf réservoirs en tout et 45 poissons par aliment. Les paramètres de qualité de l'eau étaient dans les limites standard. La température était comprise entre 25,3 et 25,6 ℃, le pH était de 6,05 à 6,16. et l'oxygène dissous était entre 2,3 et 2,45 mg/l, 25,3 et 25,6 ℃, respectivement. Les poissons nourris avec des aliments commerciaux importés (aliment A) et des aliments commerciaux produits localement (aliment B) ont montré une différence significative (P<0,05) dans le poids final et le gain de poids moyen par rapport aux poissons nourris avec des aliments commerciaux produits localement

(aliment C). Le taux de croissance spécifique, le taux de conversion alimentaire et le taux de survie n'ont pas montré de différence significative (P≥0,05) dans les trois traitements. Les poissons nourris avec des aliments commerciaux importés (aliments A) avaient le gain de poids moyen le plus élevé, suivis des aliments commerciaux produits localement (aliments B) et des aliments commerciaux produits localement (aliments C) qui en avaient le moins. Le coût estimé pour produire 1 kilogramme de poisson pour l'aliment A était de 560,48 N tandis que les aliments B et C étaient respectivement de 506,20 N et 666,51 N. En termes de taux de conversion alimentaire, de consommation d'aliments, de coût des aliments et de valeur des poissons produits, les aliments commerciaux produits localement (aliments B) ont donné le coût le plus bas de production d'un kilogramme de poisson. Par conséquent, les aliments commerciaux produits localement (aliments B) peuvent être utilisés pour la production d'Heteroclarias dans des réservoirs en plastique.

Mots-clés : aliments commerciaux, hétéroclaries, performances de croissance.

Introduction

One of the main challenges faced by aquaculture in Nigeria is the high cost of fish feeds (Ayinla, 2007). Fish feed is reported to account for approximately 60% of the total recurrent cost in fish production (Gabriel *et al.,* 2007). The growth of aquaculture will depend on affordable quality feed. Good feeds give quick return on investment to the fish farmer, allows high stocking density, accelerate growth rate and guarantees resistant to disease (Eyo, 2003). The nutrient requirements of fish include protein, lipids, carbohydrates, vitamins and minerals therefore a quality fish feed should include such nutrients in the right proportion. Imbalance of these nutrients in feed can lead to nutritional deficiency in fishes. A good feed should be acceptable, palatable and meet the nutritional requirement of the species apart from being affordable. To solve the problem of high cost of imported commercial fish feeds, different local fish feeds have been produced which has given rise to many brands of fish feed in Nigeria's market. (Mustapha *et al.,* 2014). There are few previous studies which examined the growth performance of catfishes fed commercial feeds. Jamabo and Dienye (2017) studied the growth performance of African Catfish (*Clarias gariepinus*) fingerlings fed with four commercial feeds (Top, Vital, Lynx and Coppens). Nutrient utilization and growth of *Clarias gariepinus* fed Euro, Melick, Coppens and Durante were investigated by Ajiboye *et al.* (2015). Keremah *et al.* (2013) examined the growth and feed utilization of Hybrid catfish (*Heterobranchus longifilis* x *Clarias gariepinus*) fingerlings fed practical diets (Roone feed and Coppens feed).

Catfish species are critical to the development of aquaculture in Nigeria (Owodeinde and Ndimele, 2011). Interest in the *Heteroclarias* species has increased in Nigeria and it is obtained by crossing *Heterobranchus* (male) and *Clarias gariepinus*-female (Keremah *et al.*, 2013). This hybrid combines the fast growth, ability to tolerate poor water quality conditions and hardiness of *Clarias* with the large size of *Heterobranchus* species. There is paucity of information on growth performance of *Heteroclarias* fed with commercial feeds. The aim of this study is to determine the effect of an imported commercial feed (feed A) and two locally produced commercial feeds (feed B and C) on growth and survival of Hybrid Catfish (*Heteroclarias*) juveniles.

Materials and methods

Fish and Experimental Design

The experiment was conducted in the fisheries unit, College of Agriculture and Animal Science, Mando road, Kaduna, Nigeria. A total of 150 *Heteroclarias* juveniles were purchased from a reputable farm in kaduna and transported to fisheries unit laboratory in a 50-litre jerry can. The fishes were acclimatised for two weeks during which they were fed at ad libitum. Left over feeds and faeces were siphoned daily. At the end of the acclimatisation period, 135 fishes with mean weight of (7.29±1.30g) were randomly selected, batched weighed and stocked into nine 60-liter circular rubber tanks. Fifteen (15) fishes were stocked in each of the 60 litres tanks. Each tank was covered with net to prevent fish from jumping out. The fishes were starved for 24 hours prior to commencement of the experiment. A completely randomized design consisting of 3 treatments (commercial catfish feed) and 3 replicates per treatment was employed. The commercial feeds used in this study were an imported commercial feed designated feed A and two locally produced

commercial feeds designated feed B and C respectively.

Experimental Procedure

The water in the tanks was changed three times a week and water quality parameters (Dissolved Oxygen, pH, and temperature) were taken at the beginning of the experiment then every two weeks. The water temperature was measured using mercury in-glass thermometer, Oxygen with a digital oxygen meter and pH was measured with a pH meter (pH-009) model. Fishes were fed each of the feeds at 5% of their body weight twice daily for 8 weeks. Diets were adjusted every 2 weeks after sampling. The proximate composition of the feeds was carried out as described by AOAC (1990). At the end of the experiment the following growth parameters were calculated as described by Ajayi *et al.* (2016).

$$Mean\ Weight\ Gain\ (MWG) = Mean\ final\ weight - Mean\ intial\ weight$$

$$Feed\ Conversion\ Ratio\ (FCR) = Total\ feed\ consumed / Weight\ gain\ by\ fish$$

$$Survival\ rate = Total\ number\ of\ fish\ harvested (100 / initial\ number\ of\ fish\ stocked)$$

$$Specific\ Growth\ Rate (SGR) = \ln W1 - \ln W2 \times {}^{100}/_{T2 - T1}$$

$Where\ W2 = Final\ weight, W1 = Initial\ weight$

$T2 - T1 = Time\ interval\ between\ W2\ and\ W1\ in\ days$

$ln = Natural\ log$

Cost benefit evaluation

The cost benefit was calculated employing the methods described by Ajayi *et al.* (2016) using the following indices, Average cost of feeding (N), Estimated cost of feed for producing 1kg of fish (N), Value of fish produced (N), Cost of feed per kg(N) Average feed quantity used (g). The Estimated cost of feed for producing 1kg of fish was calculated using the cost of 1 kilogramme of each commercial feed at the time of the research.

Statistical Analysis

Data collected were subjected to analysis of variance (ANOVA). Significant difference means ($P< 0.05$) were separated using Duncan's New Multiple Range Test (Duncan). The statistical analysis was done using SPSS (Windows version 15.0).

Results

Table 1 shows the proximate composition of the commercial feeds A, B and C carried out by laboratory analysis. Water quality parameters measured during the study is presented in Table 2. The temperature was between 25.3-25.6℃, dissolved oxygen was 2.3- 2.45mg/l while the pH was between 6.05-6.16.

Table 1: Proximate composition of commercial feeds

Treatment	A	B	C
Dry Matter	92.64	93.30	90.93
Ash	6.82	7.08	19.10
Ether extract	24.38	20.62	26.31
Crude fibre	1.99	0.93	0.55
Crude protein	48.44	47.25	42.44
Nitrogen free extract	18.37	24.12	11.6

Table 2. Mean physicochemical parameters of water during the study period

Treatment	A	B	C
Temperature (℃)	25.6	25.23	25.03
Dissolved Oxygen (mg/L)	2.43	2.45	2.3
Hydrogen Ion Conc (pH)	6.16	6.05	6.05

The results of the growth performance and survival of *Heteroclarias* juveniles fed three different commercial feeds is presented in Table 3. The result showed varied weight increase with each of the experimental diets. The highest weight gain was recorded in fish fed imported commercial feed A (10.71g) followed by fish fed followed by locally produced commercial feed B (8.87g) the least value was recorded in the fish fed locally produced commercial feed C (2.84g). However, fish fed commercial feeds A and B were not significantly different ($P\geq 0.05$) from one another. Weight gain in fish fed commercial feed C was significantly different ($P< 0.05$) from the rest treatments. Specific Growth Rate (SGR %) per day, followed a similar trend to the weight gain. The fish fed commercial feed A was 0.71% followed by feed B with 0.58% and the least value of 0.23% in feed C. There was significant difference ($P< 0.05$) in the SGR of all the three feeds tested in this study. The Feed Conversion Ratio (FCR) was 1.55, 2.01, 3.44 for commercial feeds A, B and C respectively. However, the Feed Conversion Ratio (FCR) was not significantly different ($P\geq 0.05$) for all the three commercial feeds

tested in this study. The Survival rate in all the three feeds showed no significant difference ($p \geq 0.05$).

Table 3 Growth performance and survival of *Heteroclarias* juveniles fed three different commercial feeds.

Treatment	A	B	C	SEM
Initial Weight(g)	6.60[a]	7.27[a]	8.00[a]	0.43
Final Weight(g)	17.31[a]	16.13[a]	10.84[b]	1.14
Mean Weight Gain(g)	10.71[a]	8.87[a]	2.84[b]	1.43
Specific growth Rate (% day)	0.71[a]	0.58[ab]	0.23[b]	0.09
Food conversion Ratio	1.55[a]	2.01[a]	3.44[a]	2.06
Mean Feed intake	16.17	16.33	14.45	-
Survival rate %	84.44[a]	75.56[a]	80.00[a]	3.68

Mean in the same row with different superscripts differ significantly ($P < 0.05$)

Table 4 shows Cost-benefit evaluation of three commercial feeds used in feeding trials. A kilogram of commercial feed A cost N600 while feed B and C cost N500. The estimated cost of feed A for producing 1 kilogramme of fish was N560.48 while estimated cost for producing 1 kilogramme of feed B and C was N506.20 and N666.51 respectively.

Table 4 Cost-benefit evaluation of three commercial feeds used in feeding trials.

Treatment	A	B	C
Production days	56	56	56
Number of fish per treatment	60	60	60
Mean Feed intake	16.17	16.33	14.45
Mean Cost of feeding(N)	9.70	8.17	7.23
Mean weight gain(g)	10.71	8.87	2.84
Value of fish produced (N)	12.12	11.30	7.59
FCR	1.55	2.01	3.44
Cost of feed/kg(N)	600	500	500
Estimated cost of feed for producing 1kg of fish(N)	560.48	506.20	666.51

Discussion

This study evaluated the effect of an imported commercial feed (feed A) and two locally produced commercial feeds (feed B and C) on growth and survival of Hybrid Catfish (*Heteroclarias*) juveniles. Good growth, health and reproduction of fish are dependent upon an adequate supply of nutrient, both in terms of quantity and quality (Solomon *et al.,* 2013). Growth parameters, are important indicators for estimating the effect of feed and its value. The increase in weight gain reported for all the 3 commercial feeds revealed that the fish was able to utilize the feeds. Ayinla (2007) reported that catfishes require at least 40% crude protein for normal growth, the crude protein in these commercial feeds were above this recommended value. The difference in the mean weight gain of fish fed the 3 commercial feeds could also be due the difference in the level of crude protein which was higher in commercial feed A, followed by feed B and then feed C. This observation is in agreement with the finding of Raimi *et al*. (2018) that different commercial feeds produce varying effects on fish under culture because of variations in their nutrient compositions. Mustapha *et al*. (2014) stated that fish growth is significantly influenced by the level of protein in the feed and must be supplied for rapid growth. Moreover, the quality of the protein could also affect the yield as observed by Umoru *et al.* (2016) when Coppens, Chi and Dizengoff was fed to *Clarias gariepinus*. The crude protein value of the 3 commercial feeds evaluated in this study were similar to the ranges reported by Umoru *et al.* (2016) and Ajayi *et al.* (2016). The mean physicochemical parameters of water in this study were within recommended levels as documented by Omitoyin (2007). The values for the Specific Growth Rate (SGR) in this study was lower than the values reported by Solomon *et al.* (2013) when *Heteroclarias* fingerlings were fed with Coppens feed. Variations in SGR may be due to feeding frequency and type of feed. However, the SGR compares well with the report of Keremah *et al*. (2013) on *Heteroclarias* fingerlings fed with practical diets. Feed conversion ratio (FCR) is often used to determine the efficiency of a test feed. Since FCR is related to weight gain, it is affected by type of fish species, diet composition and quality, culture system used, environment, fish health and size. According to Robinson and Menghe (2015) catfish converts feed efficiently and therefore opined an FCR of 1.8. The FCR in this study was close to the range (2.67- 4.39) reported by Keremah *et al.* (2013) when *Heteroclarias* was fed Roone feed, Coppens feed and a locally formulated feed. The relative high survival rate observed in this study could be due to the suitable water quality parameters which was within the acceptable range. The survival rate recorded was close to the 75-80% reported by Otchoumou *et al.* (2012) for *Heterobranchus longifilis* fingerlings. However, it was lower than the values documented by Keremah *et al.* (2013) for *Heteroclarias* fingerlings. The difference in survival

rates between this work and other studies could be as a result of different culture conditions (Keremah *et al.*, 2013).

From this experiment though feed A gave the highest weight gain yet it is cheaper to use feed B since it had a lower cost for producing 1 kg of fish also there was no significant difference in weight gain and survival rate for both feeds. Sometimes, lower costs could be attributed to good feed quality and acceptance of feed by fish. However, variations in growth performance of test fish and estimated cost of feeding 1 kg of fish indicates that farmers should be careful in selecting commercial feeds.

Conclusion

This study revealed that in terms of feed conversion ratio, feed intake, cost of feed and value of fish produced, locally produced commercial feed (feed B) gave the lowest cost of producing a kilogramme of fish. Therefore, locally produced commercial feed (feed B) can be used for *Heteroclarias* production in plastic tanks.

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Date received: 1st March, 2023

Date accepted: 5th April, 2023