



EFFECT OF FEEDING FREQUENCY ON SOME PERFORMANCE INDICES OF THE AFRICAN CATFISH (*CLARIAS GARIOPIBUS*, BURCHEL 1822) JUVENILES

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ABSTRACT

A nine-weeks feeding trial was carried out to investigate the effect of feeding frequency on the growth performance of the African catfish, *Clarias gariepinus*. *C. gariepinus* juveniles (12.72 ± 0.45 g) were stocked into 9 tanks at a density of 10 fish per tank and three different feeding frequencies were tested on triplicate groups for 63 days. Feeding frequency I: fish were fed to apparent satiation only once a day, in the mornings, throughout the experimental period. Feeding frequency II: fish were fed to apparent satiation twice a day, every other day, throughout the experimental period. Feeding frequency III: fish were fed to apparent satiation, twice a day, throughout the experimental period. A commercial catfish diet consisting of 42 % crude protein and 20 Mj Kg⁻¹ gross energy was used. No significant ($P > 0.05$) differences were observed in growth performance or food conversion ratio (FCR) amongst the three different treatments. Similarly, feed intake was not significantly higher in any group as increased feeding was observed when fish in Groups 1 and 2 were fed. This study reveals that feeding strategies such as used in Groups 1 and 2 in this study may neither improve growth performance nor be a good feeding strategy for the reduction of production cost in *C. gariepinus* farming.

Keywords: *Clarias gariepinus*, feeding frequency, food conversion ratio, growth performance, hyperphagy, restricted feeding

INTRODUCTION

Aquaculture has been adjudged the fastest growing food sector worldwide (World Bank, 2007).

This holds true in Nigeria too, with aquaculture production increasing from around 25,000 tonnes in the early 2000s to over 300,000 tonnes by 2014 (FAO, 2020). This increase has basically been due to the farming of the African catfish *Clarias gariepinus*. Nigeria is the largest producer of the African catfish, where its farming is of great socio-economic importance, including contributing to fish supply, livelihoods and job creation. However, despite this and the projection of aquaculture to bridge the gap between the ever-increasing demand for fish and the dwindling fish supply from natural resources in the country, it has not met this target. Consequently, fish (over 600,000 tonnes) is imported yearly to meet the shortfall (Bradley *et al.*, 2020). Nigeria has all the resources required to produce enough fish to meet demand, and even export, but there are several factors militating against this, chief among these is the high cost of feeds. Feed is the major cost in fish production, accounting for between 50 to 70 % of production/operational cost (Worldfish, 2009) and can thus severely affect profit margins. The high cost of feed and its ensuing effect on profitability has resulted in the shutting down of a lot of fish farms in Nigeria, even though aquaculture is widely perceived as lucrative.

Feed efficiency and the reduction of feeding cost is a priority for every fish farmer. The adoption of a variety of feed management strategies may be important in achieving these and ensuring profitability (Ali and Jauncey, 2003). Many successful African catfish farmers in Nigeria have had to adopt various feeding practices and strategies. These practices include feeding a mix of imported, locally produced, farm made feeds and/or waste product from food processing outfits. The use of alternative, locally available and cheap feedstuff for preparing farm made feeds help the farmers reduce cost of production and maximize profits (Tiamiyu *et al.*, 2018).

Other feeding strategies may pertain to feeding proportions and frequencies, such as feeding to apparent satiation or

feeding a ration that is a proportion of the body weight of fish in the system once or more a day. Eroldogan *et al.* (2008) suggested the best feed utilization of fish usually occur at a feeding rate above the maintenance feeding level but below satiation feeding level. Feeding strategies such as feeding restriction or frequencies that do not result in growth suppression offer many advantages such as high feed utilization (Eroldogan *et al.*, 2008), better feed management and increased profitability (Aderolu *et al.*, 2011; Li *et al.*, 2005) and reduced pollution. Feeding strategies that optimise feed efficiency and production and thus maximise profitability is thus of great importance in fish farming.

Feeding strategies that involve periods of starvation and result in compensatory feeding/growth have been suggested as one of the ways to reduce fish production cost through reduced feeding, improved feed efficiency and growth (Perez-Jimenez *et al.*, 2011). Compensatory growth is the growth spurt that fish may exhibit when food supply are increased after a period of starvation or restricted feeding. This phenomenon may be the result of increased food intake or improved food conversion efficiency or both (Ali and Jauncey, 2003). Restricted feeding of fish can be achieved by decreasing the amount of food fed within a feeding period or by decreasing the frequency of feeding (Hussein, 2012). In this trial, feed was restricted by decreasing number of times of feeding. Due to the role fish farming plays in food security and job creation, there is the need to research how these strategies could affect the success, profitability and thus sustainability of fish farming businesses in Nigeria. The objective of this study was therefore to test the influence of different feeding frequencies on some performance indices of *C. gariepinus* juveniles.

MATERIALS AND METHODS

Experimental Procedure

A nine (9) weeks trial was conducted to test the effect of different feeding frequencies on the growth of *C. gariepinus*. Using a complete randomised design, *C. gariepinus* juveniles weighing 12.72 ± 0.45 g (mean \pm SD) obtained from a

commercial local farm were randomly distributed among six 50 L circular plastic tanks (10 fishes per tank) containing 30 L of water. Fish were kept under natural photoperiod of approximately 12/12 hours light/dark cycle. The feeding frequencies used in this trial were carried out in triplicates. A commercial diet (Coppens) with crude protein content and gross energy of 42 % and 20 MJ Kg⁻¹ respectively was used as follow: Feeding frequency I: Fish were fed to apparent satiation only once a day, in the mornings, throughout the experimental period. Feeding frequency II: Fish were fed to apparent satiation twice a day, every other day throughout the experimental period. Feeding frequency III: Fish were fed to apparent satiation twice a day throughout the experimental period. Feeding in the morning was between 8.00-9.00 am and 5.00-6.00 pm in the evening. Feeding to satiation was achieved by presenting a small quantity of feed at a time until the fish ceased to show interest. Feed intake was recorded daily for each tank.

Data Collection and Analysis

Data on fish growth characteristics were recorded weekly. Specific growth rate (SGR), food conversion ratio (FCR), weight gain and feed intake were determined as follows:

- (i) Specific growth rate (SGR) (g/day) = (Log W2 – Log W1/ T) ×100
Where: W2 = Weight of fish at final time (T2)
W1 = Weight of fish at initial time (T1)
T = Duration of feeding trial in days (T2-T1)
- (ii) Food conversion ratio (FCR) = Total feed consumed by fish (g) / Weight gain by fish (g)
- (iii) Weight gain = Final weight – Initial weight
- (iv) Feed Intake = Total amount of feed consumed per fish throughout the feeding trial

Statistical Analysis

The results are presented as mean ± standard deviation. Data were subjected to one-way analysis of variance (ANOVA) with differences considered significant when P < 0.05.

RESULTS AND DISCUSSION

The results of the different feed frequencies trial are presented in Table 1. The highest feed intake and growth were observed in fish fed to satiation twice daily throughout the study although these were not significantly different (P>0.05) from the other groups (Figure 1 and 2).

Table 1: Growth, feed intake and utilization of juvenile *Clarias gariepinus* under different feeding frequencies

Week	Feeding Frequency I	Feeding Frequency II	Feeding Frequency III
INITIAL WEIGHT (g)	12.20±3.70	12.40±3.99	13.05±4.07
FINAL WEIGHT (g)	100.80±2.19	100.00±1.41	102.90±13.58
WEIGHT GAIN (g)	88.60±3.04	87.60±1.13	89.85±14.78
FEED INTAKE (g)	76.70±0.71	72.40±4.88	79.20±8.20
FCR	0.87±0.02	0.83±0.05	0.89±0.05
SGR	1.53±0.06	1.46±0.01	1.47±0.18

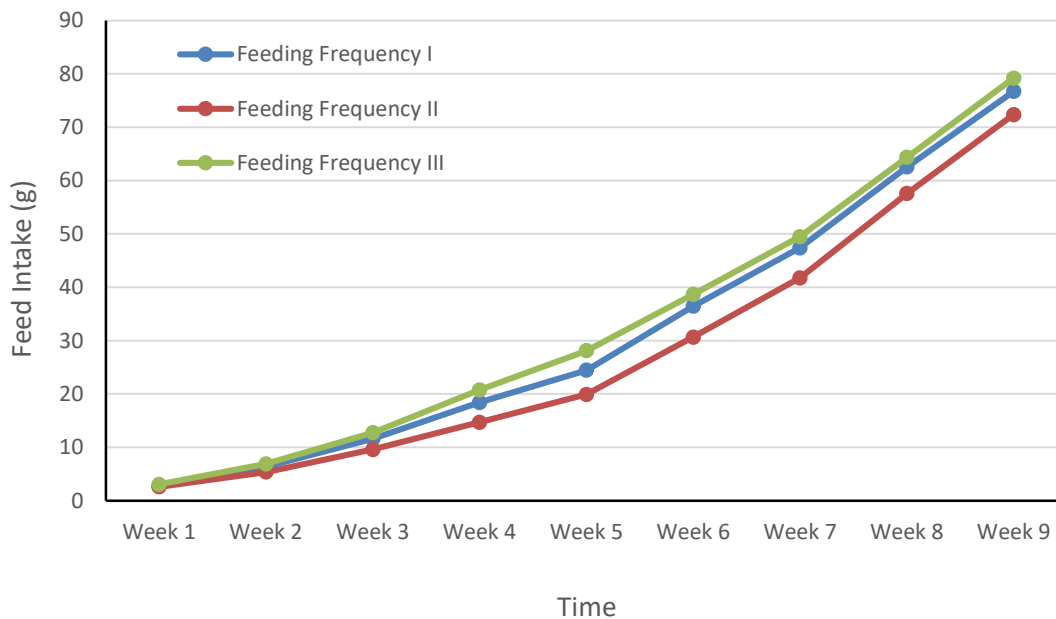


Figure 1: Feed intake of juvenile *Clarias gariepinus* under different feeding frequencies

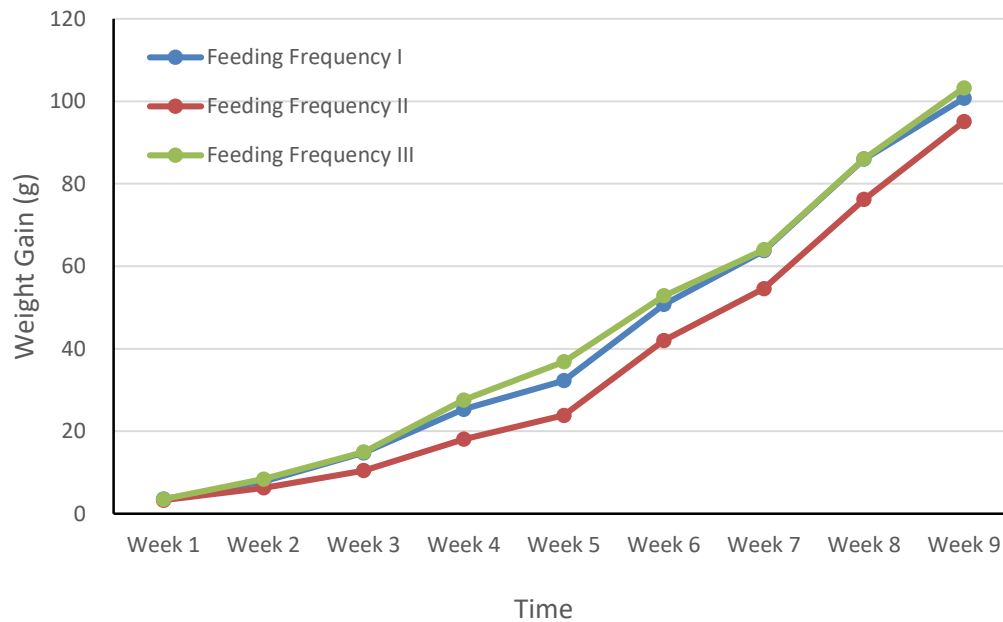


Figure 2: Weight gain of juvenile *Clarias gariepinus* under different feeding frequencies

The results demonstrated that the feeding frequencies tested did not influence feed intake, weight gain, food conversion ratio or growth performance significantly nor result in any form of compensatory growth of the fish. The average feed intake did not differ significantly among the treatments, ranging from 72.4 g to 79.2 g (Figure 1). Similarly, the average weight gain (Figure 2) and food conversion ratio were not significantly different, ranging from 87.6 g to 89.85 g and 0.83 to 0.89, respectively.

The lack of significant differences in feed intake between the different treatments could be explained by the increased feed consumption after every feed deprivation. Similar results have been obtained in channel catfish *Ictalurus punctatus* (Ali *et al.*, 2016; Li *et al.*, 2005; Wu *et al.*, 2004, SRAC, 1998). This has been attributed to hyperphagy, the state of increased feeding observed in fish deprived of food and later refed. Fish that are fed less frequently are thought to adapt by consuming larger amounts of feed during times of feeding (Zakes *et al.*, 2006). Hyperphagy was thus demonstrated in this experiment as feeding increased during times of feeding in fish under feeding frequencies I and II that involved less frequent feeding. Hyperphagy could also account for why feeding frequencies have not affected food conversion ratio or weight gain in this study. Similarly, SRAC (1998) found no difference in food conversion ratios among groups of channel catfish fed throughout the experiments and those that had undergone varying degrees of feed restriction. Tihamiyu *et al.* (2018) even obtained better growth and improved nutrient utilization in African catfish fingerlings fed twice a day, every other day, than in the fish fed the same amount of food every day.

Hyperphagia and compensatory growth may occur simultaneously. Compensatory growth responses have been reported to be higher in those fish that have suffered the greatest period of feed restriction (Bhat *et al.* 2011). It seems therefore that the length of feed deprivation determines whether compensatory growth occurs, and this length may be species specific. The restriction period employed in this study is much less than in other studies that have reported compensatory growth (Ferreira and Nuñez, 2015; Gaylord and Gatlin, 2000; Li *et al.*, 2005). Restriction for a long time

may be difficult to test in *C. gariepinus* because of cannibalism, however, this needs to be tested further.

CONCLUSION

Although feeding schedules and frequencies may be of interest in aquaculture as they may result in increased feed management and efficiency, this study involving *C. gariepinus* did not show these benefits as the overall feed intake and growth performance were not influenced by the feeding frequencies employed in this study. This could have been due to hyperphagy which was demonstrated in the groups of fish with restricted feeding. The increased feeding during times of feeding in these groups resulted in feed intake and growth that was similar to the group fed twice a day, every day. Further studies with longer periods of feed deprivations are necessary to understand and exploit the benefits of feeding restrictions and frequencies in *C. gariepinus* farming.

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