THE EFFECT OF FEEDING FREQUENCY AND FEEDING RATE ON THE GROWTH PERFORMANCE OF CLARIAS GARIEPINUS JUVENILES

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Abstract
An 8 weeks growth study was conducted to evaluate the optimal feeding rate and feeding frequency for Juvenile Clarias gariepinus 25.58±0.02g. 20 fishes were replicated randomly distributed in 27 tanks and placed on a Netherland commercial catfish diet - Coppens. They were fed at 2%, 6% and 10% rates of their body weights, and at frequency of 5, 3, and 1 time(s) daily. Results obtained indicated significant difference ($p< 0.05$) in the growth parameters. Treatment I with feeding rate of 2% and feeding frequency of 5 times daily gave best growth performance in terms of mean weight gain (3.10g), specific growth rate (1.85), as well as feed conversion ratio (2.19). However, there was no significant difference ($P>0.05$) in the mean weight gain values of treatments II, IV, VII, VIII and IX. While treatment with feeding regime of 6% body weight and once daily feeding frequency gave the poorest growth rate with mean weight gain 1.21g. feed conversion ratio (9.13), specific growth rate (0.96). Therefore, for better growth rate, Clarias gariepinus juvenile should be fed 2% body weight given 5 times daily.

Keywords: Feeding rate, Feeding frequency, Clarias gariepinus, juvenile.

Introduction
The poor feeding practices, high cost and low quality of fish feeds are some of the major constraints to the growth and rapid development of aquaculture in Nigeria. Fish feed is the most expensive input in aquaculture operations (Jauncey and Ross, 1982).Feeding rates and frequencies are in part a function of fish size. As fish grow, feeding rates and frequencies should be adjusted throughout the grow-out period (Hinshaw, 1999 and Robinson el al. 1998). Feeding fish is labor intensive and can be expensive since it is dependent on labour availability, farm size, fish species, rearing system, and water quality variables (Albert, 1990). Generally, feeding once daily is satisfactory for food fish grow out. Research has shown that feeding fish twice daily is not necessarily beneficial. Although fish fed

twice daily were offered more feed than fish fed once daily, the extracted feed fed was not completely converted into weight gain. It is likely that feeding twice daily increase feed conversion because, if the feeder is not careful, feed can be easily wasted by overfeeding. (Tomlovell, 1989). Helfrich and Smith (2001)reported that fish fed every other day or every third day consume up to 50-65 % more feed that those fed once daily. Houlihan, et al. (2001) also reported that feeding six days per week would impact negatively in single-crop systems because the smaller fish may lose more weight was shown in our study. And the condition factor, a nutritional status indicator that measures the relationship between fish body weight and length, is lower for fish fed once a week than fish fed more frequently (Albert, 1990). Fish farmers have not gotten proper guidance on the specific feeding rate and frequency for every category of fishes due to paucity of information. Most farmers therfore, resort to arbitrary style of feeding their fish. This mostly results to feed wastage and either over or under feeding of fishses. This research seeks to investigate and establish appropriate feeding regime for Clarias gariepinus juvenile.

Material and method

The experiment was carried out at the STEP-B Laboratory of the Department of Water Resources Aquaculture and Fisheries Technology, Federal University of Technology, Minna Niger State Nigeria. 540 juveniles of mean weight (25.58±0.02g) were obtained from the hatchery farm of the Departmnet of Water Resources, Aquaculture and Fisheries Technology, Federal University of Technology Minna. Fishes were randomly distributed in 20 litre bowls of a Recirculatory system in triplicate. Fishes were placed on commercial catfish feed; Coppen - from the Netherlands which was used as treatments for the experiment. Fishes were weighed individually at the commencement of the feeding trial and bulk weighed fortnightly with the aid of sensitive weighing balance (CITIZEN 300). Nine (9) treatments (T) were prepared based on feeding rate at 2%, 6%, 10% body weights and feeding frequency of 5, 3, 1 times daily respectively as indicated thus; T1 - 2:5, T2 - 2:3, T 3 - 2:1, T 4 - 6:5, T 5 – 6:3, T 6 - 6:1; T 7 - 10:5, T 8 – 10:3, T 9 - 10:1 Fishes were fed at these ratios for 56 days.

Chemical analysis

At the commencement of the feeding trial and at the end, carcass analysis were carried in the laboratory for evaluation of their proximate compositions for moisture, crude protein, crude lipid and ash of carcass, feed ingredients and experimental diets were determined according to the methods of AOAC (2000).

Final values for each group represent the arithmetic mean of the triplicates. Feed intake was monitored to measure average feed intake and their effects on growth.

Growth parameters

The growth and nutrient utilization parameters measured include weight gain, specific growth rate (SGR), feed conversion ratio (FCR), protein efficiency ratio (PER), The growth parameters were computed as stated below;

Mean weight gain = Mean final weigh – mean initial weight

Specific Growth Rate (SGR)= $\frac{(\text{Log}_e W_2 - \text{Log}_e W_1)}{T_2 - T_1} \times 100$

Where, W_2 and W_1 represent = final and initial weight,

T_2 and T_1 represent – final and initial time

Feed conversion ratio – Feed fed on dry matter/fish live weight gain

Protein efficiency ratio (PER) = Mean weight gain per protein fed

Protein intake (g) = Feed intake x crude protein of feed.

Statistical analysis

The experimental design was factorial and the data was subjected to one way analysis of variance to test their significant levels at 5% probability. The mean were separated using Turkey's method. The regression coefficients were analyzed using Minitab Release 14 while the graphs were drawn using the Microsoft excel window 2007.

Results

From the result in Table 2, there were significant differences ($p < 0.05$) in the mean weight gain (MWA), specific growth rate (SGR), feed conversion ratios (FCR) as well protein efficiency ratios (PER) among the treatments. Treatment 1 with feeding rate (FR) 2 and feeing frequency (FF) 5 gave a significantly ($p < 0.05$) high mean weight gain of 3.10g than other treatments. Treatment I also, exhibited significantly lower ($P<0.05$) FCR (2.19) which was not significantly different ($P>0.05$) from that of treatment III [(FR 2: FF1) (2.32)] which had significantly lower ($P<0.05$) MWG (2.29), SGR (1.55) than treatment I. While treatment IV (FR 6: FF 5), VII (FR10:FF5), VIII (FR10: FF3) and IX (FR 10: FF1) gave significantly high ($P<0.05$) FCR values of 11.54, 17.07, 16.38 and 14.50 respectively which were significantly different ($P<0.05$) from each other. Moreover, there was no significant difference ($P>0.05$) in the SGR values of treatments IV (1.22), VII (1.21) and VIII (1.20) respectively. exhibited lowest mean weight gain (1.21g) but with no significant difference in its SGR value (0.96) and that of treatment II (FR 2: FF 3) (0.94). However, treatments VII, VIII and IX despite high FCR values gave a significantly high ($P<0.05$) PER values with no

significant difference (P>0.05) among them (1.00, 1.07 and 1.05 respectively) than treatment I (0.25) and III (0.36) whose FCR values were the lowest (2.19 and 2.32 respectively). Furthermore, treatment V whose FCR value (7.20) was also significantly moderately high (P<0.05) gave a significantly high (P<0.05) MWG (2.56) and SGR values (1.34) than treatments II (1.96/0.96), IV (1.74/1.22), VI (1.21/0.96), VII (1.73/1.21), VIII (1.66/1.20) and IX (1.89/1.27) respectively.

Furthermore, figure 1 showed the growth response which depicted treatment I with best growth performance while treatment VI exhibited poorest growth curve. Other treatments fell in between the two treatments I and VI.

Table 1: Coppens Feed Proximate Composition*

% CP	%Lipid	%Ash	%Moisture
46.00	14.80	7.20	6.50

* As indicated by the manufacturer.

Table 2: Growth Parameters of Clarias Gariepinus **Fed Diets with Different Feeding Rates and Feeding Frequency for 8 Weeks**

Growth Parameters	T I (FR2:5FF)	T II (FR2:3FF)	T III (FR2:1FF)	T IV (FR6:5FF)	T V (FR6:3FF)	T VI (FR6:1FF)	T VII (FR10:5FF)	T VIII (FR10:3FF)	T IX (FR10:1FF)	SD±
Mean Initial Weight (g)	1.69^{a} ± 0.02	1.69^{d} ± 0.00	1.72^{a} ± 0.10	1.69^{ac} ± 0.01	1.69^{a} ± 0.02	1.68^{a} ± 0.01	1.69^{a} ± 0.03	1.71^{a} ± 0.02	1.70^{a} ± 0.02	0.02
Mean Final Weight (g)	4.79^{a} ± 0.69	3.61^{c} ± 0.76	4.02^{bc} ± 1.04	3.46^{c} ± 0.70	4.26^{d} ± 0.04	2.89^{b} ± 0.18	3.40^{c} ± 0.55	3.37^{c} ± 0.29	3.60^{c} ± 0.95	0.81
Mean Weight Gain (g)	3.10^{a} ± 0.71	1.93^{c} ± 0.76	2.29^{bc} ± 1.64	1.74^{c} ± 0.69	2.56^{b} ± 0.61	1.21^{d} ± 0.17	1.73^{c} ± 0.54	1.66^{c} ± 0.28	1.89^{c} ± 0.94	0.81
Mean feed fed (g)	6.79^{de} ±0.01	7.80^{de} ±0.01	5.31^{e} ±0.01	20.08^{c} ±0.01	18.43c ±0.01	11.05^{d} ±0.01	29.53^{a} ±0.01	27.19^{b} ±0.01	27.03^{b} ±0.01	0.01
Specific Growth Rate %/Day	1.85^{a} ± 0.27	0.94^{e} ± 0.52	1.55^{b} ± 0.59	1.22^{d} ± 0.51	1.34^{c} ± 0.38	0.96^{e} ± 0.12	1.21^{d} ± 0.28	1.20^{d} ± 0.12	1.27^{cd} ± 0.39	0.38
Feed Conversion Ratio	2.19^{d} ± 0.76	4.04^{cd} ± 1.82	2.32^{d} ± 0.97	11.54^{b} ± 3.91	7.20^{c} ± 2.40	9.13^{bc} ±4.65	17.07^{a} ±5.83	16.38^{a} ±3.26	14.50^{ab} ±4.89	3.59
Protein Efficiency Ratio	0.27^{c} ± 0.05	0.25^{c} ± 0.02	0.36^{bc} ± 0.36	0.40^{bc}± 0.40	0.44^{b} ± 0.01	$0.78^{ab\#}$ ±0.97	1.00^{a} ± 0.05	1.07^{a} ± 0.12	1.05^{a} ± 0.62	0.38

Means on the same row carrying letter (s) with different superscript(s) are significantly different from each other ($P<0.05$)

Discussion

From the results, treatment I with feeding rate and feeding frequency of 2 and 5 gave the best growth parameters in terms of mean weight gain, SGR, and FCR but with low PER value. This was followed closely in performance by treatment III with feeding rate of 2 and frequency 1. While, when the frequency was reduced to 3 times at the same feeding rate, the performance went down. This performance trend indicated that, fishes utilized feed fed at best, either little at a time but sparingly (several times daily) or little at a time once daily. The reduced in performance in treatment III with once daily feeding frequency was an indication of underfeeding which although, could be considered as being overfed at the time it was fed. When it was fed, it was too much for fish to consume and most could be wasted while when they were hungry they were not fed again for the rest of the day. Therefore, the situation could be likened to a lopsided feeding regime this was in agreement with the report of Helfrich and Smith (2001) that when fishes are not fed frequently, they appear to reduce processing yield which may extend to production cycle, which may lead to negative economic return. The fish would not be able to compensate for the yield The performance showed that feeding fish at a low rate and several times daily allowed fish to digest and utilize the ingested

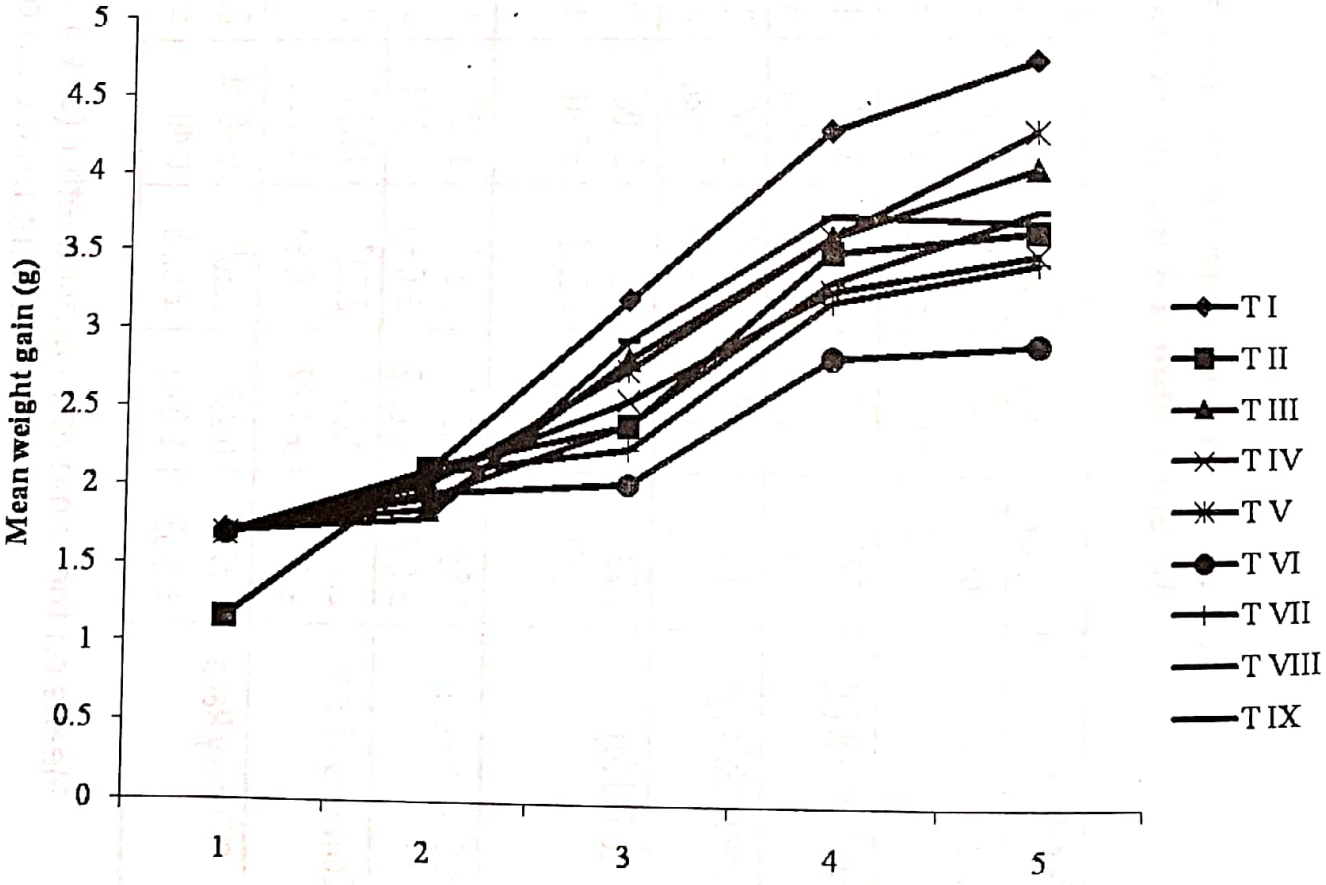

Fig. 1: Growth Response of Clarias gariepinus juveniles fed different Ratios of Feeding Rate and Feeding Frequencies for 8 Weeks

feed for growth (James, 1999; Albert (1990). However, fishes fed high feeding rate showed poor growth performance as observed with treatments IV, V, VII, VIII and IX with high feed conversion ratios, low mean weight gains and specific growth rates. The poor performance could also be attributed to feed wastage due to overfeeding (Tomlovell, 1989; James, 1999). With feeding rate of 6% and feeding frequency 3 times daily, there was improvement in feed utilization compared with diet IV, with feeding rate 6 and feeding frequency 5 and diet VI, with feeding rate 6 and feeding frequency 1 the same feeding rate but different feeding frequency. Treatment IX, with feeding rate 10 and feeding frequency 1 showed improved performance compared with the performance of treatment VII, with feeding rate 10 and feeding frequency 5 and treatment VIII with feeding rate 10 and feeding frequency 3. Those aforementioned high feeding rate and frequencies are common practices of fish farmers, who feed their fishes in this manner with the aim of speeding up their growth so as to attain table size in a very short time. However, as reported by Alison (2012) and Foster and Smith (2012), that, overfeeding is a major cause of fish loss; which may not necessarily be as a result of gastrointestinal damage as popularly believed but due to extreme toxic effect of uneaten feed. Therefore, feeding 2% body weight 5 times daily gave the best growth results compared with other feeding frequency such as 3 times or once daily. Poor diets utilization was observed as reported by (Alison, 2012) when there was increase in feeding rate as exhibited in this experiment to 6% and 10% respectively, there was a significantly decline in growth which demonstrated poor utilization of feed. In other words, high feeding rate at limited frequency would lead to feed wastage. Catfish a benthic feeder would also utilize feed fed little at a time and sparingly since it will take it sometime to graze for the feed (James, 1999). However, in a large farm, most farmers resulted to feeding their fishes at most 3 times daily due to labor cost (Robinson et al., 1998) but it from this finding, 3 times daily would not yield the expected output in terms of growth.

Conclusion

Efficient diet utilization by Clarias gariepinus juveniles was found to be appropriate at 2% body weight fed 5 times daily. This level of feeding minimized feed wastage as optimal utilization was achieved. It is therefore recommended that Clarias gariepinus juveniles should be raised at this level of feeding rate and feeding frequency to ensure effective usage of high cost of feed and feeding.

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