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Effect of Feeding Frequency on the Growth and Feed Utilization of Catfish Hybrid (Heterobranchus bidorsalis X Clarias gariepinus) Fingerlings

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Abstract

Fingerlings of the catfish hybrid, "Heteroclarias" (*Heterobranchus bidorsalis* X *Clarias gariepinus*) were randomly stocked into eight tanks of ten fingerlings per tank and subjected to four feeding frequency treatments with each treatment replicated twice. A commercial imported feed "Coppens" was used to feed the fish throughout the experimental period which was measured at 5% of their body weight and fed to the fish at frequencies of once a day, two times a day, three times a day and four times a day for treatments 1-4 respectively. The experiment lasted for a period of seventy days. Fish on treatment T2 (2 times a day) had the best growth rate and feed utilization with specific growth rate of 3.1540±0.14, feed conversion ratio of 2.085±0.08 and protein efficiency ratio of 2.80±0.34 while fish on treatment T3 (3 times a day), had the least growth rate and feed utilization with specific growth rate of 2.7895±0.04, feed conversion ratio of 2.315±0.04 and protein efficiency ratio of 2.13±0.06. It therefore could be concluded that fish fed twice a day with Coppens showed the best growth and feed utilization and is therefore the best feeding frequency.

Keywords: feeding frequency, growth, feed utilization, catfish hybrid

Introduction

Feeding is one of the most important aspects of aquaculture which a farmer cannot do without, mainly when fish are raised under intensive or semi-intensive system.

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Feeding cost is the highest single cost item of most fish farm operations, accounting for about 60% of the total cost of fish production (Fagbenro *et al.,* 2005). Both over- and under-feeding can be detrimental to the health of the fish and may cause a marked deterioration in water quality, reduced weight, poor feed utilization, and increased susceptibility to infection (Priestley *et al.,* 2006), therefore there is the need to obtain a balance between rapid fish growth and optimum use of the supplied feed in order for the operation to be economically viable and for the fish to be in good health.

"Heteroclarias" is the hybrid catfish resulting from crossing the pure lines of two catfishes: it could be the male of *Heterobranchus bidorsalis* and the female of *Clarias gariepinus* or vice versa. Hybridization is the production of progeny of parents from different lines, strains and species. It is one of the genetic improvements in aquaculture industry which has been recognized as a tool for stock improvement and management purpose. Several studies have demonstrated that catfish hybrid exhibit superior growth, early maturity traits, improved survival and general hardiness than true breeds of the parent stock (Madu *et al*., 1991; Salami *et al*., 1993; Nwadukwe, 1995).

Feeding frequency had been reported to affect feed intake and growth performance in fishes (Ali *et al.*, 2005). Therefore, to improve on fish culture especially "Heteroclarias", there is need for more information on the management method in the area of its feeding frequency, in order to produce fish within the shortest possible time and at minimum cost with good quality feed.

The optimal frequency for feeding "Heteroclarias" is yet to be clearly defined and this has led to uncertainty in the feeding routines used by many farmers. Therefore, it is important to be able to predict the most favourable feeding frequency relative to the species and size of the fish. The aim of this study therefore is to find the appropriate feeding frequency for optimum culture of "Heteroclarias" and to know the impact of feeding frequency on the growth quality and feed utilization of "Heteroclarias".

Materials and Methods

The experiment was carried out at the University Teaching and Research Farm, Ekiti State Uniersity, Ado-Ekiti, Nigeria.

Eight plastic tanks measuring 47 x 35 x 30 cm each filled to 2/3 capacity with underground borehole water were used. A total of 80 pieces of "Heteroclarias" fingerlings of average size 5g each were purchased from a reputable Commercial Farm, stocked at the rate of 10 fish per tank and allowed to acclimate to the water condition for seven days before the commencement of the experiment and fed a uniform feed quantity two times a day during the acclimation period.

Experimental Procedure

The fish were starved for 24 hours before the commencement of the experiment. The same diet (2mm Coppens ®, Holland) was used for the feeding experiment which was measured at 3% body weight of the fish. The experimental set-up involved four feeding frequencies which were replicated twice. In the first treatment (T1), the fish were given the whole quantity of feed once a day at 11.00 hour. In the second treatment (T2), the feed was divided into two portions and fed to the fish` twice a day at 9.00 hour and 16.00 hour. In the third treatment (T3), the feed was divided into three portions and fed to the experimental fish 3 times a day at 9.00, 13.00 and 17.00 hours while in the fourth treatment (T4), the feed was divided into 4 portions, and fed to the fish at 8.00, 11.00, 14.00 and 17.00 hours. The experiment lasted for 70 days. During this period, fish tanks were cleaned daily by siphoning out residual feed and faecal matter, water in the tanks were changed weekly and weight measurements were taken fortnightly.

Water Quality Assessment

The water temperature was measured weekly by the use of mercury – in – glass thermometer graduated in 0^0C, dissolved oxygen meter was used to measure the dissolved oxygen level and pH was also monitored weekly by the use of a pH meter.

Biological Evaluation

Diet performance was determined as follows:

i. Weight gain = final weight of fish (W_2) – initial weight (W_1).

ii. Specific growth rate(SGR) = $\frac{\text{In final weight} - \text{In initial weight}}{\text{Time period (Days)}} \times \frac{100}{1}$

iii. Protein efficiency ratio (PER) = $\frac{\text{fish weight gain (g)}}{\text{Protein consumed (g)}}$

iv. Feed conversion ratio (FCR) = $\frac{\text{weight of feed (g)}}{\text{Fish weight gain (g)}}$

Chemical Analysis

The proximate analysis of the fish before and after the experiment was carried out in the Fisheries and Aquaculture Technology Laboratory of the Federal University of Technology, Akure, Nigeria using the method of A.O.A.C (1990).

Statistical Analysis

The data collected from the experiment were subjected to one – way analysis of variance (ANOVA) using SAS version 2004 and the differences were separated using Duncan multiple range test.

Results

Water Quality Parameters

Table 1 shows the result of water quality parameters recorded during the period of the experiment. The temperature ranged between 23 ± 0.00 - 23.4 ± 0.15^0C., while the dissolved oxygen ranged between 7.4 ± 0.30 - 7.5 ± 0.20mg/l and the pH values ranged between 6.6 ± 0.10 - 6.6 ± 0.20.

Table 1: Mean Water Quality Parameters Recorded During The Experimental Period

Tanks	TEMPERATURE (^{0}C)	DO (Mg/Litre)	pH
T1	23 ± 0.00	7.5 ± 0.12	6.6 ± 0.10
T2	23 ± 0.00	7.4 ± 0.30	6.6 ± 0.10
T3	23 ± 0.50	7.5 ± 0.15	6.6 ± 0.15
T4	23.4 ± 0.15	7.5 ± 0.20	6.6 ± 0.20

Growth Performance of Experimental Fish

The greatest final weight (132±14.43) was achieved by the fish fed treatment T2 (fish fed twice a day), followed by fish fed treatment T1 (fish fed once a day) and the least final weight (104±2.30) was recorded with fish fed treatment T3 (fish fed 3 times a day). There is no significant difference ($p>0.05$) in the value for final weight between treatment T1, T2 and T4; no significant difference between T1, T3 and T4 ($p>0.05$) but there is a significant difference ($p<0.05$) between treatment T2 and T3.

The greatest weight gain (117.8±14.28) was achieved by the fish fed treatment T2 and the least weight gain (89.25±2.4) was recorded by the treatment T3. There is no significant different ($p>0.05$) between treatment T1, T2 and T4; no significant difference ($p>0.05$) between T1, T3 and T4 but there is a significant difference ($p<0.05$) between treatment T2 and T3.

The values for average daily weight gain and Specific Growth Rate followed the same trend with highest values recorded in treatment T2, while the least was achieved by treatment T3. Both the average daily weight gain and specific growth weight has no significant difference between treatment T1, T2 and T4, no significant difference between T1, T3 and T4, while there is significant difference between treatment T2 and T3. T2, T3 and T4 had the same Survival rate (85%), while T1 (75%) had the least.

Feed Utilization of Experimental Fish

Table 2 shows the protein efficiency ratio and food conversion ratio of the experimental fish.

The highest protein efficiency ratio was achieved by the fish fed treatment T2 (2.8±0.34), followed by fish fed treatment T1, while the least protein efficiency ratio was recorded with the fish fed treatment T3 (2.13±0.06). There is no significant difference between treatment T1, T2 and T4, no significant difference between T1, T3 and T4 but there is significant difference between treatment T2 and T3.

The best food conversion ratio was achieved by the fish fed treatment T1 (2.065±0.05), while poorest food conversion ratio was recorded with the fish fed T3 (2.315±0.04). However there was no significant difference between food conversion ratio in treatment T1, T2 and T4.

Table 2: Growth Performance and feed Utilization of "Heteroclarias"

PARAMETERS	T1	T2	T3	T4
Initial weight (g)	14.50 ± 0.28	14.25 ± 0.14	14.75 ± 0.14	14.00 ± 0.00
Final weight (g)	119.0± 2.88^{ab}	132.0± 14.43^{a}	104.0± 2.30^{b}	111.5 ± 0.86^{ab}
Weight gain (g)	104.50± 3.17^{ab}	117.80± 14.28^{a}	89.25 ± 2.45^{b}	97.50± 0.86^{ab}
Average daily weight gain (g)	1.5 ± 0.05^{ab}	1.7 ± 0.20^{a}	1.3 ± 0.02^{b}	1.4 ± 0.00^{ab}
Specific growth rate	3.0065 ± 0.06^{ab}	3.1540` ± 0.14^{a}	2.7895 ± 0.04^{b}	2.9640±0.00^{ab}
Protein efficiency ratio	2.49 ± 0.07^{ab}	2.80± 0.34^{a}	2.13 ± 0.06^{b}	2.33 ± 0.02^{ab}
Food conversion ratio	2.065 ± 0.05^{b}	2.085 ± 0.08^{b}	2.315 ± 0.04^{a}	2.2 ± 0.00^{ab}
Survival rate	75 ± 2.88^{a}	85 ± 8.66^{a}	85 ± 2.88^{a}	85 ± 2.88^{a}

Mean and SD within the same row and followed by the same superscripts are not significant different (P>0.05)

Proximate Composition of Experimental Fish

The carcass composition of the experimental fish is given in Table 3. Fish placed on T2 (58.17) had the highest protein value while fish placed on T4 (53.21) had the least value of protein. Crude protein of all the fish fed the different frequency treatments increased compared to the initial protein level. Fat content for fish placed on T1 (15.4) was the highest while fish fed T2 (10.79) had the lowest fat content. Ash was highest in fish fed T2 (14.87) and lowest was found in fish placed on T1 (14.74).

Table 3: Carcass Composition of Experimental Fish

	Initial	T 1	T 2	T3	T4
Crude protein	51.28	54.86	58.17	55.29	53.21
Moisture	12.45	11.3	11.45	11.53	11.59
Ash	16.8	14.74	14.87	14.85	14.83
Fat	14.26	15.4	10.79	13.7	15.6
NFE	5.21	3.71	4.72	4.63	4.77

Discussion

The physico-chemical parameters of water used for fish culture during the experimental period were within the range recommended for African catfish culture (Swann, 1992; Olurin *et al*., 2006).

The values recorded for the growth performance and feed utilization were best in T2 indicating that fish performed best when fed twice a day. This could safely be assumed as the maximum number of feeding frequency per day best for "Heteroclarias" fingerlings. This is in agreement with the work of Marimuthu *et al.,* (2010) and Davies *et al*., (2006) who found feeding twice a day as the best feeding frequency for *Clarias gariepinus* and *Heterobranchus longifilis* fingerlings respectively. Ajani *et al*., (2010) also found that feeding *Clarias gariepinus* fingerlings twice or thrice a day was effective for optimum result in growth. Ayo – Olalusi and Ugwumba (2010) and Adewolu and Adoti (2010) however found that feeding *Clarias gariepinus* fingerlings thrice a day gave best results in terms of growth and economic profit. Dada and Akinwande (2005) found that feeding *Heterobranchus bidorsails* once a day had the best result.

Values for the survival rate shows that there was no significant difference ($p>0.05$) between all the values. However, values recorded for T2 (85±8.66) was highest while that of T1 had the lowest survival rate (75±2.88). This could be due to stress, since the water in T1 was frequently changed compared to other treatments due to the fact that the highest quantity of feed were given to fish in this tank making the water to easily get dirty and polluted.

The proximate analysis of the fish carcass shows an increase in the value of crude protein and crude fat over the initial fish samples. The increase in the crude protein of all the samples might be an indicator that the feeding frequencies used had a positive effect on the fish. It shows that the experimental fish converted and utilized the protein from the feed into their body protein.

Conclusion

Fish fed twice a day had the best growth and feed utilization values as indicated by the weight gain, average daily weight gain, specific weight gain, feed conversion ratio and protein efficiency ratio.

Also, it had the best survival rate of 85% which shows that feeding fish twice a day is good, prevents excessive water pollution and could be assumed to be the maximum number of feeding frequency best for fingerlings of "Heteroclarias". Therefore it is recommended that feeding "Heteroclarias" fingerlings twice a day should be adopted for optimum growth, survival and efficient nutrient utilization.

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