INTERPLAY OF NUTRITION AND FEEDING FREQUENCY ON THE GROWTH OF AFRICAN CATFISH *Clarias gariepinus* FRY

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ABSTRACT

This research was carried out to investigate the interplay of nutrition and feeding frequency on the growth of Clarias gariepinus fry. Three locally compounded diets (denoted A,B & C) with crude protein (CP) contents 40%, 45% and 50% and three feeding frequencies (denoted 1,2and 3) of 4, 8 and 12 times per day were adopted in the experiment. The fish were hand fed daily with their respective experimental diets at 20% body weight per day at the different feeding frequencies. The growth parameters observed were Mean Weight Gain (MWG), Specific Growth Rate (SGR), Daily Growth Rate (DGR), Protein Intake, Food Conversion Ratio (FCR), and Survival Rate (SR).

Treatment C3 has the highest mean weight gain of 0.137g followed by A1 with 0.117g while the least value of 0.081g was recorded in B3.The highest specific growth rate of 3.3 was observed in Treatments C2, C1, B3 and A1 while the least (1.8) was recorded in B1. The least daily growth value of 2.25 was recorded in A2 while C3 has the highest value of 2.36. The highest value of 35 was recorded in C3 for protein intake followed by 33.5 in C3 while the least value of 16.2 was recorded in B1. The least value for FCR was 3.9 and it was recorded in B1 followed by 4.8 in C3 while the highest value of 7.7 was recorded in B3. Treatment A3 has the highest survival rate of 96.67% followed by C3 with 96% while the least value of 20% was recorded in B1. Though there was no significant difference (P > 0.05) among the treatments. Diet C containing 50% CP showed the best result in terms of growth responses while the feeding frequency of 12 times per day showed the highest growth responses followed by 8 times and 4 times per day respectively. At the end of the experiment, it was observed that Diet C containing 50% CP showed the best results in terms of growth responses while the feeding frequency of 12 times per day showed the highest growth responses followed by 8 times and 4 times per day respectively. There was however no significant difference (P > 0.05) between treatments' means. Clarias gariepinus fry tends to perform better when fed with diet that has more than 45%CP. A higher feeding frequency tends to give a better output even when the feed is of the same quality.

Keywords: Nutrition, Feeding Frequency, *Clarias gariepinus*, Crude protein, Growth.

INTRODUCTION

There are generally two sources of fish seeds for fish farming in Nigeria and these are wild collection and Hatchery production. It is obvious that the supply from the wild is unreliable. The fish farmer's hope in supply of sufficient fingerlings therefore depends on hatchery production (Ayinla, 1988). Fish species commonly produced in hatchery includes *Clarias gariepinus, Heterobranchus bidorsalis, Tilapia spp, and hybrid of Clarias gariepinus and Heterobranchus bidorsalis*. Production of fast growing fish seeds is very important to the development of fish farming in Nigeria. According to Ayinla (1991), if only 20% of the land and swamp available for aquaculture in Nigeria is to be cultivated, at least 3.4 million fingerlings will be required to stock the ponds at the stocking density/rate of 1 fish/m^2. The existing hatcheries in Nigeria cannot meet this demand. Fish farming becomes a lucrative venture with the provision of good quality and economic feeds. The importance of fish feeds in aquaculture can therefore not be over emphasized (Eyo, 1999). Feeding constitute one

of the highest operating expenditure in intensive aquaculture practices. Several attempts have been made to reduce the feed cost by increasing the growth performance; by employing suitable feeding strategy in order to maximize utilization of supplied nutrients to cultured fish; by mixed feeding schedule of alternating the high and low dietary protein level (Haylor, 1994) and optimizing the feeding rate (Dong-Fang *et.al.*, 2003) . Feed management in terms of optimization of feeding rate and frequency become imperative in the culture of marine and freshwater fishes and it has become one of the crucial areas of research in the field of aquaculture. Overfeeding will waste food and impair the water quality (Ng *et.al*,. 2000) while inadequate food supply has direct negative impact on growth and survival of the fish (Mihelakakis *et.al.*, 2002). By controlling the optimum feeding frequency, farmers can successfully reduce the feed cost, maximize growth and manage other factors such as individual size variation and water qualities which are very important in rearing of fish. Different species of fish have been shown to have different optimum feeding frequencies; young salmon fed continuously for 15 h/day (Shearer, 1994), common carp three times a day (Charles *et.al.*,1984), milkfish fingerlings twice/day (Sveier and Lied, 1998). The African catfish (*Clarias gariepinus*) is by far the most commonly cultured fish in Nigeria. There are numerous reports available on the nutritional requirements and use of practical diets for African catfish (Ugwumba and Abumoye 1990, Merchie *et.al.*, 1997) while limited information is available on feeding schedules for African catfish (Huisman and Richter 1987). There is a need to know what feeding frequency is optimal. This research work evaluates growth performance, food conversion ratio and survival of African catfish (*C. gariepinus*) fry cultured under different rations and feeding frequency.

MATERIALS AND METHODS

Fourteen days old *Clarias gariepinus* fry were procured from a commercial hatchery and stocked at the rate of fifteen fish per tank. The fish were weighed and randomly allocated to treatment at fifteen fish per treatment. Three diets were used in the experiment and these diets were compounded locally with 40%, 45% and 50% crude protein content.

The gross composition of the diets is presented in the Table1. The fish were fed at 20% body weight per day throughout the experimental period. The three feeding frequencies investigated were 4, 8 and 12 times per day.

Table 1:Gross Composition of Experimental Diets

Ingredients	*Diets* A (40% CP)	B (45% CP)	C (50% CP)
Fishmeal (72%)	30.9	36.19	38.62
Groundnut Cake	10.33	12.06	12.88
Palm Kernel Cake	10.33	12.06	12.88
Soyabean Meal	20.66	24.13	25.75
Cassava flour	3.41	1.39	0.44
Wheat offal	6.81	2.77	0.87
Maize	10.22	4.15	1.31
Groundnut Oil	3.00	3.00	3.00
Vitamin Premix	0.50	0.50	0.50
Bone Meal	2.00	2.00	2.00
Oyster	1.25	1.25	1.25
Salt	0.50	0.50	0.50
Total	**100**	**100**	**100**

The treatments were labeled A1, A2, A3, B1, B2, B3, C1, C2 and C3. A, B, and C were the experimental diets and 1, 2 and 3 were the feeding frequencies with 4, 8 and 12 times per day respectively. The weighing of the fish was done weekly and the quantity of feed was adjusted to the new weight. Respective sample of the fish and feed were selected for analysis. The analysis of feed was carried out before the experiment while that of fish was done after the experiment. Growth and feed utilization evaluation parameters such as Mean weight gain, Daily

growth rate, Specific growth rate, Food conversion ratio, Protein intake and Protein efficiency ratio were measured in line with Ridha and Cruz (2001). The data obtained were subjected to one way analysis of variance (ANOVA) to determine the significant difference among the rations and the feeding frequency.

RESULTS AND DISCUSSION

Growth performance

The growth responses and performance parameters of the *Clarias gariepinus* fry reared under the different experimental feeding treatments are shown in table 2. The highest Mean weight gain was recorded in treatment C3 (0.137g), followed by A1 (0.117g), the lowest was recorded in B3 (0.081g). However when compared with each other, there was no significant difference among the treatments. The highest value of daily growth rate DGR was recorded in treatments C3 (2.36), followed by B2 (2.34), and treatments A1 and C1, which had the same value of 2.33. The lowest was recorded in treatment A2 (2.25), followed by B1 and B3 (2.26), which had the same value. There was no significant difference ($P>0.05$) among the treatments. Generally, Diet C had the highest DGR followed by A and B.

The highest value of specific growth rate (SGR) was recorded in treatment A1, B3, C1 and C2 (3.3) followed by B2 (3.2), and A3 (3.1) while the lowest was recorded in treatment B1 (1.8). Although there was no significant difference ($P>0.05$) among the treatments, generally Diet C showed the highest value of SGR followed by A and B. The highest value of food conversion ratio was recorded in treatment B3 (7.7), followed by C2 (7.4) and C1 (7.3), the lowest was recorded in C3 (4.8). The lower the FCR the better the feed utilization, the lowest FCR was recorded in Treatment C3 though the difference was not significant ($p > 0.05$) among the treatments. The highest value of protein efficiency ratio (PER) was recorded in treatment B1 (0.0056) while the lowest was recorded in treatments C1 and C2 (0.00260), followed by B3 (0.0029) and A1 (0.0038). There was no significant difference ($P>0.05$) among the treatments. Treatment A3 has the highest survival rate of 96.67% followed by C3 with 96.00% while treatments A2 and B1 have the least survival rate with values 46.67% and 20% respectively.

Table 2 Growth responses of *Clarias gariepinus* fry reared under different feeding treatments

	Treatments (%CP and feeding frequency)								
	40% CP			45% CP			50% CP		
	A1(4)	A2(8)	A3(12)	B1(4)	B2(8)	B3(12)	C1(4)	C2(8)	C3(12)
duration(days)	42	42	42	42	42	42	42 42	42	42
no of fish stocked	15	15	15	15	15	15	15	15	15
mean initial weight(g)	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
mean final weight (g)	0.120	0.089	0.105	0.093	0.094	0.084	0.086	0.095	0.140
mean weight gain (g)	0.117	0.086	0.102	0.090	0.091	0.081	0.083	0.092	0.137
specific growth rate (% day)	3.3	2.6	3.1	1.8	3.2	3.3	3.3	3.3	2.9
daily growth rate (dgr)	2.33	2.25	2.29	2.26	2.34	2.26	2.33	2.32	2.36
protein intake (pi)	31.2	19.2	24.8	16.2	28.8	27.9	31.5	35	35.5
protein efficiency ratio (per)	0.0038	0.0045	0.0041	0.0056	0.0032	0.0029	0.0026	0.0026	0.0041
food conversion ratio (FCR)	6.5	5.4	5.9	3.9	6.8	7.7	7.3	7.4	4.8
Survival rate (%)	73.33	46.67	96.67	20.00	80.00	93.33	93.33	86.67	96.00

Feed intake

Fish derives the required nutrients for growth and development from the feed it consumes. The highest feed intake was recorded in treatments A1 (0.78g), followed by treatments C2 (0.70g). Generally, Diets B and C of 45 and 50% CP were observed to be well taken and consumed by the fish. The proximate analysis of the experimental fish is presented in Table 3.

Table 3: Proximate Composition of Experimental Fish

Treatment	*% Protein*	*% Fibre*	*%Fat*	*% Ash*	*% Moisture*	*%Dry Weight*
A1	19.25	0.96	5.24	13.29	90.10	9.9
A2	18.83	1.06	4.98	11.76	92.86	7.14
A3	20.13	0.98	5.19	12.11	95.65	4.35
B1	21.44	0.74	6.15	14.37	89.19	10.81
B2	20.56	1.08	6.24	14.28	93.33	6.67
B3	21.00	1.11	6.09	14.33	91.79	8.21
C1	21.00	1.05	5.92	14.84	91.15	8.85
C2	21.88	1.03	6.08	14.76	91.05	8.95
C3	21.00	1.01	6.03	14.81	90.48	9.52

The percentage proximate composition of the experimental fish seeds is a function of the composition of the feed intake and utilization.

As shown in table 3, Treatment C2 had the highest protein of 21.88%, which was followed by Treatment B1 (21.44%) then Treatments B3, C1 and C3, which had the same value of 21%. The feeding frequency of 12 times per day had the highest % protein. Fish seeds in Treatment B3 had the highest fibre (1.11%) followed by Treatment A2 and D2 which had 1.06%, it was observed that fish seeds fed with Diet C had the highest fibre while the feeding frequency of 8 times per day gave the optimum fibre. Treatment B2 had the highest fat of 6.24% followed by B1 (6.15%). Diet B has the highest fat content while fish seeds fed with Diet A had the lowest. The feeding frequency of 8 times per day seems to have the highest % fat followed by 12 times per day. Fish seeds in Treatment C1 had the highest % Ash (14.84) followed by Treatment C3 (14.81%) and C2 (14.76%). This is because Diet C had the highest % Ash followed by Diet B and A respectively (Table 1).

CONCLUSION

There is a strong relationship between nutrient composition of feed, feeding frequency and growth and feed utilization of cultured fish. *Clarias gariepinus* fry tends to grow better when fed with high quality protein at higher feeding frequency than at a lower feeding frequency even when the feed is of the same quality. Therefore feed with crude protein of above 40% and fed at 2 hours intervals (12 times daily) will most likely give the best output in the culture of fry of *Clarias gariepinus*.

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