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Feeding Frequency on Growth and Feed Conversion of *Clarias Gariepinus* (Burchell, 1822) Fingerlings

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Abstract
Effect of feeding levels on growth performance, feed conversion ratio of Clarias gariepinus fingerlings was investigated using a complete random design. Triplicate group of 12 fish with average initial mean weight of 4.12g and average length of 3.50cm. A commercial feed (Coppens®, Holland) with crude protein of 42% was fed for 8 weeks over four feeding frequencies (1, 2, 3, and 4 times daily). The mean weight gain for the treatments T1(180.35±29.07g, T2(175.51±27.65g, T3(193.82±23.29g and T4(210.02±15.46g). Mean weight gain, specific growth rate and performance index were all significantly different ($P < 0.05$). The highest feed consumption was observed in the fish fed 4times daily and d feed conversion ratio recorded the lowest in 2 time feeding daily. The results of this experiment indicate that fish could be fed 4times daily with maximum growth.

Keywords: Feeding frequency, feed conversion, growth, *Clarias gariepinus*.

Introduction
Food is the source of energy for fish to carry out basic biochemical functions such as growth, reproduction and movement. Fish growth is influenced by feed availability and intake, genetics, age and size, environment and nutrition. Among these factors, feed intake is perhaps the principal factor affecting growth rate of fish (Lee *et al*., 1997) [10]
The African catfish *Clarias gariepinus* (Burchell, 1822) is a highly valued commercial fish widely cultured in Nigeria and has been cultured at subsistence level from fingerlings sourced from the wild (Sydenham, 1997) [12]. It lives in a variety of fresh water environment, including lakes, ponds, pools and swamps. They can also be found in flowing rivers, rapids and dams. They also live in very turbid waters and can tolerate temperatures of 12-350C, their optimal temperature for growth being 28-300C (Teugels, 1986) [13]. In commercial catfish production the efficiency of production and fish growth has a lot to do with the type of feed the fish is given (Gabriel *et al*., 2007b) [5].
Feeding frequency is one important consideration as it can affect growth, survival and fillet composition as well as water quality. Feeding also at the optimum frequency can result in tremendous savings in feed cost (Davies *et al*., 2006) [4]. The amount of the daily feed intake, frequency and timing of the feedings and presentation of the predetermined ration are the key factors of feed management strategies, influencing the growth and feed conversion (Jobling, 1995; Goddard, 1995) [9, 6].
The fast growing catfish is widely accepted by fish farmers and consumers because of its moderate price, taste and fast growing rate. A good feed must be cost efficient, palatable and must meet the nutrient requirement of the fish (Jamabo and Alfred-Ockiya, 2008) [8]. Optimal feeding frequency may vary depending on species, age, size, environmental factors, husbandry and feed quality (Goddard, 1995) [6].

Materials and Methods
The study was conducted in the Demonstration farm, Fisheries unit, University of Port Harcourt, Choba, Rivers State, Nigeria.

Fish and Experimental Design and Conditioning
The experimental fish *C. gariepinus* fingerlings was obtained from ARAC (African Regional Aquaculture Centre). Mean weight, 4.12g; mean total length, 3.50cm was stocked (12 each) in plastic tanks of 26 x 27 x 40cm3 containing 30L of aerated water and labeled T1, T2, T3 and

T4 It was acclimated for a period of one week and fed a popular commercial catfish feed (Coppens®, Holland) and was fed at of 5% body weight of fish. The fishes in the different plastic tanks were fed at different feeding frequencies at 5% body weight for the period of the experiment. Those in plastic T1, T2, T3 and T4, experimentally tested in triplicate were fed once, twice, thrice and four time times daily respectively for a period of 8weeks. Measurements of weights and lengths of the fingerlings were done once every week throughout the experimental period using electronic sensitive scale and meter rule. While batch weighing per tank using electronic sensitive scale model AJ5303 (capacity 6000 g; readability 0.2 g) was performed weekly to monitor the growth performance. Fish tanks were cleaned daily by siphoning out residual feed and faecal matter.

Water Quality

Water quality parameters (Temperature, Dissolved Oxygen and pH) were monitored daily. Temperature was monitored with mercury thermometer calibrated in degree centigrade (^{0}C); Dissolved Oxygen was determined by using the a digital Dissolved Oxygen meter (mg/l), and pH was determined with a pocket pH meter, to ensure that they are within tolerant limits expected for the studied species

Calculations and Statistical Analysis

The feed conversation ratios of the fish at different feeding frequencies was calculated, growth parameters, feed utilization parameters, weight-gain, ADGR (Average daily growth rate), Specific growth rate, FCR (feed Conversion ratio), FCE (feed Conversion Efficiency), mortality, performance Index and Survival rate was calculated using the following formulae.

Weight-gain (WG) = Final-Initial Weight

$$\text{Specific growth rate (SGR)} = \frac{Log_e w_2 - \text{Log}_e w_1}{T_2 - \text{T}_1}$$

$$\text{(FCR) Feed Conversion ratio} = \frac{feed\ Consumed\ by\ Fish}{Weight\ gain\ by\ fish}$$

$$\text{Mortality (m)} = \frac{N_e - \text{N}_o}{N_o} \text{ X } 100\%$$

Where No = Number of fish at the start of the experiment.

Ne = Number of fish at the end of the experiment.

Performance Index (P_I) = final mean body weight – Initial mean body weight x Survival rate (SR)

$$\text{Survival Rate (SR)} = \frac{Final\ number\ of\ \ fingerlings}{\text{Initial number of fingerling}}$$

Analysis

Growth data (Length, weight and SGR) was analyzed using one-way analysis of variance (ANOVA) followed by Duncan's multiple range test at the 5% or ($P < 0.05$) level of significance to compare the mean differences

Results

The variations in growth parameters, survival rate and Feed conversion ratio of C. *gariepinus* fingerlings fed on different feeding frequencies are presented in Table 1. The highest values of weight gain, specific growth rate and performance index were observed in T4, highest growth (in weight and length) was also observed in treatment T4 followed by T3 (wt-23.85 ± 2.70g and L-15.27 ± 0.43acm) and T2(wt. - 22.00 ± 02.28g and L-15.62 ± 0.41b) while the lowest growth was observed in T1(wt. –21.77 ± 0.27g and L-14.51 ± 0.25acm) Feed conversion ratio values for T1, T2, T3 and T4 was 7.33 ± 1.51, 4.80 ± 0.75, 6.44 ± 0.65 and 6.02 ± 0.36. The highest value (63%) of Survival rate was observed in T3 and the lowest (44%) was recorded in T1, specific growth rate increased with duration of feeding with the least value recorded at the end of the feeding trial. Performance index values for the different treatment range between 3.07 ± 0.52 – 3.68 ± 0.27 while the highest mortality was recorded in fingerlings fed one time daily.

The results of the physico-chemical parameters are presented in Table 2. Temperature values for the different treatments range between 27.180C –27.250C, dissolved oxygen values range for T1, T2, T3 and T4 was 6.95 ± 0.01mg/L, 7.03 ± 0.01mg/L, 6.56 ± 0.01mg/L and 6.69 ± 0.01mg/L while pH values range for T1, T2, T3 and T4 during the experiment was 6.99 ± 0.00, 7.01± 0.00, 7.00 ± 0.00 and 6.98 ± 0.00.

Table 1: Variation in growth, survival and food conversion ratio of *C. gariepinus* fingerlings fed on different feeding frequency.

Parameters	Treatments			
	T_1	T_2	T_3	T_4
Initial Length(cm)	2.57±0.27	2.63±0.28	2.66±0.43	2.75±0.04
Final Length(cm)	14.51±0.28	15.62±0.41	15.66±0.43	16.27±0.22
Initial weight (g)	2.96± 0.27	3.27± 0.28	3.46 ± 0.23	3.53 ± 0.04
Final weight (g)	21.77 ±2.92	22.00 ± 2.30	23.85 ± 2.74	25.75 ± 1.54
FCR	7.33±1.51	4.80±0.75	6.44±0.65	6.02±0.36
Survival rate (%)	44%	58%	63%	55%
Specific growth rate (% day/fish)	1.26±0.02	1.28±0.01	1.27±0.00	1.29±0.02
Performance index	3.15±0.52	3.07±0.52	3.40±0.49	3.68±0.27
Mortality	2.41±0.09	2.29±0.09	2.08±0.09	2.20±0.09

Table 2: Mean values of physico-chemical parameters for the different feeding frequency.

Treatment	Temperature	DO	pH
1	27.18±0.00	6.95±0.01[a]	6.99±0.00
2	27.22±0.00	7.03±0.01[a]	7.01±0.00
3	27.24±0.00	6.56±0.01[b]	7.00±0.00
4	27.25 ±0.00	6.69±0.01[ab]	6.98±0.00

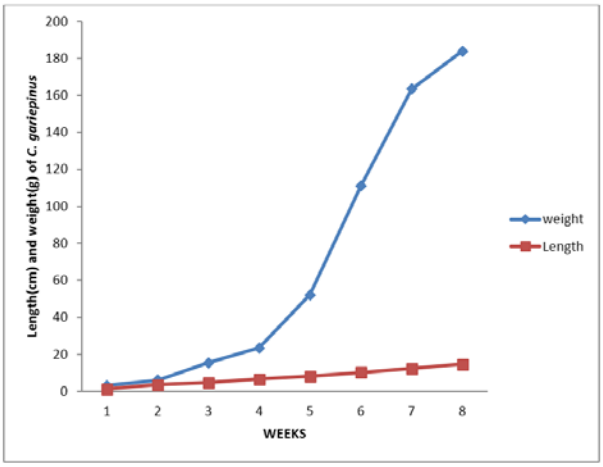

Fig 1: Fingerlings growth rate on Length and weight during eight weeks

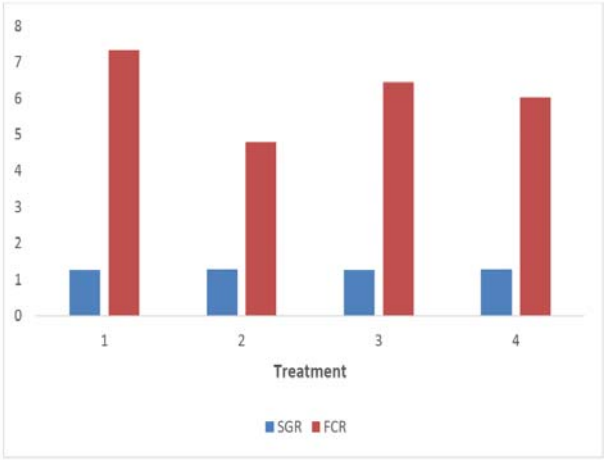

Fig 2: Variations of Specific growth rate and Food conversion ratio on the different feeding frequency

Discussion

The mean water quality parameters values observed (Temperature, DO, pH) were within the recommended range for fish culture (Boyd and Litchtkoppler, 1979, Viveen *et al*., 1985). Studies conducted on other fish species have shown that feed intake and growth generally increased with feeding frequency up to a given limit (Wang *et al*., 1998; Bascinar *et al*., 2007). This is in agreement with my findings in this study that feeding frequency had a significant effect on feed consumption and growth in the African catfish. The highest values for weight gain, performance index and specific growth rate were observed in treatment T4. This collaborates with the findings of Ibiyo *et al*., (2007) who obtained similar values for the above growth indices at different feeding frequency.

The values obtained for feed conversion ratio (FCR) were expected since the fish in T4 exhibited high feed utilization expressed in good growth performance. This is in line with the finding of Jamabo and Alfred-Ockiya (2008) who recorded low FCR in their study in dietary protein requirement and growth performance of *Clarias gariepinus*.

Clarias gariepinus is commonly produced in Nigeria because of its fast growth rate and profitability. Efficient production and growth of fish depend on feeding the best possible diets at levels not exceeding the dietary needs (Charles *et al*., 1984) [3]. Two or three feeding a day have been found to be sufficient for maximum growth of a number of different fish species (Ruohonen *et al*., 1998) [11]. This generally agrees with the result of this study as depicted by the performance index and weight gain value obtained alongside other parameters already mentioned.

Conclusion

The results from this investigation have shown that feed consumption and growth generally increased with feeding frequency up to a given limit. Feed conversion ratio and specific growth rate for *C.gariepinus* fingerlings are at best at 4 times feeding with other visual fish performance indices. It shows that this feeding frequency is optimal for the condition of this trial suggesting that both growth and feed utilization are most efficient at this frequency of feeding. However, it is pertinent to consider the prevailing physico-chemical characteristics (water temperature, pH, Dissolved Oxygen) that affect fish feeding behaviour are at optimal levels in the pond. The success of catfish culture (fingerlings) depends on effective feeding frequency

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