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EFFECT OF FEEDING FREQUENCY ON GROWTH PERFORMANCE, FEED UTILAZATION AND SURVIVAL RATE OF *Clariasgariepinus* (African catfish) FINGERLINGS

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ABSTRACT

The effect of feeding frequency on growth performance and feed utilization was investigated in the biological garden for a period of 42 days. Fingerlings of *Clariasgariepinus* were randomly stocked into nine plastic tanks of fifteen fingerlings per tank. The experimental fishes were subjected to three frequency treatments with each treatment triplicated. The fishes were fed at 3% of their body weight daily at the three-feeding frequency (once, twice and thrice). Fish on treatment T2 (fed two times a day) had the best growth rate and feed utilization with specific growth rate of 43.52±0.85, feed conversion ratio of 1.85±4.82 and protein efficiency ratio of 0.56±0.24 while fish on treatment T3 (fed three times a day), had the least growth rate and feed utilization with specific growth rate of 22.45±0.62, feed conversion ratio of 5.49±3.15 and protein efficiency ratio of 0.08±0.16.Survivalrate was highest in twice daily feeding frequency and lowest in thrice feeding frequency. Generally, it could be concluded that fishes fed twice a day with vital feed showed the best growth and feed utilization as well as best survival, therefore, the best feeding frequency.

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Introduction

Nutrition is one of the most important factors influencing performance of cultured fish and is influenced by factors such as behavior of fish, stocking density, quality of feed, daily ration size, feeding frequency and water temperature. Feeding frequency mainly depends on species cultured, age, size, feed quality and environmental factors (Alemayehu and Getahun, 2017; De Silva *et al* 2012; EI-Sayed 2006; Tekeba 2005; Storebakken 2002; Tadelle and Ogle 1997; De Silva and Anderson 1995). These characters of species and environmental factors influence gastric evacuation time (return of appetite) of cultured organisms and gastric evacuation time of cultured organism on the other hand influences feeding frequency (Richie *et al*, 2004).

Feeding cost is the highest single cost item of most fish farm operations, accounting for about 60% of the total cost of fish production (Obe and Omodara, 2014**;** 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. One problem facing fish culturists is the need to obtain a balance between rapid fish growth and optimum use of the supplied feed (Gokce*ket al*., 2008;Hossain*et al*, 2001).There, is also the need to establish the effect of number of feeding times or frequency on feed management, nutrient utilization and growth rate of fish. Since the feed cost accounts approximately40 - 60% of the operating costs in intensive culture systems (Agung, 2004), the economic viability of the culture operation depends on the feed and feeding frequency. It means that nutritionally well-balanced diets and their adequate feeding are the main requirements for successful culture operations When fish are fed using self-feeders, growth and feed conversion ratios are expected to be improved because the fish can regulate feed intake in relation to their energy demand (Kaushik and MeÂdale, 1994) and their feeding rhythms (BoujardandLeatherland, 1992).

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). 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). Optimal feeding frequency may vary depending on species, age, size, environmental factors, husbandry and feed quality (Goddard, 1995). Therefore, this research work was aimed to determine the effects of feeding frequency on the feed conversion ratio (FCR) and weight gain of *Clariasgariepinus* fingerlings; the effect of feeding frequency on the survival rate of *Clariasgariepinus* fingerlings.

Materials and Methods

The experiment was conducted at the Biological Garden, Department of Biological Sciences, Federal University of Kashere, Gombe State situated on Latitude $9^{0}52'$N, and Longitude $11^{0}0'$E in Akko LGA, Gombe State, North-Eastern part of Nigeria (Kolawole *et al*., 2021).Fingerlings of African catfish *Clariasgariepinus* and a commercial imported "Vital feed" was bought at a commercial fish farm in Gombe.

Experimental Procedure

Fingerlings of the African catfish (*Clariasgariepinus*) were stocked in a bowl for one week for acclimatization before the commencement of the experiment. The fingerlings were randomly stocked into nine bowls of fifteen fingerlings per bowl, and was subjected to three feeding frequency treatments with each treatment replicated trice (Obe and Omodara, 2014).

The fish were starved for 24 hours before the commencement of the experiment. The same diet (2mm Vital feed) was used for the feeding experiment which was measured at 3% body weight of the fish. The experimental setup involved three feeding frequencies which were replicated trice. In the first treatment (T1), the fishes were given the whole quantity of feed once a day at 12.00 hour. In the second treatment (T2), the fishes were fed twice a day at 8:00 AM and 6:00 PM. In the third treatment (T3), the fishes were fed three times a day at 8:00 AM, 12:00 PM and 6:00 PM.

Removal of dead fish was done daily and the numbers were recorded. Five fishes were selected from each tank weekly for the measurement of their length and weight. Average and total weight per thank were computed in order to monitor their growth and also to adjust the amount of feed in each feeding frequency. The experiment lasted for 42 days. During this period, fish bowls were cleaned daily by siphoning out residual feed and faecal matter, water in the bowls were changed daily (Obe and Omodara, 2014).

Water Quality Assessment

The water temperature was measure weekly by the use of mercury in glass thermometer graduated in0°C, dissolved oxygen meter was used to measure the dissolved oxygen level and pH was also monitor weekly by the use of a pH meter as recommended by Amuneke*et al.*(2019).

Biological Evaluation

The feed utilization and growth parameters such as: Mean weight gain (MWG), specific growth rate (SGR), feed conversion ratio (FCR), protein efficiency ratio (PER), survival and relative growth rate(RGR) were evaluated using the collected growth data. The growth parameters were computed using the following formulae reported in Kolawole and Ugwumba (2018) as follows**:**

i. Mean weight gain = final weight of fish (W2) – initial weight (W1).

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

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

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

v. Relative growth rate (RGR) = $\frac{\text{final weight} - \text{initial weight}}{\text{initial weight}} \times 100$

Statistical Analysis

The data collected were analyzed using one-way analysis of variance (ANOVA). Duncan's Multiple Range Test was used to compare the mean differences, which were deemed significant at $P < 0.05$.

Results

Water Quality Parameters

Table I shows the result of water quality parameter recorded during the experimental period. Temperature ranges between 30.30 – 30.53, while Dissolve Oxygen (DO) ranges between 7.43 – 7.57 and pH ranges between 6.75 – 6.84.

Table 1: Mean Value of Water Quality Parameters Recorded During the Experimental Period

Parameters	T1	T2	T3
Temperature (°C)	30.30	30.45	30.53
DO(Mg/Litre)	7.57	7.43	7.52
pH	6.75	6.84	6.78

Growth Performance of Experimental Fish

Table 2 shows the growth and survival of *Clariasgariepinus*fingerlings fed at different feeding frequencies.At the commencement of the feeding regimes, initial mean weights were taken to be 33.64, 34.45 and 33.51 for T1, T2 and T3 respectively. In the experiment, the result showed that treatment three (T3) has the highest mortality rate with 31D (dead),followed by treatment one (T1) while treatment two (T2) has the highest survival rate of 80.1%. The greatest final weight (52.73±8.40) was achieved by the fishes in treatmentT2 (fish fed twice a day), followed by fishes in treatment T1 (fish fed once a day) andthe least final weight (42.94±5.00) was recorded with fishes in treatment T3 (fish fed 3times a day). There is significant different in ($p<0.05$) in all the treatment. In the experiment, treatment two (T2) has the highest weight gain of (18.28±7.90) while the least weight gain was in treatment three (T3). There is still significant different ($p<0.05$) between the treatments.

The values for mean weekly weight gain Fig. 1 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 weekly weight gain and specific growth weight has significant difference ($p<0.05$) between treatment T1, T2 and T3.

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 (0.56±0.24), followed by fish fed treatment T1, while the least protein efficiency ratio was recorded with the fish fed treatment T3 (0.08±0.16). There is significant difference ($p<0.05$) between treatment T1, T2 and T3.The best food conversion ratio was achieved by the fish fed treatment T2 (1.85±4.82) while the poorest food conversion ratio was recorded with the fish fed T3 (5.49±3.15).

Table 2: Growth Performance and feed Utilization of *Clariasgariepinus*

Parameters	T1	T2	T3
Initial weight(g)	33.64±1.54	34.45±1.83	33.51±1.62
Final weight(g)	48.57±2.40^{b}	52.73±8.40^{a}	42.94±5.00^{c}
Weight gain(g)	14.93±4.61^{a}	18.28±7.90^{b}	9.43±0.00^{c}
Average weekly weight gain	0.06±0.00^{ab}	0.08±0.02^{a}	0.04±0.01b^{a}
Relative growth rate (%)	44.38±0.86^{b}	53.06±0.68^{a}	28.14±0.57^{c}
Specific growth rate	35.55±0.73^{a}	43.52±0.85^{c}	22.45±0.62^{b}
Protein efficiency ratio	0.45±0.00^{c}	0.56±0.24^{a}	0.08±0.16^{b}
Food conversion ratio	2.22±0.00^{b}	1.85±4.82^{a}	5.49±3.15^{c}
Survival rate	68.9%	80.1%	31.1%

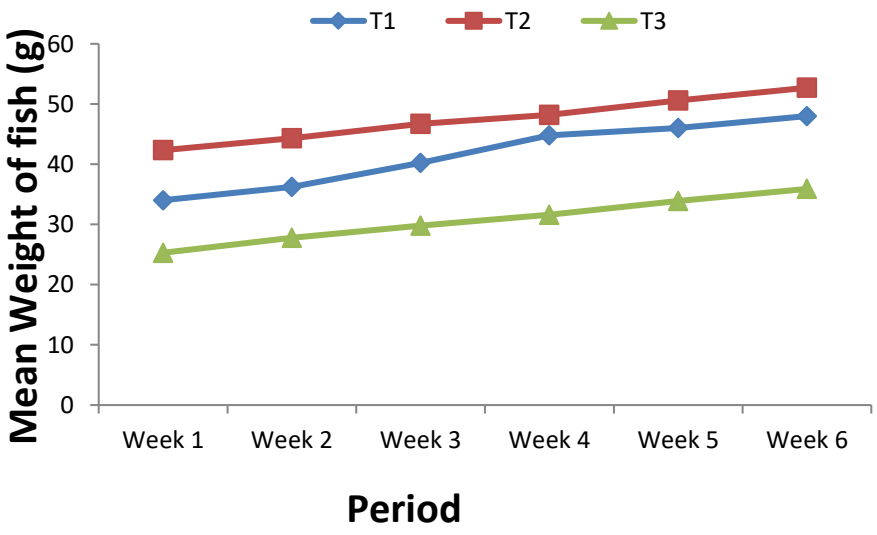

Fig. 1: Mean Weekly Weight of Experimental Fish

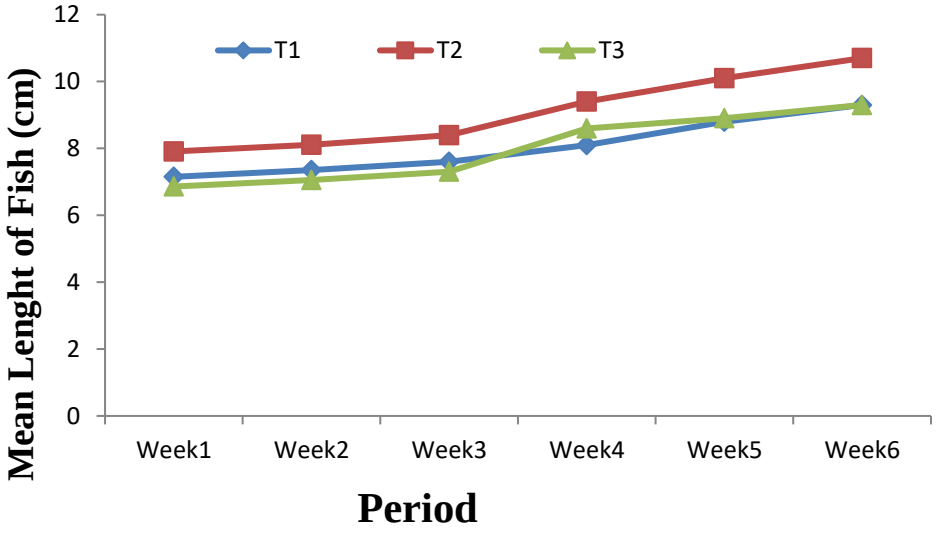

Fig. 2: Mean Weekly Length of Experimental Fish

Discussion

It was revealed from data during the period of study that water qualityparameters were within the range that provides good growth range for African catfish culture (Swann, 1992; Olurin*et al*., 2006). This is attributed to daily water replacement of the various feeding frequencies during the experimental period and also because of the fact that the various fish group fed actively at all time during the experimental period, hence little or no feed was left unconsumed after each feeding. Generally, good dissolved oxygen in fish culture are attained and maintained by ensuring proper feeding rate and frequency. Optimum supply of dissolved oxygen in the tank enhances the physiological activities of the fish and ensures proper growth. Feeding frequency is one important consideration as it has been proved to affect growth, survival and body composition as well as water quality. Feeding also at the optimum frequency can result in tremendous savings in feed cost (Davies*et al.,* 2006). The amount of 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 (Goddard, 1995 and Amuneke*et al.,* 2019).

Based on the results emanated from this feeding trial, the growth performance of *C. gariepinus* has been slightly related to number of feeding times. Given that all other parameters were significantly ($p<0.05$) different, mean weight gain and specific growth rate showed variation to the feeding frequencies tried (Table2). Feeding and feeding frequencies are key factors that determine the growth and survival chances of fish. In this investigation, it was observed that thehighest quantity of feed was consumed by fishes fed three times daily, while the least amount. was consumed by fishes fed once daily, this is in contrary to study by Lawan*et al*., (2017) which reported that least feed was consumed by fishes fed twice daily. In a related studyObe and Omodara (2014) reported that, none of the parameters associated with growth performance (survival, weight gain, specific growth rate and feed intake) showed any significant differences among treatments.

The basic principle in feeding is that fish should be fed exactly to satiation (Lawan*et al*., 2017). If they are fully fed, the fish are not stressed and they provide high quality food for human consumption. 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 *Clariasgariepinus* fingerlings. This agrees with the work of Obe and Omodara (2014) and Lawan*et al*., (2017) who found feeding twice a day as the best feeding frequency for *Heteroclarias* and *Clariasgariepinus*fingerlings respectively.

Food conversion ratio was best in fishes fed twice a day because it has the lowest feed conversion ratio value. Thrice daily feeding frequency has the highest food conversion ratio value which is the poorest food conversion this may be responsible for the poorest growth recorded for this frequency. This result is in contrary to the work of Ayo-Olalusi and Ugwumba (2009) which recorded the best food conversion ratio value to be in fishes fed four times a day.

Conclusion

Fish require adequate food to grow and survive. The success of African Catfish fingerlings culture depends on effective feeding frequency. The growth parameters showed obvious significant difference among the three-feeding frequency. It therefore showed that there is no benefit in feeding *Clariasgariepinus* fingerlings more than two times a day. Hence, it is recommended that *Clariasgariepinus*should be fed twice a day for optimum growth.

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