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The Influence of Feeding Frequency on the Growth and Feed Utilization of Catfish, *Clarias gariepinus* Fry in Outdoor Concrete Tanks

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ABSTRACT: *C. gariepinus* fry (mean weight 0.14g) were fed on 40% Crude Protein at 10% body weight per day at four different feeding regimen i.e. continuously 24h/day (24), 6 meals/d, 4 meals/d or 2 meals/d in outdoor concrete tanks. The fry attained the highest average weight of 4.92g in 56 days when fed continuously for 24h/d with significant difference ($P>0.05$) among treatments. Feed conversion ratio ranged from 0.75 to 0.96, the protein efficiency ratio from 2.69 to 3.32 with significant differences ($P < 0.05$) among treatments.

Survival of the fish varied from 87.0% to 95.5% and did not vary among treatments ($P < 0.05$). Fish fed continuously, 24h/d had the best protein deposition and the least lipid content was with 2 meals/d. The results suggest that a feeding regime of 24h/d would be a more strategy for feeding *C. gariepinus* fry to fingering size in outdoor hatchery ponds.

Key Words: Feeding frequency; *Clarias gariepinus;* Specific growth; Fry.

Introduction

Apart from diet composition, feeding frequency influences the growth performance of cultured fish (Stickney, 1994). *Clarias gariepinus* is a catfish which is very popular for fish farming in Nigeria. The fish is hardy and can grow to a size of over 10kg (Reed *et al*, 1967; Olaosebikan and Raji, 1999) which is very attractive to consumers.

However, there is paucity of information on the optimum feeding regime for the growth of fry to fingerling size of this species, *C. gariepinus* during the outdoor nursery management phase. Falaye and Akinbode (1998) working on *Oreochromis niloticus* reported that feeding regime of two times per day produced best fish performance in terms of specific growth rate compared to feeding three or four times per day. Generally, identification of optimum feeding frequencies for cultivable fish species would help to reduce feed wastage and maximize conversion efficiency.

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Different species of fish respond differently to various feeding regimes. Optimum feeding frequency determined for several fish species at fry/fingerling size is once a day for *Channa striatus* (0.66g), (Sampath, 1984), twice a day for *Heterobranchus bidorsalis* (0.08g) (Dada, 1999), thrice a day for *Cyprinus carpio* (0.17g), (Charles *et al*, 1984), eight times a day for *Chanos chanos* (0.66g), (Chiu *et al*., 1987) and continuous feeding for white sturgeon *Acipenser transmontanus* (8.6g), (Cui *et al*., 1997). These differences in optimum feeding frequency reflect differences in speciesa, diets, culture conditions and fish size. The present study was carried out to determine the optimum feeding frequency for the growth of *C. gariepinus* fry to fingerling size during the nursery management phase in outdoor nursery concrete ponds.

Materials and Methods

A total of two thousand, four hundred full-siblings of *C. gariepinus* fry (mean weight 0.14g) obtained by induced spawning with hormonal injection were used for the feeding frequency experiment. The fry were stocked in twelve 2 x 2 x $1m^3$ concrete ponds at 200 fry/pond. Prior to stocking, the ponds were prepared as described by Dada *et al*., (2001).

Throughout the experimental period, the fry were fed a powdered artificial feed containing 40% crude protein prepared containing fish meal (14.70%), Soybean meal (54.10%), blood meal (4.70%), yellow maize (25.00%), vegetable oil (1.00%) and vitamin premix (0.50%) at 10% of the total fish biomass per day at four different feeding regime (Table 1). Each feeding regime was replicated thrice. All fish were weighed and counted fortnightly and thequantity of feed adjusted according to increment in mean fish weight in each pond. At the end of the trial (56 days), the fish in the tanks were counted, weighed and the total weight recorded.

Water temperature, pH and dissolved oxygen concentration were monitored weekly using standard methods (APHA, 1980).

At the start of the experiment, 18 fish fry of *C. gariepinus* were taken for proximate carcass composition and at the end of the experiment, 6 fish were taken from each ponmd (18 fish/treatment) for carcass composition using AOAC (1990) procedures.

Analysis of variance was conducted to determine if there were significant differences in growth among treatments at the 5% level.

Results

The average final weight, specific growth rate (SGR), daily growth rate (DGR), feed conversion ratio (FCR) and protein efficiency ratio (PER) of fish at different feeding frequency are shown in Table 2. Fish fed continuously 24h/d gained significantly ($P < 0.05$) more body weight than fish fed 2 meals/d, 4 meals/d and 6 meals/d. There were variations in the feed conversion ratios and protein efficiency ratios with significant difference ($P < 0.05$) among treatments.

Survival of the fish during the experiment varied from 87.0% to 95.5% and did not vary among treatments ($P > 0.05$). However, loss of fish may attributed to the physical stress to which the fish were subjected during the samplings and cannibalism which is one of the characteristics of the catfishes, since the observed mortalities accounted for less than half the number of fish missing at the end of the experiment.

The water quality parameters measured varied as follows: temperature, 28°C to 28.5°C, dissolved oxygen 4.27 to 6.53 mg/l, pH, 7.45 to 7.62 recommended for catfishes (Viveen *et al*., 1986).

Carcass composition (Table 3) shows an increased in lipid contents as the feeding frequency increased. Fish fed continuously for 24h/d had the highest body protein content while those fed 6 meals/d had the lowest.

Table 1: Frequency of Feeding

Feeding Frequency	Notation	Feeding Times (H)
Continuous feeding using auto-feeders	24h/d*	Continous without restriction
6 times daily	6/d*	8.00; 10:00; 12:00; 14:00; 16:00; 18.00.
4 times daily	4/d*	8:00; 10:00; 12:00; 14:00.
2 times daily	2/d	8:00; 16”00.

*Daily.

Table 2: Growth performance and feed utilization parameters for *Clarias gariepinus* fry fed at four experimental feeding frequencies for 56 days.

Parameter	Treatments				
	2/d	4/d	6/d	C 24	± SE
Average Initial Weight(g)	0.14^{a}	0.14^{a}	0.14^{a}	0.14^{a}	0
Average Final weight (g)	$3/60^{c}$	4.62^{a}	4.02^{b}	4.92^{a}	0.57
Survival (%)	95.5^{a}	91.5^{a}	87.0^{a}	91.0^{a}	3.01
Specific growth date (% day-1)	5.80^{c}	6.24^{a}	6.00^{b}	6.36^{a}	0.22
Daily growth rate (DGR) (g/fish/day)	0.06^{d}	0.08^{a}	0.07^{b}	0.09^{a}	0.01
Feed intake (g dry matter/fish)	3.32^{b}	3.78^{a}	2.92^{c}	3.95^{a}	0.40
Feed conversion ratio – (FCR)	0.96^{c}	0.84^{a}	0.75^{b}	0.82^{a}	0.08
Protein efficiency ratio – (PER)	2.69^{c}	2.96^{a}	3.32^{b}	3.03^{a}	0.22

n = 600 fish per treatment
SEM = Standard error of mean
Mean values in the same row with similar superscripts are not significantly different ($P > 0.05$).

Table 3: Carcass composition (%) (± SE) of *C. gariepinus* (% fresh weight basis) fed at four different feeding frequencies for 56 days.

Feeding regimen	% Composition			
	Moisture	Protein	Lipid	Ash
Initial	85.73 ± 0.06	10.28 ± 0.04	3.05 ± 0.01	1.25 ± 0.04
C24	79.3 ± 0.3[a]	13.6 ± 0.4[a]	5.7 ± 0.2[bc]	3.1 ± 0.1[a]
6/d	82.5 ± 1.0[a]	12.9 ± 0.5[a]	4.5 ± 0.3[b]	3.0 ± 0.1[a]
4/d	80.9 ± 0.2[ab]	13.3 ± 0.3[a]	4.2 ± 0.2[bc]	3.1 ± 0.2[a]
2/d	82.3 ± 0.4[a]	13.2 ± 0.2[a]	3.4 ± 0.3[c]	3.1 ± 0.2[a]

SE = Standard error of pooled means (n = 18). Means within each column that share a common letter are not significantly different ($P \geq 0.05$).

Discussion

Based on growth performance indices (SGR, DGR and final mean weight), the best growth performance was achieved by feeding *C. gariepinus* fry continuously for 24h/d attaining a body weight of about 4.92g within 56 days of rearing in the outdoor concrete ponds. These results differ from those obtained with milk fish, *Chanos chanos* fingerlings (Teshima *et al*., 1984), Channel catfish, *Ictalurus punctatus* (Webster *et al*., 1993) and *Heterobranchus bidorsalis* fry (Dada, 1999) in which it was found that a feeding frequency in excess of 2 times per day had no extra effect on fish growth. Chiu *et al*., (1987), however, also found that for milk fish, an increase in feeding frequency from 4 to 8 feedings per day considerably improved the fed conversion and the growth rate.

Shelbourn *et al*., (1973) observed faster growth when young salmon were fed continuously for 15 hours per day compared to feeding to satiation three times daily. The present results show that feeding frequency was the more important variable in determining weight gain. The differences in growth and feed efficiency when different species of fish are fed at different feeding regimes underscore the importance of considering different feeding schemes for the various fish cultured so that feed costs can be minimized. The rate of feeding and size of fish need to be considered because optimum feeding frequency may differ with these parameters ass noted in *Oreochromis niloticus* (Desilva *et al*., 1986).

Most studies on the effect of feeding regimen have concentrated on meal feeding with different frequency, and there has been little attention given to continuous feeding. Charles *et al*., (1984)tested only meal feeding and concluded that feeding thrice a day was optimum for *Cyprinus carpio* fry (0.17g). Cui *et al*., (1997), however, showed that continuous feeding produced better growth in juvenile white sturgeon *Acipenser transmontanus* (8.6g) than less frequent feeding. Better growth was also achieved for *C. gariepinus* fingerlings by feeding continuously for 24h/d than by feeding 4 meals/d (Hogendoorn, 1981). However, all these authors carried out their studies in indoor glass tanks. Potential advantages of continuous feeding in the nursery management of other fish species in outdoor nursery phase are worth investigating. The present study suggests that in practice, when supplementary feed is provided for *C. gariepinus* fry in outdoor nursery ponds that have some amount of natural feed continuous feeding for 24h/d would improve growth and feed efficiency.

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