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Short Communication

Growth response and survival of *Heterobranchus longifilis* fingerlings fed at different feeding frequencies

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In an effort to utilize feed efficiently, promote growth, increase survival and reduce labour costs associated with feeding, *Heterobranchus longifilis* fingerlings were placed on one of four feeding frequencies; once/day, twice/day; once every other day, and twice every other day for 56 days. They were fed with a commercial floating diet containing 40% crude protein level. They were reared in twelve 14 L plastic aquaria, with 3 aquaria/treatment under laboratory conditions. Each aquarium contained 10 fingerlings. The growth parameters except relative growth rate (RGR) were significantly different for fishes receiving the different treatments. Survival was not significantly different among treatments except for fingerlings fed once every other day. The study suggests that the fingerlings of *Heterobrachus longifilis* should be fed twice daily for higher growth performance.

Key words: Growth, response, survival, *Heterobranchus longifilis* fingerlings, feeding frequency.

INTRODUCTION

As the culture of catfish *(Heterobranchus longifilis)* becomes more intensive, strategies for supplementary feeding will have to be assessed for maximum economic returns. Feeding frequency is one important consideration as it can affect growth, survival and fillet composition as well as the water quality. Feeding at the optimum frequency can result in tremendous savings in feed costs. Different species of fish have been shown to have different optimum feeding frequencies; young salmon fed continuously for 15 h/day (Shelbourn et al., 1973), channel catfish twice a day (Andrew and Page 1975), estuarine grouper once every 2 days (Chua and Teng, 1978), common carp three times a day (Charles et al., 1984), milkfish fingerlings twice/day (Teshima et al., 1984), rainbow trout 3 times/day (Ruohonen et al., 1998), hybrid sunfish 3 times/day (Wang et al., 1998), channel catfish once/day or twice/day (Webster et. al., 1992a, 1992b), and sunshine bass (*Morone chrysops x Morone saxatilis*) twice a day (Webster et al., 2001). Diet cost represents 30-70% of the total operating cost of an aquaculture enterprise thus overfeeding would mean economic waste and could adversely affect water quality (leaching of nutrients). On the other hand, underfeeding may suppress growth as a result of starvation (Seenappa and Devara, 1991).

Determination of the appropriate feeding frequency is required to give optimal growth and better survival rate. As the catfish industry expands, there is need to know what feeding frequency would be optimal at the least cost for better production. This is what this study suggests.

MATERIALS AND METHODS

Experimental tank and fish

Twelve plastic containers each having a dimension of 0.87 m^2 were used in the experiments under laboratory condition. *H. longifilis* fingerlings (mean weight 1.038 g ± 0.05 g SEM) were obtained from the hatchery unit of the African Regional Aquaculture Center (ARAC), Aluu, Port Harcourt and transported in plastic buckets to the laboratory. They were 3 weeks old at the time of collection. They were fed with ARAC compounded diets. No prophylactic treatment was given before acclimation. The fishes were acclimated for seven days in 3.30 L plastic containers, and fed experimental floating diet at 5% biomass. The containers were aerated. There were 4 treatments with 3 replicates for each treatment. Each of their tanks was stocked with 10 fish of similar sizes to avoid cannibalism

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Table 1. Means of weekly pH, dissolved oxygen, morning temperature and afternoon temperature recorded during experiment.

Week	No. of samples	pH	Dissolved O_2 (mg/l)	Morning temperature (^oC)	Afternoon temperature (^oC)
1	12	7.2 ± 0.10	3.48 ± 0.10^{abc}	27.6 ± 0.10^{b}	28.3 ± 0.00^{a}
2	12	7.2 ± 0.00	3.48 ± 0.10^{abc}	28.1 ± 0.00^{a}	29.0 ± 0.00^{a}
3	12	7.3 ± 0. 00	3.52 ± 0.10^{ab}	27.2 ± 0.00^{c}	28.9 ± 0.00^{a}
4	12	7.3 ± 0. 00	3.45 ± 0.13^{abc}	28.1 ± 0.10^{a}	29.2 ± 0.00^{a}
5	12	7.2 ± 0. 00	2.95 ± 0.11^{bc}	27.0 ± 0.0^{d}	29.0 ± 0.00^{a}
6	12	7.3 ± 0.10	2.90 ± 0.24^{bc}	24.0 ± 0.0^{c}	26.8 ± 0.00^{ab}
7	12	7.2 ± 0.10	3.93 ± 0.20^{a}	27.2 ± 0.00^{c}	25.8 ± 0.00^{a}
8	12	7.2 ± 0. 00	4.00 ± 0.24^{a}	27.0 ± 0.00^{d}	28.0 ± 0.00^{ab}

Within column, mean ± SEM with different superscripts are significantly different at P <0.05.

(Lengendre et al., 1992) for the feeding frequencies trial. The initial total length (cm) of individual fish and mean weight of the fish was recorded before placing them in the rearing containers. The aquaria were covered with mosquito net to prevent fingerlings from jumping out, intrusion of insects and other foreign bodies (lizards, geckos, etc). Dechlorinated tap water was used throughout the experiments.

Feeding and measurements

Commercial floating diet containing 40% crude protein formulated and prepared by ARAC was used (ARAC, 2001).

The fingerlings were fed at different 4 feeding frequencies (treatments) once/day, twice/day, once every other day and twice every other day at 0800 h and 1600 h depending on the treatment. Fishes were allowed to feed all they could consume in 30 min. Debris and leftovers were removed using siphon before and after each feeding. Samplings of fish for weight and length measurement were initially done with a scoop net. However, due to difficulties in collecting the fish with the net, the water volume was reduced with a siphon before the fish is collected with a scoop net. Fish weight (g) was taken using a top loading balance (model: Gottinen V-240). The fingerlings were weighed in groups once a week. The standard length of the fish was taken to the nearest cm with the aid of a measuring board. This was done once a week. Depleted water was replaced with freshwater to an effective depth of 26 cm after each cleaning. Water temperature was taken twice daily at 0800 h and 1600 h. Dissolved oxygen (by Winker's method) and pH were determined once a week.

Statistical analysis

Data were subjected to analysis of variance (ANOVA) at 0.05%. Duncan's multiple range test was used to determine the difference among means (Wahua, 1999). The parameters used to assess the performance of the fish on the various treatments were based on Castell and Tiews (1980) and Bagenal (1978).

RESULTS AND DISCUSSION

The range of values of the physicochemical parameters during the experimental period were: pH 7.2-7.3; dissolved oxygen 2.90 ± 0.24 to 4.00 ± 0.24 temperature 25.8 to 29^{o}C (Table 1). There were significant differences mg/morningtemperature 27 to 28.1ºC and afternoon between the dissolved oxygen and temperature. The values of the growth parameters were shown in Table 2. An overall survival of 80.3% was recorded at the end of the experiment. Despite the high survival rate, some mortalities were recorded. Treatment 3 (feeding once every other day) had the highest mortality rate (32%).

The highest mean weight gain, specific growth rate and relative growth rate recorded in this experiment for fish fed twice daily (Table 2) were in agreement with those reported for sunshine bass fed twice/day when grown indoors (Webster et al., 2001). The specific growth rate and relative growth rate recorded for fish fed twice daily in this study were also observed by Gabriel et al., 2000 for *Heterobranchus bidorsalis* fingerlings fed at 3% body weight twice/day. Ruohonen et al. (1998) using quadratic regression analysis observed that rainbow trout *Oncorhynchus mykiss* had higher growth rates when fed 3 times/day compared to fish fed once/day or twice/day, but were not different from fish fed four times/day. The results of this study of fish fed twice daily also agree with those of Noeske-Hallin et al., (1985) for channel catfish fed twice daily.

However, reports show that feeding channel catfish once/day produced similar growth rates compared to fish fed twice/day when grown in cages (Webster et al., 1999a) or in ponds (Webster et al., 1992b). Robinson et al. (1995) reported that when channel catfish were fed once daily, time of feeding had no significant impact on growth, feed conversion or body composition. The mean weight gain and daily weight gain recorded in this experiment were very much lower than that reported for *Heterobranchus* and *Clarias* species in low input homestead concrete tanks and brackish water pond environment (Legendre, 1983; Egui, 1986a), but similar to those observed by Gabriel et al. (2000). The water temperature, pH and dissolved oxygen recorded in this study fall between the acceptable range for fish growth and health (Boyd, 1979; Viveen et al., 1986; Ugwumba and Abumoye, 1998; Gabriel et al., 2000). Survival in the

Table 2. Growth responses of experimental fish.

Growth parameters	Feeding frequency			
	Once/day	Twice/day	Once/EOD	Twice/EOD
Initial mean weight (g)	1.041	1.063	1.019	1.028
Final mean weight (g)	1.338	1.623	1.194	1.283
Mean weight gain(g)	0.297	0.560	0.175	0.255
Mean daily growth rate g/d)	5.30^{-03}	0.01	3.125^{-03}	4.55^{-03}
Specific growth rate (g)	0.53	1.00	0.31	0.45
Relative growth rate (%)	28.53	52.68	17.17	24.81
Initial mean length (cm)	4.07	4.70	4.10	4.10
Final mean length (cm)	6.36	8.23	6.12	4.10
Mean length gain (cm)	2.29	3.53	2.02	0.3
Mean daily length rate (cm/d)	0.041	0.063	0.036	5.36^{-3}
Survival (%)	83.3	80	68	90

Values are means of three replicates.
EOD: Every other day

present study was within the range reported by Webster et al. (2001) who observed that juvenile sunshine bass, *Morone chrysops X M. saxatifilis*, had survival percentages between 62-75%. All mortalities may be attributed to handling stress after weekly parameters' handling.

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