



Effect of four feeding rations on the growth performance of african giant catfish *Heterobranchus bidorsalis* fingerlings

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ABSTRACT

Feed ration is one of the important variables considered for the improvement in production of fish. The effects of four feeding rations on growth performance of *Heterobranchus bidorsalis* fingerlings were investigated for 7 weeks. The specific growth rate (SGR) at 4.0% feed ration was significantly higher than 10.0% feed ration, and there was no significant difference in SGR between 4.0%, 6.0% and 8.0%. The growth performance was best at 6.0 % feeding ration while the best feed utilization was obtained at 4.0 % feeding ration with no significant difference ($P > 0.05$) between the fish fed at 4.0 % and 6.0 % feeding rations. Based on the results, an intermediate feeding ration between 4.0 % and 6.0 % body weight per day is ideal for adequate growth and development of *H. bidorsalis* fingerling during culture period.

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Keywords: *Heterobranchus bidorsalis*, Survival, growth performance, feed utilization.

INTRODUCTION

The success of fish farming depends on maximizing production with minimum feed cost (Abdel-Hakim et al., 2009). The economic success of artificial feed depends upon appropriate feeding regime. Inappropriate feeding practices often lead to over feeding, pollution and higher production cost, while inadequate feeding may lead to stunted growth with high mortalities (Eroldogan et al., 2006). Knowledge of feeding rate and protein concentration is necessary to select appropriate feed quantity for a particular age group (Le et al., 2012).

Heterobranchus bidorsalis is a catfish with remarkable fast growth rate and commands a very good commercial value in Nigeria markets. There is paucity of data on the optimum feeding rate for this species. According to Abdelghany and Ahmad (2002) fish growth rate is directly related to ration level. The amount of feed consumed, age, body size and temperature are the most important factors that limit maximum growth of fish and prawn (Le et al., 2012; Zikria, 2012).

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Many studies have been conducted on effect of feeding rate on fish growth (Rad et al., 2003; Abdel-Hakim et al., 2009; Wunderlich et al., 2011). Hongendoorn (1981) suggested 10% of the live body weight per day for *C. gariepinus* (0.85 g). Santiago et al. (1987) in their study recommended maximum feeding rate at 45% of the live body weight for *Oreochromis niloticus* fry (0.01 g). Desilva and Anderson (1995) recommended feeding at 50% of body weight per day for fry of channel catfish *Ictalurus punctatus*., while Dada et al. (2001) recommended feeding at 40% of the live body weight for *H. bidorsalis* (0.03 g). Based on the assertion that feeding rate varies with the species, size and age, and environmental factors, the present study was conducted to determine the effects of different feeding rations on the growth and food utilization of *H. bidorsalis* fingerlings.

MATERIALS AND METHODS

Collection and acclimatization of experimental fish

One hundred and eighty *H. bidorsalis* fingerlings from the same broodstock (mean mass, 10 ± 0.42 g) obtained from the National Institute for Freshwater Fisheries Research hatchery, New-Bussa, Niger State, Nigeria were used. The fingerlings were acclimated to laboratory conditions for 14 days before being distributed randomly among 15 aquarium tanks (40-litre capacity) at 15 fish per aquarium (60 cm \times 30 cm \times 30 cm). The experimental treatments represented by four feeding rations were tested in triplicate.

Feed ingredients and preparation of artificial feed

The detail of feed ingredients and proximate composition is given in Table 1. These ingredients were ground to a small particle size (3.0 mm). Ingredients including vitamin premix were thoroughly mixed in a Hobart A- 2007 pelleting and mixing

machine (Hobart Ltd London, England) to obtain a homogenous mass, and cassava starch was added as a binder. The resultant mash was then pressed without steam through a mixer with 0.9 mm die attached to the Hobart pelleting machine. The produced pellets were dried at ambient temperature of 27 °C – 30 °C and packed in plastic bags and stored.

Experimental setup

The design utilized fifteen aquarium tanks (60 cm \times 30 cm \times 30 cm) of 40-litre capacity. A water volume of 26 L was maintained in each tank. Continuous aeration was provided in all the tanks using Tecax air pump model AP 3000. Prior to the feeding of the experimental diets, the fish were starved overnight. The fish were fed with experimental feed 40% crude protein at 4%, 6%, 8% and 10% body weight, twice a day during morning (08:00 hr) and afternoon (18:00 hr) for 7 weeks and quantity of feed introduced adjusted to mean fish weight in each aquarium tank..

At the beginning of the experiment, pooled samples of 15 fish (fingerlings) samples were randomly taken for carcass composition and at the end of the experiment pooled samples of 15 fish were randomly taken from each treatment for carcass composition using AOAC (1997) procedures. All treatments were tested in triplicate where each aquarium tank was considered as an experimental unit.

Water quality parameters such as temperature, pH and dissolved oxygen concentration were studied on daily basis using standard methods as described by APHA (1998) using a thermometer for temperature (°C), pH meter (Hanna H198106 model) and dissolved oxygen meter (JP 607 model).

Fish growth studies

The fishes were monitored individually for their total body weight (g) after every two weeks for 7 weeks. The data: Weight gain (WG), specific growth rate (SGR), food conversion ratio (FCR) and protein efficiency ratio (PER) were calculated by following formulae:

WG = Final weight (g) – Initial weight (g).

SGR = (ln final body weight – Initial body weight) × 100/ No. of days of experiment.

FCR = Feed given (g)/ Wet weight gain (g).

PER = Live body weight gained (g) / Protein intake (g).

Where: Protein Intake (g) = Protein (%) in feed × Feed given (g) / 100.

Survival rate (%) = Number of surviving fish / Number of fish at the beginning × 100.

Statistical analysis

The values were recorded as mean ± standard deviation. The statistical significance of difference in the mean and standard deviation ($P < 0.05$) was analyzed by one-way ANOVA test comparison of each of the test groups and the control using the SPSS 15. Duncan's multiple range was used to compare differences among individual means (Zar, 1984). Differences were considered significant at p levels < 0.05 .

RESULTS AND DISCUSSION

Mean water quality parameters during the experiment were 5.2- 6.5 mg/l, 7.4 – 7.9 and 27.00 – 27.50°C for dissolved oxygen, pH and temperature respectively. These were within optimal limits for production of African catfish (Viveen et al., 1986). Loss of fish was attributed to the physical stress to which they were subjected during samplings.

Feeding rate significantly ($P < 0.05$) affected the SGR, FCR, PER and ADG. Data on growth and feed utilization performance is given in Table 2. Fish fed at 4% feeding ration had the best FCR and PER (Table 2), due to efficient conversion of the diet by *H. bidorsalis* at that feeding ration. There were improvements in the growth responses with increasing feeding ration up to 6% feeding ration. Thereafter, further improvements were not significant. The poorest growth rate was obtained in the 10% feeding ration, while the 6% feeding ration gave the highest growth performance values, followed by the 4% feeding ration. No significant differences ($P > 0.05$) were found between the growth of fish fed at 4% and 6% feeding ration.

Generally, low feed conversion ratio (FCR) were obtained in all treatments, but the poorest occurred in both 8% and 10% feeding rations (Table 2), although better FCR was obtained at 4% feeding ration, but there were no significant difference ($P > 0.05$) between the FCR of fish fed 6% feeding ration. The PER decreased ($P < 0.05$) with increased in feeding ration. Similar observations were reported for other fish species such as *Cyprinus carpio*, whitefish *Coregonus lavaretus* and Tilapia (GIFT) (Abdelghany and Ahmad, 2002; Wunderlich et al., 2011; Zikria et al., 2012).

Carcass composition (Table 3) shows an increased in crude protein and a decreased in fat contents as the feeding ration increased. Data on carcass composition followed the same trend as those of earlier studies, i.e. an increased in the body protein with an increased in the feeding ration (Pouomogne and Mbongblange, 1993; Dada et al., 2001).

Based on the results and the foregoing, it could be concluded that an intermediate feeding ration between 4% and 6% body weight per day is ideal for adequate growth and development of *H. bidorsalis* during culture period.

Table 1: Ingredient composition (kg) and proximate composition (% DM) of basal diet.

Ingredients	g/kg diet
Fish meal	14.70
Soybean meal	54.10
Blood meal	4.70
Yellow maize	25.00
Vegetable oil	1.00
Vitamin-mineral premix	0.50
Corn starch	1.00
Proximate composition (%)	
Crude protein	40.4
Crude lipid	17.4
Ash	12.1
Gross energy (MJ/Kg)	16.9

Vitamin premix – A Pfizer livestock product containing the following per kg of feed: A = 4500 I. U, D = 11252 I.U, E = 71 I.U, K₃ = 2 mg, B₁₂ = 0.015 mg, panthothenic acid = 5 mg, nicotinic acid = 14 mg, folic acid = 0.4 mg, biotin = 0.04 mg, choline = 150 mg, cobalt = 0.2 mg, copper = 4.5 mg, iron = 21 mg, manganese = 20 mg, iodine = 0.6 mg, selenium = 2.2 mg, zinc = 20 mg, antioxidant = 2 mg

Table 2: Comparison of growth parameters of *H. bidorsalis* fingerlings at different rations (means are of three replicates with n=15).

Parameters	Ration levels (% body weight)			
	4	6	8	10
Initial mean wt (g)	10.12 (0.51) ^a	10.56(0.49) ^a	10.48(0.38) ^a	9.64(0.40) ^a
Final mean wt (g)	18.62 (1.44) ^a	19.44(1.46) ^a	18.76(1.41) ^a	14.09(0.74) ^b
Mean wt gain (g)	8.50(0.62) ^a	8.88(0.40) ^a	8.28(0.48) ^a	4.45(0.28) ^b
SGR (%/day)	0.87(0.00) ^a	0.87(0.00) ^a	0.83(0.01) ^a	0.54(0.03) ^b
ADG (g/day)	0.12(0.01) ^a	0.13(0.02) ^a	0.12(0.01) ^a	0.06(0.00) ^b
FCR	1.67 (0.01) ^a	1.93(0.02) ^a	2.93(0.03) ^b	6.73(0.01) ^c
PER	0.24(0.00) ^a	0.16(0.01) ^b	0.14(0.01) ^b	0.06(0.00) ^c
% survival	60 (0.00) ^a	80(0.01) ^a	60(0.00) ^a	60(0.00) ^a

Mean in a given column with the same letter were not significantly different at p<0.05. Values in parentheses are standard errors of mean values.

Table 3: Chemical composition of whole body of *H. bidorsalis* fingerlings fed at different feeding rations (as wet basis).

Composition (%)	Experimental Feeding rations (% body weight)			
	4	6	8	10
Moisture	8.73(0.06) ^a	79.73(0.04) ^a	79.87(0.09) ^a	77.48(0.02) ^a
Protein	13.75(0.02) ^b	14.70(0.04) ^b	15.40(0.02) ^c	16.80(0.03) ^d
Lipid	3.54(0.01) ^b	3.43(0.01) ^b	3.04(0.02) ^c	3.05(0.01) ^c
Ash	1.87(0.01) ^b	2.14(0.04) ^b	2.33(0.14) ^b	2.67(0.24) ^c

Initial moisture, 85.7(0.06), crude protein, 10.75(0.02), crude lipid, 2.03(0.02), ash, 1.49(0.01). Values in the same row with common superscripts are not significantly Different ($P < 0.05$). Values in parentheses are standard errors of mean values.

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