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Effect of different feeds on growth, survival and production of African catfish (*Clarias gariepinus* Burchell)

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Abstract
An experiment was conducted to study the effect of different feeds on growth survival and production of African catfish (*C. gariepinus*) in six cemented tanks (3 m^2 each) over a period of 120 days. Three different feeds namely Feed A (Saudi-Bangla fish feed, 33.43% protein), Feed B (formulated feed, 40.12% protein) and Feed C (chicken raw intestine, 59.58% protein) were applied to treatments I, II and III respectively. Each of the tanks was stocked with 24 fry with mean initial body weight of 2.56 ±0.06 g. Feeds were supplied to the fish *ad- libitum* daily in two instalments. Significantly highest weight gain was obtained in treatment III, however, survival rate was low compared to other treatments. The feed conversion ratio (FCR) values ranged from 2.52-6.4. Survival rate of fish varied between 83 and 96%. Treatment II yielded the highest (5000 kg/ha/120 days) production with the highest survival rate of fish. On the basis of survival rate and production, it is suggested that the formulated feed (Feed B) is suitable for the culture of *C. gariepinus* in cemented tanks.

Key words: *Clarias gariepinus,* Feed

Introduction

The development of quality fish feed is a key to the success in commercial fish culture. A large number of indigenous raw materials mainly poultry by-product meal, blood meal, various oilcakes, cereal by-products, leaf meals etc. are available in the country (Akand *et al.* 1991). These raw materials can be used in developing supplemental feed for rearing and culture of different fish species (Bhadra *et al.* 1997).

African catfish, *Clarias gariepinus* is very popular for aquaculture in a number of African, Asian and European countries (Huisman and Rechter 1987). This popularity stems from several characteristics of the fish, which includes wide distribution, ability to tolerate poor water quality conditions, adaptability to overcrowding, extremely high yields and good response to the artificial feed. For the good result of this fish production, good quality artificial feed is essential and requires protein level of 35-45% in feed (Degani *et al.* 1989). The aim of the present investigation was to evaluate the suitability of different feeds for African catfish (*C. gariepinus*).

Materials and methods

The experiment was carried out over a period of 120 days in cemented tanks, belonging to Department of Aquaculture, Bangladesh Agricultural University, Mymensingh during the month of August to December'95.

Six cemented tanks each of size 3 m^2 were used for the growth trial. For convenience of study, the tanks were numbered as 1, 2, 3, 4, 5 and 6. Water level in each tank was maintained 1.00 m throughout the experimental period by adding freshwater from a deep tubewell. In each tank, earthen plate was hung from a pipe just half metre below the surface for supplying the feed daily.

The tanks were divided in to three treatments namely I, II and III each having two replicates. Three different feeds namely Feed A, Feed B and Feed C were applied to the treatments I, II and III respectively. *C. gariepinus* fry used in the present study were obtained from Faculty of Fisheries, BAU, Mymensingh. Fish fry of 2.56±0.06 g size were randomly distributed to the tanks at the rate of 8/m^2. Fish, during the experimental period, were fed up to satiation twice daily.

Feed A was the pelleted catfish feed collected from Saudi-Bangla Fish Feed Ltd. Bhaluka, Mymensingh. Feed B was prepared with the combination of various indigenous ingredients i.e. fishmeal 40%, blood meal 10%, mustard oilcake 30%, rice bran 10%, wheat flower 3.5%, powder milk 1.5%, table salt 0.5%, vit. & mineral premix 3%, casein 0.5% and molasses 1%, maintaining 40% crude protein level. Prior to preparation of Feed B all the dietary ingredients were subjected to proximate analysis and the results are presented in Table 1. All the collected ingredients were ground finely with a mortar and sieved to be passed through 0.5 mm mesh. All the ingredients were mixed thoroughly and adequate amount of water was added in it. Then, the diet was prepared by using pelleting machine (Hobart Mixture Machine Model A 200). The resultant pellets were then sun dried for 2 days and kept in an air tight polyethylene bag in a deep freezer for further use. Feed C was chopped chicken intestine (raw) bought from BAU Co-operative market.

Table 1. Proximate composition of the protein sources (% dry matter basis) used

Ingredients	Composition					
	Dry matter	Protein	Lipid	Ash	Crude fibre	NFE*
Fish meal	90.60	50.47	20.98	21.81	1.24	5.50
Blood meal	95.52	90.02	1.40	6.48	-	2.1
Mustard oil cake	85.55	30.33	13.44	9.73	12.12	34.68
Rice bran	90.44	10.94	17.23	21.81	23.09	26.93
Wheat floor	90.07	17.78	3.9	1.6	1.12	75.60

** Nitrogen free extract (NFE) calculated as*
100- %(moisture + protein + lipid + ash + crude fibre)

All the feeds were analysed for proximate composition using standard method given in AOAC (1980) and the results are presented in Table 2.

Table 2. Proximate composition (% dry matter basis) of experimental feeds

Feeds	Composition					
	Dry matter	Protein	Lipid	Ash	Crude fibre	NFE*
Feed- A	88.33	33.43	8.53	13.49	12.80	31.75
Feed- B	89.70	40.12	10.25	8.30	9.3	32.03
Feed- C	22.71	59.58	17.78	6.79	ND	15.85

** Nitrogen free extract (NFE) calculated as 100- %(moisture +protein + lipid + ash + crude fibre)*
ND = Not determined

Fortnightly temperature and DO were measured by DO meter (YSI, model 58, USA), pH was recorded by pH meter (Jenway, model 3020, UK) and NH_3-N was estimated according to phenol-hypochloric method (Stirling 1985).

Sampling of fish during feeding trial was done fortnightly by using cast net and 40% of total population from each tank were caught and then length and weight of individual fish were measured carefully. The water of the tanks were replenished fortnightly by draining the water of the tanks for removing unused feed and faeces.

The one-way analysis of variance (ANOVA) was used to determine the suitability of different feeds on the growth of fish. This was followed by Duncan's New Multiple Range Test (Duncan 1955) to identify the level of significance of variation among the treatment means. Standard errors (±SE) of treatment means were calculated from the residual mean square in the analysis of variance.

Results

The values of water quality parameters *viz.* water temperature, dissolved oxygen, pH and NH_3-N are presented in Table 3. Water temperature of the experimental tanks was found to vary from 17.5-30^{0}C. The highest temperature was recorded in the treatment II and lowest was recorded with the treatment I. The range of dissolved oxygen values of water was 4.7 - 8.7 mg/l, highest in treatment II and lowest in III. pH of water was recorded around neutral 6.5-7.8. The values of NH_3-N varied from 0.03-0.59 ppm, highest in treatment II and lowest in I.

Table 3. Ranges of water quality parameters in different treatments during the experiment

Parameters/ Treatments	I	II	III
Temperature (^{0}C)	17.8-29.9	18.0-30.0	17.5-29.2
Dissolved oxygen (mg/l)	5.1-7.5	5.7-8.7	4.7-7.8
pH	6.5-7.3	6.7-7.2	6.8-7.8
NH_3-N	0.05-0.52	0.03-0.59	0.04-0.58

The growth performance of *C. gariepinus* in terms of weight, specific growth rate (% per day), feed conversion ratio (FCR), survival rate and total production are shown in Table 4.

Table 4. Growth, survival and production of fish in different treatments during the study period

Parameters/ Treatments	I	II	III	±SE[1]
Initial weight (g)	2.6[a]	2.6[a]	2.5[a]	0.01
Final weight (g)	64.1[b]	65.4[b]	72.1[a]	0.47
Weight gain (g)	61.5[b]	62.8[ab]	69.6[a]	0.17
Specific growth rate (% per day)	2.67[b]	2.69[b]	2.80[a]	0.03
Feed conversion ratio (FCR)	2.5[b]	3.1[ab]	6.4[a]	0.34
Survival rate (%)	88[a]	96[a]	83[a]	5.62
Production (kg/ha/120 days)	4500[a]	5000[a]	4800[a]	3.15

[1]*Standard error of treatment means calculated from the residual means square in the analysis of variance.*
[2]*Figure in the same row having same superscripts are not significantly different (P>0.05).*

The weight gain was significantly (P>0.05) highest (69.60 g) in treatment III and lowest (61.50 g) in treatment I. The specific growth rate (% per day) of fish in different treatments varied between 2.67 and 2.80. Significantly (P<0.05) the highest value was obtained in treatment III and lowest in treatment I. The mean feed conversion ratio (FCR) values in different treatments varied from 2.5 to 6.4 with treatment III producing significantly (P<0.05) the poorest (6.4) FCR. However, significantly better FCR (2.5) was obtained in treatment I followed by treatment II (Table 4). The survival rate of fish did not vary significantly (P>0.05) among the treatments. However, the highest survival rate of fish (96%) was observed in treatment II and the lowest (83%) in treatment III. The highest fish production (5000 kg/ha/120 days) was obtained in treatment II followed by treatment III & I respectively. However, there was no significant difference (P>0.05) in total fish production among the treatments.

Discussion

African catfish can tolerate temperatures as low as 6°C and as high as 50°C (Babiker 1984). During the period of investigation, water temperature varied from 17.5-30°C. Mollah (1984) found highest growth of *C. geriepinus* at the temperature of 28-30°C whereas Henken *et al.* (1986) found best result of *C. gariepinus* at temperature ranges from 24-29°C. The range of water temperature recorded during the study period was quite fluctuating which showed minimum value of 17.5°C in December. The ranges of dissolved oxygen values recorded in the present study were 4.7-8.7 mg/l. Lakshmanan *et al.* (1967) reported the dissolved oxygen content of water ranging from 6.7-8.3 ppm were at satisfactory level of fish production. Dissolved oxygen contents of water in the present investigation were within the productive range (Dewan *et al.* 1991). The ranges of pH values recorded in the present study are more or less similar to that reported by Dewan *et al.* (1991) and Lakshmanan *et al.* (1967). Ammonia-nitrogen (NH_3-N) is toxic for fish and above a certain level in water it can cause mortality in fish. In culture condition lower the value of NH_3-N, the better the quality of water for fish (Alabaster and Lioyd 1980). Chen (1988) suggested to bring down ammonia-nitrogen content in pond water to less

than 1 ppm. In the present study, the NH_3-N content was 0.03-0.59 ppm, which was acceptable for fish culture.

Growth rate of *C. gariepinus* was highest in treatment III receiving chopped chicken intestine (Feed C). The increasing trend of mean weight gain in fish was obtained during first two months of culture period and there was gradual decline in growth increment until harvesting. This decline may be due to decrease in temperature of water. Average weight gain by fish in the present study was higher than that the growth (53 g) recorded by Hecht and Appelbaum (1987) in *C. gariepinus* fed fish meal based diet (40.56% protein) whereas growth of 494.3 g recorded by Tangtrogpairos *et al.* (1988) in 141 days of rearing of *C. gariepinus* was much higher with artificial diet containing 45% protein. The lowest growth performance of fish fed Feed A might be due to the fact that this feed was less acceptable to *C. gariepinus*. Similar result was obtained by Bhadra *et al.* (1996) in *C. gariepinus*. In the present study, the growth of fish increased with the increase of dietary protein level and recorded highest growth with Feed C containing 59.58% protein, which was similar to that reported by Sanaullah *et al.* (1986).

The specific growth rate (% per day) of fish in all treatments was unsatisfactory. As water temperature has direct effect on the growth and metabolism of fish, fish during the culture period of last two months showed minor increment in growth until harvesting. However, the highest SGR (% per day) value was found in treatment III because feed contained 59.58% crude protein level. Unlike this, Bhadra *et al.* (1997) obtained satisfactory SGR value (6.42-7.43) of *C. gariepinus* fingerlings with formulated feed (49% protein).

Feed conversion ratio is a measure of diet efficiency. The more suitable the diet the less feed is required to produce a unit weight gain i.e. lower feed conversion ratio. FCRs of all the treatments ranged from 2.5 to 6.4. The FCR values obtained in treatment III are more or less similar to that reported by Bolock (1973) for *C. lazera* with supplementary feed.

The survival rate of fish fed with different feeds ranged from 83 to 96%, with highest value in treatment II receiving Feed B. The similar survival rate (96%) of *C. gariepinus* was recorded by Polling *et al.* (1988) with supplementary live foods.

The total production of fish obtained in the present study ranged from 4500-5000 kg/ha/120 days. The highest production of fish was obtained in treatment II might be due to the greater survival of fish fed with formulated feed. However, the production obtained in the present study was lower (97,000 kg/ha/yr) than that reported by Viveen *et al.* (1985) in *C. gariepinus* fed with artificial diet (45% protein).

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