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Effects of different supplementary feeds on the growth performance and survival of *Labeo bata* fry

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Abstract

An experiment was conducted with *Labeo bata* fry for 60 days to examine the growth performance and survival in response to three supplementary feeds i.e. wheat bran, maize bran and mixed diet. The length gain, percent length gain, weight gain, percent weight gain and specific growth of the fry were found significantly higher ($p<0.05$) in mixed diet. The highest survival rate (74.38±8.1%) was shown by the mixed diet treated fry which was significantly higher than those of maize bran and wheat bran treated fry respectively. There were no significant differences ($p<0.05$) among the treatments in term of water temperatures, pH and dissolved oxygen (DO). Thus, on the basis of the fry growth performance and survival rate, it could be suggested that the mixed diet of wheat bran and maize bran is suitable for the culture of *L. bata* fry.

Key words: *Labeo bata*, fry, maize bran, wheat bran, growth.

INTRODUCTION

Bangladesh is one of the world's leading fish producing countries. The availability of fish fry is an essential prerequisite for fish culture (Moniruzzaman & Mollah, 2010). Nowadays, due to the degradation of fish habitat and increase in aquatic pollution the natural resources of fish fry are being destroyed. So, hatcheries are now the main sources of fish fry supply. Bangladesh is facing tremendous problem of fry production and rearing due to the lack of technical knowledge and proper management practices. For improved fish culture, it is therefore imperative to know how feeds are related to growth and survival of fry (Moniruzzaman & Mollah, 2010) in laboratory condition.

Labeo bata inhabits rivers, haors, baors, beels, canals and ponds of Bangladesh (Mahfuj *et al*., 2012b). *L. bata* has faster growth rate, higher market value, deliciousness and easy culture system using supplemental feeds making it popular fish to adopt in culture by medium scale fish farmers (Suraiya *et al*., 2009). They eat protozoa, algae, and tiny fishes. Many commercial fish feeds viz. Saudi-Bangla Nursery Feed (Saudi-Bangla Fish Feed Bangladesh Ltd.), Quality Nursery Feed (Quality Fish Feed Bangladesh Ltd.) and Aftab Nursery Feed (Aftab Feed Bangladesh Ltd.) are commonly used for mass

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production of *L. bata* seeds. Among these, Saudi-Bangla nursery feed for carps and catfishes has become popular because of its high protein content (30%) and also fish can take it easily due to its high compactness (Ahammad *et al*., 2009). With the growing demand for fish, the use of aquaculture feed in Bangladesh has grown substantially. It seems that commercial pelleted feeds are beginning to replace farm-made and raw unformulated feeds. At present there are at least 25 commercial fish feed mills in Bangladesh. But the total fish feed pellet production is not sufficient to fulfill the increasing demand for fish feed. Therefore, there are great demands for million tonnes of locally-formulated and processed fish feed pellet in Bangladesh. Nutritionally deficient diets can lead to poor growth and induce disease conditions which ultimately leading to death while adequate and appropriate diets can lead to successful aquaculture (Mollah *et al*., 2009).

Protein is the basic component of animal tissues, and is therefore, an essential nutrient for both maintenance and growth. The requirements for protein in larval fish are greater than in adult fish and the requirement for essential fatty acids are also greater (Mahfuj *et al*., 2012a). Fish farmers of the country are using high protein content artificial feed for the nursery rearing of this species in their nursery ponds which is not cost effective. So, suitable feed for nursery rearing needs to be identified and finally ensured. Therefore, in this study supplementary feeds such as wheat bran, maize bran and mixed diet of wheat bran, maize bran were used to study the growth and survival of *L. bata* in successful aquaculture. This study will be helpful to the hatchery owners, fish culturists and extension workers to run a hatchery effectively as well as to improve the quality fish seed and fry production in a cost effective way.

MATERIALS AND METHODS

Fish collection and conditioning: The experiment was conducted for two months starting from first of April to the end of May 2017 in the laboratory of Fish Hatchery and Research Centre, Jahangirnagar University, Bangladesh. Healthy, mature *L. bata* was collected from Jahangirnagar University campus hatchery pond prior to 4 hours of induced breeding.

Induced breeding: The induced breeding of *L. bata* was carried out as previously described **(**Miah *et al*., 2008; Hossain *et al*., 2007). Briefly, the females were first injected at the rate of 1.0 mg PG/kg body wt. while the second doses were performed at the rate of 5.0 mg PG/kg body wt. after 6 h from the first dose. On the other hand, the males were administered a single dose of 2 mg PG/kg body wt. at the time of second dose of the female. The male and female fishes were kept in a circular tank for natural spawning. After 8 hours the fertilized eggs were collected and the hatchings were reared in a hapa for 7 days.

Preparation of feeds: About two-third water from each aquarium was replaced with deep tube well water at each alternate day. The faecal matter and wastage of food were removed by siphoning. Proper aeration was provided and was stopped during feeding.

The proximate composition of wheat bran, maize bran and mixed diet (50% wheat bran + 50% maize bran) were analyzed following the standard methods given by Association of Official Analytical Chemists (AOAC, 1980). The fish were fed with extruded fish feeds at 3% of the fish body weight.

Experimental design: The experiment was designed as described previously with slight modification (Ahammad *et al.*, 2009; Moniruzzaman & Mollah, 2010 and Mahfuj *et al*., 2012a).

Stocking: The 15 days old fry (average length 3.62±0.9mm and weight 0.008g) were taken in glass aquaria and fed with different artificial feeds to examine the growth performance in response to different diets. The experiment was conducted in nine rectangular glass aquaria (47x26x24cm) each containing 50L of deep tube well water. The experiment was designed with 3 treatments (T_1, T_2 and T_3) each having 2 replications. The fry were released in the aquarium at the density of 4 fry/L of water i.e. 200 fry in each aquarium and reared for 60 days as described previously (Ahammad *et al*., 2009; Moniruzzaman & Mollah, 2010).

Sampling procedure: The fish were sampled at weekly interval to determine the increase in length and weight. Sampling of fish was done early in the morning when the stomach of the fish was almost empty to avoid the biasness of fish weight due to intake of food. Fifteen (15) fry were randomly collected to take length and weight data. Weight was taken by digital analytical balance and length was measured placing the fish on 1mm graph paper

Water quality parameters: During the study period the physico-chemical parameters i.e., temperature, pH, DO and transparency of both fry rearing tank and aquarium were investigated with the help of aqua mate water testing kit (Model WAKQ-1A). All analysis was done in the fish hatchery and research centre in Jahangirnagar University.

Growth parameters: For determining the growth parameters, the following formulae were used as described by Mahfuj *et al*., 2012b.

1) Length gain of fry (mm) = Average final length of fry – average initial length of fry.
2) Weight gain of fry (g) = Average final weight of fry – average initial weight of fry.
3) Percent gain in length= Average final length-average initial length)/ Average initial length × 100
4) Percent gain in weight = (Average final weight-average initial weight)/ Average initial weight × 100
5) Specific Growth Rate (SGR) = $(\ln W_f - \ln W_{i\,x100}) / t$
$\ln W_f$ = the natural logarithm of the final weight, $\ln W_i$ = the natural logarithm of the initial weight, t = time (days) between $\ln W_f$ and $\ln W_i$
6) The survival rate = (No. of fry alive/Total number of stocked) X100

Statistical analysis: All the growth parameters were tested using one-way analysis of variance (ANOVA). Significant results ($p<0.05$) were further tested using Duncan's Multiple Range Test (DMRT) with the aid of the computer software SPSS 17.0 program.

RESULTS AND DISCUSSION

Water Quality Parameters: During the experimental period the measured water quality parameters were given in Table-1. In this experiment, the water temperature was maintained at 28°C, 29°C, 28°C and 32°C in T_1, T_2, T_3 and nursery rearing pond respectively. No significant differences in mean water temperatures were recorded among the treatments ($p>0.05$). The water temperatures recorded during the study period in both experiments were within the suitable range for fish culture (DOF, 2010). Hossain *et al*., (2007) also reported similar temperature ranges during nursery practices of *L. bata*. But, the ranges of pH were 7 in T_1, T_2, T_3 and nursery rearing pond respectively. pH value was not found significant among the treatments throughout the study period. In addition, the dissolved oxygen ranged 5mg/L in T_1, 5mg/L in T_2, 5mg/L in T_3 and 45 mg/L in nursery rearing pond. The average dissolved oxygen was within the normal range as recommended by (DOF, 2010).

Table 1. Mean (±SD) water quality parameters recorded in nursery pond and glass tank aquariums

Parameters	Wheat bran (T_1)	Maize bran (T_2)	Mixed diet (T_3)	Nursery pond	Level of significance
Temperature	28±0.36	29±0.14	28±0.29	32±0.16	NS
pH	7± 0.48	7±0.62	7±0.52	7±0.41	NS
DO (mg/L)	5±0.11	5±0.61	5±0.32	4±0.17	NS

NS indicates non-significant at 0.05% level

Growth performance of *L. bata*: The experiment was conducted for 60 days in order to observe the effects of different supplementary feeds on the growth and survival of the fry of *L. bata*. Proximate composition of feeds were analyzed and given in Table 2. The initial average lengths of the fry were 3.62±0.41, 3.60±0.13 and3.59±0.52 mm for treatments T_1 (wheat bran), T_2 (maize bran) and T_3 (mixed diet) respectively, whereas, the initial weight for treatments T_1, T_2 and T_3 were 0.008±0.11, 0.005±0.51 and 0.006±0.29 g respectively (Table 3).

The highest length gain was found to be 31.81±3.75 mm in treatment T_3 which is significantly ($p < 0.05$) higher than that of T_1 and T_2. Similarly, the highest gain in weights of the fry was 0.504±0.11g in treatment T_3 which is significantly ($p< 0.05$) higher than those of T_1 and T_2 treatments. The highest percent length gain was 886.07±9.1% and percent weight gain was 8400±18.12% as observed in treatment T_3 where the fry were fed with mixed diet (Table 3). At the end of the experiment, the highest specific growth rate and survival rates were found to be 3.2±0.06 and 74.38±8.10% in case of T_3 treatment

which was significantly ($p < 0.05$) higher compared to those in treatment T_1 and T_2 (Table 3). Outcomes of the experiment showed better performance of mixed diet over the treatment performance of wheat bran and maize bran alone in case of *L. bata* fry culture.

Table 2. Proximate composition of feeds (after 60 days) used for rearing of *L. bata* fry

Feeds	Protein (%)	Lipid (%)	Moisture (%)	Others (%)
Wheat bran	19.10	8.97	12.57	59.36
Maize bran	17.34	10.53	11.21	60.92
Mixed diet	22.41	9.71	9.56	58.32

Table 3. Growth performance of *L. bata* fry (after 60 days) exposed to different feeds

Parameters	Wheat bran (T_1)	Maize bran (T_2)	Mixed diet (T_3)
Initial length (mm)	3.62±0.41	3.60±0.13	3.59±0.52
Final length (mm)	23.12±1.05[a]	27.5±1.061[b]	35.4±1.03[c]
Length gain (mm)	19.5±1.25[a]	23.9±2.13[b]	31.81±3.75[c]
Percent length gain	538.67±6.1[a]	663.88±7.2[b]	886.07±9.1[c]
Initial weight (g)	0.008±0.11	0.005±0.51	0.006±0.29
Final weight (g)	0.22±0.03[a]	0.36±0.08[b]	0.51±0.01[c]
Weight gain (g)	0.212±0.04[a]	0.355±0.08[b]	0.504±0.11[c]
Percent weight gain	2650±11.01[a]	7100±14.24[b]	8400±18.12[c]
Specific growth rate	2.3±0.03[a]	3.0±0.01[b]	3.2±0.06[c]
Survival	54.21±6.13[a]	69.12±4.76[b]	74.38±8.10[c]

Values with different superscripts in a row are significantly different (one way ANOVA followed by Duncan test, $p < 0.05$).

Hossain *et al*. (2007) conducted experiment to observe the breeding performance and nursery practices of the threatened indigenous fish species, *Labeo bata* in Jessore, Bangladesh during 1998 to 2002. In this study, they found the highest length (19.37mm), weight (57.67mg) and survivability (63.33%) when used rice bran and mustard oil cake together at rate 30g/day. Similarly, in our study we obtained the highest length, weight and survivability when *L. bata* fry were fed with mixed diet (50% wheat bran + 50% maize bran) for 60 days. In an another study (Selvaraj *et al.*, 1972), *L. boggut* spawn were fed with zooplanktonic food for 10 days and the total length was obtained 16.993mm which was almost similar when rice bran was used (Hossain *et al*., 2007). This suggests that the growth and survival rate of carp hatchlings depend largely on the easy availability of planktonic food organisms in general.

Hecht & Appelbaum (1988) conducted an experiment with the fry and juveniles of *Clarias gariepinus* and found that growth and survival was density dependent and live food was preferred to formulate feed. In this experiment, the stocking density was 30 fry in each aquarium but in our experiment we took 200 fry in each aquarium as described earlier (Ahammad *et al*., 2009; Maniruzzaman & Mollah 2010).

Another study reported that the growth performance and survival of fry and fry of *Clarias macrocephalus* were directly influenced by feeding frequency (Mollah & Tan, 1983). They explained that three times feeding frequency was best for rearing the fry and fry of *Clarias macrocephalus.* In our experiment, we fed the fry two times daily.

Debnath & Brugge (2005) conducted an experiment and found that in early stage of the life cycle of common carp the survival rate was very poor. In their study, pellet feed was used but the survival rate was lower because pellet food deteriorated the water quality much than that of other feeds. The reason might be the poor physiological development of earlier stage. In our experiment, the water quality parameters were within the range of fish culture and mixed diet yielded better growth performances over the treatment performance of wheat bran and maize bran alone.

The water temperatures, pH and dissolved oxygen recorded in this study were within the suitable range for fish culture. The highest length gain, percent length gain, weight gain and percent weight gain of the fry was found in mixed diet (50% wheat bran + 50% maize bran) which was significantly higher than those of wheat bran and maize bran treatments alone. The highest specific growth rate and survival rates were found 3.2±0.06 and 74.38±8.10% in case of fry fed with mixed diet. Therefore, depending on growth performance mixed diet (50% wheat bran + 50% maize bran) for fry rearing of *L. bata* could be recommended. The results of the present study clearly demonstrated that the use of low cost supplemental mixed feed (50% wheat bran + 50% maize bran) has significant role in promoting the growth of *L.bata* fry.

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