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GROWTH PERFORMANCE OF LARVAE PRODUCED FROM VITAMIN E TREATED FEMALE *Clarias batrachus* (LINNAEUS)

M. F. A. Mollah*, A. Roy[1] and M. S. A. Mamun[1]
Department of Fisheries Biology and Genetics, Bangladesh Agricultural University
Mymensingh-2202, Bangladesh

ABSTRACT

An experiment to observe the growth performance of the larvae produced from female *Clarias batrachus* treated with 4 dietary levels of vitamin E viz. 0 mg, 50 mg, 100 mg, and 200 mg /kg feed was conducted for 28 days. After rearing for 3 months females were used for induction of breeding to produce larvae. Same dose of pituitary gland (100 mg PG/kg body weight) was used for all treatments. From the 7th day of hatching, the larvae were reared for another period of 28 days to see growth and survival rate of the larvae produced by the broods maintained under different dietary levels of vitamin E. In case of growth performance (percent length gain, percent weight gain, specific growth rate) and health condition larvae of T_2 (50 mg vitamin E/kg feed) showed significantly better result when compared with those of T_1 and T_3. There was no significant difference in the growth performance between the larvae of T_2 and T_4. Larvae of T_2 although showed higher survival rate but the difference between different treatments was insignificant. The results concluded that 50 mg vitamin E/kg feed is more suitable to increase growth and survival rate of the larvae.

Key words : Vitamin E, Larvae, Growth performance, Survival rate

INTRODUCTION

Our population is increasing geometrically but the resource is not increasing in the same manner. Moreover inland open water capture fisheries is decreasing due to various man-made causes such as over exploitation, unplanned construction of flood protection embankments, irrigation canals, improper use of pesticides, habitat degradation, industrial waste, inorganic fertilizer and natural causes such as siltation, weather change, outbreak of diseases etc. Our per capita annual fish intake is 12 kg but the requirement is 18 kg. This large amount of gap (6 kg fish/person/year) should be fulfilled from our captivity. The immediate probable solution that appears relevant is the expansion of aquaculture (Watson and Blake, 1985).

[1] Department of Fisheries Biology and Genetics, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
* Corresponding *E-mail* :- mollahfa@yahoo.com

In freshwater aquaculture, major culturable fish species of Bangladesh are Indian major carps, Chinese carps, Common carps and Tilapia. Although a number of air-breathing fishes such as shing (*Heteropneustes fossilis*), magur (*C. batrachus*), koi (*Anabas testudineus*) etc. have great commercial significance, little attention has been paid to their culture.

Among them *C. batrachus* is the most widely distributed species in South and South-East Asia. It occurs in fresh and brackishwater of India, Bangladesh, Myanmar, Ceylon and the Malaya Archipelago (Day, 1978). In Bangladesh, *C. batrachus* is commonly known as magur and inhabits in all types of freshwater habitats such as rivers, canals, beels, swamps and ponds. Magur is a popular indigenous air- breathing catfish. Due to many special qualities such as attainment of maturity within the first year of life, ability to spawn in open and confined water, reasonable growth rate, exceptionally high market value it has become a perfect candidate for pond culture. But the culture is not increasing with the expected rapidity due to unavailability of fry.

In our country fry of magur produced in natural water is not sufficient to meet the demand for its culture. Therefore, the production of a large number of fry and fingerlings is a pre-requisite to flourish the culture of this fish. Proper techniques of induced breeding and larvae rearing for production of fry in commercial scale are the most crucial factors in expanding culture practice for the species.

Though substantial amount of research on induced breeding and fry rearing techniques of this species was conducted by several workers (e.g. Alam and Mollah, 1988; Mollah and Alam, 1989; Nurullah *et al.,* 1989; Madhury and Mollah, 1990), and considerable amount of success have been achieved towards production of their fingerlings, yet in true sense sufficient number of stockable sized seed of this species are very seldom available on demand for farming purpose. In order to do so some sophistication in the existing induced breeding and larvae rearing techniques need to be brought.

For the supply of quality seeds in sufficient number the broodfish must be of good quality. So in case of brood management, there should be regular supply of balanced food for their growth and development. In the present work some attempts have been made to focus on the broodstock nutrition of magur for their growth and development as well as the fry produced by them.

During the past three decades, considerable attention has been paid to the effects of vitamin C (ascorbic acid) and E (tocopherol) in broodstock performances, egg quality and fry viability of several fish species (Watanabe and Takashima, 1977; Takeuchi *et. al*., 1981; Dabrowski and Blom, 1994). A previous study (Kanazawa, 1985) found that addition of vitamin E to diets resulted in improved survival of larvae of *Penaeus japonicus*.

The objective of the present work was to observe growth performance of the larvae produced from female *C. batrachus* treated with different dietary levels of vitamin E.

MATERIALS AND METHODS

For this experiment about 150 female *C. batrachus* broods were collected from the Reliance Aqua Farms, Ukilbari, Bailor, Trishal, Mymensingh and conditioned in the cistern for 15 days. Then healthy, strong and equal sized fish were used for the experiment. Eight cisterns were divided into four groups containing 2 cisterns in each group. These four groups corresponded to four experimental treatments. Each cistern was stocked with 10 females. Then four feeds were prepared keeping all the ingredients same except vitamin E. Doses of vitamin E were 0 mg (served as control), 50 mg, 100 mg and 200 mg /kg feed. Fish were reared with these feeds for three months. Then these fish were used to produce larvae through induced breeding method.

Experimental design

This experiment was conducted with 7 days- old larvae of *C. batrachus* for a period of 28 days. The experiment was conducted in 16 bowls located at the Wet laboratory. Each bowl was 21 cm deep having an internal diameter of 32 cm with an effective water holding capacity of 10L. Each bowl was provided with continuous flow of water from porous pipe and outlet facilities. Sixteen bowls were divided into 4 groups. Each group was considered as one treatment e.g. T_1, T_2, T_3, T_4 and each bowl was considered as one replication. Each of four bowls of each treatment (T_1, T_2, T_3, and T_4) was stocked with 100 larvae produced by using the females fed 0 mg, 50 mg, 100 mg, and 200 mg vitamin E/kg feed respectively.

Rearing technique

For the first few days larvae were fed only with chopped tubificid worms. After 10 days both tubificid worms and special diet formulated by Saha *et al*. (1998) were applied alternatively. The larvae were fed twice (08 : 00 and 20 : 00 h) a day upto satiation. When the larvae were seemed satiated the left over feeds were siphoned out after approximately 15 minutes of their provision.

Other management

Special emphasis was given to ensure a 24 hour supply of water from porous pipe for providing continuous aeration to the larvae. The bowls were cleaned twice daily to remove dirt from the bottom and half of the total water was exchanged at morning and evening. During cleaning the bowls, dead fry, if any, was removed and the number was recorded.

Sampling procedure

Ten larvae were randomly selected from each bowl to take the length and weight. Sampling was done at 7 days interval. The weight (mg) was taken in an analytical balance and the length (mm) was measured by placing the larvae on a petridish placed on a 1 mm graph paper. Sampling was done before application of feed to avoid the biasness of weight due to presence of excessive feed.

Parameters used to observe the performance of the larvae

Length gain (mm) = Average final length – average initial length.
Weight gain (mg) = Average final weight – average initial weight.

$$\text{Percent length gain} = \frac{\text{Average final length – average initial length}}{\text{average initial length}} \times 100$$

$$\text{Percent weight gain} = \frac{\text{Average final length – average initial weight}}{\text{average initial weight}} \times 100$$

Specific growth rate (SGR)

$$\text{SGR (\% day)} = \frac{\text{Log}_e\, w_2 - \log_e w_1}{T_2 - T_1} \times 100$$

Where W_2 = Final live body weight (mg) at time T_2 (day)
W_1 = Initial live body weight (mg) at time T_1 (day)

Health condition

$$\text{HC} = \frac{\text{Weight of the larvae (mg)}}{\text{Length of the larvae (mm)}} \times 100$$

Percent survival

$$\text{\% survival} = \frac{\text{No. of larvae alive}}{\text{Total No. of the larvae stocked}} \times 100$$

Survival rate and health condition

After completion of the experiment total number of larvae of each bowl was counted and the percent survival calculated. Weight (mg) of the larvae of each treatment was divided by the length (mm) of the larvae to ascertain the health condition of the larvae.

Statistical analysis

Percent length gain, percent weight gain, specific growth rate, health condition, and survival rate of the larvae were all tested using one-way analysis of variance (ANOVA). Significant results ($P<0.05$) were further tested using Duncan's Multiple Range Test (DMRT) to identify significant difference between means. This statistical analysis was performed with the aid of the computer software SPSS programme.

RESULTS AND DISCUSSION

Growth performance of larvae

The average initial lengths of the larvae were 11.50 ± 0.52 mm, 11.40 ± 0.51 mm, 11.30 ± 0.63 mm and 11.60 ± 0.80 mm respectively in T_1, T_2, T_3 and T_4. The final average lengths of the larvae were 40.01 ± 0.59 mm, 41.56 ± 0.44 mm, 38.92 ± 0.50 mm and 41.50 ± 0.52 mm respectively i.e. final gain in length were 28.51 ± 0.59 mm, 30.06 ± 0.44 mm, 27.75 ± 0.50 mm and 29.90 ± 0.52 mm respectively. The initial weights of the larvae in T_1, T_2, T_3 and T_4

were 13.90 ± 1.96 mg, 14.30 ± 1.58 mg, 13.50 ± 1.17 mg and 14.70 ± 1.70 mg respectively. The average final weights were 549.92 ± 35 mg, 629.75 ± 19.69 mg, 535.49 ± 19.3 mg and 610.51 ± 28.3 mg respectively in T_1, T_2, T_3 and T_4. So the gain in weights of the larvae was 536.10 ± 35 mg, 615.27 ± 19.69 mg, 521.69 ± 19.3 mg and 595.81 ± 28.3 mg respectively in T_1, T_2, T_3 and T_4.

The growth pattern of the larvae under different treatments is shown in Fig. 1a for length gain and in Fig. 1b for weight gain.

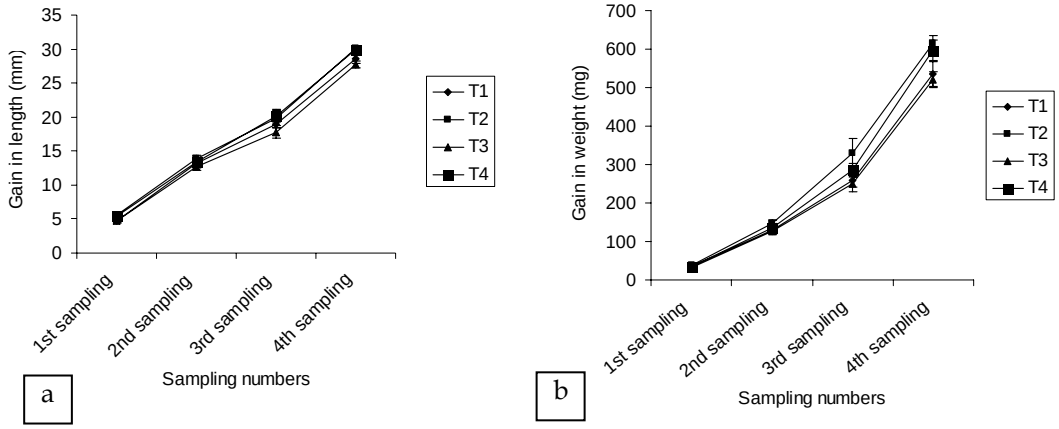

Fig. 1. Comparison of gain in length (a) and weight (b) of larvae produced from vitamin E treated female *C. batrachus*. Vertical bars = ± SD

The growth parameters i.e. percent length gain, percent weight gain, specific growth rate (%) are presented in Fig. 2a, 2b and 2c respectively. The highest percent length gain, percent weight gain, specific growth rate were found to be 264.62 ± 3.97, 4304.71 ± 141.58 and 13.50 ± 0.12 respectively in T_2.

The physico-chemical parameters of the rearing bowls used during the larvae experiment were within the suitable range (Table 1).

The ANOVA result indicated that there was a significant difference in mean percent length gain ($P<0.01$), mean percent weight gain ($P<0.05$) and specific growth rate ($P<0.05$) among the different treatments. DMRT showed that percent length gain of larvae of T_2 and T_4 were significantly different from those of T_1 and T_3. DMRT also showed that there was no significant ($P<0.05$) difference between T_2 and T_4. T_1 and T_3 were also not significantly different. Larvae of T_2 showed the best result for percent length gain and poorest result was shown by the larvae of T_3. The larvae of T_2 showed significantly ($P<0.05$) higher percent weight gain compared to those of T_1 and T_3. The best result was performed by the larvae of T_2 and poorest result was shown by the larvae of T_1. In case of specific growth rate (SGR) DMRT showed the similar result to that of percent weight gain. Here larvae of T_2 showed the best result followed by T_4, T_3 and T_1.

Table 1. Physico-chemical parameters of the larvae rearing bowls during the experimental period

Sampling No.	Parameters	T_1	T_2	T_3	T_4
Initial	Temperature (°C)	28.5 ± 0.47	28.4 ± 0.42	28.2 ± 0.45	28.4 ± 0.37
	pH	7.1 ± 0.17	7.3 ± 0.18	7.2 ± 0.19	7.1 ± 0.28
	Dissolved oxygen (DO) (mg/l)	5.8 ± 0.26	6.0 ± 0.08	5.9 ± 0.09	5.9 ± 0.16
1st	Temperature (°C)	27.6 ± 0.23	27.5 ± 0.41	27.7 ± 0.28	27.7 ± 0.35
	pH	7.1 ± 0.20	7.2 ± 0.21	7.2 ± 0.23	7.1 ± 0.31
	Dissolved oxygen (DO) (mg/l)	5.9 ± 13	5.9 ± 0.22	5.8 ± 0.16	6.0 ± 0.21
2nd	Temperature (°C)	28.1 ± 0.27	27.9 ± 0.24	28.1 ± 0.38	27.8 ± 0.23
	pH	6.9 ± 0.45	7.1 ± 0.17	7.1 ± 0.31	7.1 ± 0.26
	Dissolved oxygen (DO) (mg/l)	5.9 ± 0.28	6.1 ± 0.18	5.9 ± 0.23	5.8 ± 0.25
3rd	Temperature (°C)	27.9 ± 0.22	28.0 ± 0.34	27.9 ± 0.13	28.0 ± 0.38
	pH	7.1 ± 0.21	7.1 ± 0.21	7.0 ± 0.21	7.12 ± 0.22
	Dissolved oxygen (DO) (mg/l)	5.8 ± 0.21	5.7 ± 0.24	5.7 ± 0.14	5.8 ± 0.22
4th	Temperature (°C)	27.8 ± 0.22	27.7 ± 0.31	27.9 ± 0.23	27.8 ± 0.23
	pH	7.1 ± .23	7.1 ± 0.28	7.1 ± 0.30	7.12 ± 0.26
	Dissolved oxygen (DO) (mg/l)	5.6 ± 0.20	5.6 ± 0.29	5.5 ± 0.21	5.6 ± 0.26

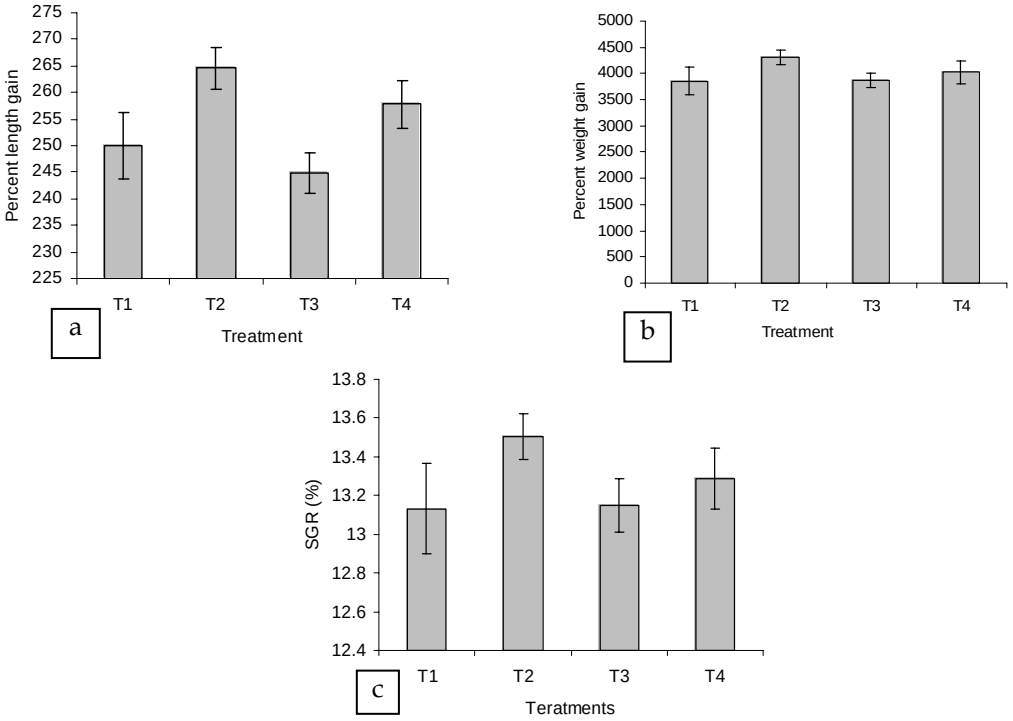

Fig. 2. Comparison of the percent length gain (a) percent weight gain (b) specific growth rate (c) of *C. batrachus* larvae during 28 days experimental period, produced from the broods reared under different dietary levels of vitamin E. Vertical bars = ± SD. Columns marked with the different letter are significantly different

Health condition

Health condition of the larvae of *C. batrachus* was 13.73 ± 0.77 mg/mm, 15.18 ± 0.36 mg/mm, 13.70 ± 0.53 mg/mm and 14.68 ± 0.53 mg/mm respectively in T_1, T_2, T_3 and T_4 (Fig. 3). ANOVA test for health condition indicated that there was a significant ($P<0.01$) difference between the different treatments. DMRT showed that T_2 and T_4 were significantly ($P<0.05$) different from those of T_1 and T_3. There was no significant difference between T_2 and T_4. T_1 and T_3 were also not significantly different. The best result was performed by the larvae of T_2 followed by T_4, T_3 and T_1.

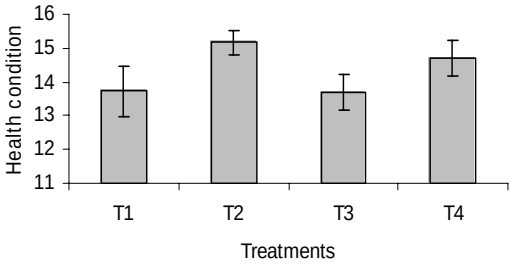

Fig. 3. Comparison of the health condition of *C. batrachus* larvae during 28 days experimental period, produced from the broods reared under different dietary levels of vitamin E. Vertical bars = ± SD. Columns marked with the different letter are significantly different

Survival rate

The survival rate was found to be 37.50 ± 11.61, 51.25 ± 8.99, 44.50 ± 10.46 and 45.0 ± 12.03 respectively in T_1, T_2, T_3 and T_4 after 28 days of experimental period (Fig. 4a). ANOVA test showed that there was no significant difference in the survival rate among the treatments. The best result was performed by the larvae of T_2 and the worst result was exhibited by the larvae of T_1. Pattern of mortality with the progress of experimental period is presented in Fig. 4b.

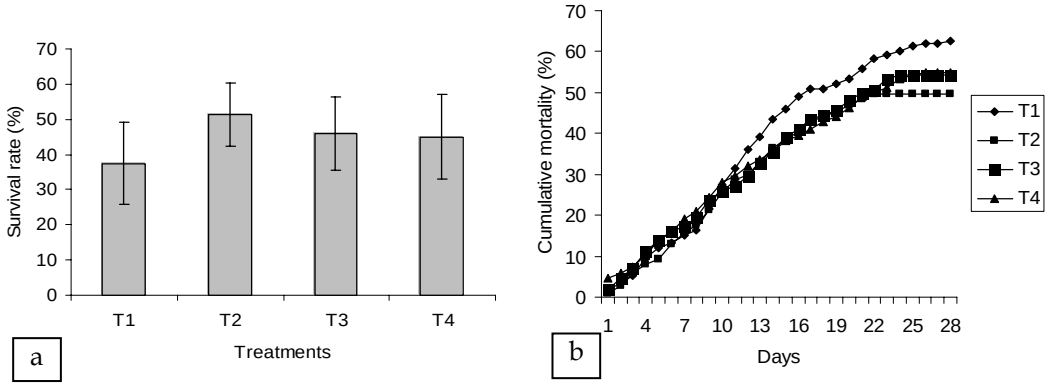

Fig. 4. Comparison of the survival rate (a) and cumulative mortality pattern (b) of *C. batrachus* larvae during 28 days experimental period, produced from the broods reared under different dietary levels of vitamin E. Vertical bars = ± SD

In the present experiment growth rate of the larvae produced by vitamin E treated female *C. batrachus* was observed. Larvae obtained from the females treated with 50 mg vitamin E/kg feed showed significantly higher percent length gain, percent weight gain, specific growth rate and better health condition when compared with those obtained from females treated with 0 mg and 100 mg vitamin E/kg feed. However these growth parameters were not significantly different between the larvae obtained from the females treated with 50 mg and 200 mg vitamin E/kg feed. King (1985) advocated that the use of vitamin E in the diet of rainbow trout had a significant effect on the final levels of alpha-tocopherol in eggs than fish deprived vitamin E. During egg development alpha-tocopherol slowly but efficiently transferred from the yolk to the developing embryo and the mortalities during egg development was inversely related to alpha-tocopherol content of the eggs.

In case of survival rate of the larvae, though there was no significant difference among the different treatment but the larvae of vitamin E treated females showed better survival rate compared to control and the larvae produced from 50 mg vitamin E/kg feed treated females showed highest survival rate. Takeuchi *et al.* (1981) conducted an experiment on the broodfish of 'ayu' *Plecoglossus altivelis,* and observed better hatchability and survival of larvae obtained from females treated with 3.4 mg vitamin E/100 g of diet which supports our result.

Stocking density is recognized as an important factor which directly affects the growth, survival and production of fish (Backiel and Le Cren, 1978). Generally higher stocking density results in the reduction of growth and survival and increases food conversion ratio (FCR), together with severe competition for food and space (Powell, 1972). During the present larvae rearing experiment 10 larvae/L was stocked to ensure the better environment. This was choosen because Mollah (1991) after a detailed study on stocking density of larvae of *C. batrachus* recommended the density of 12 larvae/L to obtain better growth and survival.

Collins (1973) reported that temperature and food also played a significant role in the survival and growth of catfish. In our larval rearing system temperature, dissolved oxygen and pH were within the suitable range.

Tubificid worms and formulated diet were used for larvae rearing of *C. batrachus* because Yasmin *et al.* (1998) found Tubificid worms as the best diet for larval rearing of *C. batrachus*. On the other hand Saha *et al.* (1998) observed that *C. batrachus* larvae can be successfully reared by the formulated diet, produced by them. Tubificid worms had also been reported as the most suitable live feed for some other indigenous and exotic catfishes of similar nature (Haque and Barua, 1989; Mollah *et al.*, 1998).

Feeds were applied two times daily. This feeding frequency was chosen because Mollah and Nurullah (1988) after detailed study concluded that feeding frequency of two times/day was suitable for rearing of *C. batrachus* larvae from economic and management view point.

All possible care and precautions were taken in selecting the stocking density, feed type and feeding frequency during the present larvae rearing experiment and as such the result obtained can only be attributed to the effect of vitamin E fed to the broods.

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