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GROWTH PERFORMANCE AND SURVIVAL OF LARVAE OF *Ompok pabda* PRODUCED FROM VITAMIN E TREATED FEMALE BROODFISH

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ABSTRACT

An experiment was conducted to observe growth performance and survival of the larvae produced from the brood fish of *Ompok pabda* treated with 4 dietary levels of vitamin E for 90 days viz. 0 (served as control), 50, 100 and 150mg vitamin E/kg feed under 4 treatments *i.e.* treatment T_1, T_2, T_3 and T_4. After the feeding trials, the brood fish were induced to breed with equal dose of PG extract *i.e.* 12 and 18mg/kg body weight for male and female respectively and subsequently larvae were produced. The experiment was started with 5 days-old larvae having an average weight and length of 21.4 ± 8.6 mg and 13.8 ± 2.49 mm respectively in 16 bowls of 10*l* capacity divided into 4 treatments corresponding to the broods fish having 3 replications each with 100 larvae in each bowl *i.e.* 10 larvae per liter. After rearing for 28 days with live-food tubificid worms the highest growth rate in terms of weight (609.13 ± 15.20 mg) and length (86.70 ± 1.84 mm), gain in weight (587.78 ± 15.27 mg) and length (72.98 ± 1.81 mm), specific growth rate (30.36 ± 0.12%), health condition (16.63 ± 0.69 mg/mm) and survival (83.25 ± 2.87) were showed by the larvae produced from brood fish fed with 100 mg vitamin E/kg feed (treatment T_3) while poorest was observed by the larvae produced from brood fish fed 150 mg vitamin E/kg feed. The results imply that inclusion of 100mg vitamin E/kg feed in the diet of *O. pabda* brood fish is best for enhancing growth and survival of larvae indicating that vitamin E has a positive impact. The results also suggest that inclusion of higher level of vitamin E in the diet exerts an antagonistic effect on the produced larvae.

Key words : Vitamin E, *Ompok pabda*, Larvae, Growth rate, Survival

INTRODUCTION

Among many indigenous fishes of Bangladesh, *O. pabda* locally known as pabda, a small freshwater catfish belonging to the family Siluridae of the order Siluriformes (Siddiqua *et al.,* 2000) is a highly priced and one of the most sought after fishes. It can thrive in all types of freshwater habitats, especially in rivers, canals, beels, swamps, floodplains and ponds. It is also geographically distributed in India, Pakistan, Afghanistan and Myanmar (Mukhopadhyay and Ghosh, 2007). Its total production from different water bodies of Bangladesh is only 150mt (FRSS, 2009). Its production can be increased through culture

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practice but sufficient number of fry and fingerlings of this catfish is, however, quite difficult to obtain from natural waters for stocking in the ponds. Added to this, the fry and juveniles of this species exhibit cannibalistic tendencies (Parameswaran *et al.,* 1971) which creates management problem.

In spite of many advantages, very few attempts have been made to popularize its commercial culture and mass production of fry and fingerlings stands as one of the major impediments towards its aquaculture. Fry production and survival can be enhanced by feeding the broodstock with supplemental diets (Santiago *et al.,* 1991). Vitamins are likewise needed for proper reproduction in fish; this has been documented for vitamin A, E and C (Sandnes *et al*., 1984; Watanabe, 1985; Soliman *et al.,* 1986; Lie and Mangor-Jensen, 1993; NRC, 1993). Dietary additives e.g. vitamin E have been found to have positive effects in the growth and reproduction of fishes (Gaylord *et al*., 1998; McDowell, 1989). A dietary requirement of vitamin E has been demonstrated in a number of fishes including salmon (Woodall *et al*., 1964), channel catfish (Wilson *et al.,* 1984), bass (Kocabas and Gatlin, 1999), carp (Takeuchi *et al*., 1993), tilapia (Shiau and Shiau, 2001) and shing (Roy and Mollah, 2009). As a fat-soluble vitamin, it is the most effective chain-breaking, lipid-soluble antioxidant in biological membranes, where it contributes to membrane stability. A major function of vitamin E is to prevent peroxidation of polyunsaturated fatty acids of phospholipid and cholesterol in cellular and subcellular membranes. Aquatic animals have high levels of unsaturated fatty acids to maintain cell membrane fluidity especially at low temperatures; it is assumed that vitamin E plays an important role in this context (Blazer, 1992).

The importance of vitamin E in fish reproduction has been reported by many researchers (Watanabe *et al*., 1970; Hamre and Lie, 1995; Halver, 2002; Paul *et al*., 2004; Mollah *et al.,* 2003; and Roy and Mollah, 2009). Vitamin E caused higher gonadosomatic index, larger ova, and more eggs than a control in a study on the effect of vitamin E on the gonad maturity of freshwater fish (*Cyprinus carpio*) (Gupta *et al*., 1987). In addition, complete spawning occurred in fish fed a diet containing vitamin E, but only partial spawning occurred in the fish fed diets without vitamin E. In a different study, Sutjaritvongsanon (1987) found better gonad development and spawning for goldfish (*Carassius auratus*) fed with added vitamin E. Therefore, fry production and its survival can be enhanced by feeding the brood stock with vitamin E enriched diets (Santiago *et al.,* 1991). Taking into account the above realities the present research was undertaken to study the growth and survival of the larvae produced from *O. pabda* broodfish treated with different dietary levels of vitamin E.

MATERIALS AND METHODS

The research work was conducted in the 16 bowls divided into four treatments in Wet Laboratory, Faculty of Fisheries, Bangladesh Agricultural University (BAU), Mymensingh. Before that the rearing and breeding of brood fish were done in the cisterns

of the backyard hatchery, the mini hatchery cum breeding complex, located at the Southern side of the Faculty of Fisheries.

A total of 84 healthy, strong, and similar sized female fish collected from wild were selected for rearing for the research work. There were four treatments including the control (treatment T_1, T_2, T_3 and T_4) each with 3 replications. The female broods of treatment T_1 served as control (i.e. fed vitamin E free diet) while those of treatment T_2, T_3 and T_4 were fed with a feed having 50, 100 and 150mg vitamin E/kg feed respectively. The feed ingredients included fish meal, soybean meal, mustard oil cake, rice bran, wheat bran, vitamin mineral premix and vitamin E in the form of α-tocopherol acitate, marketed as *E-vet* powder manufactured by the *ACME* Laboratories Ltd. The experimental feeds were administered directly into the corresponding cisterns twice daily *ad libitum*. Having rearing for 90 days with the experimental diets, a total of 36 broodfish from four treatments were randomly selected for induced breeding using PG extract at a dose of 12 and 18mg/kg body weight of male and female respectively. After injecting PG extract, both females and males were kept together treatment wise in the hapa set in a pond for spawning. Continuous water flow was maintained in the hapa with porous PVC pipes for aeration. When the breeding was completed the fertilized eggs were removed from the hapas and placed in separate trays (101.6 × 40.6 × 12.7 cm^3) treatment wise for incubation. The trays were previously filled with filtered pond water to reduce the temperature difference and environmental shock. Gentle shower was maintained through porous PVC pipes for aeration of eggs. After hatching the spawn were reared with cleaned and chopped tubificid worms for 5 days before the larvae rearing experiment could be started.

The larvae rearing experiment was started with 5 days old larvae and continued for 28 days. To study the performance of the larvae produced from female broods fed with different dietary levels of vitamin E, they were reared in 16 bowls of 10*l* capacity divided into 4 treatments e.g. T_1, T_2, T_3 and T_4 having 3 replications each with 100 larvae in each bowl having an average weight and length of 21.4 ± 8.6 mg and 13.8 ± 2.49 mm respectively *i.e.* 10 larvae per liter.

The larvae stocked under different treatments were fed with chopped tubificid worms twice daily (0900 and 2100h) up to satiation. 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 immediately and the number was recorded. During sampling at 7 day interval, ten larvae were randomly selected from each bowl to take the length and weight. Sampling was done before the application of feed to avoid the biasness of weight due to presence of excessive feed.

After the completion of the experiment total number of larvae of each bowl was counted and the percent survival and health condition of larvae was calculated using the stated formulae.

The temperature, dissolved oxygen (DO) and pH of water in each bowl under each treatment were recorded daily. Temperature was recorded by using a celsius thermometer, DO was measured by a digital DO meter (multi 340i/set, Germany) and pH was measured by a portable digital pH meter (MICRO-TEMP, pH 500).

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

RESULTS AND DISCUSSION

The initial weights of the larvae stocked under different treatments *i.e.* T_1, T_2, T_3 and T_4 were 21.35 ± 0.06mg, 21.40 ± 0.08mg, 21.35 ± 0.13mg and 21.40 ± 0.08mg respectively while the average final weights after 28 days were found to be 419.48 ± 12.65mg, 475.55 ± 8.62mg, 609.13 ± 15.20mg and 316.75 ± 17.19mg in the respective treatments (Table 1). The weight gain trend (Fig. 1) of the larvae of different treatments shows that the highest gain in weights of the larvae was 587.78 ± 15.27mg in treatment T_3 followed by 454.15 ± 8.60 mg in treatment T_2, 398.13 ± 12.62mg in treatment T_1 and 295.35 ± 17.21 mg in treatment T_4. The highest specific growth rate (%SGR) was also observed to be 30.36 ± 0.12 in treatment T_3 followed by treatment T_2 (29.13 ± 0.09), treatment T_1 (28.51 ± 0.15) and treatment T_4 (27.08 ± 0.28). The weight gain, percent weight gain and specific growth rate (% SGR) were significantly ($P<0.05$) higher in treatment T_3 compared to those of treatment T_1, T_2 and T_4.

Table 1. Weight gain, percent weight gain and specific growth rate (% SGR) of larvae of *O. pabda* during 21 days experiment under different doses of vitamin E (Mean weight, mg ± SD)

Treatment	Initial weight (mg)	Final weight (mg)	weight gain (mg)	weight gain%	SGR (%)
T_1	21.35 ± 0.06	419.48 ± 12.65	398.13 ± 12.62^{c}	1864.70 ± 56.82^{c}	28.51 ± 0.15^{c}
T_2	21.40 ± 0.08	475.55 ± 8.62	454.15 ± 8.60^{b}	2122.18 ± 38.48^{b}	29.13 ± 0.09^{b}
T_3	21.35 ± 0.13	609.13 ± 15.20	587.78 ± 15.27^{a}	2753.30 ± 81.91^{a}	30.36 ± 0.12^{a}
T_4	21.40 ± 0.08	316.75 ± 17.19	295.35 ± 17.21^{d}	1380.23 ± 82.48^{d}	27.08 ± 0.28^{d}

Values in the column with different superscripts are significantly ($P<0.05$) different

On the other hand, the average initial lengths of the fry were 13.75 ± 0.24mm, 13.83 ± 0.10 mm, 13.73 ± 0.10mm and 13.78 ± 0.05mm respectively in treatment T_1, T_2, T_3 and T_4 while the final average lengths of the fry were 55.38 ± 3.91mm, 64.68 ± 2.01mm, 86.70 ± 1.84 mm and 43.18 ± 1.73mm in the respective treatments (Table 2). The highest length gain was found to be 72.98 ± 1.81mm in the fish under treatment T_3 while the lowest was observed

to be 29.40 ± 1.70 in treatment T_4. Statistical analysis showed that both length gain and percent length gain were significantly ($P<0.05$) higher in treatment T_3 compared to those of treatment T_1, T_2 and T_4.

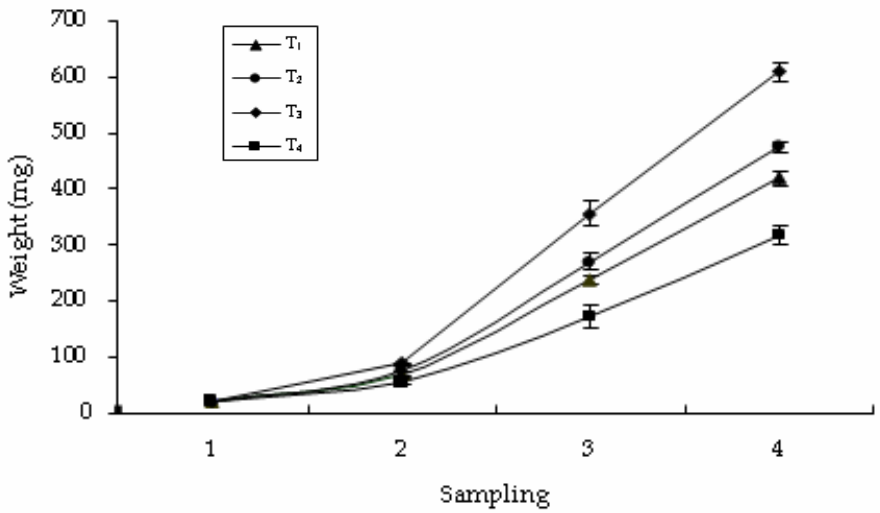

Fig. 1. Weights of larvae of *O. pabda* produced from broodfish reared under different dietary levels of vitamin E. Sampling was done at 7 days interval (Vertical bars = ± SD)

Table 2. Length gain, percent length gain, health condition and survival (%) of larvae of *O. pabda* during 21 days experiment under different doses of vitamin E (Mean weight, mm ± SD)

Treatment	Initial length (mm)	Final length (mm)	length gain (mm)	Length gain%	Health condition (mg/mm)	Survival (%)
T_1	13.75 ± 0.24	55.38 ± 3.91	41.63 ± 3.84	302.70 ± 26.72^c	10.35 ± 1.31^b	71.00 ± 2.16^b
T_2	13.83 ± 0.10	64.68 ± 2.01	50.85 ± 1.95	367.78 ± 12.59^b	11.56 ± 0.84^b	71.75 ± 4.03^b
T_3	13.73 ± 0.10	86.70 ± 1.84	72.98 ± 1.81	531.69 ± 12.54^a	16.63 ± 0.69^a	83.25 ± 2.87^a
T_4	13.78 ± 0.05	43.18 ± 1.73	29.40 ± 1.70	213.41 ± 11.86^d	7.68 ± 0.46^d	58.50 ± 4.80^d

Values in the column with different superscripts are significantly ($P<0.05$) different

The highest health condition and survival rate of the larvae were 16.63 ± 0.69 mg/mm and 83.25 ± 2.87 respectively also found in treatment T_3 which was significantly ($P<0.05$) different from those of other three treatments while the poorest were observed to be 7.68 ± 0.46 mg/mm and 58.50 ± 4.80 respectively in treatment T_4. The Physico-chemical parameters of water in bowls under different treatments i.e. temperature, pH and dissolved oxygen during the experimental period ranged between 27.52 and 28.55°C, 7.05 and 7.25, 5.7 and 6.07 mg/*l* respectively.

The broodfish treated with 100 mg vitamin E/kg feed showed significant difference among means of all treatments in case of length gain, percent length gain, weight gain, percent weight gain, specific growth rate, health condition and survival of larvae when compared with those treated with 0mg, 50mg and 150mg vitamin E/kg of feed. Similar results were observed by Mollah *et al.* (2009) where the larvae of *Clarias batrachus* produced from female broods fed with 100mg vitamin E/kg feed performed better compared to other feeding doses. King *et al.* (1985) observed that the use of vitamin E in the diet of rainbow trout (*Salmo gairdneri*) had a significant effect on the final levels of α-tocopherol in eggs than fish deprived vitamin E. They further added that during egg development, α-tocopherol slowly but efficiently transferred from the yolk to the developing embryo and the mortalities during egg development were inversely related to α-tocopherol content of the eggs. This may be because vitamin E is an essential nutrient for all species of animals (McDowell, 1989). As a fat-soluble vitamin, it supports as an effective chain-breaking, lipid-soluble antioxidant in biological membranes, where it contributes to membrane stability. It protects critical cellular structures against damage from oxygen free radicals and reactive products of lipid peroxidation.

The better performance of larvae produced from vitamin E treated female broods compared to the control may be due to the fact that vitamin E is known to have a profound effect on the immune response of the younger fishes (Lygren *et al.,* 2001; Lygren *et al.,* 2000) which may enable them to grow faster. However, poor performance of the larvae of higher dosed female broods may be related to the activity of protein kinase C (PKC). It is reported that excess amount of vitamin E arrests the somatic growth by inhabiting the function of PKC in vascular smooth muscle cells leading to growth arrest (Boscoboinic *et al.,* 1991).

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 larval rearing 10 larvae/l were stocked to ensure the better environment. This was chosen because Mollah (1991) after a detailed study on stocking density of larvae of *Clarias batrachus* recommended the density of 12 larvae/l to obtain better growth and survival. Tubificid worms were used for larval rearing of *O. pabda* because Yasmin *et al.* (1998) found Tubificid worms as the best diet for larval rearing of catfish. Tubificid worms had also been reported as the most suitable live food for some other indigenous and exotic catfishes of similar nature (Haque and Barua, 1989; Mollah *et al.,* 1998).

Dietary vitamin E treatment of broodfish of *O. pabda* has been found to have positive impact on the produced larvae in terms of growth and survival. However, it seems important to conduct experiments of similar nature to investigate the quantitative retention of vitamin E in the larvae and its (vitamin E) mode of action on gonad to understand the function and characterization. The success obtained through this work can serve as an important base for future research on this topic.

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