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Effect of Dietary Vitamin E (α-Tocopheryl) Supplementation on Growth Performance and Survival Rate of Texas Cichlid (*Herichthys cyanoguttatus*) Larvae

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Abstract: The effects of three dietary levels of vitamin E (T1: 100, T2:200 and T3:400 mg vitamin E/kg) with control group (without vitamin E), on growth performance and survival rate were studied in Texas Cichlid (*Herichthys cyanoguttatus*) larvae (average weight 1.5±0.34g) via supplementation with Biomar. Diets were fed to Texas cichlid larvae in triplicate aquaria for 60 days. The results clearly showed that vitamin E had significant effect on body weight increase (BWI), specific growth rate (SGR) and food conversation ratio (FCR) on Texas cichlid larvae with increasing levels of vitamin E and the best result in growth performance was obtained in T2: 200 mg vitamin E/kg ($P<0.05$). Also vitamin E had positive effect on fish survival rate, but there were not any significant differences among treatments ($p>0.05$).

Key words: Texas Cichlid Larvae · *Herichthys cyanoguttatus* · Vitamin E · Growth Performance and Survival Rate

INTRODUCTION

The Texas Cichlid (*Herichthys cyanoguttatus*), also known as the Rio Grande Perch and the Rio Grande Cichlid, is an iridescent golden color with pearl highlights and white dots on its body and fins. There are several black spots at the base of the caudal fin and along the middle, rear half of the body. The juveniles have an iridescent pearl-gray body with white dots on the body and fins. There is a black dot at the base of the caudal fin and one in the center of the body. It is also leaner in size.

The Texas cichlid is one of the most popular aquarium species, as this species commands a higher price compared with most freshwater food species and other ornamental fish. In spite of the importance of Texas cichlid in ornamental fish culture, there has been neither research nor development of cost- effective feed for the intensive culture of this species [1].

Nutrient supplementation in fish diets has been an economically promising method for improving the performance of different intensive fish production systems.

Vitamin E is one of the most important nutrients influencing the fish immune system and supplying of vitamin E can reduce mortality and improve fish performance, while increasing specific and nonspecific immune responses [2-5]. Vitamin E is a lipid-soluble vitamin that comprises eight naturally occurring tocopherols. Among them, d-α- tocopherol has the highest biopotency. Vitamin E functions as a metabolic antioxidant, preventing the oxidation of biological membranes and lipoproteins. It has been demonstrated to be an essential dietary nutrient for all fish studied. Many studies reported its optimum requirement in diets for many fish species. Several deficiency symptoms, such as erythrocyte fragility, anemia, muscular dystrophy and depigmentation have been induced in fish by vitamin E deficient diets, NRC [6]. In addition, vitamin E is potent antioxidant that offers protection against oxidative damage to various fish tissues [7], enhances resistance of red blood cell membranes [8] and protects leukocyte functions [9]. Addition of vitamin E to rancid diets significantly improved growth performance of the fish [10].

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Many authors have studied the effect of vitamin E on growth and immune response in various organisms, but studies related to effects of vitamin E on growth and survival in Texas Cichlid are scanty. Hence, the present study was undertaken to study the effect of different levels of dietary vitamin E on growth performance and survival rate of Texas Cichlid (*Herichthys cyanoguttatus*) larvae.

MATERIALS AND METHODS

Experimental Design: One hundred and eighty Texas Cichlid larvae, with 1.5±0.34g initial mean body weight were obtained from a private institute of ornamental fish hatchery in Gorgan, Iran. Fish larvae were randomly distributed in 12 groups of 15 fish each in 15 L glass aquaria. Fish were weighed individually at the beginning and at the end of the experimental period using a digital scale with precision of 0.01 g. The natural light cycle was close to 12h light/12h dark. The water temperature was kept at 26±2°C. The water was permanently aerated. Before starting the experiments water was dechlorinated. Once a week pH was checked and total hardness in water (°dH) was examined titrimetric ally. Oxygen content was recorded weekly.

Experimental Diet: We used a diet which was supplemented with 100, 200 and 400 mg vitamin E/kg (treatments 1, 2 and 3 respectively). The control treatment was fed without supplemented Biomar. Three levels of Biomar experimental diets (54 percent protein and 18 percent lipid) were prepared by adding vitamin E (100, 200 and 400 mg/kg) at the basal diet (Biomar) and the Texas Cichlid larvae in experimental treatments were fed of the three levels of vitamin E with 4 percent of their total weight daily, three times a day during 60 days.

Feed Analysis: Nutrient compositions of experimental diets are given in Table 1. Proximate composition of diets was carried out using the Association of Analytical Chemists [11] methods. Protein was determined by measuring nitrogen (N×6.25) using the Kjeldahl method; Crude fat was determined using petroleum ether (40-60 Bp) extraction method with Soxhlet apparatus and ash by combustion at 550°C.

Calculations of Some Growth Indices: Growth parameters were calculated as follows: body weight increased (BWI) = final body weight (g)-initial body weight (g). Specific growth rate (SGR) (% BW day^{-1}) = (Ln final body weight (g)-Ln initial weight (g))/ (experimental period) × 100. Daily growth rate (DGR) = (final body weight (g)-initial weight (g)) × (100)/ (experimental period × initial weight (g)). Survival (%) = (Total live fish after production / initial fish throughout experimental period) × 100 where it is the day of experiment.

Table 1: Nutrient composition of experimental diets (%)

Ingredients	%
Protein	54
Lipid	18
Fiber	1.5
Ash	10
Vitamin	2

Statistical Analysis: The data obtained from the trial were subjected to one-way analysis of variance (ANOVA) (using SPSS 19.0 program) to test for effects of dietary treatments. When ANOVA identified significant difference among groups, multiple comparison tests among means were performed using Duncan's new multiple range test. For each comparison, statistically significant differences were determined by setting the aggregate type I error at 5% ($P<0.05$).

RESULTS AND DISCUSSION

Results (Figures 1, 2 and Table 2) show that body weight increased (BWI) and specific growth rate (SGR) of Texas cichlid larvae were significantly ($P<0.05$) improved by Biomar supplementation by vitamin E. The final body weight and Specific growth rate (SGR) generally were improved by increasing the vitamin E during the time (Figure 1 and 2). The highest BWI was recorded in T3 treatment (200 mg/kg vitamin E) (1.7±0.34 g) followed by the T2 (0.94±0.21g) and T1 (0.62±0.17g), also the lowest was obtained in control group. There were significantly differences in BWI among T1, T2, T3 and control group ($P<0.05$).

Our results obviously showed that vitamin E had positive effects on the growth factors of Texas cichlid larvae. The growth and survival rate of Texas cichlid larvae are presented in Table 2. The SGR of Texas cichlid larvae fed with vitamin E diets also showed similar trend to increase BWI in T3 (1.26±0.19g) followed by T2 (0.81±0.5g) and T1 (0.57±0.02g) and the lowest was

Table 2: Growth parameters and survival rate of Texas cichlid larvae (*Herichthys cyanoguttatus*) in experimental treatments (trial 1-3) and control

Growth Indices	Control Unsupplemented Vit. E	T1 100mg/kg Vit. E	T2 200mg/kg Vit. E	T3 400mg/kg Vit. E
Initial weight (g)	1.5±0.34	1.5±0.34	1.5±0.34	1.5±0.34
Final body weight (g)	1.75±0.01^{d}	2.12±0.1^{c}	2.44±0.06^{b}	3.2±0.06^{a}
Body weight increased (BWI) (g)	0.25±0.07^{d}	0.62±0.17^{c}	0.94±0.21^{b}	1.7±0.34^{a}
Specific growth rate for weight (% BW day^{-1})	0.25±0.03^{d}	0.57±0.02^{c}	0.81±0.5^{b}	1.26±0.19^{a}
Daily growth rate (g)	0.27±0.01^{c}	0.68±0.17^{c}	1.04±0.11^{b}	1.88±0.06^{a}
Survival rate (%)	100±0.0^{a}	100±0.0^{a}	100±0.0^{a}	100±0.0^{a}

Groups with different alphabetic superscripts differ significantly at P<0.05 (ANOVA)

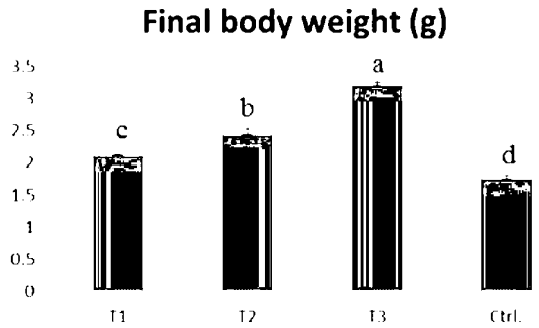

Fig. 1: Final body weight (g) of Texas cichlid larvae placed on different treatments

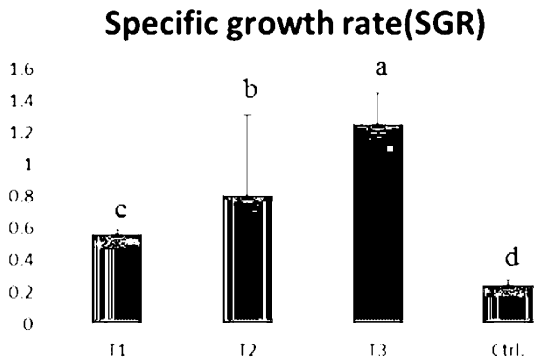

Fig. 2: Specific growth rate (SGR) of Texas cichlid larvae placed on different treatments

recorded in the control group (0.25±0.03g) than they had significantly different to each other (P<0.05). Survival rate in the present experiment was 100% (P>0.05).

Previous investigations showed that vitamin E requirements of fish are affected by dietary lipid levels [12-14]. Naziroglu *et al.* [15] mentioned that vitamin E especially a-tocopherol form, has very effective role on immune system response and it is one the few nutrients for which supplementation with higher than recommended levels enhance certain aspects of immune function in fish.

In the present study, the growth of Texas cichlid larvae improved significantly with increasing supplementation of dietary vitamin E. These results further confirm that Texas cichlid larvae need adequate exogenous vitamin E to maintain normal growth and physiological functions. Growth is a function of both the nutritional quality and the rate of consumption, among other things [16]. In this research trial, a diet containing 200 mg of vitamin E/ kg diet was found to be the more optimal dietary requirement for Texas cichlid larvae than other groups. The diet without vitamin E supplementation decreased the specific growth rate of Texas cichlid larvae in compared to other groups that contain vitamin E and this is in accordance with studies conducted by Mehrad and Sudagar [17] who also observed declining specific growth rate with vitamin E deficient diet for guppy *(Poecilia reticulate)*. A significant difference in survival rate was observed between the treatments containing vitamin E. This result are conform to a study conducted by Mourente *et al.* [18] in gilthead sea bream, they found that addition of vitamin E in diets containing oxidized oil did not improve the survival of sea bream and also are conform to a study conducted by Mehrad and Sudagar [17] on *P. reticulate*.

CONCLUSIONS

The significance of the results herein obtained underlined the importance of diet in the reproductive process, supporting the hypothesis that feed additives can improve fecundity. Considering that the Texas cichlid larvae has been clearly established as a vertebrate model for biomedical research, these results support the potentiality of feed additives such as vitamins, frequently used in the human diet, as a new technology to improve reproduction in all vertebrates, including humans.

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