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Effect of Vitamin E (A-Tocopheryl) on Growth and Reproductive Performance and Survival Rate of Angel Fish (*Pterophyllum scalare*)

Hamed Nekoubin, Mahboube Hosseynzadeh, Mohammad Reza Imanpour, Alireza Asgharimoghadam, Meysam Raki and Salar Montajami

Department of Fishery,
Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran

Abstract: This study was carried out to determine the effects of dietary vitamin E (a-tocopherol) in three levels (T1: 200, T2: 400 and T3:600 mg vitamin E/kg) with control group (0 mg/kg) on growth performance, survival rate and reproductive parameters of angelfish (*Pterophyllum scalare*) via supplementation with Biomar. Diets were fed to angelfish in triplicate aquaria for 60 days. The obtained results clearly showed that vitamin E had significantly difference on body weight increase (BWI), specific growth rate (SGR) and food conversation ratio (FCR) on angelfish with increasing levels of vitamin E and the best result in growth performance was obtained in T3 ($P<0.05$). Increasing levels of vitamin E had positive effects on fecundity parameters but, there were no significant difference among treatments however they were better in T3 ($P>0.05$). Also in this comparison there were no significant differences in survival rate ($P>0.05$).

Key word: Angelfish · *Pterophyllum scalare* · Vitamin E · Growth Performance · Fecundity · Survival Rate

INTRODUCTION

Age-associated change in immune function is well documented in numerous human and animal studies [1,2]. Unregulated immune response contributes to higher morbidity and mortality from infectious, neoplastic and inflammatory diseases in the elderly compared to young subjects [3, 4].

Nutrients like fatty acids, amino acids, minerals and vitamins have clear affects on reproduction as well as growth in fish [5].

Vitamin E is a potent peroxyl radical scavenger and serves as a chain-breaking antioxidant to prevent biological membranes from oxidative damage [6]. Vitamin E is an indispensable nutrient required to maintain flesh quality, immunity, normal resistance of red blood corpuscles to haemolysis, permeability of capillaries and heart muscle [7]. Vitamin E occurs in several naturally occurring forms, with a-tocopherol having the highest vitamin E activity [8]. Vitamin E functions as a lipid soluble antioxidant and protects biological membranes, lipoproteins and lipid stores against oxidation. Its main function is to protect unsaturated fatty acids against free radical-mediated oxidation [9]. A dietary requirement of vitamin E has been demonstrated in a number of fish. Vitamin E was originally considered as a dietary factor of animal nutrition, which has an importance in reproduction. In aquaculture, vitamin E is used for the fortification of feed to improve the growth, resistance to stress and disease as well as for survival of fish and shrimp [10]. As in higher vertebrates, vitamin E deficiency affects reproductive performance, causing immature gonads and lower hatching rate and survival of offspring [11]. The nutritional status of the broodstock can affect offspring quality. The accumulation of essential nutrients such as essential fatty acids and vitamins are dependent on the nutrient reserves in the mother animal and consequently on the dietary input of broodstock in the period preceding gonadogenesis [5 and 12]. Food or vitamin shortages may have caused suspension of vitellogenesis, resorption of oocytes and decreased fecundity in the goldfish, *Carassius auratus* [13].

The objectives of the present study were to determine the dietary vitamin E requirement and its effect on growth performance survival rate and reproductive parameters of angelfish.

Corresponding Author: H. Nekoubin, Department of Fishery, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran.

MATERIALS AND METHODS

Fish and Condition: Angelfish with initial weight 6.5±0.01g was obtained from the Institute of Ornamental Fish Hatchery in Gorgan, Iran. They were kept in glass aquaria (each with a dimension of 30×40×60 cm). This experiment was conducted in a completely randomized design with four treatments (three vitamin E levels and a control) and three replicates per treatment for a total of fifteen juvenile of angelfish. The densities of fish per aquarium were 5 fish. At the end of rearing, adult female and male angelfish fish were divided from each treatment. The animals were kept in 50 L glass tanks under controlled conditions (14 h light: 10 h darkness). During the experiment, the water quality parameters were monitored during the trial and average value for temperature, dissolved oxygen, hydrogen ion concentration (pH) and salinity were 26±2°C, 5.7-7.7 mg L^{-1}, 6.9-7.8 and 0.1 mg L^{-1} respectively.

Experimental Diet: We used a diet which was supplemented with 200, 400 and 600 mg vitamin E/kg (treatment 1, 2 and 3 respectively). three levels of Biomar experimental diets (54% protein and 18% lipid) were prepared by adding vitamin E (200, 400 and 600 mg/kg) at the basal diet (Biomar) and the angelfish in experimental treatments were fed of the three levels of vitamin E with 5 percent body weight for 3 times a day (6.00, 14.00 and 22.00). The control treatment was fed without supplemented Biomar.

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 [14] 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.

Table 1: Nutrient composition of experimental diets (%)

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

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. Reproduction parameters were investigated after 60 days. Breeders after 60 days feeding were spawned during one month. Spawning, hatching and larval survival for each pair of breeders were investigated.

Statistical Analysis: The data obtained from the trial were subjected to one-way analysis of variance (ANOVA) (using SPSS 18.0 programmer) 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

Growth data (Table 2) showed that body weight increased (BWI) and specific growth rate (SGR) of angelfish were significantly (P<0.05) improved by biomar supplementation by vitamin E. The highest BWI was recorded in T3 treatment (600 mg/kg vitamin E) (6.8±0.15g)

Table 2: Growth and reproductive parameters and survival rate of Angelfish (*Pterophyllum scalare*) in experimental treatments (trial 1-3) and control

	Treatments			
Growth Indices	Control Unsupplemen Vitamin E	T1 200 mg/kg Vitamin E	T2 400 mg/kg Vitamin E	T3 600 mg/kg Vitamin E
Initial weight (g)	6.5±0. 01	6.5±0. 01	6.5±0. 01	6.5±0. 01
Final body weight (g)	$10.5±0.2^{d}$	$11.2±0.2^{c}$	$12.1±0.1^{b}$	$13.4±0.15^{a}$
Body weight increased (g)	$4.06±0.21^{d}$	$4.67±0.2^{c}$	$5.6±0.23^{b}$	$6.8±0.15^{a}$
Specific growth rate for weight (% BW day^{-1})	$0.8±0.02^{d}$	$0.91±0.04^{c}$	$1.03±0.05^{b}$	$1.12±0.01^{a}$
Daily growth rate (DGR)	$1.04±0.05^{d}$	$1.19±0.06^{c}$	$1.45±0.08^{b}$	$1.76±0.01^{a}$
Fecundity	$389.44±17.3^{a}$	$398.32±31.1^{a}$	$420.16±18.2^{a}$	$431.14±14.3^{a}$
Hatching (%)	$81.22±4.12^{a}$	$81.89±3.3^{a}$	$82.67±7.8^{a}$	$82.93±7.3^{a}$
Survival rate (%)	$100±0.0^{a}$	$100±0.0^{a}$	$100±0.0^{a}$	$100±0.0^{a}$

Groups with different alphabetic superscripts at the same row differ significantly at p<0.05 (ANOVA)

followed by the T2 (5.6±0.23g) and T1 (4.67±0.2g), also the lowest was obtained in control group. There were significantly differences in BWI among T1, T2, T3 and control group (P<0.05). The results clearly showed that the vitamin E had beneficial effects on the growth parameters of angelfish. The growth and reproductive parameters and survival rate of angelfish are presented in Table 2.

The SGR of angelfish fed vitamin E diets also showed similar trend to increase BWI in T3 (1.12±0.01g) followed by T2 (1.03±0.05g) and T1 (0.91±0.04g) and the lowest was recorded in the control group (0.8±0.02g) than they had significantly different to each other (P<0.05). Survival rate in the present experiment was 100% (P>0.05). The best fecundity and hatching were found in treatment T3 (431.14±14.3 and 82.93±7.3 respectively) but there was no significant difference with other groups (p>0.05).

Adequate vitamin E supplementation in fish diets under intensive rearing is essential for survival and growth performance [15]. The requirement for vitamin E as an essential dietary component in fish has long been recognized and minimum requirements for many fish species have already been established. Naziroglu *et al.* [16] 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. The results from this study showed that growth performance of angelfish fed biomar supplementation by vitamin E was significantly better than control fish, in agreement with the results of Mehrad *et al*. [5] who found that measures of BWI was significantly improved when *Danio rerio* were fed a diet supplemented with vitamin E (1000 mg/kg). Similar result was also obtained by another author for *Carassius auratus* [17]. While some authors [5 and 18] reported that diet supplemented with vitamin E had no significantly different in SGR this findings disagree with our results. Also increased dietary vitamin E levels, had positive effect in reproductive parameters however it was not significant (P>0.05), this finding agree with the Faramaezi [18] Boggio *et al*. [19] and Kiron *et al.* [20] and disagree with James *et al*. [17] and Mehrad [15].

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REFERENCES

1. Chakravarti, B. and G.N. Abraham, 1999. Aging and T-cell-mediated immunity. Mech. Ageing Dev., 108: 183-206.
2. Miller, R.A., 1996. The aging immune system: primer and prospectus. Science, 273: 70-74.
3. Goodwin, J.S., 1995. Decreased immunity and increased morbidity in the elderly. Nutr. Rev., 53: S41-S44.
4. Roberts-Thomson, I.C., S. Whittingham, U. Youngchaiyud and I.R. Mackay, 1974. Ageing, immune response and mortality. Lancet, 2: 368-370.
5. Mehrad, B., H. Jafaryan and M. Mehdi Taati, 2012. Assessment of the effects of dietary vitamin E on growth performance and reproduction of zebrafish, *Danio rerio* (Pisces, Cyprinidae), Journal of Oceanography and Marine Science, 3(1): 1-7.
6. Burton, G.W. and K.U. Ingold, 1989. Vitamin E as an *in vitro* and *in vivo* antioxidant. Ann. N Y Acad. Sci., 570: 7-22.
7. Halver, J.E., 2002. The vitamins. In: J.E. Halver and R.W. Hardy, (Eds.), Fish Nutrition. Academic Press, San Diego, CA, pp: 61-141.
8. NRC (National Research Council), 1993. Nutrient Requirements of Fish. National Academic Press, Washington D.C.
9. Hamre, K., R.K. Berge and O. Lie, 1998. Turnover of a-g-and y-tocopherol and distribution in subcellular and lipoprotein fractions indicate presence of a hepatic tocopherol binding protein in Atlantic salmon (*Salmo salar* L.). Fish Physiol. Biochem., 18: 71-83.
10. Vismara, R., S. Vestri, C. Kusmic, L. Brarsanti and P. Gualtieri, 2003. Natural vitamin enrichment of *Artemia salina* fed freshwater and marine microalgae. J. Appl. Phycol., 15: 75-80.
11. Izquierdo, M.S., H. Ferndez-Palacios and A.G.J. Tacon, 2001. Effect of broodstock nutrition on reproductive performance of fish. Aquaculture, 197: 25-42.
12. Blom, J.H. and K. Dabrowski, 1996. Ascorbic acid metabolism in fish: Is there a maternal effect on the progeny?. Aquaculture, 147: 215-224.
13. Bekker, V.E., 1958. On the influence of environmental conditions on gonad development and spawning intensity in the goldfish (*Carassius auratus* L.). DokI. Akad. Nauk SSSR Biol. Sci. Sect. (Engl. Trans. Ser.), 117: 960-963.

14. A.O.A.C., 2000. Official methods of analysis. Association of official analytical chemist. EUA.
15. Chagas, E.C. and A.L. Val, 2003. Effect of vitamin C on growth performance and reproduction of zebra fish. Pesquisa Brazil, 38: 397-402.
16. Naziroglu, M., U. Ispir and M.E. Yonar, 2003. Effects of vitamin E on immune response in fish. Kafkas Univ. Vet. Fak. Derg., 9(1): 101-106.
17. James, R., I. Vasudhevan and K. Sampath, 2008. Effect of dietary vitamin E on growth, fecundity and leukocyte count in goldfish (*Carassius auratus*). Israeli J. Aquac. Bamidgeh, 60(2): 121-127.
18. Faramarzi, M., 2012. Assessment study about effect of vitamin E (a-Tocopheryl) on feeding performance, survival rate and reproductive performance of angel fish (*Pterophyllum scalare*), World Journal of Fish and Marine Sciences, 4(3): 254-257.
19. Boggio, R.W., J. Hardy, K. Babbitt and E.L. Brannon, 1985. The influence of dietary lipid source and alpha-tocopheryl acetate level on product quality of rainbow trout (*Salmo gairdneri*). Aquaculture, 51: 13-24.
20. Kiron, V., J. Puangkaew, K. Ishizaka, S. Satoh and T. Watanabe, 2004. Antioxidant status and nonspecific immune responses in rainbow trout (*Oncorhynchus mykiss*) fed two levels of vitamin E along with, three lipid sources. Aquaculture, 234: 361-379.