

Original Research Article

Effects of dietary vitamin E supplementation on growth performance, body composition of golden trevally, *Gnathanodon speciosus*

ABSTRACT

This experiment was designed to determine the effect of vitamin C on the golden trevally, *Gnathanodon speciosus*. Three levels of vitamin E (50, 100, and 200 mg kg⁻¹ diet) were supplemented to the basal diet (control diet) and fed to golden trevally for eight weeks (initial weight 7.63 g ± 0.13 (SEM)). The growth performance and protein and lipid content of tissues were evaluated. The presence of vitamin E in a fish's diet resulted in a significant increase in its growth rate (P < 0.05). The survival rate of fish fed diets containing 50 to 200 mg of vitamin E was substantially higher than that of control fish. In addition, protein and lipid levels in the flesh of golden trevally increased significantly as vitamin levels in their diets rose. For optimal growth and survival, it is recommended to supplement the diet of golden trevally with at least 50 mg of vitamin E per kilogramme. In conclusion, supplementing the diet with vitamin E improves growth, survival, and body composition in juveniles of this species.

Keywords: growth performance, vitamin E, body composition golden trevally, *Gnathanodon speciosus*.

1. INTRODUCTION

Vitamin E (VE) is a group of fat-soluble molecules. The most active component in this group was tocopherol. Vitamin E can protect the phospholipids and red blood cells of farmed fish against oxidation, preserving the structural and functional integrity of animal cells [1]. It has been showed that vitamin E supplements promote immune responses, increase survival, and enhance growth performance [1, 2], maintain the flesh quality [3]. Fish are incapable of synthesizing all biologically active forms of vitamin E and rely on exogenous dietary sources for their supply [4]. The vitamin E requirements of several farmed fish have been documented including Atlantic salmon, *Salmo salar* [5], grass carp, *Ctenopharyngodon idellus* [6], cobia, *Rachycentron canadum* [7], which ranged from 6 to 200 mg kg⁻¹ α-tocopherol. A

Comment [s1]: The abstract is not clear. Treatment and repetition too little

deficiency or absence of vitamin E in the diet can result in stunted growth, impaired erythropoiesis, muscular dystrophy, darkened skin, exudative diathesis, skin depigmentation, liver fat degeneration, and even death [1].

The golden trevally (*Gnathanodon speciosus*) inhabits tropical and subtropical environments in the Eastern Pacific, Western Indo-Pacific, Eastern and Western Atlantic Oceans. The golden trevally is both a sustenance fish and an ornamental species. Its natural habitat is the tropical Indo-Pacific region. This species, whose spawning has been effectively induced in Vietnam, is a new candidate for aquaculture. Due to its rapid development, high market value, delectable flavour, and current supply problem, the golden trevally is a crucially important cultivated species in Viet Nam. However, the species faces significant obstacles due to environmental stressors present in aquaculture facilities, such as water pollution, high stocking density, and poor water quality.

Numerous research has investigated the effects of vitamin E on aquatic species, but to the authors' knowledge, no one has yet identified how vitamin E influences golden trevally growth. The appropriate dosage of feed additives is crucial because an inappropriate dosage can have adverse effects [8, 9]. Therefore, the purpose of the present investigation was to determine the optimal range of vitamin E inclusion in diets for golden trevally, *Gnathanodon speciosus*, growth performance, and protein content.

2. MATERIALS AND METHODS

2.1 Experimental fish and culture systems

The golden trevally, *Gnathanodon speciosus*, was purchased from a hatchery in Nha Trang, Vietnam. A total of 300 fish from the same broodstock with a mean initial wet weight of 7.63 g 0.01 (SEM) were randomly stocked in 12 composite tanks. Each is outfitted with a separate recirculation system with a 350 L/min flow rate.

2.2. Experimental diets and husbandry

A base diet (consisting of 39.3% crude protein, 8.71% lipid, and 19.72 GE MJ/kg) was supplemented with vitamin E at three levels (50, 100, and 200 mg kg⁻¹ diet). On the first day,

Comment [s2]: Added new reference. Explain the advantages and disadvantages of vitamin E and what percentage of vitamin E is given the minimum and maximum limits, why did this study use *Gnathanodon speciosus*, and what are the advantages? Adding research references that are in accordance with the parameters studied

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experimental fish were fed 5% of their average body weight in each tank. Thereafter, the amount of feed supplied was monitored and adjusted daily based on the quantity of leftover pellets. The fish were given meals twice a day, at 08:00 and 17:00, for eight weeks.

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2.3 Experimental design

The design of the experiment was to evaluate the growth response and mortality of fish fed an 8-week vitamin E-supplemented diet. The four dietary treatments were divided into three replicate tanks with twenty fish were stocked in each tank using a randomization technique. There were 300 golden trevally (25 fish each tank) stocked in a total of 12 tanks.

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2.4 Data collection and sampling

Fish were weighed and total length was measured individually at beginning and end of the experiment. At the end of the experiment, two fish from each tank (6 animals in each treatment) was randomly sampled and sacrificed for measurement of muscle composition. Fish were starved for 24 h prior to measuring or sampling. All individual fish were weighed, and their total lengths were measured before and after the experiment. At the end of the experiment, two fish from each tank - a total of six fish in each treatment - were randomly selected and sacrificed to be measured for muscle composition. Prior to measuring or sampling, fish were starved for 24 hours.

2.5 Chemical analysis of culture fish

Six fish from each treatment were sampled at the conclusion of the experiment (week 8), and their muscles were preserved at -20 °C for protein and lipid analyses. Crude protein and fat concentrations were determined using standard method, as described by Do-Huu et al. [10].

2.6 Data calculation

Following equations were used to calculate specific growth rate (SGR, % d⁻¹) and survival [11]: $SGR (\% d^{-1}) = 100 \times (\ln W_t - \ln W_o) / \text{days}$; $\text{Survival rate} = 100 \times (N_t) / N_o$, where W_t and W_o were the fish's weights at the end of week 8 and their respective starting weights (in g), respectively. The number of fish at the beginning of the experiment was N_o , and the number at

its conclusion was Nt. Following is how the coefficient of variation (CV, %) was determined: $CV = (100 \times S/M)$, where S represents the standard deviation and M represents the mean fish weight.

Comment [s6]: The parameters of this study are too few. Add more parameters to this research.

2.8 Statistical analysis

The presentation of data is by means of standard error (SEM). The growth performance and body composition data of fish under various feeding treatments were examined using ANOVA and Least Significant Difference (LSD) procedures. If $P < 0.05$, differences were considered significant. To compare survival rates, a non-parametric Kruskal-Wallis test was used. SPSS 18 (IBM, Chicago, IL) was used for all statistical analyses.

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3. RESULTS

3.1 Growth performance of golden trevally fed different levels of vitamin E

The fish were all similar weight (7.63 g + 0.13) at the beginning of the experiment. At the start of the experiment, there was not a significant difference in the average weight of golden trevally across treatments (ANOVA, $P = 0.524$).

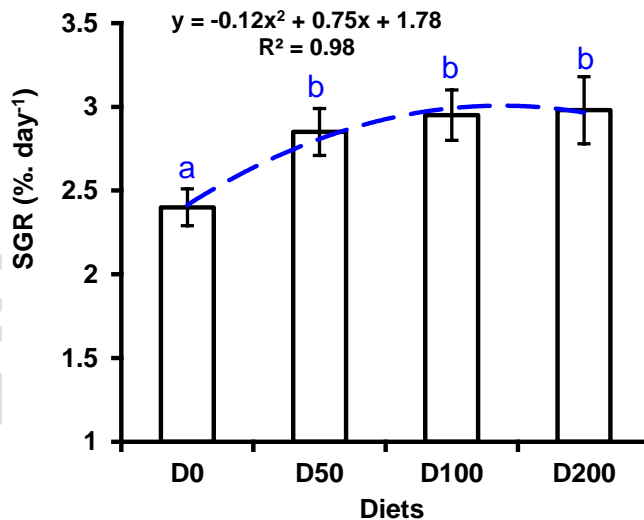


Fig. 1. Average daily growth coefficient (SGR % d⁻¹) (± SEM) of golden trevally fed vitamin E. Significant alterations between treatments are indicated by different letters.

Figure 1 shows the effects of various vitamin E supplementation levels on golden trevally growth. Fish given vitamin E supplementation had a better growth rate at the trial's conclusion (week 8). The specific growth rate (SGR) ranged from 2.4 to 2.98% day⁻¹. Golden trevally receiving 200 mg of vitamin C experienced the greatest growth, followed by growth of fish receiving 100 and 50 mg of vitamin E in their diets, but there was no discernible difference between them ($P = 0.532$). Fish fed the control food grew much less than fish fed the three vitamin concentrations ($P \leq 0.003$).

3.2 . Survival rate of golden trevally

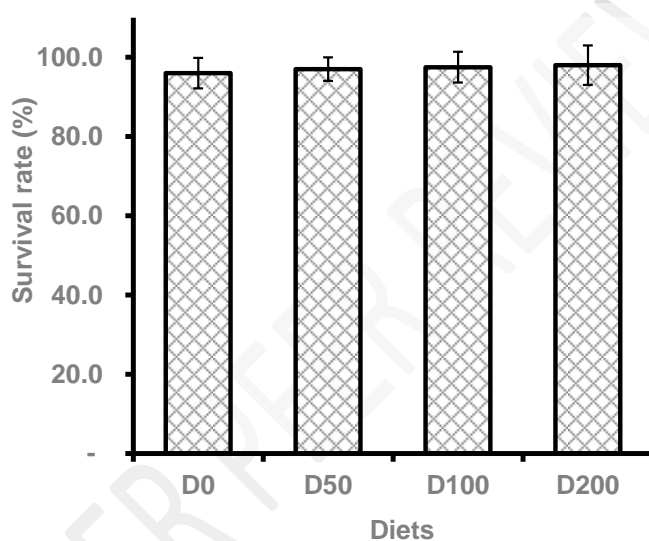


Fig. 2. Survival rate of golden trevally. Different letters indicate significant differences between treatments.

The effect of dietary vitamin E incorporation on the golden trevally's survival rate is demonstrated in Figure 2. The final survival of golden trevally among treatments ranged from 96.05% to 98.12%. Fish fed diets containing 200 mg of vitamin E had the highest survival rate (98.12%), followed by fish fed diets containing 100 mg, 50 mg, and no vitamin supplementation, which had survival rates of 97.50%, 97.00%, and 96.05%, respectively. The survival rates of fish fed with any dose of vitamin E and fish on a control diet did not differ significantly from one another, though ($P = 0.438$).

3.3. Variations in the size of golden trevally

The coefficient of variation (CV, %) was used to evaluate the heterogeneity of fish body weight. Results at week eight showed that the fish fed a control diet had the largest variation coefficient (CV, %) of body weight for golden trevally. As the amount of vitamin E supplements in the diet increased, the CV declined. When compared to fish fed a control diet, there was a significant difference in CV value between diets containing 100 and 200 mg of vitamin E ($P \leq 0.010$). The size variations of fish given a diet containing 50mg of vitamin E per kg^{-1} did not, however, differ significantly from CV in the control group ($P = 0.276$). Additionally, no correlation between the CV values of fish fed any quantity of vitamin E was discovered ($P = 0.161$).

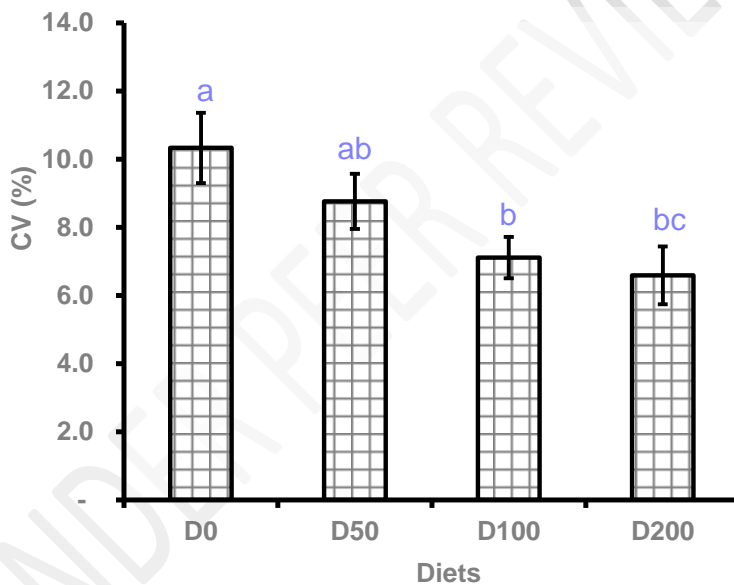


Fig. 3. Coefficient of variations in weight (CV, %) of golden trevally fed vitamin E. Different letters indicate significant differences between treatments.

3.4 Protein content in flesh of golden trevally

Figure 4 demonstrates the protein content of golden trevally diets supplemented with vitamin E. As a result of our research, we were able to determine that the protein content in the muscle of golden trevally varied from 19.02% in the group given the control diet to 22.73% in the group given a meal containing 200 mg E per kilogramme. Diets supplemented with graded levels of

vitamin E significantly influenced protein content ($P \leq 0.001$). However, there was no significant difference in the protein content of fish fed any level of vitamin E added to the diets ($P = 0.110$) (Figure 4).

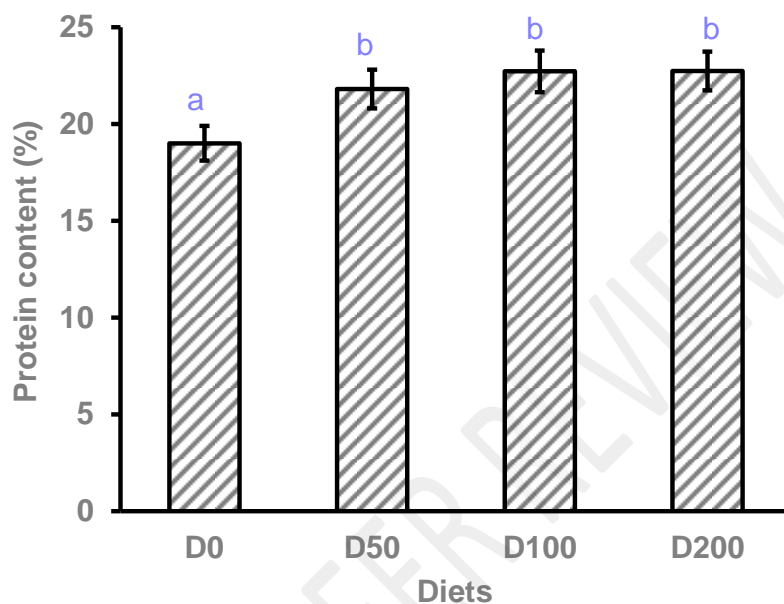


Fig. 4. Protein in the muscle of golden trevally fed vitamin E. Different letters indicate significant differences between treatments.

3.4 Lipid content in flesh of golden trevally

Figure 5 shows the effect of vitamin E supplementation on the lipid content of the golden trevally. The lipid content of golden trevally among the diet regimens ranged from 6.5 to 8.4% at the completion of the experiment. Additionally, more vitamin E in the diet resulted in a rise in the lipid content of the golden trevally. Fish fed the control diet had the lowest amount of lipids (6.5%), whereas fish fed diets with 200 mg of vitamin E had the highest lipid content (8.4%). Fish fed any dose of vitamin E had lipid contents that were considerably higher than this value when compared to fish fed the control diet ($P \leq 0.013$). However, lipid levels did not significantly differ between the groups that received vitamin E supplements at any dosage ($P = 0.438$).

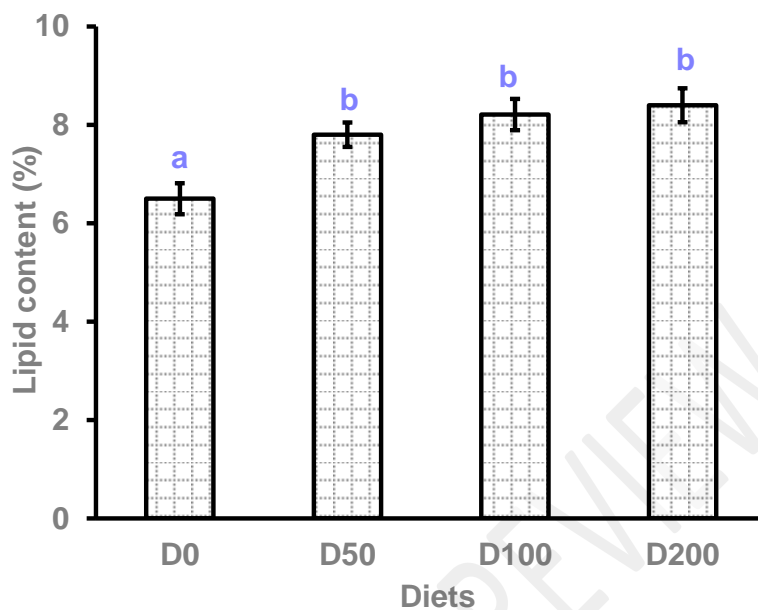


Fig. 5. Lipid in the muscle of golden trevally fed vitamin E. Different letters indicate significant differences between treatments.

4. DISCUSSION

This study is the first to investigate whether dietary vitamin E affects the growth and body composition of golden trevally. According to this study, vitamin E is beneficial for the growth and survival of the golden trevally, *Gnathanodon speciosus*. Fish growth was enhanced when fed diets containing 50–200 mg of vitamin E per kilogram of diet.

This was in line with other studies that discovered vitamin E to be essential for promoting the growth and survival of fish, such as the Japanese eel *Anguilla japonica* [12], hybrid snakehead (*Channa argus* × *Channa aculate*) [13], and great sturgeon, *Huso huso* [14]. According to previous findings, dietary vitamin E promotes survival of *Caspian trout* [15].

The protein composition of golden trevally fed various vitamin E concentrations showed substantial differences in the current investigation. This was consistent with recent research that

found that increasing dietary vitamin E supplementation in the diet of the Caspian trout, *Salmo caspius*, had a substantial impact on the protein content and crude fat in the whole body [15]. Similar findings have been made by [16], who reported lower levels of whole-body crude protein and lipid in *Labeo rohita*, the vitamin E-deficient rohu fry. The total body proximate composition of the cobia, *Rachycentron canadum* [7], sea bass, *Dicentrarchus labrax* [17], and Japanese eel, *Anguilla japonica* [18] did not significantly change when the quantities of vitamin E in the meal were varied. In contrast, it has been proven that decreased whole body crude protein followed by increased moisture content in fish fed a vitamin E deficient could be related to the severity of muscular atrophy [19].

Comment [s8]: Little discussion. Add new references that fit the discussion

5. CONCLUSION

The inclusion of vitamin E in diets enhances the growth and survival of golden trevally, *Gnathatanodon speciosus*, according to the results of a feeding trial reported here. 50-200 mg kg⁻¹ of vitamin E has been proposed as a supplement to the golden trevally diet to promote optimal growth. Also, additional research is required to determine the vitamin E concentration necessary to optimise the growth of golden trevally exposed to diverse environmental conditions and stressors, as well as their physiological and immunological responses. It is further suggested that the effects of dietary vitamin E on various life stages should be investigated. In conclusion, supplementing vitamin E in the diet may improve the growth, survival, and body composition of juvenile golden trevally. It is suggested that adding a minimum amount of 50 mg of vitamin E kg⁻¹ will improve growth and reduce mortality in juveniles of this species.

Comment [s9]: Conclusions are made clear and concise

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Comment [s10]: Add new references as appropriate

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