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THE STUDY OF FILLET PROXIMATE COMPOSITION, GROWTH PERFORMANCE AND SURVIVAL RATE OF STRIPED CATFISH (*PANGASIUS HYPOPHTHALMUS*) FED WITH DIETS CONTAINING DIFFERENT AMOUNTS OF ALPHA-TOCOPHEROL (VITAMIN-E)

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Abstract

Context: Alpha-tocopherol has significant effect on the growth performance and fillet proximate composition of Striped Catfish (*Pangasius hypophthalmus*).

Objectives: To study the effect of DL-alpha tocopheryl acetate on the fillet proximate composition (moisture, crude protein, crude lipid, ash and alpha-tocopherol), survival rate and growth performance (SGR, weight gain, PWG) of *P. hypophthalmus.*

Materials and methods: Striped Catfish were fed with three trial diets (diet-1, diet-2 and diet-3) were prepared by adding different amounts of alpha-tocopheryl acetate (ATA, 0, 90 and 300 mgKg^{-1} diet), over a period of 122 days. In each pond, 10% of the total fish were randomly selected and individually weighed once every fortnight and growth parameters were determined after each weighing. Moisture, dry matter, crude protein, lipid, ash and alpha-tocopherol of the experimental diets and fish fillet were determined by Conventional procedure, standard test method, micro-kjeldahl method, Bligh and Dyer method, standard methods and chromatographic method, respectively.

Results: Fish that were fed 90 mg kg-1 and 300 mg kg^{-1} ATA supplemented diets had significantly higher growth performance than fish that were fed only farm processed diet ($P<0.05$). The fillet protein, lipid content and alpha tocopherol level of the fish flesh were increased due to ATA supplementation in diets. The vitamin-E levels in fish fillet reflected dietary ATA levels. These results showed that fish on Diets 2 (supplemented with 90 mgKg^{-1} ATA) and Diet 3(supplemented with 300 mg kg^{-1} ATA) had significantly better production and resulted better flesh quality of fish than those on Diet 1 (without ATA supplementation).

Conclusion: Scanty information is available on the fillet proximate composition and growth performance of *P. hypophthalmus* fed with diets containing different amounts of alpha-tocopherol. The present study provides baseline information for establishing improved and profitable cultured system of the fish in impounds water of Bangladesh.

Key words: Nutrition, vitamin supplementation, alpha-tocopheryl-acetate, weight gain, Flesh's proximate composition.

Introduction

Pangasius hypophthalmus is widely produced around the world because of its proved attractive for its robust characteristics, rapid growth rates and high productivity compared to other species. It is desirable for striped catfish feed to be high in lipid content, with the aim of improving growth performance. However, high levels of dietary lipid leads to increased lipid content in the entire body of fish (Lie 2001, Chaiyapechara *et al.* 2003). The dietary lipids for fish culture are high in polyunsaturated fatty acid content and the polyunsaturated fatty

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acids are readily incorporated into fillets of fish. In absence of natural antioxidants such as vitamin-E, fish quality may be affected due to degradation of the fish fillet through lipid oxidation. Therefore, diets should be fortified with appropriate amounts of antioxidants (Jensen *et al.* 1998, Chaiyapechara *et al.* 2003). Vitamin-E is a lipid-soluble vitamin and a natural antioxidant. Alpha-tocopherol acetate (ATA) is used as a vitamin-E source in fish feed in aquaculture, with the aim of improving fish growth (Hamre *et al.* 1998, Kaushik *et al.*, 1998, Huo *et al.* 1999). The effects of including varying amounts of vitamin-E on the quality of fish fillet has been studied for several species such as Rainbow trout (Boggio *et al.* 1985, Frigg *et al.* 1990, Jensen *et al.*, 1998, Chaiyapechara *et al.* 2003), Channel catfish (Bai and Gatlin 1993), Sea bass (Gatta *et al.* 2000), Atlantic salmon (Waagbo *et al.*1993, Hamre *et al.* 1998, Scaife *et al.* 2000), turbot (Ruff *et al.* 2003), Catfish (Lim *et al.* 2001), Nile tilapia (Gammanpila *et al.* 2007), Sunshine bass (Trushenski 1999) and hybrid Tilapia (Huang *et al.* 2003).

This study was carried out to examine the effects of farm made feeds containing with low lipid and protein and different levels of ATA, on the growth performance, survival rate and proximate composition of the fillet in striped catfish.

Materials and Methods

Fish and Experimental Diets

The study was conducted at University of Rajshahi's Faculty of Agriculture, Department of Fisheries, Bangladesh (July to November, 2011). The experimental diets were prepared by adding 0 mg kg^{-1} (Diet 1), 90 mg kg^{-1} (Diet 2) and 300 mg kg^{-1} (Diet 3) of DL-alpha-tocopheryl acetate dry powder (ACI Company Ltd., Dhaka, Bangladesh) to a farm-made striped catfish diet produced with rice bran, boiled rice and mustard oil cake. The actual levels of vitamin-E in the experimental diets were 90.2 ± 0.2, 192.5 ± 0.4 and 386.9 ± 0.3 mg kg-1 (because the feed ingredients also contains indigenous vitamin E), respectively, as shown in Table 1. Striped catfish fingerlings with a mean initial weight of 125.05 ± 0.50 g (±SE, n = 200) were randomly allocated to three treatments (T_1, T_2, T_3 with two replication each) in six ponds and fed the experimental diets once daily for 122 days. The daily feeding rations were adjusted to 5% of body weight.

Growth Performance

In each pond, 10% of the total fish were randomly selected and individually weighted once every two weeks, and daily rations were determined after each weighting. The body weight gain (BWG) was calculated using the following equation: BWG (g) =final weight (g)-initial weight (g). The specific growth rate (SGR) was calculated using the following equation: SGR ($\%bwd^{-1}$) = [(ln final weight–ln initial weight) x 100 / time in days]. The percentage weight gain (PWG) was calculated using the following equation: PWG (%) = [(final weight– initial weight) x 100 / initial weight]. The survival rate was calculated using the following equation: Survival rate (%) = [(Number of harvested fish/Number of stocked fish) x 100].

Proximate Analysis

Twenty random samples, each month were killed and submitted for analysis of fillet composition. The fillets were blended prior to proximate analysis. Moisture, dry matter, crude protein, lipid, ash and alpha-tocopherol of the experimental diets and fish fillet were determined by Conventional procedure (ICOMR, 1971), Standard test method (ASTM 2003), Micro-kjeldahl method (Rangama 1979), Bligh and Dyer method (1959), Standard methods (AOAC 1998) and Chromatographic method (Huo *et al.*1999).

Statistical Analysis

The difference between the growth performance and body composition among groups were analyzed with one-way analysis of variance (ANOVA) and Duncan's multiple range test (Duncan 1955) with a statistical package program (SSPS version 11.0) for P<0.05 at the end of feeding trials.

Results

Effect on diet compositions

Chemical composition of the diets supplemented with different level of alpha-tocopherol shown in Table 1 where it is observed that addition of DL-alpha-tocopheryl acetate does not show significant difference in case of ash content (P>0.05), but is significant in case of alpha-tocopherol amount (P<0.05), of the diet extract in T_2 and T_3. Supplementation of DL-alpha-tocopheryl acetate in diets increased the dry matter, crude protein and lipid level slightly in case of diet-2 and diet-3.

Table 1. Chemical composition of the experimented diets during the study period.

Chemical composition	Diet-1(used in T_1)	Diet-2(used in T_2)	Diet-3(used in T_3)
Dry matter (g/100g)	58.6 ± 0.2	60.3 ± 0.3	60.1 ± 0.5
Crude protein (g/100g)	21.8 ± 0.4	22.8 ± 0.3	22.4 ± 0.2
Crude lipid (g/100g)	13.7 ± 0.1	15.6 ± 0.2	15.8 ± 0.6
Ash (g/100g)	1.8 ± 0.6	1.2 ± 0.2	1.3 ± 0.3
Alpha-tocopherol (mgKg^{-1})	94.2 ± 0.2	192.5 ± 0.4	386.9 ± 0.3

Effect on growth performances

The body weight gain (BWG), percentage weight gain (PWG) and specific growth rate (SGR) of striped catfish fed diets supplemented with 0 mg kg^{-1}, 90 mg kg^{-1} and 300 mg kg^{-1} ATA differed significantly from one another (P<0.05, Table 2). Monthly variation on the body weight gain (BWG), percentage weight gain (PWG) and specific growth rate (SGR) was also observed during the study. The minimum weight gain (49.00±0.78g) was recorded with treatment T_1 at 1st month where the maximum weight gain (504.00±0.52g) was recorded with treatment T_2 at 3rd month (Fig.1). The minimum percentage weight gain (37.69±0.21%) was recorded with treatment T_1 at 1st month where the maximum percentage weight gain (89.32±0.56%) was recorded with treatment T_2 at 4th month (Fig. 2). The minimum SGR (1.03±0.021%) was recorded with treatment T_1 at 1st month where the maximum SGR (2.05±0.047%) was recorded with treatment T_2 at 4th month (Fig. 3). The survival rate was affected by dietary ATA supplementation (P<0.05, Fig. 4). In case of Survival rate (%), the minimum value was recorded with treatment T_1 where the maximum value was recorded with treatment T_2.

Table 2. Variation in the mean values of growth parameters under different treatments during the study period.

Growth performance	T_1	T_2	T_3
Weight gain(g)	154.75±0.59	250.00±0.68	201.25±0.54
Percentage weight gain(%)	55.26±0.30	73.91±0.47	65.23±0.62
SGR(% bwd^{-1})	1.44±0.054	1.80±0.045	1.63±0.060
Survival rate(%)	55.31±0.0016	75.14±0.0013	69.73±0.0023

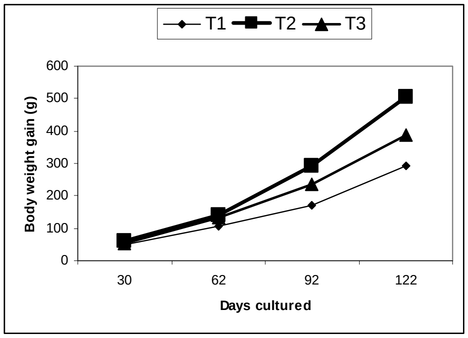

Fig 1. Monthly variation in body weight gain of fish with alpha-tocopheryl supplemented diets (diet-1,diet-2 and diet-3)

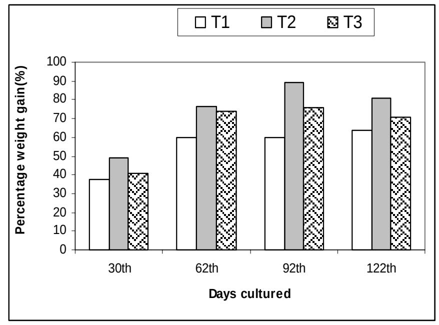

Fig 2. Monthly variation in percentage weight gain of fish with alpha-tocopheryl supplemented diets (diet-1,diet-2 and diet-3)

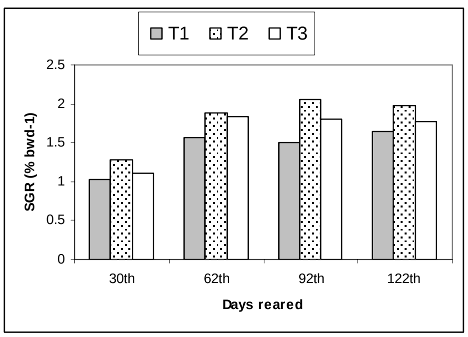

Fig 3. Monthly variation in specific growth rate of fish with alpha-tocopheryl supplemented diets (diet-1,diet-2 and diet-3)

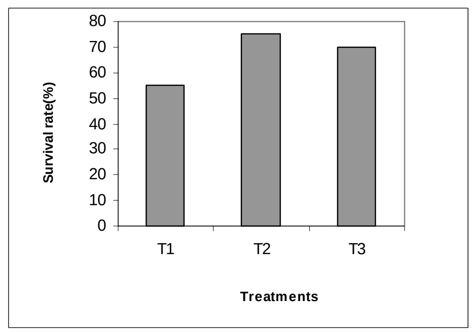

Fig 4. Survival rate of fish with DL-alpha-tocopheryl acetate supplemented diets (diet-1,diet-2 and diet-3)

Effect on proximate composition of the fillet

Table 3 shows the proximate composition of the fillets of *Pangasius hypophthalamus* under different treatment during the study period. The moisture, crude protein, crude lipid and ash content of fish fillets were affected variously by changes in dietary vitamin-E level from DL-alpha tocopheryl acetate supplementation (Table 3). The fillet moisture level and ash content decreased in comparison to initial values at T_1 (P<0.05). The fillet lipid level of experimental fish on Diet 1 was lower (P<0.05) than for those on Diets 2 and 3 (Table 3). Fillet lipid increased from an initial value of 4.08±0.15% to 8.08±0.18% and 8.01±0.16%, respectively (P<0.05). The highest amount of lipid was found in the fish fillet on Diet 2 (8.08±0.18%) and the lowest amount was found in the fish on Diet 1 (4.08± 0.15%). The fillet moisture level of experimental fish on Diet 1 was higher (P>0.05) than for those on Diets 2 and 3 (Table 3). Fillet moisture decreased from an initial value of 79.15±0.10 to 74.20±0.10 and 74.10±0.20, respectively (P>0.05). The highest amount of moisture was found in the fish on Diet 1 (79.15±0.10%) and the lowest amount was found in the fish on Diet 3 (74.10± 0.2%). The fillet ash content of experimental fish on Diet 1 was higher than for those in both Diet 2 and 3 (Table 3).

Table 3. Proximate composition of the fillets of *Pangasius hypophthalamus* under different treatment during the study period.

Proximate composition	T_1(Fed D-1)	T_2(Fed D-2)	T_3(Fed D-3)
Moisture (g/100g)	79.15±0.10	74.20±0.10	74.10±0.20
Crude protein (g/100g)	15.50±0.18	16.40±0.23	16.60±0.18
Crude lipid (g/100g)	4.08±0.15	8.08±0.18	8.01±0.16
Ash (g/100g)	1.24±0.10	1.21±0.12	1.20±0.13
Alpha-tocopherol (mgKg^{-1})	9.55±0.18	33.41±0.13	34.58±0.20

Fillet ash content decreased from an initial value of 1.12±0.10 to 1.21±0.12 and 1.20±0.13, respectively but the result is not significant. The highest amount of ash content was found in the fish on Diet 1 (1.24±0.13%) and the lowest amount was found in the fish on Diet (1.20± 0.10%). Vitamin-E level (Alpha-tochopherol) increased significantly with increasing dietary ATA levels. The fillet vitamin-E content of fillet on Diets 1, 2, and 3 were 9.55±0.18, 33.41±0.13 and 34.58±0.20 mg kg-1 diet, respectively ($P<0.05$).

Discussion

The present study showed that the growth performances of *P. hypophthalmus* was significantly enhanced when different amounts (0 mgKg^{-1}, 90 mgKg^{-1} and 300 mgKg^{-1} feed) of DL-alpha tocopheryl acetate (ATA) were added in farm processed feed. The result were in agreement with the previous findings for Chinook salmon (Woodall *et al.* 1964), channel catfish (Murai and Andrew 1974, Lovell *et al.* 1984, Wilson *et al.* 1984, Yildirim-Aksoy *et al.* 2008), rainbow trout (Cowey *et al.* 1983) and parrot fish (Galaz *et al.* 2010). In the present study, no significant change in growth performance was observed in higher α-TA levels (300 mg/kg feed). The negative effects by a high dose of dietary α-TA have been reported with respect to growth performance in other fish species such as, parrot fish (Galaz *et al.,* 2010), brook trout fry (Poston and Livingston, 1969), African catfish (Baker and Davies, 1996), and rainbow trout (Kiron *et al.* 2004), red drum (*Sciaenops ocellatus*, Li *et al.* 2008). In the present study the survival rate in case of T_2 (Diet-2) and T_3 (Diet-3) is higher than T_1 (Diet-1). This result is supportive to Yildirim-Aksoy *et al.* (2008) in case of *I. punctatus*; Mehrad *et al.* (2012) in case of *Danio*, Onivie *et al.* (2010) in case of *Heterobranchus longifilis and* Mehrad and Saudagar (2010) in case of Guppy (*Poecillia reticulate*), Faramarzi (2012) in case of Angel Fish (*Pterophyllum scalare*) fed with Vitamin-E containing diet.

The present study showed that vitamin-E containing diet has significant effect on moisture, crude lipid, ash content and alpha-tocopherol level of the fillet. According to Jasour *et al.* (2011), the concentration of α-tocopherol in fillets increased linearly in response to feed alpha-tocopherol concentration ($P<0.05$) in case of *Oncorhynchus mykiss.* The alpha-tocopherol content in turbot liver and muscle tissue was significantly influenced by dietary intake of a-tocopherol (Stephan *et at.* 1995). Gatta *et. al.* 2000) found a correlation between dietary Vitamin-E level and flesh deposition in sea bass *(Dicentrarchus fabrax).* Bai & Lee (1998) found a linear relation between dietary levels of alpha-tocopheryl acetate with fillet vitamin E content in Korean rockfish. Weatherup and McCracken (1999) state that lipid level in fish increases with growth which is similar to the present study. Yildiz (2004) proved that the fillet Vitamin-E content of the fish reflected their dietary ATA levels. This positive correlation between dietary and fillet Vitamin-E content is also reported for rainbow trout and other aquaculture species such as Atlantic salmon, sea bass, turbot and Atlantic halibut show comparable results (Bjerkeng *et al*. 1999, Pirini *et. al*. 2000, Ruff *et. al*. 2003, Stephan *et al*.1995).

Conclusion

In conclusion, the conducted study demonstrated that diets containing different amount of alpha-tocopheryl acetate affect growth performance and led to increased vitamin E and lipid content in the fish flesh. These results suggest that feeding the fish diets containing 90 $mgKg^{-1}$ and 300 $mgKg^{-1}$ alpha-tocopheryl acetate results in higher flesh quality and comparatively batter growth in case of *P. hypophthalmus* compared to diet-1(diet without alpha-tocopheryl acetate).

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