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GENERAL INFORMATION

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PHYTASE AS A FACTOR FOR IMPROVING GROWTH PERFORMANCE OF NILE TILAPIA (*OREOCHROMIS NILOTICUS*) FED ON PLANT-BASED DIETS

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Abstract

An experiment with average weight 1.5 g Nile tilapia, *Oreochromis niloticus* was conducted to evaluate the influence of phytase as a factor for improving growth performance of Nile tilapia fed on plant-based diets. The experimental period lasted 12 weeks; fish were randomly distributed into 15 glass aquaria in 5 treatments (3 replicates per treatment). The experiment was based on completely randomized design with five levels of dietary phytase supplementation 0, 250, 500, 750 or 1000 FTU/kg diet of phytase enzyme (1 g of phytase product content 2500 FTU). Phytase supplementation in fish diets significantly affects the wet live body weight after 8 and 12 weeks of the experimental period. Daily body gain and weight gain% gradually increased with increasing phytase level in fish diets. Fish group fed diets supplemented with 750 or 1000 FTU recorded higher body gain and daily weight gain than the other experimental groups. Also, fish group fed diets supplemented with 750 or 1000 FTU recorded the best feed conversion than the other experimental groups. The concentration of total protein, albumin and ALT in plasma increased with increasing phytase level in fish diets. Fish fed diets supplemented with 1000 FTU recorded higher concentrations of urea-N, creatinine and AST in plasma. Supplemented fish diets with phytase insignificantly affected the whole fish body compositions. Feed cost, return from body gain, and final margin increased gradually with increasing the level of phytase in fish diets. Fish fed diets supplemented with phytase 1000 FTU recorded the higher feed cost, return from body gain and final margin than the other groups. These results suggest that the supplementation of

phytase (750 - 1000 FTU) in plant-based diets can significantly improve growth performance and feed utilization in Nile tilapia, *O. niloticus* fingerlings.

Keywords: Phytase, plant-based diet, growth rate, feed conversion, blood chemistry, body composition, profit analysis.

INTRODUCTION

Aqua-feeds cost represents up to 70% of variable operating production costs, depending on the intensity of the operation (Muzinic *et al*., 2006). Due to the high price of fishmeal, the replacement of fish meal with plant or grain by-products will become increasingly important for the development of low cost fish diets. One of the major problems associated with the use of plant by-products in fish diets is the presence of anti-nutritional factors, like phytic acid or phytates and enzyme inhibitors (Goda, 2007). Phytic acid has a potential for binding positively charged proteins, amino acids, and/or multivalent cations or minerals in foods. The reduction of this phytates can be achieved through both enzymatic and non-enzymatic removal. Enzymatic degradation includes addition of either isolated form of wild-type or recombinant exogenous phytate-degrading enzymes microorganisms in the food matrix (Afinah *et al*., 2010). The unique structure of phytic acid offers its ability to be strongly chelated with cations such as calcium, magnesium, zinc, copper, iron and potassium to form insoluble salts (Denstadli *et al*., 2006; Kumar *et al*., 2011a).

The addition of phytase to diets for monogastric animals is commonly used to enhance the digestibility of phytate-associated phosphorus (Pontoppidan *et al*., 2007). The effectiveness and limitations of phytase supplementation may also depend on substrate specificity (Greiner and Farouk 2007). Several anti-nutritional factors present in soybeans can be partially removed by proper heat treatment and extraction procedures (Liener, 1994). However, phytate is relatively heat-stable. Phytate-P (Phytatae-phosphorus) is not available to monogasteric

animals including fish (NRC, 1993). Furthermore, phytate may interfere with the availability (Liener, 1994) of other minerals and can bind trypsin and decrease protein availability for fish (Singh and krikorian, 1982 and Spinelli *et al*., 1983). The digestibility in these plant protein is generally low as compared with fish meal protein in fish diets (Lin *et al*., 2007). Exogenous enzymes are often used to increase the nutritive value of feed ingredients of plant origin in animal diets (Buchanan *et al*., 1997).

Irrespective of dietary soybean meal levels, supplementation of microbial phytase at 1000 FTU kg^{-1} level has demonstrated to be efficient for increasing dietary phosphorus supply for Nile tilapia fingerlings, thereby reducing the phosphorus effluent from aquaculture facilities. This may have to be taken into consideration for ongoing feeding strategies for the control of waste discharge (Goda, 2007).

The results of Tahoun *et al*. (2009) showed that diets with added levels of 75 and 150 mg/kg phytase recorded higher final body weight, weight gain, average daily gain and specific growth rate of Nile tilapia. Increasing the phytase level markedly reflected on lower values for the above mentioned parameters. The addition of 75 mg phytase/kg feed resulted in a better feed conversion, protein efficiency ratio, protein productive value and energy utilization. There was no significant difference among treatments in survival rate.

The objective of the present study was to investigate the effect of dietary supplementation of phytase on growth performance, feed efficiency, blood chemistry and body composition of Nile tilapia (*Oreochromis niloticus*) fed on plant-based diets.

MATERIALS AND METHODS

The present study was carried out at the wet Laboratory of Animal Production Department, Faculty of Agriculture, Zagazig University, Egypt with cooporation of Department of Fish Nutrition,

Central Laboratory for Aquaculture Research, Abbassa, Abo-Hammad, Sharqia. Nile tilapia (average weight 1.5 g after three weeks acclimation under normal laboratory conditions) were randomly distributed into 15 glass aquaria (35 X 40 X 70 cm) in 5 treatments (3 replicates per treatment).

The experiment was based on completely randomized design with five levels of dietary phytase supplementation 0, 250, 500, 750 or 1000 FTU/kg diet of phytase enzyme (1 g of phytase product content 2500 FTU). All fish groups were fed on basal pelleted diet consistent of fish meal 5.0%, soybean meal 45.0%, corn 17.0%, wheat bran 17.5%, alfalfa hay 10.0%, sunflower oil 3.0%, minerals mixture 0.5%, vitamin mixture 1.0% and carboxymethyl cellulose 1.0%. The chemical composition of the diet was crude protein 28.82%, ether extract 7.48%, crude fiber 6.27%, ash 9.47%, nitrogen free extract (NFE) 47.96% and gross energy 4558.6 Kcal/Kg. Fish were fed at the rate of 3% of body weight per day and it offered three feedings at 8.00, 12.00 and 17.00 hours for 12 weeks. Fish in each aquarium were weighed every 2 weeks, and the feed amount was adjusted after each fish weighing.

All fish were individually weighed to the nearest 0.1 g at the beginning of the experiment and biweekly intervals throughout the experimental period. Feed conversion was calculated according to Berger and Halver (1987).

After the feeding trial blood samples were collected from the caudal vein of three fish with a heparinized syringe. The plasma separated by centrifugation at 3000 rpm for 20 min and stored at –20 °C for further biochemical analysis. Total protein, albumin (Sundeman, 1964), creatinine, urea-N (Henery, 1974), plasma transaminase enzymes (AST; aspartate amino transferase and ALT; alanine amino transferase (Reitman and Fankel, 1957) were measured.

Proximate chemical composition of experimental diets and fish body were determined according to AOAC (1990). Water quality parameters were monitored at the end of 6 and 12 weeks of the experimental period before replacing the water in the aquarium during the experimental period. All the water quality parameters were within the acceptable ranges for fish growth (Boyd, 1984).

Weight gain (WG), weight gain%, feed conversion ratio (FCR) were calculated using the following equations:

WG = FBW (g) - IBW (g).

Weight gain% = [(FBW - IBW) / IBW] X 100

FCR = feed intake (g)/weight gain (g).

Where: FBW is final body weight (g); IBW is initial body weight (g).

Economic evaluation was calculated as: Margin = Income from body gain weight - Feed cost. Other overhead costs were assumed constant. Price of one kg of diet was 2.65 LE (Egyptian pound = 0.168 US$), the price of one kg phytase was 150 LE and price of selling of one kg live body weight of fish was 9.0 LE.

The data were statistically analyzed with SAS (2002) according to the following model:

$$Y_{ij} = \mu + P_i + e_{ij}$$

Where, μ is the overall mean, P is the fixed effect of dietary phytase level (I = 1 …5), e_{ij} is random error. Differences between treatments were tested with Duncan's multiple range test (Duncan, 1955).

RESULTS

The non significant differences between the experimental groups for initial live body weight indicated that the groups at the beginning of the experiment were homogenous (Table 1). Phytase supplementation in

fish diets significantly (P<0.004 and 0.001, respectively) affects the wet live body weight at 8 and 12 weeks of the experimental period (Table 1). On the other hand, live body weight at 4 weeks insignificantly affected by phytase supplementation. Daily body gain was affected significantly (P<0.01 and 0.001, respectively) with phytase addition in fish diets at 4-8 and 0-12 weeks of the experimental period. Live body weight, daily body gain and weight gain% gradually increased with increasing phytase levels in fish diets. Fish group fed diets supplemented with 750 or 1000 FTU recorded higher body gain and daily weight gain (P<0.05) than the other experimental groups.

Daily feed intake increased significantly (P<0.01 or 0.001) with increasing dietary phytase supplementation in fish diets at 4-8, 8-12 and 0-12 weeks of the experimental period (Table 2). Fish group fed diets supplemented with 1000 FTU recorded higher feed consumed during the whole experimental period. Feed conversion was improved significantly (P<0.01) with phytase supplementation in fish diets at 0-12 weeks of the experimental period. Fish group fed diets supplemented with 750 or 1000 FTU recorded the best feed conversion than the other experimental groups. Fish group fed diets supplemented with 750 or 1000 FTU recorded higher survival rate (Table 2).

Supplemented fish diets with phytase significantly affected plasma total protein, albumin, ALT (P<0.001), urea-N, AST (P<0.01) and creatinine (P<0.05), while globulin concentration was insignificantly affected (Table 3). The concentration of plasma total protein, albumin and ALT increased with increasing phytase level in fish diets. Fish fed diets supplemented with 1000 FTU recorded higher concentrations of total protein, albumin and ALT than the other experimental groups. On the other hand, the concentrations of plasma urea-N, creatinine and AST decreased significantly with increasing phytase level in fish diets (Table 3). Supplemented fish diets with phytase insignificantly affected the

whole-fish body compositions (Table 4). Feed cost, return from body gain and final margin increased gradually with increasing the level of phytase in fish diets. Fish fed diets supplemented with phytase 1000 FTU recorded higher feed cost, return from body gain and final margin than the other groups (Table 5).

DISCUSSION

The use of phytase enzyme supplementation is to improve the nutrient digestibility, to destroy or to inactivate the anti-nutritional factors, to improve non-starch polysaccharides, to improve the endogenous enzymes activity, minimize environmental pollution caused by residuals and to spare the use of amino acids on enzyme synthesis. The obtained results indicated that the final body weight increased by 6.48, 11.87, 30.76 and 38.39%, respectively, in fish fed diets supplemented with 250, 500, 750 and 1000 FTU phytase when compared with those fed the basal diet. The same figures in daily weight gain were 8.70, 13.91, 37.39 and 45.22%, respectively. Liebert and Portz (2005) reported that the optimal growth of Nile tilapia is achieved by phytase supplementation at 750–1250 FTU/kg in plant-based diets. Also, Cao *et al*. (2008) observed that 1000 FTU/ kg feed gives better growth performance and feed conversion in the same fish species. Li and Robinson (1997) found that fish fed the diets containing <250 FTU phytase/kg feed gained more weight in comparison to fish fed the basal diet containing no microbial phytase. Eid *et al*. (2004) demonstrate that a diet containing 35% crude protein with 20% protein from fish meal and 15% protein from soybean meal supplemented with 1500 IU phytase is adequate for good growth of Nile tilapia.

In the present study, weight gain % were 681.94, 705.72, 881.67 and 896.20% in fish fed diets supplemented with 250, 500, 750 and 1000 FTU phytase respectively. The control group (fed the basal diet without

phytase supplementation) was 620.41%. Similarly, Vielma *et al*. (2004) found an increase in weight gain from 243 to 459% in rainbow trout fed soybean meal-based diets with phytase and P supplementation. This result may be because Tilapia *O. niloticus* and *O. aureus* are capable of releasing inorganic P from phytate (La Vorgna, 1998) and this phytase activity appears to be localized in the small intestinal brush border membrane (Maenz and Classen, 1998). Protein digestibility in rainbow trout was significantly increased when fed a practical diet supplemented with 2000 FTU/kg and also when reared with soybean meal-based diets sprayed with phytase (Vielma *et al*., 2001, 2004). Although, protein digestibility was significantly influenced by phytase supplementation, protein retention efficiency was not enhanced in red sea bream fed soybean meal based diets supplemented with graded doses of phytase (Biswas *et al*., 2007). Studies on common carp showed that incorporation of microbial phytase in basal diets (soybean meal based diets) improved overall growth performance in rohu fingerlings (Baruah *et al*., 2007).

Daily feed intake increased by 2.70, 10.27, 22.70 and 27.57%, respectively, in fish fed diets supplemented with 250, 500, 750 and 1000 FTU phytase, respectively when compared with those fed basal diets. On the other hand, feed conversion was improved by 4.69, 2.56, 9.81 and 11.75%, respectively, in fish fed diets supplemented with 250, 500, 750 and 1000 FTU phytase when compared with those fed the basal diets. Li and Robinson (1997) reported that fish fed the diets containing <250 FTU phytase/kg feed consumed more feed in comparison to fish fed the basal diet containing no microbial phytase. Also, Vielma *et al*. (2001) found that feed conversion ratio were significantly improved when trout were fed with phytase supplemented diet at 2000 FTU/kg feed (containing 55% of soybean meal). Conversely, no substantial effect of phytase addition was observed on performance of large sized rainbow

trout (initial body mass 250 g and final body mass about 2 kg) fed a diet supplemented with phytase at 1000 FTU/kg (Vielma *et al*., 2000).

The biochemical parameters are generally used as a basic index for health and nutritional status of fish (Martinez, 1976). The dietary phytate and phytase significantly influenced the levels of albumin, globulin and total protein in blood. Two major groups of proteins in the blood are albumin and globulin and these proteins play a significant role in the immune response. The dietary phytase significantly influenced the levels of albumin and plasma total protein (Table 3). As phytase levels increased in the experimental diets, the levels of plasma total protein, albumin and globulin also increased. These findings are in agreement with Kumar *et al*. (2011b). The decrease of blood albumin is resulted from sub-health or sub-nutritional status of the host (Zunszain *et al*., 2003). Albumin, the most abundant blood protein, is essential for maintaining the osmotic pressure for proper distribution of body fluids between intravascular compartments and body tissues, and it also acts as a blood carrier by non-specifically binding hormones and a transport protein for hemin and fatty acids (Schell and Blumberg, 1977). Blood urea-N levels are thought to be associated with liver or gill dysfunction (Stoskopf, 1993), as these are the sites of urea production and excretion, respectively. In this study, urea-N and creatinine concentrations in the blood differed significantly among the different treatments (Table 3). Fish fed diets supplemented with 1000 FTU recorded higher concentrations of plasma urea-N and creatinine. Creatinine, a degraded product of creatine is used as an indicator of kidney damage or malfunction (Tietz, 1986). Blood creatinine is normally quite stable and its level in the blood becomes elevated if kidney function is impaired. The creatinine concentration in the blood was within the normal range (Ceschia *et al*., 1978; Tietz, 1986 and Kumara *et al*., 2011a). Large amounts of AST and ALT are released into blood, mostly during liver

cell damage, and their detection could monitor liver cell damage. In fish, the normal range of blood transaminase cannot be established because of the limited reports related to effects of phytate on these enzyme activities. So, it is difficult to judge whether the transaminase changes caused by the dietary factors interfered with liver function of fish in this study. As phytase concentration increased in the experimental diets, ALT activity increased, whereas AST activity exhibited opposite trend. These results are in contrast with Liu *et al*. (2010). However, Kumar *et al*. (2011b) reported that the lower transaminase activity in the blood observed in fish fed high phytate basal diets without phytase might suggest that phytate depresses transamination and consequently affects the nutrient metabolism of the fish.

The crude protein and lipid contents in fish were found to be insignificantly differing among fish fed phytase in all groups (Table 4). The obtained results are not consistent with those of (Richardson *et al*., 1985 and Usmani and Jafri, 2002). Those authors reported that fish fed phytate supplemented diets had lower protein and lipid contents in whole body compared with those in control diet (without phytate). The phytate inhibits the rise in hepatic total lipids, exhibiting hypolipidaemic effect and is attributed to the inhibition of hepatic enzymes involved in lipogenesis (Katayama, 1997; Kumar *et al*., 2010).

In conclusion, these results suggest that the supplementation of phytase (750 - 1000 FTU) in based diets can significantly improve growth performance and feed utilization in Nile tilapia *O. niloticus* fingerlings.

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Table 1. Growth performance of Nile tilapia as affected by dietary phytase supplementation (FTU/kg diet).

Items	T_0	T_{250}	T_{500}	T_{750}	T_{1000}	*P* value
Body weight (g):						
Initial body weight	1.566± 0.033	1.533± 0.033	1.567± 0.033	1.500± 0.000	1.567± 0.033	0.452
At 4 Weeks	5.700± 0.321	5.767± 0.393	6.267± 0.186	6.767± 0.088	6.467± 0.260	0.083
At 8 Weeks	8.690± 0.531^{c}	9.127± 0.245^{c}	9.963± 0.819^{bc}	11.133± 0.186^{ab}	11.833± 0.17^{ab}	0.004
At 12 Weeks	11.263± 0.329^{c}	11.993± 0.495^{bc}	12.600± 0.276^{b}	14.727± 0.183^{a}	15.587± 0.137^{a}	0.001
Daily body gain (g/day):						
At 0-4 Weeks	0.148± 0.012	0.151± 0.014	0.168± 0.007	0.188± 0.003	0.175± 0.008	0.069
At 4-8 Weeks	0.107± 0.009^{c}	0.120± 0.008^{bc}	0.132± 0.023^{bc}	0.156± 0.007^{ab}	0.192± 0.013^{a}	0.008
At 8-12 Weeks	0.092± 0.007	0.102± 0.017	0.094± 0.024	0.128± 0.002	0.134± 0.004	0.168
At 0-12 Weeks	0.115± 0.004^{c}	0.125± 0.006^{bc}	0.131± 0.004^{b}	0.158± 0.002^{a}	0.167± 0.002^{a}	0.001
Weight gain%	620.41	681.94	705.72	881.67	896.20	-----

Means followed by the same superscript in the same column are not significantly different.

Table 2. Daily feed intake (g/fish), feed conversion (g food/g gain) and survival rate (%) of Nile tilapia as affected by dietary phytase supplementation (FTU/kg diet).

Items	T_0	T_{250}	T_{500}	T_{750}	T_{1000}	*P* value
Daily feed intake (g/day):						
At 0-4 Weeks	0.083± 0.002	0.081± 0.004	0.086± 0.002	0.091± 0.003	0.090± 0.003	0.111
At 4-8 Weeks	0.191± 0.010^{b}	0.193± 0.010^{b}	0.213± 0.006^{ab}	0.229± 0.005^{a}	0.234± 0.004^{a}	0.005
At 8-12 Weeks	0.281± 0.011^{c}	0.295± 0.009^{bc}	0.315± 0.014^{b}	0.362± 0.007^{a}	0.384± 0.005^{a}	0.001
At 0-12 Weeks	0.185± 0.007^{c}	0.190± 0.007^{bc}	0.204± 0.007^{b}	0.227± 0.004^{a}	0.236± 0.001^{a}	0.003
Feed conversion (g food/g gain):						
At 0-4 Weeks	0.568± 0.036	0.538± 0.031	0.513± 0.012	0.481± 0.014	0.514± 0.027	0.253
At 4-8 Weeks	1.795± 0.095	1.633± 0.161	1.716± 0.305	1.476± 0.091	1.231± 0.094	0.222
At 8-12 Weeks	3.117± 0.390	3.004± 0.383	3.923± 1.128	2.823± 0.058	2.870± 0.091	0.648
At 0-12 Weeks	1.600± 0.011^{c}	1.525± 0.035^{bc}	1.559± 0.044^{ab}	1.443± 0.014^{a}	1.412± 0.014^{a}	0.003
Survival rate %	86.67	93.33	93.33	100.00	100.00	-----

Means followed by the same superscript in the same column are not significantly different.

Table 3. Plasma blood components of Nile tilapia as affected by dietary phytase supplementation (FTU/kg diet).

Items	T_0	T_{250}	T_{500}	T_{750}	T_{1000}	*P* value
Total Protein (g/100 ml)	4.083± 0.218^{d}	4.630± 0.040^{c}	5.127± 0.043^{b}	5.347± 0.133^{ab}	5.577± 0.146^{a}	0.001
Albumin (g/100 ml)	2.160± 0.067^{c}	3.090± 0.060^{b}	3.417± 0.142^{a}	3.373± 0.058^{a}	3.613± 0.032^{a}	0.001
Globulin (g/100 ml)	1.923± 0.175	1.540± 0.091	1.710± 0.143	1.973± 0.122	1.963± 0.177	0.221
Urea-N	10.950± 0.436^{a}	10.793± 0.046^{a}	9.200± 0.527^{b}	8.953± 0.413^{b}	8.813± 0.132^{b}	0.008
Creatinine (mg/100 ml)	1.360± 0.075^{a}	1.247± 0.047^{ab}	1.177± 0.015^{b}	1.210± 0.012^{b}	1.137± 0.009^{b}	0.026
AST (IU)	25.810± 0.266^{a}	24.857± 0.886^{ab}	23.040± 0.795^{bc}	22.070± 0.212^{c}	21.693± 0.557^{c}	0.003
ALT (IU)	10.923± 0.410^{d}	12.880± 0.375^{c}	12.833± 0.295^{c}	14.983± 0.406^{b}	16.593± 0.528^{a}	0.001

Means followed by the same superscript in the same column are not significantly different.

Table 4. Whole body composition of Nile tilapia as affected by dietary phytase supplementation (FTU/kg diet).

Items	T_0	T_{250}	T_{500}	T_{750}	T_{1000}	*P* value
Dry matter %	24.787± 1.105	24.597± 0.227	25.048± 0.367	25.622± 0.424	25.413± 0.453	0.734
Crude protein %	60.920± 0.331	60.125± 0.231	60.393± 0.307	62.870± 1.559	60.946± 0.282	0.157
Ether extract %	14.553± 0.318	15.538± 0.190	14.711± 0.335	14.565± 0.306	14.372± 0.411	0.163
Ash %	17.250± 0.233	17.925± 0.366	17.574± 0.402	16.834± 0.085	17.213± 0.598	0.377

Table 5. Profit analysis of Nile tilapia as affected by dietary phytase supplementation (U/kg diet).

Items	T_0	T_{250}	T_{500}	T_{750}	T_{1000}
Total feed intake/fish g	15.54	15.96	17.136	19.068	19.824
Total body gain/fish g	9.66	10.50	11.004	13.272	14.028
Feed cost LE/fish	0.041	0.042	0.045	0.051	0.053
Return from body gain LE/fish	0.087	0.095	0.099	0.119	0.126
Final margin LE/fish	0.046	0.053	0.054	0.068	0.073

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الفايتيز كعامل لتحسين آداء النمو لاسماك البلطي النيلي المغذاه على علائق معتمدة على المصادر النباتية

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الملخص العربي

أجريت تجربة على البلطي النيلي (١.٥ جم) لتقييم تأثير انزيم الفايتاز كعامل لتحسين أداء النمو في البلطي النيلي التي تتغذى على الغذاء النباتي. واستمرت الفترة التجريبية ١٢ اسبوع. واستندت هذه التجربة على تصميم عشوائي لخمسة مستويات للمكملات الغذائية للفيتاز ٠ ، ٢٥٠ ، ٥٠٠ ، ٧٥٠ أو ١٠٠٠ FTU / كيلوغرام من انزيم فيتاز (١ جم/ ٢٥٠٠ FTU). تأثر وزن الجسم الحي الرطب معنويا باضافة الفايتيز لعلائق الاسماك عند الاسبوع ٨ ، ١٢ من زمن التجربة، وزاد وزن الجسم اليومي والنسبة المئوية لزيادة الوزن مع زيادة مستوى الفايتيز في علائق الاسماك.

تأثر وزن الجسم الحي معنويا باضافة الفايتيز لعلائق الاسماك عند الاسبوع ٨ ، ١٢ لفترة التجربة حدث زيادة تدريجية في الوزن اليومي والنسبة المئوية لزيادة الوزن مع زيادة مستوى الفايتيز في علائق الاسماك. سجلت مجاميع الاسماك التي تغذت على علائق مضاف لها ٧٥٠ أو ١٠٠٠ من انزيم الفايتز زيادة اعلى في الوزن الحي وزيادة في الوزن اليومي عن المجاميع الاخرى في التجربة. وكذلك سجلت اعلى تحول غذائي واعلى معدل بقاء عن باقي المجاميع.

زاد البروتين الكلي والالبومين و ALT في بلازما الدم بزيادة مستوى الفايتيز في علائق الاسماك. وقد سجلت مجموعة الاسماك التي تغذت على عليقة بها ١٠٠٠ وحدة من انزيم الفايتيز اعلى تركيز من اليوريا، الكرياتنين و AST في بلازما الدم.

لم يحدث اي تأثير معنوي للتركيب الكيميائي للجسم عند اضافة الفايتيز للعلائق. وجد ان هناك زيادة تدريجية لتكلفة العلف و العائد من الزيادة في وزن الجسم مع زيادة مستوى الفايتيز في علائق الاسماك.

هذه النتائج تشير الى ان اضافة الفايتيز بتركيز ٧٥٠ – ١٠٠٠ وحدة من انزيم الفايتيز في العلائق يمكن ان تحسن من آداء النمو والاستفادة من الغذاء لاسماك البلطي النيلي وتزيد من الربحية.