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The Effects of Fodder Use Enzyme in Fish Nutrition

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Abstract. The main purpose in fish nutrition from scientific point of view is to obtain a good growing rate but maintaining flesh quality and fish health also, resulting a healthy product for the consumer at low cost (Sing, 2008). First attempts about the use of enzymes to increase the digestibility of fodders have been made with enzymes isolated from fish guts. Several studies about using enzyme extracts from fish guts in fish nutrition were made by Dabrowski (1977) and Dabrowska (1979) with small positive results after using proteolytic enzyme extract from fish, in carp diet, Tomassion (1982) analyzed the enzymatic digestion with α-amylase on trout and Carter (1992) presents the lack of response of Atlantic salmon to supplementation with α-amylase. Jakson et all (2007) have analyzed the effect of microbial phytase on phytic phosphorus use. At the end of the experiment they noted that the fish fed with diet containing 500 units of phytase/kg have registered a superior growth rate than the control group. Analysis showed that bone ash, bone phosphorus and weight gain were higher and feed conversion ratio (FCR) was lower at experimental groups comparative with the control group. Nwanna L. C. et all (2008) had studied the effect of pre-treatment of dietary plant feed stuffs with phytase on growth and mineral concentration in common carp (*Cyprinus carpio* L.). Nwanna L. C. et all (2008) noticed that the phytase has increased mineral availability and utilization and decreased the discharges into the environment.

Keywords: enzyme, α-amylase, exogenous enzyme, Allzyme SSF

INTRODUCTION

At global level the wish to obtain a higher production of meat and fish in a short period of time has lead to a large scale fish production.

The main purpose in fish nutrition from scientific point of view is to obtain a good growing rate but maintaining flesh quality and fish health also, resulting a healthy product for the consumer at low cost (Sing, 2008).

The use of enzyme as additives in fish diets it is not a new idea. First attempts about using enzymes to increase the digestibility of fodders heave been made with enzymes isolated from fish guts. A few studies about using enzyme extracts from fish guts were made by Dabrowski (1977) and Dabrowska (1979) with small positive results after using proteolytic enzyme extract from fish, in carp diet, Tomassion (1982) analyses the enzymatic digestion with α-amylase on trout and Carter (1992) presents the lack of response of Atlantic salmon to supplementation with α-amylase. Multiplication of enzyme on different environments and the processes of obtaining high quantities and pure products were very expensive and not very safe. The exogenous enzymes can be obtained through fermentation and extraction from fungus, bacteria or yeasts cultivated on different environments. These enzymes had been utilized in different industries through time, industries like textiles, beer industry, alcohol industry, etc. In the last years these enzymes had been used in poultry, pigs and ruminants nutrition, fact that raised the interest of using these enzymes in fish nutrition.

Following a trial of 10 weeks on *Ictalurus punctatus* with an average initial body weight of 6.5 g/exemplar and 5 different receipes containing 0, 500, 1000, 2000 and 4000 phytase units per kilogram of fodder, Jakson et al 2007 analyzed the effect of microbian phytase on phytic phosphorus utilisation. At the end of the trial they reported that the experimental group that received 500 phytase units / kg of fodder had a higher consumption and a faster growth rythm than the control group. There weren't no differences regarding the survival percent and the feed convertion ratio (FCR), exception the experimental group that received 1000 phytase units /kg fodder. The ash from bones, the phosphorus from bones, the fodder consumption and the growth rythm had been higher at the experimentals groups. The phosphorus concentration from the solid weist droped corelated with the increasment of fodder phytase. This trial showed that microbian phytase is highly effective in the increasment of phytic phosphorus bioavailibility in *Ictalurus punctatus*.

Kumar et al (2006) made a 60 days trial to see the effect of gelatinized and non-gelatinized corn with or without supplementing the fodder with exogenus α-amilase at two different proteic levels, 35 % (optimum level) and 27 % (sub-optimum level) on *Labeo rohita.* The trial was made on 360 fish of 10,00±0,15g, distributed in 12 groups. 12 semipurified diets containig 35 % and 27 % crude protein (CP) had been supplemented with different levels of α-amylase (0, 50, 100 and 150 mg/kg^{-1}) and gelatinized (G) and non-gelatinized (NG) starch. The growth rate, the specific growth rate, the protein efficiency ratio and the relative protein usage had been significantly higher at the groups fed with non-gelatinized corn 42,43 % ($P<0,05$) comparative with the groups that had been fed with gelatinized corn. Non-gelatinized corn with 50 mg α-amylase/kg^{-1} and a 27 % CP level improves the growth rate meanwhile the addition of α-amylase in the fodder with gelatinized corn shows no positive results at *L. Rohita.*

Eya and Lovell (2007) made a trial on *Ictalurus punctatus* (765 g/exemplar) fed with comercial fodder with the addition of phosphorus 0,40% from different sources of phytase (1000 and 3000 units) raised in circular tanks (1m³) for 21 days at 28-30 ºC. Eya and Lovell determined phosphorus net absorbtion from fodder using chromic oxyde as indicator. The net absorbtion of supplimentary phosphorus was corected with the help of rezidual phosphorus from the basal diet. The net absorbtion coeficients for monosodium phosphate, monoammonium phosphate, mineral defluorinated phosphate (grounded small) and monocalcium phosphate were 88,6 ; 85,4; 81,7; 81,2% (unsignificant). The net absorbtion coeficient for dicalcium phosphate was significantly lower, 74,8% but significantly higher than the coeficient of mineral defluorinated phosphate (grounded big) and tricalcium phosphate (55,1 and 54,8%). These results are meet with the values of bioavailibility obtained from the farming of *Ictalurus punctatus*, determined in other trials. The net absorbtion of phosphorus from the basal diet made only from vegetals was 31,2 % and it was improved to 55,1 % and 62,5 % through the addition of 1000 and 3000 phytase units of fungal origin.

Nwanna L.C. et al (2008) studied the effect of phytase pre-treatement of fodder plants on the growth performances and mineral concentration in common carp (*Cyprinus carpio* L.). Diets used were: C0-diet without any supplement; CI- diet with incubated vegetals; CP0-diet supplemented with 3 gr. P/ Kg.; CPI- diet with incubated vegetals and the addition of phosphorus 3 g./Kg.; Phyt0- diet supplemented with 4000 U phytase/ Kg; PhytI- diet with incubated vegetals and the addition of 4000 U phytase/Kg. The specific gowing rate (SGR) and feed convertion ratio (FCR) were the same, $P < 0,05$ for the fish fed with CP0, CPI and PhytI but lower ($P<0,05$) for all the other fish. Bone phosphorus was the same for the fish fed with CP0 (74,9), CPI (75,9) and PhytI (71,5mg/g SU) but higher ($P<0,05$) than fish fed with

C0. Ca and Mg from bones was similar for the fish fed with CP0, CPI and PhytI but lower (P<0,05) at the other fish. Zn from bones was higher at fish fed with C0, PhytI and Phyt0 (P<0,05) than fish fed with CP0 and CPI. It can be seen that CP0,CPI and PhytI have the same effect, showing that phytase pre-treatement is a very efficient method. CPI doesn't show any advantage towards CP0. The phytase led to the improvement of minerals bioavailibility, fact which can led to the minimalization of minerals supplementation costs and the reduction of losses in the surounding environment.

Sardar P. et al (2007) made a trial of 8 weeks regarding the effects of supplementing the basal diet with microbial phytase on the growth performances and on the hemato-biochemical status of common carp juveniles (6,66±0,08g body weight). Sardar P. et al wanted to determine if dicalcic phosphate, microminerals, lisine and methionine can be reduced through the supplimentation of carp diet with microbian phytase. The basal diet was supplemented with dicalcic phosphate, microminerals premix, lisine and methinonine without microbial phytase. 4 experimental diets were made through reduction of dicalcic phosphate or microminerals premix or lisine and methionine or of all 4 elements with 100 % also without microbial phytase. Another 2 experimental diets were made through reduction of all 4 elements with 0% and 100 % from the control diet but with the addition of phytase 500 FTU/ Kg^{-1}. The results obtained show that phytase had a major effect on releasing most of the phytic connections from proteins, aminoacids and minerals for the optimum usage. The results obtained also show that dicalcic phosphate, microminerals premix, lisine and methinonine added in diet can be replaced with microbian phytase 500 FTU Kg^{-1} in carp diets based on soja without altering the production performances of carp. The optimum level of replacing dicalcic phosphate, microminerals premix, lisine and methinonine with microbian phytase 500 FTU/Kg^{-1} in carp diets based on soja must be standardized in other investigations. Shimei L. et al (2007) made a trial of 2 weeks regarding the effects of supplementing the basal diet with exogenus enzymes on the growth performances of *Oreochromis niloticus X O. aureus* juveniles (18g body weight). A comercial enzymatic complex was added in ratio of 0,0 (Control group), 1 and 1,5 g/Kg^{-1} in 3 experimental diets. Shimei L. et al used 3 groups of fish, 50 fish/group, and fish received 3 meals/day (fodder represented 4-6% of the total biomass). The results obtained show that speciffic growth rate (SGR) and feeding efficiency raised significantly (P<0,05) in response to the increasment of the enzymes level in diet. The highest FCR was registered at Control group (P<0,05). The highest relative protein retention was noticed at the group that received 1,5 g/Kg^{-1} enzymes in diet (P<0,05). There were no differences regarding the relative protein digestibility, lipids and total energy (P>0,05). However, the relative digestibility at fish fed with a high level of enzyme (1,5 g/Kg^{-1}) was higher than the control group. There were no differences regarding the condition factor, total body moisture, protein, lipids and ash among the 3 treatements. The visceral ratio, hepato-somatic index and stomach lipids significantly decreased once with the increasment of enzyme (P<0,05). The protease activity and amylase activity in intestin and hepato-pancreas increased once with the increasment of enzymes in diet (P<0,05). The results show that the addition of enzymes can improve the production performances of tilapia hybrid juveniles.

Stone D.A.J. et al (2003) studied the effects of exogenus enzymes on starch digestibility from wheat or diets containing decorticated wheat or lupin (*Lupinus angustifolius* var. gungurra) in silver bass(*Bidyanus bidyanus* M.). In diets containing wheat starch or 100 % gelatinized was added Natustarch ® (α-amylase) in doses of 0,50,100,150 mg/Kg^{-1} diet. The coefficients of relative digestibility for SU, starch and energy were calculated. The addition of Natustarch® in diets containing wheat starch crude or gelatinized led to an average improvement in the reduction of sugar from diet with 67% and 34%,

showing that α-amylase was more efficient in wheat gelatinized starch hidrolisis. Wheat gelatinized starch was digested more efficiently than the crude starch. The addition of Natustarch® (de ≥50mg Kg^{-1}) led to the improvement of wheat crude starch digestibility but had no effect on gelatinized starch. Losses due to the imersion in water on α-amylase activity were insignificant (13% after 5 minutes). The activity of α-amylase in the intestinal tractus of silver bass fed with fodder supplemented with Nastustarch® wasn't afected, showing that α-amylase was denaturated by the acid conditioning in silver bass stomach.

Feiler K. et al (2007) presented following a trial the effect of using enzymes in fodder treatement before granulation. The trial consisted in 3 diets divided in 2 treatements, following the effect of Allzyme® SSF enzimatic complex on the improvement of phosphorus, glucids and nitrogen availibility.

Although SSF-treated sample 1 showed no increase in release of phosphate (Table 1, Figure 1), sugar (Table 2, Figure 2) or soluble N (Table 3, Figure 3) in the SSF-treated sample 2 whase showed increased release of all three components: sugar by 490%, phosphate by 43%, and soluble N by 73% and in the SSF- treated sample 5 whase showed increased release of sugar (+9%) and N (+35%) with no change in phosphate.

As a conclusion the use of enzymes in the aquaculture industry has the potential to lower costs and improve performance as it has in other species, but the aquaculture environment imposes some unique obstacles in terms of product delivery and stability. Digestion of feeds with enzymes immediately before pelleting could offer an opportunity for the aquaculture industry to benefit from enzyme use. These results indicate that Allzyme® SSF may assist in the digestion of aquaculture feeds before pelleting. Feiler K. et.all. (2007).

Tab. 1

Effect of Allzyme® SSF on phosphate release

Sample Numbers*	Phosphate		
	Control (µmole/mL)	Sample (µmole/mL)	Change (%)
3 vs 1	10.21	8.95	-12
4 vs 2	6.21	10.93	+43
6 vs 5	29.20	26.11	-11

*Set of samples with first being control and second being treatment sample
Feiler K. et. all (2007)

Tab. 2

Effect of Allzyme® SSF on sugar release

Sample Numbers*	mg/ml sugar as glucose		
	Control (µmole/mL)	Sample (µmole/mL)	Change (%)
3 vs 1	2.23	2.25	-
4 vs 2	0.66	3.90	+490
6 vs 5	3.71	4.06	+9

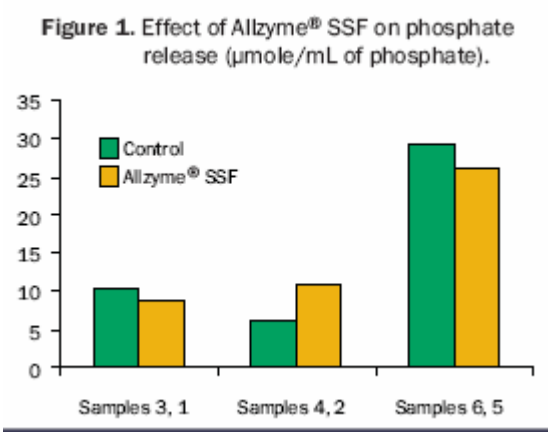
*Set of samples with first being control and second being treatment sample
Feiler K. et. all (2007)

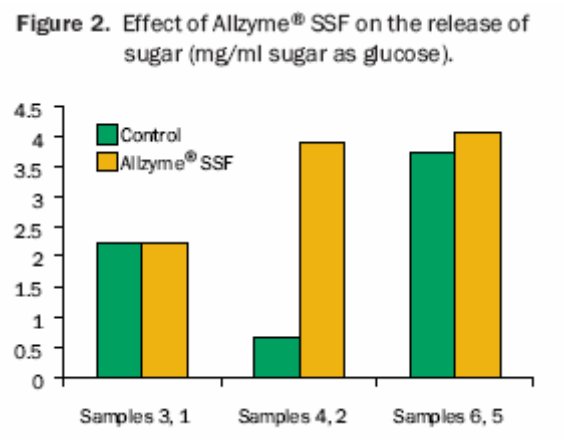
Tab. 3

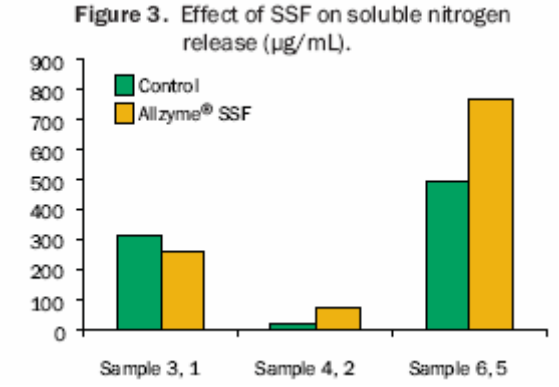
Effect of Allzyme® SSF on soluble nitrogen release

Sample Numbers*			
	Control (µg/mL)	Sample (µg/mL)	Change (%)
3 vs 1	312	261	-16
4 vs 2	19	71	+73
6 vs 5	493	763	+35

*Set of samples with first being control and second being treatment sample
Feiler K. et. all.(2007)







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