The Influence of Multienzymatic Complex Allzyme SSF on Production Performances of Common Carp (*Cyprinus carpio l.*) and Grass Carp (*Ctenopharyngodon idella v.)* Juveniles after Introduction of Alfalfa Meal in Feed

Aurel Şara, Florin Molnar, Erol Gabor, Mihai Benţea

University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca, 400372 Cluj-Napoca, Manastur, 3-5, Romania

Abstract

The purpose of research was to determine the effects of Allzyme SSF administration after introducing of alfalfa meal in feeds, over performances of common carp (*Cyprinus carpio* L.) and grass carp (*Ctenopharyngodon idella* V.) juveniles. The experiments where carried out on 75 common carp (*Cyprinus carpio* L.) – mean initial body weight 47.5g/fish and 75 grass carp (*Ctenopharyngodon idella* V.) – mean initial body weight 24g/fish; the fishes were randomly distributed in three groups: control group M - feed with base diet, experimental group 1E - 70% base diet and 30% alfalfa meal and experimental group 2E - 70% base diet and 30% alfalfa meal and 0.02% Allzyme SSF. The digestibility coefficient of Crude Protein, Crude Fat and Crude Fiber were higher for common carp and grass carp juveniles after supplementation with Allzyme SSF compared to the other groups. The production and consumption indices were improved for groups 2E from both common carp and grass carp juveniles, compared with 1E group and to the control group. The SGR and FCR were improved in group 2E for common carp and grass compared to the other groups. The results indicate the positive effects of Allzyme SSF on enhancing the ADC of vegetal raw materials.

Keywords: Allzyme SSF, apparent digestibility coefficient, common carp, grass carp

1. Introduction

A way to increase the nutritive value of a fish fodder is the supplementation of fodder using various additives that allow an enhancement of the bio-productive performances of the species used. Adding enzymes allows an increase of the feed efficiency in the reared species that subsequently determines an enhancement of the productive indices. The use of enzymes as fodder additives in fish was tested first by using enzyme extracts of animal origin by Dabrovski [1] and Dabrovska [2] that reported favorable results on common carp. One of the most used enzymes is phytase, as most of the phosphorus in plants is found as phytate, a form that is not digestible by the enzymes found in the fish intestine. Phytase has been introduced in fish feed of various species like common carp [3] [4], channel catfish [5], tilapia, trout or other species. In a research using phytase, on channel catfish, over a period of 10 weeks, Jackson et al., [6] reported a decrease in the amount of phosphorus released in water as a result of the increase of it's availability.

The use of the enzyme complex Allzyme SSF before pelleting can increase the carbohydrates, phosphates and nitrogen digestibility [7]. The positive effect of the Allzyme SSF enzyme complex was also reported by Filler [8] in a research carried out on Nile tilapia (*Oreochromis niloticus*) wich obtained, at the end of the experimental period, positive results ($P<0.01$) regarding the body weight gain evolution.

*Corresponding author: Şara Aurel, Tel: 0749021648
Email: aurel.sara@usamvcluj.ro

Common carp, although without a developed stomach, compensates the albumin activity, that suppresses α-amilase, by secreting up to 3-4 times more quantities of amylase [9]. The apparent digestibility coefficient indicates the status of nutrient utilization and can help choosing the proper feed ingredients leading subsequently to cost reductions.

Carbohydrates represent a alternative source of energy for fish, especially for herbivorous fish (grass carp) or omnivorous fish (common carp) due to their higher ability to digest plant raw materials compared to the carnivorous species (salmonids).

The aim of this research was to determine the apparent digestibility coefficient of nutrients found in fodders and to highlight the effects of administering Allzyme SSF enzyme complex on production performances of common carp (*Cyprinus carpio L.*) and grass carp (*Ctenopharyngodon idella* V.) juveniles after fodder supplementation with alfalfa meal.

2. Materials and methods

The researches were carried out in the Department of Animal Nutrition from the University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. The experimental period was 15 days: 01.02.2011-15.02.2011 for common carp juveniles and 01.03.2011-15.03.2011 for the grass carp juveniles. The research was carried out on 75 common carp (*Cyprinus carpio L.*) juveniles with a mean initial weight of 47.5g/fish randomly assigned to 3 groups (25 fish/group) and 75 grass carp (*Ctenopharyngodon idella V.*) juveniles with a mean initial weight of 24g/fish randomly assigned to 3 groups (25 fish/group). The fish were reared in a recirculating system, designed to fulfill the requirements to carry out digestibility tests, based on Guelph-system–CYAQ2 [11] system. The groups were fed as follows: control group – combined pelleted food (crude protein 38%, crude fat 6.86%, and crude fiber 3.87%); group 1E – 70% base diet and 30% alfalfa meal (crude protein 32.11%, crude fat 6.43%, and crude fiber 12.30%) and group 2E – 70% base fodder + 30% alfalfa meal + 0.02% Allzyme SSF. To determine the apparent digestibility coefficient, the feed was administered 3 times a day (at 8:00, 12:00 and 16:00 hour) and the feces collecting was carried out in the morning, 10 minutes before the first meal. Body mass evolution, weight gain, specific growth rate and feed conversion ratio were monitored throughout the experimental period. Crude chemical composition was determined in the Laboratory of Animal Nutrition from the Faculty of Animal Sciences and Biotechnology, Cluj Napoca, according to known methods [10]. At the end of the experiment, the apparent digestibility coefficient was determined using the indirect method by spectrophotometer [12].

Data collected were statistically analyzed using one-way ANOVA and GraphPad InStat software v 3.05.

3. Results and discussion

Due to the digestive particularities of the Cyprinids, especially the ability to consume plant raw materials and the effects of Allzyme SSF enzyme complex on plant feed use, the present work aimed to determine the effects of Allzyme SSF on biological use of plant feed after supplementation of the base diet with alfalfa meal and production performances in common carp (*Cyprinus carpio L.*) juveniles and grass carp (*Ctenopharyngodon idella* V.) juveniles.

Based on the results regarding the main nutrients concentration (crude protein, crude fat and crude fiber) determined after chemical analysis of fodder and feeces, the feed apparent digestibility coefficient was determined using chrome oxide (Table 2).

Analyzing the results obtained in Table 2, it can be stated that diet supplementation with Allzyme SSF after introduction of alfalfa meal, led to an increased digestibility coefficient of feeds.

Regarding the use of alfalfa meal as feedstuff, the biological use of protein, after using Allzyme SSF 0.02% increased in group 2E by 2% both for carp and grass carp juveniles, compared to group 1E. The digestibility coefficient of fat was slightly increased by 1.49% and 2.33% in common carp and grass carp respectively from group 2E compared to group 1E, following the supplementation with 0.02% Allzyme SSF. The apparent digestibility coefficient of cellulose

increased by 6% for the common carp and grass carp juveniles.

Table 1. Concentration of main nutrients in fodder and feeces

Group		Fodder			Feeces		
		Pb%	Gb%	Celb%	Pb%	Gb%	Celb%
Common carp	M	38	6.86	3.87	17.23	4.51	2.61
	1E	32.11	6.43	12.3	10.8	3.74	8.56
	2E	32.11	6.43	12.3	10.2	4.31	7.16
Grass carp	M	38.00	6.86	3.87	18.00	5.54	2.55
	1E	32.11	6.43	12.3	15.32	4.85	8.21
	2E	32.11	6.43	12.3	15.32	6.12	9.12

M Control group; 1E (alfalfa meal 30%); 2E (alfalfa meal 30% + Allzyme SSF 0.02%)

Table 2. The aparent digestibility of nutrients

Group		PB %	GB %	CELB %
Common carp	M	73.33	61.34	65.34
	1E	70.89	56.92	60.45
	2E	72.73	57.77	66.02
Grass carp	M	78.47	63.31	70.06
	1E	75.07	56.93	66.71
	2E	77.1	58.26	72.28
References values		70-90%	55-90%	60-80%
References		[13]	[14]	[14]

M Control group; 1E (alfalfa meal 30%); 2E (alfalfa meal 30% + Allzyme SSF 0.02%)

At the end of the experimental period, growth and consumption indices were determined to determine the efficiency of alfalfa meal and Allzyme SSF enzyme complex.

Table 3. Main growth and consumption indices of common carp and grass carp juveniles in trial period

Specification	Group					
	Common carp			Grass carp		
	M	1E	2E	M	1E	2E
n	25	25	25	25	25	25
Initial body weight(g)	47.50±3.05	47.00±3.31	47.45±3.42	23.72±0.44	23.96± 0.41	23.96± 0.43
Final body weight(g)	52.75±3.25	52.00±3.46	53.7±3.73	33.02±1.31	33.11± 1.19	34.4±1.45
Growth (g)	5.25	5.00	6.25	9.3	9.15	10.44
Specific growth rate(g)	0.35	0.33	0.42	0.62	0.61	0.69
FCR kg fodder/kg body weight	1.62:1	1.78:1	1.43:1	1.30:1	1.32:1	1.21:1

M Control group; 1E (alfalfa meal 30%); 2E (alfalfa meal 30% + Allzyme SSF 0.02%)

Due to the Cyprinids ability to efficiently use carbohydrates, an increase of the weight gain can be observed in group 2E for the common carp juveniles, fed with alfalfa meal and Allzyme SSF supplemented fodder. The body weight increased in group 2E by 3.26% compared to group 1E, as a result of Allzyme SSF supplementation of fodders. The specific growth rate was 27% higher in group 2E compared to group 1E and the FCR dropped from 1.78:1 (group 1E – alfalfa meal) to 1.43:1 (group 2E – alfalfa meal + 0.02% Allzyme SSF).

Also for the grass carp, an increase in body weight was recorded in group 2E, 3.89% higher compared to group 1E. The specific growth rate in group 2E (alfalfa meal + Allzyme SSF) was 13.11% higher compared to group 1E (alfalfa meal). The FCR was 1.32:1 in group 1E and 1.21:1 in group 2E highlighting the beneficial effect of the enzyme complex Allzyme SSF on digestibility of the plant raw materials.

4. Conclusions

The use of Allzyme SSF enzyme complex after feed supplementation using alfalfa meal, le to the increase of nutrients apparent digestibility coefficient. The biological use of protein after Allzyme SSF supplementation increased by 2% both for common carp and grass carp juveniles, in group 2E compared to group 1E. Fat digestibility cefficient was increased after the use of Allzyme SSF in group 1E compared to group 1E. The use of Allzyme SSF enzyme complex in feed for group 2E led to an increased cellulose digestibility, by 6% in group 2E compared to group 1E, both for common carp andgrass carp juveniles.

The weight gain was increased in common carp group 2E (by 3.26%) at the end of the experimental period as a result of diet supplementation using Allzyme SSF enzyme complex, compared to group 1E (30% alfalfa meal). The use of Allzyme SSF enzyme complex in grass carp feed (group 2E) led to the increase of the final body weight by 3.89%, compared to group 1E (alfalfa meal), highlighting the beneficial effect of the enzyme complex Allzyme SSF on digestibility of the plant raw materials, thus explaining the more accelerated growth

References

1. Dabrowski, K. and Glogowski, J., Studied on the proteolztic enzymes of invertebrates constituting fish food, Hzdrobiologia, 1977, 52, (2-3), 171-174

2. Dabrowska, H., Grudniewski, C., and Dabrowski, K., Artificial diets for common carp: Effect of the Addition of enzyme extract, The Progresive Fish-Culturist, 1979, 41, 196-200; doi: 10.157/158-8659(1979)41[196:ADFCC]2.0.CO;2

3. Nwana, L., C, Kolahsa, M., Eisenreich, Schwarz, R., Pre-treatment of dietary plant feedstuffs with phytase and its effect on grtale inowth and mineral concentration in common carp (Cyprinus carpio L.), Journal of Animal Physiology and Animal Nutrition, 2008, 92(6), 677–682

4. Sardar P., Randhawa, H.S., Abid, M., Prabhakar, S.K., Effect of dietary microbial phytase supplementation on growth performance, nutrient utilization, body compositions and haemato-biochemical profiles of Cyprinus carpio (L.) fingerlings fed soyprotein-based diet, Aquaculture Nutrition, 2007, 13 (6), 444-456

5. Eya, J. C., Lovell, R. T., Net Absorption of Dietary Phosphorus from Various Inorganic Sources and Effect of Fungal Phytase on Net Absorption of Plant Phosphorus by Channel Catfish Ictalurus punctatus, Journal of the World Aquaculture Society, 2007, 28, 4, 386 – 391, Published Online: 3 Apr 2007

6. Jackson L.S., H Li, Meng, Edwin H., Robinson Use of Microbial Phytase in Channel Catfish Ictalurus Punctatus Diets to Improve Utilization of Phytate Phosphorus, Journal of the World Aquaculture Society, 2007, 27, (3), 309–313, Published Online: 3 Apr. 2007

7. Filler K, Nattawade Jantasilia, Navaporn Chauynarong, Influence of Allzyme® SSF on the digestion of aquaculture feed ingredients prior to pelleting, Nutritional Biotechnology in the Feed and Food Industries Proceedings of Alltech's Twenty Third Annual Symposium Edited by TP Lyons, KA Jacques and JM Hower, 2007, poster

8. Filler, K., Ben L., Schafer, Steven, R., Craig, Brain, Hoskins and James L., Pierce, Effects of Allzyme® SSF on the Growth Performance of Nile Tilapia, Aquaculture 2010 - Meeting Abstract(poster), Aquaculture 2010 San Diego, California, Feeds/Nutrition Posters, posted online: http://www.was.org/WasMeetings/meetings

9. Sturmbauer, C., R. Hofer, Compensation for amylase inhibitors in the intestine of the carp (Cyprinus carpio), Aquaculture, 1986, 52(1), 31–33

10. Şara, A. and Odagiu, A., Controlul calităţii nutreţurilor. Ed. AcademicPres Cluj-Napoca, 2005.

11. Cho, C.Y., Cowey, C.B., Watanabe, T., Methodological approaches to research and development. In: Cho, C.Y., Cowey, C.B., Watanabe, T. (Eds.), Finfish Nutrition in Asia. IDRC, Ottawa, Canada, 1985, pp. 10–80.

12. Furukawa, H., and Tsukahara H., On the acid digestion method for the determination of chromium oxide as an index substance in the study of digestibílity of fish fed. Bulletin of the Japanese Society of Scientific Fisheries, 1966, 32(6), 502-508.

13. Kirchgessner, M., Kurzinger, H. and Schwarz, F. J., Digestibility of crude nutrients in different feeds and estimation of their energy content for carp (Cyprinus carpio L.). Aquaculture, 1986, 58, 185-194.

14. Spurný, P., Estimation of digestibility of nutrients in feed mixtures for carp (Cyprinus carpio L.) fry when using chromium oxide as an indicator. Acta Ichthyol. Piscat., 1996, 26 (1), 83-91.

15. Jimoh, W. A., Fagbenro, O. A., and Adeparusi, E. O., Digestibility coefficients of processed jackbean meal Cannavalia ensiformis (L.) DC for Nile tilapia, Oreochromis niloticus (Linnaeus, 1758) diets, International Journal of Fisheries and Aquaculture, 2010, 2(4), 102-107, November 2010 Available online at http://www.academicjournals.org/IJFA ISSN 2006-9839 ©2010 Academic Journals.