The Effects of Prebiotic Products in Fish Nutrition

Mihai BENŢEA*[1)], Aurel ŞARA[1)], Alina ANI[2)], Aurelian BARBU[1)]

[1)]University of Agricultural Sciences and Veterinary Medicine, Faculty of Animal Science and Biotechnologies, 3-5Mănăştur Street, 400372 Cluj-Napoca, Romania
[2)]Alltech Romania
*Corresponding author, email: *mihaib78@yahoo.com*

Bulletin UASVM Animal Science and Biotechnologies 71(2) / 2014,
Print ISSN 1843-5262; Electronic ISSN 1843-536X
DOI:10.15835/buasvmcn-asb:10445

Abstract

Prebiotics are natural or synthesized organic or inorganic substances that favor the development of useful microorganisms in the digestive tract. Prebiotics have only recently been used in aquaculture, for their beneficial effects on production performances and health status, as an alternative strategy for the use of antibiotics. Other members of the prebiotics group are: inulin, fructo-oligosaccharides (FOS), short-chain fructo-oligosaccharides (scFOS), mannan oligosaccharides (MOS), galacto-oligosaccharides (GOS), xylo-oligosaccharides (XOS), arabino-xylo-oligosaccharides (AXOS). Effects of prebiotics on growth, feed conversion, disease resistance and immune parameters in different species of fish, have been studied worldwide, but to a lesser extent compared to the land animals. From the previously listed prebiotics, the most efficient in fish nutrition are the mannan oligosaccharides, extracted from the cell wall of *Saccharomyces cerevisiae*. An important product from this category is Bio-Mos and Actigen. This mannan based prebiotic inhibits the development of pathogenic bacteria in the gut, at the same time having immuno-stimulatory effects, thus determining a greater disease resistance. At an intestinal level, prebiotics determine the increase of the nutrient absorption area, leading to an increased growth rhythm and a better-feed conversion.

Keywords: *prebiotics, production and consumption indices, survival rate*

Introduction. Prebiotics are substances of organic or inorganic origin, natural or synthesized that favor de development and multiplication of useful microorganisms in the intestinal tract, thus contributing to maintaining a good health status and the increase of the productive performances in animals and fishes. The effects of prebiotics on growth, feed conversion, disease resistance and immune parameters were studied worldwide, but to a lesser extent in fishes. As an alternative strategy to the use of antibiotics in aquaculture, the prebiotics only recently drew attention (Ringo *et al*., 2010). Other members of prebiotics with beneficial effects in fish are: inulin, fructo-oligosaccharides (FOS), short chained fructo-oligosaccharides (scFOS), mannan-oligosaccharides (MOS), galacto-oligosaccharide (GOS), xylo-oligosaccharides (XOS) and arabino-xylo-oligosaccharides (AXOS).

Inulin is found in cereals, legumes and fruits (wheat, onions, leek, garlic, asparagus, artichoke and bananas). This prebiotic stimulates the beneficial bacteria from the gastro-intestinal tract by suppressing the pathogens and by enhancing the immune response.

Fructo-oligosaccharides **(FOS).** Dietary supplementation using fructo-oligosaccharides determined a better growth rate in different species of fishes like the Atlantic salmon (*Tab. 1*).

Short chained fructo-oligosaccharides **(scFOS).** Chinese researchers recorded positive effects after using scFOS on productions performances and intestinal microbiota in hybrid tilapia (*Tab. 1*).

Mannan-oligosaccharides **(MOS).** A very efficient prebiotic in fish nutrition, based on oligosaccharides, is Bio-Mos, marketed by the US based Alltech Company, obtained from the

Tab. 1. The effects of fructo-oligosaccharides (FOS), short chained fructo-oligosaccharides (scFOS), mannan-oligosaccharides (MOS) galacto-oligosaccharides (GOS) and xylo-oligosaccharides (XOS) in fish nutrition

Prebiotic	Species of fishes and weight (g)	Results	References
FOS	Atlantic Salmon (*Salmo salar* L.) (200±0,6 g)	Improvement of the growth rate and digestibility	Grisdale-Helland *et al.* (2008)
scFOS	Hybrid tilapia (Oreochromis niloticus♀ x Oreochromis aureus♂) (5,6±0,02g)	Improvement of the growth rate and feed conversion; no influence on survival rate.	Hui-Yuan *et al.* (2007)
MOS	Rainbow trout	Increases the absorption area in the posterior region of the intestine. Increases the microvilli density and length	Dimitroglou şi col (2008)
Bio-Mos	Catfish (*Sillirus glanis)*	Improvement of the weight gain, feed conversion and survival rates, at the end of the experimental period.	Bogut *et al.* (2006), Barbu A (2010)
GOS	Red drum (*Sciaenops ocellatus*)	Significantly enhanced the apparent digestibility coefficient of proteins while the apparent digestibility coefficient of lipids significantly dropped.	Burr *et al.* (2008)
XOS	Prussian carp (*Carassius auratus gibelio*)	Significant differences were recorded regarding the growth rate, but the survival rate was not influenced by dose of XOS	Xu *et al.* (2009)

cellular walls of the *Sacharomyces cerevisiae* yeast, grown on a complex mix of sugars. Actigen is a 2nd generation prebiotic product containing mannan-oligosaccharides (MOS); it is a specific product derived from the cellular wall of the SCvB yeast (*Saccharomyces cerevisiae* var. *Boulardii*). Bio-Mos and Actigen are considered to be a growth promoter through their roles in enhancing the growth performances and health status by modulating immunity and improving the intestine health.

***Galacto-oligosaccharides* (GOS), *Xylo-oligosaccharides* (XOS) and *Arabino-xylo-oligosaccharides* (AXOS)** in fish nutrition are scarce.

Researches regarding oligosaccharides (FOS), short-chained fructo-oligosaccharides (scFOS), mannan-oligosaccharides (MOS), galacto-oligosaccharides (GOS), xylo-oligosaccharides (XOS) in fish nutrition are shortly presented in *Table 1*.

REFERENCES

1. Barbu A (2010). Utilizarea unor aditivi furajeri în alimentația unor specii de pești. Teză de doctorat USAMV Cluj-Napoca.
2. Bogut I, Milakovic Z, Pavlicevic J and Petrovic D (2006). Effect of Bio-Mos on performance and health of European catfish, *Sillirus glanis*. Proceedings of Alltech's 22nd Annual Symposium April 23-26, Lexington, KY, USA.
3. Burr G, Hume M, William H, Neill WH *and* Gatlin DM III *(*2008*).* Effects of prebiotics on nutrient digestibility of a soybean-meal-based diet by red drum *Sciaenops ocellatus* (Linnaeus). Aquacult. Res., 39, 1680–1686.
4. Dimitroglou A, Davies S and Sweetman J (2008). The effects of dietary mannan oligosaccharides on the intestinal histology of rainbow trout (*Oncorhynchus mykiss*). Abstracts/Comp. Biochem.Physiol., A., S63.
5. Grisdale-Helland B, Helland SJ, Gatlin III DM (2008). The effects of dietary supplementation with mannanoligosaccharide, fructooligosaccharide or galactooligosaccharide on the growth and feed utilization of Atlantic salmon (*Salmo salar*). Aquaculture 283:163-167.
6. Hui-Yuan L, Zhigang Z, Rudeaux F *&* Respondek F *(*2007*).* Effects of dietary short chain fructo-oligosaccharides on intestinal microflora, mortality and growth performance of *Oreochromis aureus*♂ x *O. niloticus*♀. Chinese J. Anim. Nutr, 19, 1–6.
7. Ringo E, Olsen RE, Gifstad TO, Dalmo RA, Amlund H, Hemre GI, Bakke AM (2010). Prebiotics in aquaculture: a review. Aquaculture Nutrition, 16: 117-136.
8. Xu B, Wang Y, Li J *&* Lin Q *(*2009*).* Effects of prebiotic xylooligosaccharides on growth performance and digestive activities of allogynogenetic crucian carp (*Carassius auratus gibelio*). Fish Physiol. Biochem, 35, 351–357.