AQUACULTURE III

11. WEEK

Aquaculture nutrition: gut health, probiotics, and prebiotics

WEEKLY TOPICS

Week	Topics
1. Week	Aquaculture Science and Aquaculture Engineering
2. Week	Aquaculture: Economic and Environmental
3. Week	Aquaculture: Innovation and Social Transformation
4. Week	Aquaculture: Food Ethics
5. Week	Shellfish Aquaculture and the Environment
6. Week	Advances in aquaculture hatchery technology
7. Week	Recirculating Aquaculture
8. Week	Selection and Breeding Programs in Aquaculture
9. Week	Ecological and Genetic Implications of Aquaculture Activities
10. Week	Aquaculture: Biotechnology
11. Week	Aquaculture nutrition: gut health, probiotics, and prebiotics
12. Week	Mucosal Health in Aquaculture
13. Week	Off-Flavors in Aquaculture
14. Week	Sustainable Aquaculture Techniques

- **Prebiotics in aquaculture: a review**

- A prebiotic is a non-digestible food ingredient that beneficially affects the host by selectively stimulating the growth and/or the activity of one or a limited number of bacteria in the colon. Despite the potential benefits to health and performance as noted in various terrestrial animals, the use of prebiotics in the farming of fish and shellfish has been less investigated. The studies of prebiotics in fish and shellfish have investigated the following parameters: effect on growth, feed conversion, gut microbiota, cell damage/morphology, resistance against pathogenic bacteria and innate immune parameters such as alternative complement activity (ACH50), lysozyme activity, natural haemagglutination activity, respiratory burst, superoxide dismutase activity and phagocytic activity.

Ringø, E., Olsen, R.E., Gifstad, T.Ø., Dalmo, R.A., Amlund, H., HEMRE, G.I. and Bakke, A.M., 2010. Prebiotics in aquaculture: a review. *Aquaculture Nutrition*, *16*(2), pp.117-136.

- **Prebiotics in aquaculture: a review**

- Prebiotics are defined as non-digestible components that are metabolized by specific health-promoting bacteria such as *Lactobacillus* and *Bifidobacterium*. These bacteria are considered beneficial to the health and growth of the host by decreasing the presence of intestinal pathogens and/or changing the production of health related bacterial metabolites.

Ringø, E., Olsen, R.E., Gifstad, T.Ø., Dalmo, R.A., Amlund, H., HEMRE, G.I. and Bakke, A.M., 2010. Prebiotics in aquaculture: a review. *Aquaculture Nutrition*, *16*(2), pp.117-136.

- **Prebiotic Applications in Shellfish**

- The current research demonstrates great potential for the dietary application of prebiotics in the culture of larval, post larval and juvenile stages of shrimps and prawns (Penaeidae), freshwater crayfish (Astacidae and Parastacidae) and lobsters (Nephropidae and Palinuridae). Specific prebiotics used in such applications include mannanoligosaccharides (MOS), fructooligosaccharides (FOS), isomaltooligosaccharides (IMO), xylooligosaccharides (XOS) and inulin. Prebiotic applications have been demonstrated to increase growth and survival during culture, improve feed conversion, enhance development, elevate survival and improve immune status and/or stress tolerance.

Daniels, C. and Hoseinifar, S.H., 2014. Prebiotic applications in shellfish. *Aquaculture nutrition: gut health, probiotics and prebiotics*, pp.401-418.

- **Prebiotic Applications in Shellfish**

- These benefits are mediated by modulated gastrointestinal (GI) microbiology and enhanced physical GI structures, which may account for improved feed conversion and consequently growth of the host species. This review thus demonstrates that by making positive changes in GI structure and bacterial community composition combined with influencing immune status, culture success can be enhanced through dietary prebiotic supplementation. However, it is clear that prebiotic efficiency is dependent on a number of independent and interacting factors specific to the culture conditions and host species; further research is required to elucidate these factors in order to improve prebiotic applications.

Daniels, C. and Hoseinifar, S.H., 2014. Prebiotic applications in shellfish. *Aquaculture nutrition: gut health, probiotics and prebiotics*, pp.401-418.

- Effects of dietary mannan oligosaccharide on growth, body composition and hepatopancreas histology of *Penaeus semisulcatus* (de Haan 1844)

- Rapid growth and high disease resistance are two of the most important concerns in aquaculture production. For the past decades, antibiotic growth promoters have been included in animal feeds worldwide at subtherapeutic concentrations as a standard practice because of their positive effects on weight gain, feed utilization and mortality (Rosen 1996). Recently, however, the effects of antibiotics on the development of resistant bacteria in both animals and humans, and associated risks to human health, have been the subjects of controversy. Restriction or ban of antibiotic usage as feed additives in fish and shrimp diets in many countries, because of the development of antibiotic resistance in micro-organisms, has led to an increase in research carried out on health-promoting feed additives.

Genc, M.A., Aktas, M., Genc, E. and Yilmaz, E., 2007. Effects of dietary mannan oligosaccharide on growth, body composition and hepatopancreas histology of *Penaeus semisulcatus* (de Haan 1844). *Aquaculture Nutrition*, *13*(2), pp.156-161.

- Effects of Dietary Mannan Oligosaccharides (MOS) on Growth, Body Composition, and Intestine and Liver Histology of the Hybrid Tilapia (*Oreochromis niloticus* x *O. aureus*)

- This is the first study on the effects of dietary mannan oligosaccharides (MOS) on growth, body composition, and intestine and liver histology of hybrid tilapia (*Oreochromis niloticus x O. aureus*). Experimental diets were prepared from commercial trout diet, supplemented with MOS at levels of 0, 1.5, 3.0, or 4.5 g MOS/kg feed and randomly assigned to triplicate groups. At the end of the trial, there were no significant differences between treatment groups ($p>0.05$) in growth parameters (live weight gain, specific growth rate, feed conversion ratio, protein efficiency ratio) or body indices (hepatosomatic and viscerosomatic). Dry matter and protein contents increased with increasing rates of dietary MOS ($p<0.05$) while the mean villi length of fish fed the diet containing 1.5‰ MOS was significantly longer ($p<0.05$) than that of the fish fed 4.5‰ dietary MOS. The different levels of dietary MOS had no detrimental effects on liver tissue or general fish health.

Genc, M.A., Yilmaz, E., Genc, E. and Aktas, M., 2007. Effects of dietary mannan oligosaccharides (MOS) on growth, body composition, and intestine and liver histology of the hybrid Tilapia. *Oreochromis niloticus*× *O. aureus) Israel Journal of Aquaculture*, *59*, pp.10-16.

- Effects of dietary mannan oligosaccharides on growth, body composition, and intestine and liver histology of rainbow trout, *Oncorhynchus mykiss*.
- This study investigated the effects of dietary mannan oligosaccharides (MOS) on growth, body composition, and small intestine and liver histology of rainbow trout (*Oncorhynchus mykiss* Walbaum). Experimental diets were supplemented with 0 (control), 1.5, 3.0, or 4.5 g MOS per kg commercial trout feed and randomly assigned to treatment groups. Enhanced growth performance was generally observed in fish fed the diet supplemented with 1.5‰ MOS. Villi of fish fed diets supplemented with 1.5 or 3.0‰ MOS were longer than those of fish fed 4.5‰ or no dietary MOS ($p<0.05$). Protein contents increased as the rate of MOS increased ($p<0.05$). There were no significant differences in feed conversion ratio, protein efficiency ratio, or hepatosomatic index ($p>0.05$) and MOS had no detrimental effects on the intestine.

Yilmaz, E., Genc, M.A. and Genc, E., 2007. Effects of dietary mannan oligosaccharides on growth, body composition, and intestine and liver histology of rainbow trout, Oncorhynchus mykiss. *Israeli Journal of Aquaculture-Bamidgeh*, *59*(3), p.182e8.

- References

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- Aquaculture Farming Aquatic Animals And Plants,2012, John S. Lucas