

## Effect of Feed Additives on Growth Performance of Fish

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Fishes are one of the best and cheap source of lean meat and more than half of the population on earth depends on fish for dietary protein source. From the past decade heavy importance has been given to fish production and their nutrition. Nutrition is the most important factor influencing the ability of cultured fish to exhibit its genetic potential for growth and reproduction. Live food is the best feed for fish, as it is natural and healthy (Oramary, S.O.M., Koramarky, D.M.I., Salih, S.A., Mustafa, A.A. 2016). It is a money saver. But, in artificial tanks and ponds or natural habitats which are used exclusively for the fish farming, the natural feed availability is limited. Most commonly used fish feed contains Fish meal as protein source, which ranges between 10-50% of the operational costs (Ida, M. 1927). Moreover, the common edible fish's food habits have been well established, so that we can easily formulate the feed rations (Gupta, S., Banerjee, S. 2016).

Increasing costs and short supply of Fish feed has created the need to search for an alternative (Bimbo, A.P., Crowtber, B. 1992). Hence, the fish feed feed needs to be fortified with feed additives. Feed additives are edible substances that are added to animal feeds in small quantity to enhance the feed quality which in turn enhances growth performance and reduces mortality in fish (Dada, A.A. 2015). As there are strict regulations on the application of antibiotics and chemotherapeutics in aqua feeds due to bioaccumulation (Lim, et al. 2013), increasing importance is being given to feed additives. Feed additives can be broadly classified into two categories live and non-living. Use of low cost live feed supplements as feed additives is highly accepted and encouraged due to its eco-friendly nature. However, only few options are available in this category.

Probiotics, plants and some algae comes into the live category. Probiotics are useful microorganism to the host. Addition of probiotics to the feed enhances the feed conversion ratio and decreases the mortality rate. Probiotics are also proved to have increase the immune response and enhance immune system in fish. However some scientists concluded that prebiotics should be given along with probiotics to enhance the effect of probiotics on the host or fish. Supplementation of host originated probiotics like *B. mycoides* significantly improves stress, tolerance which may help in live transportation (Ambas, I., Fotedar, R., Buller, N. 2016). Now a day's most of the probiotic supplementation is fortified with Prebiotics to enhance the probiotic activity.

Prebiotics are non-digestible to the host that enhances the growth and metabolism of probiotics in the host gastrointestinal tract. Fructooligosaccharide (FOS) is the commonly used prebiotics (Ye, J.D., Wang, K., Li, F.D., Sun, Y.Z. 2011; Akrami, R., Iri, Y., Rostami, H.K., Mansour, M.R. 2013). The effect of FOS has been documented well by many researchers (Abd, El-latif, A.M., Abd, El-Gawad, E.A., Emam, M.A. 2015; Zhang, et al. 2014; Zhang, et al. 2015). Some researchers reported antioxidant activity in fish fed with FOS (Guerreiro, I., Perez-Jimenez, A., Costas, B., Oliva-Teles, A. 2014; Abd, El-Gawad, E.A., Abd El-latif, A.M., Shourbela, R.M. 2016).

Recently, some scientists proved the positive effects of medicinal plants or herbs as feed additives. These herbs improved the growth and feed utilization of the fish and also reduced

diseases by regulating pathogens in Gastro intestinal tract (Farahi, A., Kasiri, M., Sudagar, M., Soleimani, I.M., Zorriehzahra, S.M.J. 2012; Manaf, et al. 2016). But instead of using single medicinal herbs a mixture of them will effectively overcome disease problems, and can complement inadequacy of nutrients and phytochemicals. Even treating with herbs before cooking can enhance the taste of the cooked fish (Agbabiaka, L.A., Kuforiji, O.A., Egbuikwe, C.C. 2016).

Oil extracted from herbs is also valuable and alternative to antibiotics as there will be negligible chance for the development of resistant strains (Christaki, E., Bonos, E., Giannenas, I., Florou-Paneri, P. 2012). Garlic oil is 200 times greater than garlic powder and 900 times the strength of fresh garlic (Helou, L., Harris, I.M. 2007). Seeds of *Carum carvi* (Ahmad, M.H., Abdel-Tawwab, M. 2011), *Cuminum cyminum* powder (Yilmaz, S., Ergün, S., Soytaş, N. 2013), *Allium sativum*, oregano oil, *Origanum heracleoticum*, thyme and fennel oil are being used as additives in fish feeds (Hassaan, M.S., Soltan, M.A. 2016). Fish feed supplements with oils extracted from Orange Peel (*Citrus auranticum L*) has been proved to enhance the growth performance of fish (Acar, Ü., Kesbic, O.S., Yilmaz, S., Gultepe, N., Turker, A. 2015; Kusuma, H.S., Putra, A.F.P., Mahfud, M. 2016).

Some researchers found that the use of plant based protein in fish feeds improved growth performance (Mzengereza, et al. 2016). While some concluded that soya bean based protein supplements in fish feed enhance the fish growth. However, plant protein sources contains enzyme inhibitors, toxins like Gossypol Tanins, Saponins, Lectins, Phytic acid etc., which can adversely affect the growth performance of fish (Krogdahl, A. 1986; Ali, et al. 2016).

In order to overcome the effect of the toxins or anti-minerals or anti-vitamins, enzymes like phytase can be supplemented in the feed. Phytase breaks phytate, which increases the availability of phytate-phosphorus in fish diet (Cain, K.D., Garling, D.L. 1995; Nwanna, L.C. 2007; Nwanna, L.C. 2007). However, Dietary Ca: P ratios are crucial for the phytase activity (Li, et al. 2016; Pai, I.K., Altaf, M.S., Mohanta, K.N. 2016). Probiotics usage can also minimize the effect of the anti-nutrients (Ida, M. 1927).

Some scientists got positive results in including the vegetable and other food wastes in fish feeds (Akpoilih, B.U., Ajani, E.K., Omitoyin, B.O. 2016). While other researchers recommended usage of poultry waste meal instead of fish meal which costs less than the usage of generally used fish meal (Yones, A.M.M., Metwalli, A.A. 2016). Some studies concluded that salt can be used as additive in fish diets to enhance growth (Mzengereza, K., Kang'ombe, J. 2016). But the usage of these additives is species specific and various with geographical location.

As fishes are valuable and cheap sources of omega fatty acids and other vital nutrients for humans, there is a need to optimize their production and management. Fish nutrition must be carefully analyzed and there is a requirement to search for the novel feed additives or supplements which ensure low feed cost, maximum digestibility with minimum side effects and high feed conversion ratio.

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