



RESEARCH PAPER

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Importance of cinnamon as a growth and immunity promoter in *Ctenopharyngodon idella*

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Abstract

Aquaculture practices always strive for the betterment of human lives and for providing cheaper resources for fish production. As fish is the most common food source all over the world, its sustainable production is very important. The use of herbs provides a cheaper way towards the progress of aquaculture. Herbs are used in place of expensive chemicals and growth enhancers. Like others, cinnamon is also a good alternate for growth chemicals. Cinnamon is an aggregate of many related species with different names depending on the environmental conditions of different landmasses. Cinnamon contains many compounds and chemicals which are important for fish growth. Cinnamon when added to fish feed makes the fish fight against stress and grow healthy than before. Cinnamaldehydes, polyphenols, carbohydrates, flavonoids, etc., boost up the immune system of fish and act as an important antioxidant and antibiotic species. It fastens the growth rate of fish and enhances the other growth and blood parameters as compared to other aquaculture systems using chemicals. Moreover, the use of cinnamon as a growth and immunity promoter is cheaper and environmentally friendly.

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Introduction

The feed is the most important survival need of all organisms, but balanced diet is vital as well. As, the ingredients of fish meal are primarily the fish products, the dire need of the hour is to get less expensive and much nutritious products. Therefore, expansion of aquaculture emphasis to find out alternative of fish meal for aquafeeds because of its increasing demand, less availability and high price. Plant sources, being effective alternative to the fish meal, are good source of energy and protein, are helpful for the formulation of cost-effective and ecofriendly aquaculture feeds (Hardy, 2010).

World health organization is promoting the usage of remedial replace or lessen the chemical use in aquaculture. Immunostimulants, the products to improve feed's nutritional value, can increase specific and non-specific immunity by increasing the resistance for disease. These immunostimulants produce more fighting bodies against infectious agents by activating the innate defence system resulting in production of anti-microbial particles (Setiawati *et al.*, 2015).

In the fast and expensive world, there should be another way available for poor farmers to carry out their business and make some profit. Feed additives are minute amounts of some substances for enhancement of growth performance, survival rate and reproduction of the fish stock (Ogunkalu, 2019). Fish is the cheapest dietary protein source. More than half of the total world population rely on fish as its sole dietary protein source. For fish to exhibit greater genetic capacity for growth, survival, and reproduction, nutrition is the most crucial factor (Handayani and Widodo, 2010).

There is a whole market of different feed ingredients of plants and animal sources which claim to enhance performance of fish growth. In the process of feed preparation, some chemicals such as antibiotics and hormones are must (Gunawardena *et al.*, 2015). But they cause certain negative side effects. Therefore, the use of chemicals is strongly sentenced at every level to promote the use of herbs or medicinal plants.

Because, these agents increase fish immunity and impart less-dangerous impacts on its health and alternatively the human (Baruah *et al.*, 2008).

Growth-stimulants, products of herbs and medicinal plants, are recyclable, low in cost, biodegradable and harmless for environment. Supplemented feed is source of essential nutrients for fish that are mandatory for growth, survival, proper functioning and for obtaining other ingredients. Remedial plants or probiotics which are used in feed can increase growth rate and activate the other non-specific immunity functions of fish (Mohammad *et al.*, 2011).

Grass carp is an herbivorous fish which can utilize plant proteins and other compounds to produce top-notch quality meat (Kristan *et al.*, 2018). Grass carp account for 11% of the world aquaculture production (FAO, 2016). Grass carp is widely found in Pakistan in slow running and standing waters. More than 186 fish species are found from the water bodies of Pakistan. The inland fisheries account for 30 species of high economic value, *Ctenopharyngodon idella* is one of them. Grass carp is one of the exotic fishes introduced in Pakistan in last four decades. Exotic Carps are present abundantly in three provinces in Pakistan viz Sindh, K.P.K and Punjab (Khan *et al.*, 2008).

Carp species are eminent all over the world for their fast growth, good performance, high feed conversion ratio, easy cultivation, convenient harvesting and high nutritional value. Grass carp (*C. idella*) is one of the most important carp species from the economic point of view in subcontinent. Its contribution is 35% of total carp production in the subcontinent. Due its taste and good profile of protein and fatty acid, it is of immense importance for human health (Song *et al.*, 2012).

Cinnamomum verum is a notable member of family Lauracea. This species is known for its remedial property, and also for defence effects against various stress conditions. Approximately, 49.9% of cinnamon bark is cinnamaldehyde (Wong *et al.*, 2014). Cinnamon also contains bioactive molecules like essential oil, tannins, polyphenol, carbohydrates and flavonoids (Gruenwald *et al.*, 2010).

It is reported that dietary cinnamon supplementation increases metabolism and blood circulation (Kucukbay *et al.*, 2006). *Cinnamomum verum* is also used as taste-enhancer in meal. It has wide medicinal properties and is used widely in Chinese traditional medicine. Moreover, it also an antioxidant, antimicrobial and anti-inflammatory in nature. Oil obtained from cinnamon contain cinnamaldehyde which is under investigation for its effects for human diseases. These diseases include cancer and dyspepsia (Shan *et al.*, 2009).

It is an attractive way to improve feeding, health, productivity and growth performance of a fish by using herbal medicines. Herbal medicines like cinnamon enhance feed quality and impart a therapeutic impact to the fish population (NRC, 2011). These are cost-effective too and are imperative to be used in fisheries sustainable fish production and ecologically friendly aquaculture. *Cinnamomum zeylanicum* is a well-known herbal spice in human society since ancient times as it is remedy of many diseases (Nugroho, 2016).

Growth rate and survival rate as well as immunity can be improved by addition of medicinal plants to fish feed. Flavour and storage ability of feed is also improved with added spices. Cinnamon leaf extract, cinnamon bark oil and cinnamon powder is known for significant increase in energy utilization, PER, SGR, APU, FCR, PER, FER and protein retention in fish. Cinnamon exhibits various biological activities i.e. antioxidant, antiallergic, antidiabetic and antimicrobial (Begum *et al.*, 2018).

Aims and objectives

- To minimize the aquaculture cost by replacing the chemicals by natural herbs in the system
- To promote the replacement of toxic chemicals with natural remedies
- To evaluate the beneficial effect of cinnamon on growth and immunity of grass carp
- To understand the effectiveness of plants in fish body

Discussion

In past studies a lot of work has been performed in field of aquaculture nutrition innovations, but this research should be expanded to encompass all the fish and aquaculture animals. All the edible aquatic organisms should be tested for herbs to be used as medicinal products and replacing the environmentally harmful chemical products.

Kanghear *et al.* (2005) reported the improved immunity and growth performance in sex reversed tilapia by administration of bark oil of cinnamon *Cinnamomum zeylanicum*. Fish fed with 250 ppm also showed the most stimulated immunity responses as compared to other groups. But on the other hand, the higher concentrations of 1000 ppm caused atrophy and degenerations in cells leading to abnormal hepatic cells.

Younes *et al.* (2013) determined the effect of cinnamon powder on growth, blood glucose and survival rate of green terror *Andinocara rivulatus*. There was an observable difference in blood contents of control and 1% cinnamon group fish in WBCs and blood glucose. It was concluded that fish fed with 1% cinnamon showed significant growth than all others.

Setiawati *et al.* (2014) reported the effect of cinnamon leaves supplementation in the diet of patin i.e. *Pangasius hypophthalmus* on nutrient value and growth performance. It was observed that SGR, feed consumption and survival rate of fish were independent of increasing levels of cinnamon leaves. However, there was significant increase in feed digestibility and feed efficiency as compared to control.

Rolin *et al.* (2015) reported the enhanced growth performance of *P. hypophthalmus* *sauvage* by the addition of *Cinnamomum burmannii* leaves extract in fish diet. The maximum protein retention and feed efficacy was observed when 1g/kg diet of cinnamon leaves extract was administered.

Rahmawati and Ubaidillah (2017) evaluated the growth rate and survival of *Oreochromis nilotica* by supplementation of diet with cinnamon leaves. After the trial period was over, the 0.25% level showed the most significant growth rate and feed conversion rate enhancement.

Begum *et al.* (2018) reported the improvement in growth performance by cinnamon supplementation of fish feed in Bloch. Low feed conversion ratio was seen in 0.5% supplemented diet. Also, 1% supplemented diet showed greater immunity than other diets. It was recommended that cinnamon should be used to maintain a good growth and enhanced immunity of fish culture.

Dairun *et al.* (2018) examined the cinnamon leaves and shrimp head supplementation in the catfish feed. It was found that specific growth rate was increased with cinnamon leaf flour and shrimp head. The increase in SGR was 1.67-1.70%/day. Likewise, the feed efficiency was 57% and protein retention 55% as compared to control.

Conclusion

As fish production is directly related to development of a country, feeding innovation should be experimented with different feed ingredients. Cinnamon is helpful in improvement of growth and immunological parameters as compared to expensive and pollution causing chemicals. Natural herbs are safe for environment and are ecosystem friendly.

These can be used without environmental hazards. Moreover, cinnamon is responsible for production of many expensive substances in fish body. Grass carps are widely used for eradication of excess vegetation in the ponds so their production must be enhanced too. It can provide easy alternate to farmers who wish to maximize their profit. Of all the concentrations of cinnamon presented in literature, 0.5%-1% of cinnamon per 100% feed is recommended for best growth enhancement and immunity system improvement of grass carp.

References

Baruah K, Norouzitallab P, Debnath D, Pal AK, Sahu NP. 2008. Organic acids as non-antibiotic nutraceuticals in fish and prawn feed. *Aquaculture Health International* **12**, 4-6.

Begum K, Eshik ME, Punom NJ, Abedin M, Rahman MS. 2018. Growth performances and bacterial load of *Heteropneustes fossilis* (bloch, 1794) using cinnamon as feed supplement. *Bangladesh Journal of Zoology* **46**, 155- 166.

Dairun S, Setiawati M, Suprayudi MA, Utomo NBP. 2018. Utilization of cinnamon *Cinnamomum burmannii* leaves and shrimp head in the feed on growth performance of catfish *Pangasianodon hypophthalmus*. *Jurnal Akuakultur Indonesia* **17**, 87- 93.

FAO. 2016. The State of World Fisheries and Aquaculture 2016, Rome. 56pp.

Gruenwald J, Freder J, Armbruster N. 2010. Cinnamon and health. *Critical Reviews in Food Science and Nutrition* **50**, 822-834.

Gunawardena D, Karunaweera N, Lee S, Kooy FD, Harman DG, Raju R, Bennett L, Gyengesi E, Sucher NJ, Munch G. 2015. Anti-inflammatory activity of cinnamon (*C. zeylanicum* and *C. cassia*) extracts—identification of E-cinnamaldehyde and o-methoxy cinnamaldehyde as the most potent bioactive compounds. *Food and Function* **6**, 910-919.

Handayani H, Widodo W. 2010. Fish nutrition Ed. 1. UMM Press, Malang 34pp.

Hardy RW. 2010. Utilization of plants proteins in fish diets effects of global demand and supplies of Fishmeal. *Aquaculture Research* **41**, 770-776.

Kanghear H, Suanyuk N, Khongpradit R, Subhadhirasakul S, Supamattaya K. 2005. Effect of cinnamon bark oil (*Cinnamomum zeylanicum* Blume) on the prevention of streptococcosis in sex-reversed red tilapia (*Oreochromis niloticus* × *O. mossambicus*). *Songklanakarin Journal of Science and Technology* **27**, 327-358.

Khan AM, Shakir HA, Khan MN, Abid M, Mirza MR. 2008. Ichthyofaunal survey of some freshwater reservoirs in Punjab. *Journal of Animal and Plant Sciences* **18**, 155-157.

- Kristan J, Blecha M, Policar T.** 2018. Survival and growth rates of juvenile grass carp (*Ctenopharyngodon Idella*) overwintered in ponds and recirculating aquaculture systems including a comparison of production economics. *Turkish Journal of Fisheries and Aquatic Sciences* **19**, 261-266.
- Kucukbay FZ, Yazlak H, Shin N, Cakmak MN.** 2006. Effects of dietary chromium picolinate supplementation on serum glucose, cholesterol and minerals of rainbow trout (*Oncorhynchus mykiss*). *Aquaculture International* **14**, 259-266.
- Mohammad HA, Amani MD, Mesallamy E, Samir F, Zahran F.** 2011. Effect of Cinnamon (*Cinnamomum zeylanicum*) on Growth Performance, Feed Utilization, Whole Body Composition, and Resistance to *Aeromonas hydrophila* in Nile Tilapia. *Journal of Applied Aquaculture* **23**, 289-298.
- NRC (Nutritional Research Council).** 2011. Nutrient requirement of fish and shrimp. National Academic Press, Washington DC 392- 393.
- Nugroho IF.** 2016. Additional leaves cinnamon (*Cinnamomun burmannii*) in mandiri's feed on growth performance of striped catfish (*Pangasianodon hypophthalmus*). *Bogor Agricultural University Bogor* **65**, 23-27.
- Ogunkalu OA.** 2019. Effects of feed additives in fish feed for improvement of aquaculture. *Eurasian Journal of Food Science and Technology* **3**, 49-57.
- Rahmawati HH, Ubaidillah MF.** 2017. The effect different dosage of cinnamomum leaves (*Cinnamomum burmannii*) supplementation on growth and survival rate of tilapia (*Oreochromis niloticus*). *Aquacult. Indones* **18**, 62-66.
- Rolin F, Setiawati M, Jusadi D.** 2015. Evaluation of the addition of cinnamon (*Cinnamomum burmannii*) leaves extract in diet for growth performance of catfish (*Pangasianodon hypophthalmus*) Sauvage, 1878. *Jurnal Iktiologi Indonesia* **15**, 201- 208.
- Setiawati M, Jusadi D, Marlinda S, Syafruddin D.** 2014. Effect of addition *Cinnamomun burmanni* leaf in the diet on the growth performance and nutrient composition of *Pangasius hypophthalmus*. *Indonesian Journal of Agricultural Science* **19**, 80-84.
- Shan B, Cai YZ, Brooks JD, Corke H.** 2009. Antibacterial and antioxidant effects of five spice and herb extracts as natural preservatives of raw fish. *Journal of the Science of Food and Agriculture* **89**, 1879-1885.
- Song GS, Lin WL, Zeng QX, Zhu ZW.** 2012. Relation between protein characteristics and TPA texture characteristics of crisp grass carp (*Ctenopharyngodon idellus*). *Journal of Texture Studies* **43**, 1-11.
- Wong YC, Mudzaqqir MYA, Nerdiana WAW.** 2014. Extraction of essential oil from cinnamon (*Cinnamomum zeylanicum*). *Oriental Journal of Chemistry* **39**, 37-47.
- Younes R, Narges M, Zahra Z, Jalil S, Masoud H.** 2013. Effect of different levels of powdered cinnamon (*Cinnamomum zeylanicum*) in the diet of fish green terror (*Andinocara rivulatus*) index, blood glucose and survival. *Breeding Aquaculture Science Quarterly Fall* **1**, 41-52.