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Fish *Review Article*

Selected herbs as growth promoters in aquaculture

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ABSTRACT

Aquaculture has a key role in healthy human diets. These organisms constitute several nutrients such as proteins, fats, and numerous minerals. To be able to mass-produce whilst conserving aquaculture stability, mediating factors are required to enhance the fishes' immunity, environment, and growth rate. The use of medicinal herbs to increase immune response has been discussed in various studies. In this study, the effect of selected herbs (*Aloe vera*, garlic, echinacea, peppermint, and thyme) on growth rate have been classified and reviewed. In this manner, using such herbs to enhance aquaculture seems beneficial as herbs are a natural and harmless means that can be added to animal diets. It was observed that all studies that analyzed growth rate parameters such as specific growth rate and percent growth rate depicted that increased weight and growth rate were significant, justifying the beneficial use of selected herbs as growth promotors in aquaculture.

Keywords: Medicinal herb, Fish, Natural, Aquaculture.

INTRODUCTION

Plants depict a significant part of the chemo-diverse planet. Many plants are desired for a wide variety of uses such as food, pharmaceuticals, and cosmetics. Present studies have shown antiviral, antifungal, and antibacterial activities of a large variety of plants in animal husbandry and aquaculture. Proper nutrition and supplementation of fish diet can affect our health status and can decide the quality of life on a physiological level.[1]

Fish consist of vast nutrients that are required for our bodies to run efficiently. To sustain and produce aquaculture, we require rigorous planning, which entails new and natural approaches. Numerous studies have previously depicted the promoting effects of medicinal herbs in aquaculture.[2,3] They are proved to increase the growth and performance of cultured fish.[4,5] In addition, they can promote fish's immune system, resulting in milder diseases with less mortality and economic loss.[4-6] Although they are not a drug, these raw or extracted products have antimicrobial effects that can limit pathogens and improve fishes' immune systems.[7,8] There are several reports on the antimicrobial resistance in aquatic pathogens resulting from the extensive use of antibiotics.[9-11] These benefits for fish farmers and the consumers justify the use of plant-derived products in aquaculture. Furthermore, the application of such natural methods to prevent infectious diseases in fish farms will result in safer products for consumers.[3,12] In this paper, we tried to address the benefit of selected plants mostly used in previous research, with a focus on their growth-promoting effects.

ALOE VERA

Pharmaceutical and cosmetic industries have acknowledged just over 3002 aloe species. *Aloe barbadense*, more commonly known as *A. vera* is a magnificent plant with a wide variety of implications. Species, climate, and growing conditions can affect chemical composition. Hawaiian *A. vera* was also observed to contain fat, protein, fiber, 25.5% sugars (glucose and mannose), 30% mucilage, and 22.3% crude aloin oil and resin.[13] Thus, the wide spectrum of nutrients found within the *A. vera* plant justifies its use as a supplement in diets for humans as well as animals.

As observed by Harsimranjit *et al*.,[14] fish that was supplied by *A. vera* powder (AVP) were witnessed to have positive effects on their growth rates. A variety of parameters were used to assess the results of their study. Parameters including Chlorophyceae, Cyanophyceae, Baccillariophyceae, and Euglenophycae were measured to assess the ingestion behavior in fish. The results signified that the quantity of phytoplankton had decreased after supplementations of AVP. Supplementation of *A. vera* was best seen effective at a 3% inclusion level. Furthermore, to assess the health condition of fish while supplying them with AVP, the condition factor (CF) (K-value) was evaluated and was observed to remain greater than 1.0, denoting a healthy status of the fish. Protein and lipid levels had escalated with increasing the AVP inclusion level (1–3%). Subsequently, the total amount of carbohydrates and moisture levels had de-escalated within the inclusion level. In summary, enhancements in flesh quality resulted as fish were supplied with *A. vera*.[13] These results were also similar in studies conducted by Alishahi *et al*. (2017), and Safari *et al*.[15] A series of studies were conducted on rainbow trout and assessed certain indices, including WG, specific growth rate (SGR), FCR, Percentage weight gain (PWG), and CF. The fish displayed notable differences in terms of PWG and total WG. Fish that were supplemented with 0.1 and 0.2% *A. vera*, showed significant differences in only 30 days. All indices except CF were observed to improve with a comparison with control groups.

Likewise, a 60-day feeding trial was carried out to depict the effects of dietary modification by supplying *A. vera*. 240 *Tor grypus* were selected that weighed 50–60 g each and was divided into 4 groups of T1 (0.1% of *A. vera*), T2 (0.2%), and T3 (0.5%) and control. The indices selected to assess were similar to Alishahi *et al*.'s study, which included CF, WG, SGR, PER, FCR, FE. The CF was observed to have a reduction, as seen in Alishahi's (2017) study. However, in Safari *et al*.,'s study[15] FCR was also reduced. A more rigorous study by Munu Khanal *et al*. (2021) signified that total flesh quality, including proteins, globulin, and Albumin, had significantly increased as *A. vera* supplement concentration increased.

ECHINACEA

Echinacea purpurea is an important member of the Asteraceae family. This herb can mainly be found in North America; however, it is also found across the globe. This plant is more commonly used among the native people of North America as a therapeutic for infections, trauma, inflammation, and fever. Most of the plant's immunostimulatory substances exist in the root and are extracted to be used orally and topically.[16] Alongside its immunostimulatory effects, WG has been observed in a variety of studies. Aly *et al*.[17] conducted a study to assess the efficiency of Echinacea in tilapia fish. Aside from this, they evaluated the SGR and body gain. Their study resulted in significantly higher SGR in treated fish in the summer months. On the contrary, not much difference was noted when the same diet was supplied during the winter period. The SGR and CF also had positive modifications (0.29 SGR and 0.14 CF) in *Poecilia reticulata* fed with *E. pupurea* supplementation. In the same study, fish length was observed to increase a total of 0.6 mm.[17] This mode of action can be attributed to the enhancements in digestive system functions.[18] SGR was also seen to increase (0.35 SGR) and FCR to decrease (0.9 FCR) in Somayeh *et al*.'s (2011) study where they fed *Oncorhynchus mykiss* with dietary *E. purupurea*. Mesalhy *et al*. (2007) observed similar results when they conducted studies similar to ones mentioned on *O. niloticus* fish.

GARLIC

Garlic is considered an immunostimulant. It contains immunomodulatory ingredients such as allicin. Allicin is known to boost the immune system and also is considered an odor stimulant to increase tilapia fish response.[18,19] The daily growth rate maximized when tilapia fish were fed with 1% garlic in feed and surprisingly dropped when they were treated with 3%, and 5% garlic in feed. Subsequently, the absolute WG had a similar pattern when fish were treated with the above-mentioned feeds.[18] Another study displayed the same pattern when it came to modifying Benni fish diet with garlic. They emphasized that the fish fed with 10 kg^{-1} of garlic powder had major augmentation unlike any other.[19] Nabil *et al*. (2010) investigated the effects of fresh and dry garlic in Nile tilapia. They administered garlic orally via dietary modification and evaluated specific parameters. Their results signified a maximum total WG of 89.76 g, daily WG of 0.58 g; the SGR of 4.81, and a survival rate of 93.89%. The fish that were administered dried garlic (56/kg) were considered to have the best FCR (ratio). A variety of studies with similar procedures were conducted by Dong-Hoon *et al*. (2012) in which they all observed augmentation of weight parameters such as SGR, TWG, and decrease in CF whilst remaining above 1.0 to signify healthy fish status. Fish that were used in their study included *Acipenser ruthenus*, and *O. mykiss*, respectively.

MENTHA PIPERITA

M. piperita (Peppermint) is an herb that can be found in several forms (i.e., leaf, oil, leaf water, and leaf extract). The oil form tends to be the most used in different industries. This herbal substance is used in cosmeceuticals, personal hygiene products, foods, and pharmaceutical products for both its flavoring and fragrance properties.[20] Many studies now signify WG as an effect of this herb if administered orally.[20-22]

To depict whether *M. piperita* caused WG, it was administered to carpus fish that were previously deprived of food for 24 h in a study conducted by Adel *et al*.[23] Their results signified that the two parameters WG and SGR had increased significantly in fish that were fed 3% Mentha diets. On the contrary, diets that were enriched with 1% peppermint had seen a similar increase in FCR whilst diets with 2% and 3% showed a decrease in the parameter (relative to an increase in 1% diet). Similarly, it was also signified that the lipid and protein profiles did not change in diets consisting of 1%, 2%, or 3% Mentha. Similarly, a total WG of 1.79 g was observed in a study by Hammed *et al*. SGR and WG likewise witnessed augmentation while FCR decreased significantly. The dosage for maximum and most efficient WG was concluded to be 4 g/kg. Furthermore, the protein profiles of the skin mucus had seen enhancements.[21]

THYME

Thyme belongs to the Labiate family. This common herb places its roots in the Eurasian and Mediterranean regions. Historically, thyme has been used as a medicinal herb in some regions and a cooking additive in others. This plant not only carries a great taste and fragrance but also contains immunomodulatory effects that can affect the immunohistological response a living organism shows to pathogens.[11]

To understand the vast effects of thyme on WG, Mohiseni, *et al*.[24] administered Shirazi thyme (Zataria multiflora Boiss) in common carp fish. PWG and feed conversion efficiency (FCE) were observed to augment similar to protein, Cholesterol, and Glucose profiles. In an experiment, Al Safah *et al*.[25] signified that the maximum growth rate increase was seen in fish (*Cyprinus carpio*) fed with 1.5% enriched thyme. This group even succeeded the fish that were fed with a greater amount of enriched thyme (2%). This signifies that the herbal enrichment-growth rate is not linear; thus specifying the exact amount of thyme to feed fish as an additive is highly important. In their study, Oana *et al*. (2015) depicted WG from different parameters and observed and analyzed length increase in the studied fish.[26] In a recent study, the effect of a combined plant (*Mentha longifolia*, *Thymus carmanicus*, and *Trachyspermum copticum*) on growth performance, immune responses, and key immune gene expression of rainbow trout. This is the first and the only study on the effects of *T. carmanicus* plant on fish. This plant is grown in the central parts of Iran, with a high carvacrol level that can affect fish maintenance. According to the results, growth parameters including FCR and digestive enzymes were improved. Immunological responses such as lysozyme and ACH50 were significantly improved and stress biomarkers decreased. The key Immune-related genes were significantly up-regulated in the fish that received 3% medicinal plants, compared to other treatments. Furthermore, antioxidant enzyme coding genes were strongly up-regulated in the fish that were supplemented 1 and 3% of the combined plants. Raissy *et al*. have suggested that 1% inclusion of the mixture of *M. longifolia*, *T. carmanicus*, and *T. copticum* (T2) can be used to improve the growth and immunity of rainbow trout.[27]

CONCLUSION

Herbal extracts have the potential to be used as key nutritional supplements in aquaculture. Each herb consists of a specific composition and affects living organisms in different methods. Some herbs like *E. purpurea* and garlic have been observed to have immunostimulatory effects, while herbs such as *A. vera* tend to be used in the cosmetic industry more commonly. Alongside these benefits, these plants were also identified to have stimulatory effects on growth parameters in various types of fish. These parameters included SGR, WG, PWG, FCR, and FCE. The outcome of these studies depicted that *A. vera*, Echinacea, Garlic, Peppermint, and Thyme all have positive effects on growth parameters when administered in a specific dosage.

Declaration of patient consent

Patient's consent not required as there are no patients in this study.

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Conflicts of interest

There are no conflicts of interest.

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