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Review Article

HERBAL FEED SUPPLEMENTS AS DRUGS AND GROWTH PROMOTER TO FISHES

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ABSTRACT

The herbs/herbal drugs can act against several diseases and are also growth promoters, stress resistance boosters and preventatives of infections. Research has been initiated to evaluate the feasibility of herbal drugs in fish diseases. Use of herbs as drugs in disease management is gaining success, because herbal drugs are cost effective, eco-friendly and have minimal side effects. Many studies have proved that herbal additives enhanced the growth of fishes and protected them from diseases. The inclusion of herbal feed supplements often provides cooperative action to various physiological functions. Vitamins C and E as herbal drugs or feed have beneficial role in fish nutrition, reproduction, growth and related indices. In deed, the herbs/herbal drugs overcome all these problems and keep the fish healthy by acting as growth promoters and treating the diseases as well. Hence, this present article elucidates the importance and benefits of herbal drugs as aqua feed supplements, which act as growth promoters as well as cure various diseases of fishes and other aquatic animals.

KEYWORDS: Fish, growth promoter, herbs/herbal drugs, herbal feed supplements.

INTRODUCTION

The herbs/herbal drugs are used not only against diseases but also as growth promoters, stress resistance boosters and preventatives of infections. Herbs can also act as immunostimulants, conferring the non-specific defense mechanisms of fish and elevating the specific immune response[1]. Recently, research has been initiated to evaluate the feasibility of herbal drugs in fish diseases[2]. Additionally, the herbal drugs provide a cheaper source for treatment and greater accuracy than chemotherapeutic agents without causing toxicity[1-2].

Nutritional requirements of an animal are a fundamental aspect that depends on species, habitat and live cycle stage[3]. The use of antibiotics and other chemotherapeutics for controlling diseases has been criticized for their negative impacts. Use of herbs as drugs in disease management is gaining success, because herbal drugs are cost effective, eco-friendly and have minimal side effects. Traditional herbal medicines seem to have the potential immunostimulation. Thus, the use of herbs is an alternative to antibiotics in fish health management. Many studies have proved that herbal additives enhanced the growth of fishes and protected them from diseases[4]. The herbs are not only safe for consumers but also widely available throughout Asia and they also have a significant role in aquaculture[5]. The inclusion of herbal feed supplements often provides cooperative action to various physiological functions. The synergistic effect of herbs has been reported in many fishes, including Japanese flounder[6] and *Clarias gariepinus*[7].

Vitamins C and E as herbal drugs or feed have beneficial role in fish nutrition, reproduction, growth and related indices. In addition, vitamins C and E are credited with modulating the stress response in fish. Vitamins are the important essential nutrients for most animal species. Vitamin deficiencies in fish under aquaculture are known to produce biochemical dysfunction leading to tissue and cellular level clinical manifestations. Several morphological and functional abnormalities have been reported in various fish species deprived of vitamins. Thus, it is clear that the biological role played by vitamins C and E as two important vitamins is very vital for the sustained growth and health of many living organisms as well as fish[3]. The beneficial utility of herbal growth promoters as an additive in the carp feed has been observed. There is a significant difference between different herbal additives on the effect of growth rate in goldfish. The non-specific immune system of fish is the first line of defense against invading pathogens. Neutrophils and phagocytes, lysozyme and complement are some important indices of non-specific immunity in fishes[5].

Various factors are effective on the haematological and biochemical parameters of fishes, out of which the species, environmental condition, age, maturation and nutrition are very important. In fish, glucose concentration may vary greatly, depending on the physiological status of the animal. Normally, it is assumed that the nutritional state of a fish can affect the animal health and possibly the way they deal with stress. The stress response in fish is generally mediated by a neuro-endocrine response, which includes the release of stress hormones such as cortisol and catecholamines into the circulatory system[8]. These and possibly other hormones, elicit several compensatory physiological responses that help the fish to deal with the stressor. Glucose is one of the most important energy substrates used by fish to cope with physiological stress. Plasma glucose levels can increase, decrease, or keep constant under high plasma cortisol[9]. In deed, the herbs/herbal drugs overcome all these problems and keep the fish healthy by acting as growth promoters treating the diseases as well.

With the above background, this article has been put forth to elucidate the importance and benefits of herbs/herbal drugs as aqua feed supplements, which act as growth promoters as well as cure various diseases of fishes and other aquatic animals.

RESEARCH REPORTS ON CERTAIN HERBAL FEED SUPPLEMENTS

Dietary vitamins were reported to have antibody enhancement effects in salmon fish. Properties of disease resistance in fish fed with vitamin C and E have been reported by several researchers. Disease resistance and humoral antibody production in rainbow trout fish was directly and positively related to the levels of vitamin C in the trout feed. Vitamins C and E function as biological

antioxidants to protect cellular macromolecules (DNA, protein, lipids) and other antioxidant molecules from uncontrolled oxidation by 'oxygen free radicals' during normal metabolism or under the conditions of oxidative challenge such as infection, stress and pollution. Interaction between these two vitamins is also known to influence the beneficial effects they induce in cultured fish. Vitamin C/E sparing action in channel catfish was studied to explain the variability observed in its sensitivity to Vitamin E deficiency. So, due to their potential for interaction, dietary requirements for vitamins C and E are often considered together. A study was conducted on the starlet (a kind of fish) which showed that the dietary levels of vitamins C and E may have influence on some of haematological and biochemical parameters of starlet[3].

Dietary vitamin C prevented the appearance of vitamin E deficiency signs in Atlantic salmon in a dose-dependent manner. Vitamin C deficiency also developed earlier in Atlantic salmon fed a diet high in vitamin E due to the accumulation of the vitamin E radical (tocopheroxyl) which is otherwise reduced by C vitamin. There are two interaction mechanisms between vitamins C and E: a synergistic simultaneous protection effect of the lipid and aqueous phases against oxidation and the action of vitamin C on vitamin E regeneration in the tissues. Data on growth, mortality, haematology and lipid oxidation in the liver have shown that vitamin C protected the fish against vitamin E deficiency[10]. It was also shown that supra dietary levels of vitamins C and E may enhance antibody production and immune memory in juvenile milk fish to formalin-killed *Vibrio vulnificus* bacteria[11]. In a study on the effect of different levels of vitamin E on immune response of grouper, it was shown that by increasing vitamin E as feed supplement, the fish WBC count was increased accordingly[12]. It was demonstrated that cortisol and glucose could increase in teleost exposed to stress[9].

The herbs/herbal drugs, viz., ginger, nettle and mistletoe were used as an adjuvant therapy in rainbow trout through feed. The enhanced phagocytosis and cellular and humoral defense mechanisms were noticed against fish pathogens in rainbow trout fish[13]. The traditional Chinese medicines in yellow croaker elevated the non-specific defense mechanism and increased the disease resistance of fish against the bacterial pathogens. The administration of herbal extract through immersion and injection enabled the immunostimulant to be quickly absorbed and functional[14]. The disease resistant of *Catla catla* (catla) fish was produced through immersion herbal drugs (neem, garlic and turmeric) of spawn. *Aloe vera* herb was found effective as a disease suppressing and antibacterial agent in juvenile rock fish. The survival rates of challenged fishes were in the increasing trend when there was an increase in the concentration of all the herbal additives tried in the experiment. There was a significant difference between the different herbal additives at different concentrations on the survival rate of goldfish[5].

Aqueous root extract of *Achyranthes aspera* herb was incorporated in the experimental feed of *Labeo rohita* (Rohu). Feeding of fishes with this diet significantly ($P<0.05$) enhanced the serum anti-proteases level than fishes fed with control diet[15]. *C. catla* were fed a diet containing seeds of *A. aspera* (0.5%) for 4 weeks prior to and after ip injection with chicken erythrocytes (RBCs). The haemagglutination antibody titers, serum globulin levels, anti-trypsin activities and RNA/DNA ratio of spleen and kidney were found to be significantly higher in test group than the control group. These results confirm that *A. aspera* enhances the immunity of catla[16]. In a similar study, *A. aspera* seed (0.5%) was incorporated in the diet for *Cyprinus carpio* fish. After 4 weeks of feeding, fish were immunized with chicken RBC. Antigen-specific antibody response, total serum protein, serum albumin and globulin, lysozyme, serum α1-protease inhibitor and α2-macroglobulin and RNA/DNA ratio of spleen and kidney were significantly ($P<0.05$) higher, suggesting that the immune response of the fish was enhanced when fed with diet containing *A. aspera*[17]. *A. aspera* seed was incorporated in the diets (at 0.01%, 0.1% and 0.5%) of *L. rohita* fingerlings. After 2 weeks, the fish were immunized with heat-killed *Aeromonas hydrophila* bacteria, and after a further 2 weeks, these fishes were experimentally infected with *A. hydrophila*. After 7 days, the superoxide anion production, serum bactericidal activity, lysozyme, alkaline phosphatase (ALP), serum protein and albumin:globulin ratio (A/G) were enhanced (towards normal); while the serum glutamate oxaloacetate transaminase (SGOT) and serum glutamate pyruvate transaminase (SGPT) levels were decreased (towards normal) in fingerlings treated with *A. aspera* herb. The results indicated that this herb stimulates the immunity and increases resistance to infection in *L. rohita*[18]. Furthermore, *A. aspera* after 4 weeks of its feeding to *C. catla*, significant ($P<0.05$) enhanced bovine serum albumin (BSA)-specific antibody titers were seen. The efficiency of antigen clearance was also enhanced[19].

Goldfish, *Carassius auratus* fed with mixed herbal feed supplements significantly restored the altered haematological (viz., WBC, RBC, haemoglobin, haematocrit value, mean corpuscular volume and mean corpuscular haemoglobin concentration), biochemical (viz., total protein, glucose and cholesterol) and immunological parameters, and triggered the innate immune system against *A. hydrophila*[20]. The herbs *Phyllanthus niruri, Andrographis paniculata, Abrus precatorius, Quercum infectoria* and *Terminalia chebula* warded off the growth of pathogen completely at minimum inhibitory concentrations. The inhibitory potency of *T. chebula* and *Q. infectoria* indicated that the potential of these herbs may replace the antibiotics in controlling *A. hydrophila* bacteria associated fish diseases[21].

Herbs promoted the cellular lipid and fatty acid utilization and protein accumulation resulting in good growth performance in *Pagrus major* fish[6]. The growth increase in *L. rohita* fish fed with herbal supplemented diet was due to improved food utilization and high protein synthesis[4]. Among the two different herbal feed supplements, the *Phyllanthus niruri* fed group recorded higher specific growth rate followed by *Aloe vera* fed group. The herbal incorporated feed fed fishes were challenged with *A. hydrophila* at the end of experimental period of 60 days. In *P. niruri* fed group, the highest survival rate of 75% was observed at 1% concentration followed by 1.5% concentration (70%). However, in the case of *A. vera*, higher survival rate of 80% was recorded at 1.5% concentration followed by 1% concentration (75%)[5]. Feeding tilapia fish with *Ganoderma* and *Lonicera* herbs alone or in combination enhanced the phagocytosis by blood phagocytic cells and stimulated the lysozyme activity after 2 weeks, but not respiratory burst activity of the phagocytic blood cells, total protein or total immunoglobulin in plasma. Both herbs when used alone or in combination increased the survival of fish after challenge with *A. hydrophila*. Thus, it can be concluded that the herb

extracts added to feed act as immunostimulants and appear to improve the immune status and disease resistance of fish[22].

'AquaImmu' (AquaImmu Premix, also as ImmuPlus), a polyherbal drug (manufactured by Indian Herbs, Saharanpur, UP) contains the extracts of four Indian medicinal plants, viz., *Emblica officinalis* Gaertn. (Amla), *Ocimum sanctum* Linn. (Tulsi), *Tinospora cordifolia* (Willd.) Miers ex Hook. f. & Thoms. (Giloe) and *Withania somnifera* Dunal (Ashwagandha). The recommended dosage of ImmuPlus Premix in fish, prawn and shrimp is 3 kg/ton (1000 kg) of feed. In these animals, the AquaImmu is indicated for strong body defenses with optimum immune-status, to successfully meet the challenges of viral, bacterial and fungal infections; to improve and maintain the humoral and cell mediated immunity, and non-specific resistance to prevent the recurrence of infections and secondary infections; to optimize the vaccinial response with longer staying and higher antibody titres; to minimize the incidence of diseases and mortality thus increasing profits; and to maintain the health, livability, growth and performance at optimum levels[23]. ImmuPlus has been used to modulate the immune system of commercially important giant freshwater prawn, *Macrobrachium rosenbergii*. The prawns were fed with basal diet supplemented with ImmuPlus @ 1g/kg feed for 4 weeks. Results showed that the phenoloxidase activity (PO), haemagglutination and lysozyme activities were significantly elevated in ImmuPlus fed prawn up to 3 weeks of feeding. The total protein level in ImmuPlus fed prawn raised up to 2nd week of feeding. Thus, the incorporation of ImmuPlus @ 1g/kg feed in the diet for 3 weeks may be beneficial in raising the immune status of prawn[24]. Different experiments of AquaImmu (@ 1g/kg feed for 15 and 30 days) on fish (different stages of Rohu) and prawn (*M. rosenbergii*), and suggested that the AquaImmu can be used as an immunopotentiator for healthy production of fish and prawns[25].

'AquaCE' (AquaCE Premix) is anther herbal drug (Aqua herbal feed supplement prepared by Indian Herbs, Saharanpur), which contains the extracts of some Indian medicinal plants. AquaCE is fed to fish, prawns, shrimps and other aquatic species. It has all the desired effects for use as antistress, adaptogenic and antioxidant, and is safe and free from side effects generally associated with chemical products. It overcomes stress and minimizes the adverse effects of the stress response in fish, prawns, shrimps and other aqua species. The herbal ingredients of AquaCE are proven to have sustained antioxidant activity, more potent than activity of synthetic vitamin C and vitamin E combination. Thus while using AquaCE, there is no need for extra supplementation of synthetic these two vitamins. AquaCE also increases the adaptability of the body against stress by regulating the physioIogical and biochemical functions, and by increasing the non-specific resistance. The adaptogenic and antistress properties of AquaCE and its herbal components have been proved in many scientific studies against a variety of physical, chemical and biological stress conditions. It helps to maximize the production and profits in fish and aquaculture[23]. A trial was conducted to observe the beneficial effect of AquaCE against the bacteria (*Edwardsiella tarda*) on *L. rohita* fingerlings (fish). Supplementation of AquaCE showed the lower mortality rate and total lymphocyte count. The globulin levels of fingerlings fed with AquaCE were recorded higher than the bacteria-challenged fingerlings. The experiment showed better natural resistance and survivability against virulent pathogenic bacteria[26].

'AmmoFree Premix' herbal feed supplement has also been found effective in fish, prawns and shrimps suffering from ammonia poisoning. The gaseous ammonia is primarily released from the gills of these aquatic animals as a metabolic waste from protein breakdown and from the lesser secondary sources such as decomposition of uneaten feed and organic wastes by bacterial actions. Ammonia concentration is increased because of reduced algal population in the pond and due to reduced rate of assimilation of ammonia by plankton algae. Additionally, lower water temperature slows aerobic bacterial nitrification process whereby ammonia is converted to nitrates. High aquatic pH also severely accounts for the enhanced aqua-concentration of ammonia. Ammonia is extremely toxic and its toxicity is attributed mainly to its un-ionized form. Ammonia tends to block oxygen transfer from the gills to the blood and can cause both immediate and long-term gill damages. Similarly, 'AquaPro Premix' has been developed by Indian Herbs for fish, prawns, shrimps and other aqua species. This herbal feed supplement is safe and has all the desired effects for use as performance enhancer and growth promoter. AquaPro is a purely herbal drug containing natural herbs without any chemical transformation and is free from toxic or residual side effects, which are commonly associated with synthetic hormones, antibiotics and other chemical growth promoters, etc. It improves the intake and utilization of feed, promotes growth and thus ensures higher profits. Two other herbal feed supplements, viz., 'MoultMore Premix' and 'StickOn' are available as growth promoter and medicines for fish, prawns and shrimps[23].

CONCLUSION

In recent times, the research has been initiated to evaluate the feasibility of herbal drugs in body development and diseases of fishes. The studies have proved that herbal feed supplements enhance the growth of fishes and protect them from diseases. The inclusion of herbal feed supplements often provides cooperative action to various physiological functions. Vitamins C and E as herbal drugs or feed have beneficial role in fish nutrition, reproduction, growth and related indices. Conclusively, the herbs/herbal drugs overcome all the health and disease related problems of fishes. Thus, the herbal feed supplements act as drugs against several diseases, and are the growth promoters, stress resistance boosters and preventatives of various infections in fishes and other aquatic animals.

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