

PROSPECT OF *MORINGA OLEIFERA* LAM. (DRUMSTICK), A HIGHLY NUTRITIOUS MEDICINAL PLANT IN INDIAN AQUACULTURE: A SHORT REVIEW

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ABSTRACT

Moringa oleifera (Moringa) is a nutritional powerhouse. *Moringa oleifera* is often referred as a panacea and used to cure more than 300 diseases. Moringa plant possesses unique nutritional qualities that hold promise to many undernourished communities. In the present review article, briefing is given on the nutritional potential and its multiple uses especially as growth promoter, antioxidants and immunostimulators on some vertebrates including human and thereby enhanced the health status of the animals. Owing to its high nutritional profile, it is also used as good source of protein (food supplement) in the diets of some animals including fish. Among the parts, dried leaves found to be highly nutritive. This report will explore the urgency in the application of this plant product in Indian aquaculture for economically sustainable, environmentally friendly and viable production.

KEYWORD: Antioxidants, immunostimulants, *Moringa oleifera*, protein sources, sustainable aquaculture.

INTRODUCTION

Aquaculture products represent a very valuable source of animal protein and essential nutrients. Fish and other aquatic products supply at least 20% of protein intake in developing countries and more than 50% of the protein intake and minerals in the poorest countries of Africa and South Asia (Bene *et al.*, 2006). However, the intensive and semi-intensive practices of aquaculture production caused an increase of disease outbreaks resulting in partial or total loss of fish production. Furthermore, many factors including overcrowding, handling, temperature, poor water quality and poor nutrition are responsible for creating a state of stress leading to immunosuppression in fish, and thus boosting the susceptibility to infectious diseases (Awad and Awaad, 2017). The strategies used to control infectious diseases in fish farms are similar to the one used in animal. Used of veterinary medicines in treating diseases leads to accumulation of residues both in the environment and in fish tissues and finally affect human health. Regarding the harmful effect of veterinary drugs used in aquaculture either on fish or on the environment and human health, medicinal plants came as a promising and substitute method for the control of fish disease (Santos and Ramos, 2016; Awad and Awaad, 2017). Actually, medicinal plants are used in aquaculture not only as chemotherapeutics but also as feed additives as they contain a wide variety of nutrients and chemical compounds. Many biological activities have been recorded for medicinal plants including growth promotion, appetite stimulation, immune stimulation, antimicrobial, and anti-stress in fish (Chakraborty and Hancz, 2011; Citarasu, 2010). There are several reports of using *Achyranthes aspera* seeds, Neem leaves, fruits of Amla, Turmeric powder, Green tea, Ashwagandha root powder to produce disease resistance and promote strong immunity in economically important fish.

Easy access and the cheap price for many plants are also encouraging factors for their use in large scale in aquaculture to provide better growth and protection at the same time. And also the high cost and fluctuating quality of fish meal as well as its uncertain availability have led to the need of herbs as alternative protein sources for fish feeds *Moringa oleifera* Lam. is a rapidly growing perennial indigenous medicinal tree belonging to the family Moringaceae and popularly known as “arbol de rabano”, horseradish tree and drumstick tree (Ramachandran *et al.*, 1980; Kwaambawa and Maikokera, 2007).

It is a native to the sub-Himalayan tracts of India, Pakistan and Bangladesh with an annual rainfall range of 250-3000 mm. A biodiversity hotspot, Northeast region of India, is also a suitable place to grow this miracle plant. Every part of *Moringa oleifera* (Moringa) is a storehouse of important nutrients. *Moringa oleifera* is often referred as a panacea and used to cure more than 300 diseases. It is marketed as “superfood” on International markets. Therefore, in order to



attain a more economically sustainable, environmentally friendly and viable production, research interest has been directed towards the evaluation and used of plant products such as flowers, fruits, seeds, leaves and roots in aquaculture.

NUTRITIONAL POTENTIAL AND MULTIPLE USES OF MORINGA

Globally, India is the largest producer and supplier of *Moringa oleifera* (CBI, MoFA 2018). And it is categorized as 'Novel Food' on the European market. The leaves and seed pods of *Moringa* are rich in a range of minerals and vitamins and essential amino acids (Mbikay, 2012; Kasolo *et al.*, 2010). *Moringa* leaf contains crude protein (CP) with about 260 g/kg of leaf, of which about 87% is true protein (Makkar and Becker, 1996). Essential amino acids found in *moringa* leaf are methionine, cysteine, tryptophan and lysine. *Moringa* plant possesses unique nutritional qualities that hold promise to many undernourished communities (Gopalakrishnan *et al.*, 2016). They are rich source of calcium, potassium, vitamin A, vitamin C and choline (Ramachandran *et al.*, 1980; CBI, MoFA 2018). Saini *et al.* (2014) analyzed the fatty acid profile of *moringa* vegetative parts and concluded that *moringa* based products could provide enhanced health benefits due to their high mono, polyunsaturated fatty acid content and low saturated fatty acids. The same authors reported the effect of dehydration methods on retention of tocopherols, carotenoids (b-carotene), antioxidant and ascorbic acid activity in *Moringa oleifera* leaves. In an attempt to study the antioxidant activity of *moringa* leaves, Siddhuraju *et al.* (2003) found that *moringa* natural antioxidants are functionally similar to widely used synthetic antioxidants such as butylated hydroxytoluene and butylated hydroxyanisole.

Moringa oleifera is used as potential antioxidant, anticancer, anti-inflammatory, anti-diabetic and antimicrobial agent. *Moringa oleifera* contains a large composition of polyphenolic compounds such as hydroxycinnamic acid derivatives and flavonoids known to have antioxidant activities towards oxidative stress. . Leaves, bark, root, pods, flowers and seed of this plant are known to have several pharmacological effects (Morimitsu *et al.*, 2000). The components from methanol extract of *Moringa oleifera* leaves significantly increased the levels of serum immunoglobulins, phagocytic activities and hemagglutinating in mice (Sudha *et al.*, 2010). Research has also reported that *Moringa* seeds oil contains approximately 76% PUFA (Lalas and Tsaknis, 2002). Studies also confirmed the crude leaf powder and extracts of *Moringa oleifera* can act against bacteria like *Bacillus subtilis*, *Staphylococcus aureus* and *Vibrio cholera* (Kampen *et al.*, 2005; Jayawardana *et al.*, 2015). *Moringa oleifera* has been shown to cure both Type 1 and Type 2 diabetes patients. There are reports of *Moringa* used as an anticancer agent as it is natural, reliable and safe, at established concentrations (Gopalakrishnan *et al.*, 2016). Reports say that *Moringa oleifera* is a potent neuroprotectant. Research reports have suggested that *Moringa oleifera* leaves can be an alternative source of protein in Nile tilapia (*Oreochromis niloticus* L.) (Richtler *et al.*, 2003). *Moringa oleifera* leaves provide antioxidant and antimicrobial benefits to chicken sausages (Jayawardana *et al.*, 2015). The components from methanol extract of *Moringa oleifera* leaves significantly increased the level of serum immunoglobulins in mice. A recent research on oral administration of *Moringa* to murine showed significant proliferation of splenocytes and macrophages (Anudeep *et al.*, 2016). Studies have also shown that *Moringa oleifera* can provide protection against the photo-oxidative damages imposed by gamma radiation (Ramabulana *et al.*, 2016) and UV radiation (Araoju *et al.*, 2016). *Moringa oleifera* can enhance the reproductive success of the fish, *Etroplus suratensis* (Dhas *et al.*, 2015). Based on the composition, *Moringa oleifera* leaf powder is commonly marketed as: supporting immune health, improving general health, increasing energy levels and supporting weight management for human consumption (CBI, MoFA 2018). The seed and oils of this plant are also being used in human for digestive health, normal blood circulation, weight management, respiratory health and regulation of perspiration.

CONCLUSION

Maintenance of good health of fish is most essential to achieve sustainable development of aquaculture. So, in aquaculture, there is an urgent need to look for eco-friendly, economically and practically feasible disease preventive measures to promote sustainable aquaculture. The use of immunostimulants in fish diets has accelerated in recent years as more production-grade diets are fortified with variety of natural substances that promise to heighten immunity. Similarly, incorporation of antioxidants in the fish diet will boost the activity of detoxification enzymes. It may also help to keep steady-state concentration between production and elimination of free radicals. There is dearth of information regarding the use of *Moringa* in aquaculture in India. Owing to its high nutritional profile, this herb can be



a suitable alternative protein sources for fish feeds in Indian aquaculture industry and will also be a highly useful immunostimulator and potent antioxidant for the fish. More scientific investigations have to be made to explore all the potential of such plants for a healthy and sustainable environment. And it will give a huge relief to the Indian fish farmers.

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