



Mini Review

Drumstick tree – An explicable miracle

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Abstract

People these days have become aware and are looking for products that provide benefits beyond nutrition. Drumstick tree (*Moringa oleifera*) of the family *Moringaceae* is one such tree that is having immense nutritional as well as medicinal uses. People often call it a “Miracle Tree”. Drumstick tree, also popularly referred to as *Moringa* in the scientific literature, can be a focus for health and economic related potential in various developing countries due to its easy cultivation in adverse environmental conditions and large availability. It can withstand both severe drought and mild frost conditions and that is why cultivated across the world. Every part has been used for a variety of ailments in the indigenous medicine of South Asia. Nutrients of this wonder tree are exploited for a variety of purposes. It is well-known as “one of the most amazing trees God has created”, each and every part of this tree including root, seed, fruit, leaves, flowers, gum, and bark is a rich storehouse of many nutrients that are proteins, vitamins and minerals. *Moringa oleifera* is referred to as panacea and can be used to cure more than 300 diseases like diabetes, malnutrition, CVD’s, cancer, liver fibrosis, anemia, dementia, and various others. The medicinal potential of this tree derives from secondary metabolites including tannins, saponins, alkaloids, coumarins, flavonoids, resins, and steroids. *M. oleifera* has versatile utility as medicine, nutraceutical, functional food, thus this is considered to be the most useful tree globally. Traditional uses and pharmacological properties of *M. oleifera* made it a true miracle tree. Conclusively, the present review is an attempt to provide information about the nutritional and therapeutic properties of the drumstick tree.

Keywords drumstick tree, malnutrition, miracle tree, moringaceae, moringa leaves, *moringa oleifera*

Introduction

Nowadays, people are becoming concerned about their health with their changing socio-economic status. People have become aware and are looking for products that provide benefits beyond nutrition. There is immense scope of foods that can impart health benefits beyond traditional nutrients.


The drumstick tree is one such tree which is having immense nutritional as well as medicinal uses. People often call it a “Miracle Tree” as the drumstick leaves are also available in summers when other vegetables are scarce [1]. It’s an angiosperm plant that is native to the Indian subcontinent. *Moringa* these days is cultivated all over the world in tropical and sub-tropical regions [2]. The tree is indigenous to northwest India [3]. In the traditional medicinal system, several pharmaceutical effects of this plant are capitalized as a therapeutic remedy for different diseases. *Moringa* be a focus for health and economic related potential in various developing countries due to its easy


Received: 21 March 2021

Accepted: 25 May 2021

Online: 27 May 2021

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Emer Life Sci Res (2021) 7(1): 49-55

E-ISSN: 2395-6658

P-ISSN: 2395-664X

DOI: <https://doi.org/10.31783/elsr.2021.714955>



cultivation in adverse environmental condition and large availability [4]. It is well-known as “one of the most amazing trees God has created”, all parts of this tree including root, seed, fruit, leaves, flowers, gum, and bark are a rich storehouse of many nutrients that are proteins, vitamins, and minerals. Fresh leaves can be eaten, can be cooked, or can be stored in their powder form for a long time without refrigeration, without losing their nutritional content. Every part has been used for a variety of ailments in the indigenous medicine of South Asia [5-6].

Taxonomic classification [7]

Kingdom – Plantae
Sub Kingdom – Tracheobionta
Super Division – Spermatophyta
Division – Magnoliophyta
Class – Magnoliopsida
Subclass – Dilleniidae
Order – Capparales
Family – Moringaceae
Genus – *Moringa*
Species - *oleifera*.

Botanical background of Drumstick Tree

The prime producer of Drumstick tree in India, having 2.2 to 2.4 million tonnes annual production of tender fruits from an area of 43600 ha resulting in productivity of about 50 tonnes per ha [8]. Common names of the tree include drumstick tree, mother’s best friend, moonga, kelor tree, mulangay, benzolive tree, mlonge tree, never die tree, horse-radish tree, and various others. The tree has minimal growth needs because of its tolerance to drought and survival in nutrient-deficient soils. *Moringa* have the capacity to withstand high humidity climatic conditions. The maximum height reached by this tree 7-12 meters and 20-40cm diameter [9-12]. It propagates relatively easily both by sexual and asexual means [13].

Drumstick Tree as a potential miracle tree

The Drumstick plant claimed to have the potential for improving nutrition, increasing food security, and encouraging rural development [14]. All parts of the tree including leaves, roots, seeds, flowers, fruits, bark having numerous advantageous nutrients. Trees for Life organization mentioned that “every part of the *Moringa* tree is said to have beneficial properties that can serve humanity” [15]. It is a rich source of macro as well as micronutrients too including protein, carbohydrate, calcium, potassium, iron, vitamins, phosphorus, and various other bioactive compounds [1]. *Moringa* leaves are a good source of minerals that are copper, iron, magnesium, potassium, zinc, and calcium [16]. It also contains vitamins such as vitamin A (β carotene), vitamin B like nicotinic acid, folic acid, and pyridoxine, vitamin C, vitamin D, vitamin E [2]. It is also rich in phytochemicals like alkaloids, anthraquinones, saponins, sterols, flavonoids, tannins, terpenoids, reducing sugar, and anti-carcinogenic agents like glycoside compounds, glycerol-1-9-octadecanoate, glucosinolates, and isothiocyanates [17]. *Moringa* contains iron 25 times higher than spinach, calcium 17 times higher than milk, potassium 15 times higher than bananas, protein 9 times higher than yogurt, vitamin A 10 times higher than carrots, and vitamin C 7 times higher than oranges [18]. AVRDC (Asian Vegetable Research and Development Centre) reported that Drumstick leaves are rich in nutrients and antioxidants [12]. In which the nutrients and their contents differ due to certain factors like preparation method, age of leaves, and harvesting season. It was found that leaves of *Moringa* whether it is fresh or cooked or stored in powdered form for a very long time without using refrigeration, they did not lose their nutritional value [19].

Scientifically proved pharmacological actions



Anti-fibrotic: In rats, seed extract of Drumstick tree exhibits anti-fibrotic effects on their liver fibrosis. Significant protective effect against CC14-induced liver fibrosis was seen. It was found that against hepatocellular injury, treatment with *Moringa* stimulates hepatoprotective effects [20].

Antimicrobial effects: Drumstick parts including seed coat, seed cotyledon, barks of stem and root, leaves are reported to hold anti-microbial potential [21]. Pods and husks aqueous extract shows antimicrobial activity against pathogenic gram-negative and gram-positive bacteria and yeast strains [22].

Anti-hyperglycemic effect: Diabetic patients exhibit a stage of chronic hyperglycemia as well as glucose tolerance impairment [23]. *M. oleifera* is used to treat diabetes mellitus because of its pharmacological actions [24]. The presence of terpenoids in *Moringa* leaves is possibly the reason for anti-hyperglycemic and hypoglycemic activity [25].

Antioxidant properties: Extracts of tender and mature leaves show antioxidant activity against free radicals, prevents oxidative damage. Due to its high polyphenol content, it protects against oxidative damage. A comparative study indicated that leaf extract of *Moringa* exhibited enzymatic and non-enzymatic antioxidants [26].

Anti-cancer properties: Drumstick trees possess potential therapeutic effects to fight against cancer. It is utilized in the treatment of different diseases, particularly in South Asia [27]. Pods of *Moringa* possibly will be a chemopreventive agent. Due to fatty acids present in this tree, attributed to the chemopreventive effect of boiled *Moringa* that modulates apoptosis in colon carcinogenesis [28].

Caceres et al., [29] reported that the roots of this tree hold anti-spasmodic activity. In albino rats, after giving ethanol extract of seeds, it was observed that there was a dose-dependent decrease in the usual temperature of the body and yeast-provoked pyrexia [30]. Extract of seeds hold the inhibitory effect on airway inflammation [31]. Agarwal and Mehta [32] reported that powder of dried seed kernels holds great utility for individuals with bronchial asthma. Extracts of almost all parts of *Moringa oleifera* exhibit anti-inflammatory activity [33]. Extracts of root and flower also possess anti-hepatotoxic activity [34].

Use of different parts of Drumstick Tree

Almost all parts of the tree including seed, root, bark, flowers, pods, leaf, seed oil, resin have food, agriculture, and industrial uses. This tree has versatile utility as medicine, nutraceutical, functional food, and water purifying properties, thus considered to be the most useful plant globally [14].

Leaves: Leaves of this tree are packed with nutritional values and are 100% edible. Leaves are considered as a rich source of nutrients like fiber, protein, carbohydrate, beta-carotene, vitamin C, and various minerals like iron, potassium, calcium, and phosphorus [35]. They also have essential amino acids such as tryptophan lysine, methionine, and cysteine. Thus, ideal for a regular diet [36]. They act as a natural antioxidant as they contain a range of flavonoids, phenolic compounds, carotenoids, and ascorbic acid [37].

Flowers: Flowers of this tree are used for nectar in the production of honey. These flowers can be eaten raw in form of salads, can be used to make tea, can be eaten after blanching, etc. [1].

Pods: Pods contain the 6-O-Me-D-galactose, 1-rhamnose, D-galacturonic acid, 1-arabinose, polysaccharide D-galactose, nitriles, an isothiocyanate, and thiocarbamates. They can be boiled and can be utilized just like beans [38].

Seeds: Seeds contain an average amount of Vitamin A and Vitamin E as well. It contains polypeptides that act as a coagulant and therefore use in treating river water [39] and as a source of oil for the production of biodiesel [11]. They are used commercially to produce oil that is “ben oil”. Also used for wastewater treatment and also possess antimicrobial activity [1].



Potential application of drumstick tree

Drumstick trees have water-soluble proteins. Its seeds pumice effectively precipitates and various organics out of solution when added to contaminated water supplies [40-42]. The seeds are used in purifying water due to their antimicrobial and coagulant properties and also yield high-quality oil (ben oil) which is edible and has potential use as biofuel. The leaves, roots, and bark are used in the treatment and or prevention of over 300 ailments [43]. The oil of *Moringa* contains oleic acid in a high amount that is used in cosmetic products for healthy hair and skin [44].

The drumstick tree is a very beneficial tree and even beyond food it serves numerous benefits. It also plays a vital role in mitigating climate change, water, and soil conservation [45]. The extracted juice of the leaves helps in controlling glycemia and is used to apply on swollen glands. It is used for the treatment of hemorrhoids, fever, bronchitis, inflammation of the throat and nose, infections of the eye and ear [46]. In southern India, immature pods and leaves are utilized as vegetable accompaniments and as healthy foods. To enhance breast milk production, it is consumed by pregnant and lactating women [47].

Culinary Uses: It is used to make a range of sambhar and is also fried in South India. It is used in different curry dishes. Pods of this tree are used to make sweet as well as sour curries known as Aamatee in Maharashtra. In Rajasthan and Gujarat as well, the pods are used to cook “Saragva ki Kadhi”. Leaves are also used as seasoning, salads, and pickles.

Aqueous leaf extracts exhibit an antioxidant effect and are used in the treatment of hypothyroidism by regulating thyroid hormone [48]. Seeds of the tree protect skin from environmental influences and help in combating premature skin aging. The seed extract is an innovative solution for hair care due to its twin activity of antipollution, strengthening, and conditioning of hair [49]. For treating constipation, roots and leaves both are traditionally used [50]. Leaves are the greatest source of protein [44]. The leaves are very rich in proteins, vitamins, minerals while the roots and other parts are used in traditional medicine. Its husk can be used for making activated carbon. The defatted cake (seed residue after oil extraction) can be used as fertilizer or processed for animal feed [51]. Leaves are also used in treating anemia as well as menstrual irregularities. Internally for stomachache and externally for sprains, its young leaf paste combined with curd is used. Whereas juice of leaves and bark paste is consumed for treating constipation and piles [52-53]. The juice of roots is utilized superficially as a rubefacient, in hiccups, counter-irritant, lumbago, for enlarged liver or spleen. Bark, roots and leaves all are pungent and acrid, consumed for promoting digestion. A reddish gum of drumstick bark holds various properties such as anti-diarrhoeal, abortifacient emmenagogue, and antiscorbutic. Compound spirit prepared from taking an equal amount of orange peel and roots of *Moringa* acts as stimulant and carminative in nervous debility, epilepsy, paralytic afflictions, and hysteria [54-55]. It is glorified as a “traditional mother care plant”, as leaves are very nutritious for pregnant females [56]. The aqueous extract and ethyl extract of drumstick leaves hold the significant potential of wound healing [57-58].

Conclusion

Drumstick tree is known for having plenty of therapeutic as well as medicinal properties. This review focuses on the nutritional content of the *Moringa* tree up to several specific remedial properties including its anti-fibrotic, anti-inflammatory, anti-microbial, anti-hyperglycemic, antioxidant, and anti-cancer. Further studies for the mechanism of action and constituents of this plant may provide incredible capabilities to develop pharmacological products. In conclusion, *Moringa* has numerous applications in the medicinal field. Traditional uses and pharmacological properties of *M. oleifera* made it a true miracle tree. Its high nutritional content proved this a better nutraceutical. As this is edible, further researches can be carried out, helping to avail herb holding multifarious effects in the future market. India can easily fight against various problems such as malnutrition, hunger, poverty, because of its nutritional value and the broad range of pharmacological properties. Therefore, the Drumstick tree can be incorporated into a daily diet for availing its highest possible nutrients and to prevent malnutrition as well as various other problems.



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