

Drumstick (Moringa) as an Underutilized Super Vegetable: Nutritional and Beneficial Benefits

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Moringa (*Moringa oleifera* L), also referred to as the "drumstick tree," is a member of the Moringaceae family. Although it is native to India, it is currently grown all over the world. It is a fast-growing tree with a strong capability for regeneration following pruning and a response to few inputs. It is a wonder tree because of its nutritional richness and ability to thrive profitably in a variety of soils and environmental circumstances. Each portion is used in different ways, and it is quite healthy. It is commonly grown for its young pods, flowers, and leaves, which are used as a vegetable and in traditional herbal medicine. Indigenous populations in the tropics and subtropics also use it as a source of cures. Many nations throughout the world also use the leaves as a source of fodder since they can maintain the supply of green fodder year-round without further work. Ascorbic acid, calcium, iron, protein and antioxidant chemicals can be found in many portions of this tree. As a result, its exceptional qualities aid in the treatment of human illnesses, nutritional deficiencies and cattle performance.

Introduction

Moringa oleifera, or drumstick, is a very nutritious vegetable crop that is commonly grown in tropical and subtropical climates. Bangladesh, Pakistan, India, and a number of African countries grow it extensively. Despite their exceptional nutritional and medicinal properties, drumsticks are still considered an underutilized vegetable in many parts of the world. The crop is highly valued for its delicate pods, leaves, blooms, and seeds, all of which are incredibly healthful and delicious. Drumsticks are frequently called "super vegetables" because of their remarkable nutritional composition.



It is believed to have originated in the sub-Himalayan regions of the Indian subcontinent, although being commonly used throughout south and southeast Asia. The world's tropical

and subtropical regions are ideal for this plant's growth. It is a deeply rooted, quickly growing plant that can withstand drought. India is the greatest producer of Moringa, producing 2.2 million tonnes of delicate fruits each year. (a productivity of 51 tonnes per ha) from an area of 43600 ha with Andhra Pradesh leading in its production, followed by Karnataka and Tamil Nadu” (Kumar et al., 2014). It is extensively grown for its immature seed pods and leaves, which are utilized in traditional herbal remedies in addition to being a vegetable.

Why Drumstick Is Underutilized

Underutilized vegetables are those crops that possess high nutritional potential but are not widely consumed or commercially exploited. Despite being widely available, drumsticks are still underutilized in rural and semi-urban India for the following reasons:

- A lack of understanding regarding its nutritional benefits.
- Considered a "traditional" or "regular" vegetable.
- Lack of inclusion in processed foods and modern diets.

Botanical Description

The 13 species in the genus *Moringa* are found in tropical and subtropical parts of Asia and Africa, and they range in size from a little shrub to massive tree. However, the most extensively grown species is *oleifera*, which is indigenous to northwest India's Himalayan foothills. (Olson, 2010). The deciduous *Moringa oleifera* tree grows quickly, reaching a height of 10 to 12 m with a trunk diameter of 46 cm.

- **Leaves & young shoots:** This plant's leaves are arranged differently, with pinnae and pinnules growing in opposition to one another. The leaflets themselves vary in shape, with elliptic lateral leaflets and obovate terminal ones. They are 1.2 to 2.0 cm long and 0.6 to 1.0 cm wide. The leaflets' petioles also vary in length, with the lateral ones measuring 1.5 to 2.5 mm and the terminal ones measuring 3 to 6 mm. The green, finely hairy twigs eventually turn brown. The twigs lose their tiny hairs and take on a smooth texture as they get older. Furthermore, the leaflets' paler, matte underside contrasts with their smooth, glossy top surface.
- **Fruits, Flowers & Seeds:** This plant produces flowers that are not only aesthetically pleasing but also fragrant. They play a crucial role in the plant's reproductive cycle. Individual flowers have five uneven yellowish-white, thinly veined, spathulate petals, five stamens with five smaller sterile stamens (staminodes), and a pistil made up of a one-celled ovary and slender style. They are set in a basal cup (hypanthium) that is about 3 mm long and 2 cm broad. When the pods reach maturity, they grow woody and brown before splitting open to release the seeds. The seeds are tiny, oval-shaped, and have a glossy outer layer of dark brown or black. Furthermore, the wings on the seeds' angles facilitate wind-borne seed dispersal, expanding the plant's genetic material's reach.
- **Bark & Wood:** The bark is thick, soft, fissured, warty or corky, whitish-grey, and eventually rough. When the bark is injured, it releases a gum that is initially white but turns reddish brown or brownish black when exposed. Because of its ease workability and appealing grain patterns, it is frequently utilized in construction, furniture manufacturing, and handicraft.
- **Rooting habit:** The taproot stores water and nutrients, enabling the seedling to endure challenging circumstances. Rather, these plants grow a fibrous root system made up of many thin, branching roots. It can better absorb water and nutrients from the soil thanks to its fibrous root system, which increases its adaptability to various growing environments.

Nutritional Powerhouse

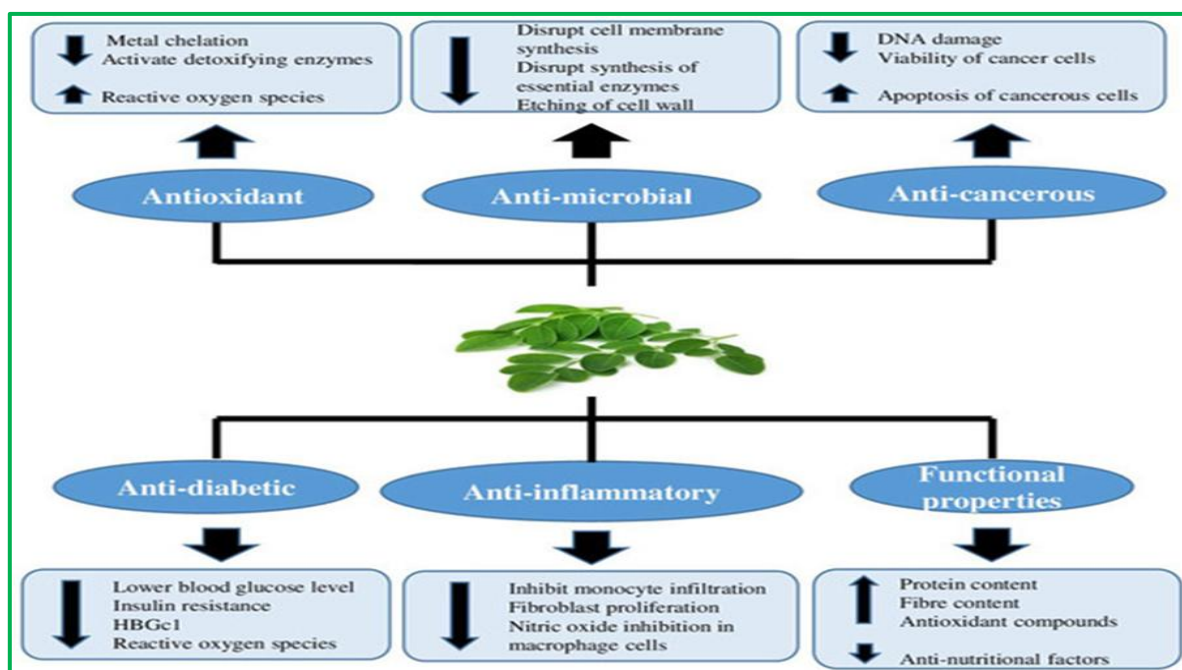
Drumstick is regarded as a nutritious powerhouse. The moringa plant is rich in nutrients in every section. Minerals including Ca, K, Zn, Mg, Fe and Cu are abundant in leaves. The leaves also include vitamins C, D and E, beta-carotene, pyridoxine, nicotinic acid, and folic

acid. Moringa pods provide roughly 46.8% fiber and 20.7% protein, with amino acids evenly split across the pods (30%), leaves (44%), and blossoms (31%). Moringa powder can supply 4000 mg of calcium per 100 g, whilst moringa leaves can supply 1000 mg (Gopalakrishnan et al., 2016). Anaemia may be treated with moringa leaf powder since it provides 28 mg of iron per 100 g compared to 2 mg in beef. Moringa leaves have a higher iron concentration than spinach (Asiedu-Gyekyeet et al., 2014). A person's daily zinc needs can be satisfied by the 25.5–31.0 mg of zinc per kilogram found in *M. oleifera* leaves. Drumsticks are a wonderful source of important minerals including calcium and magnesium as well as vitamins A and C. Moringa is high in nutrients because its leaves, pods, and seeds contain a variety of essential chemicals. The leaves of the moringa plant can be used as food and health supplements because they contain naturally occurring compounds like flavonoids, phenolic acids, carotenoids, and glucosinolates.

Medicinal and Health Properties

Moringa (*Moringa oleifera*) is regarded as a highly valuable medicinal plant because of its nutritional and pharmacological qualities. All parts of the plant contain various bioactive chemical compounds, including phenolics, tannins, flavonoids, isothiocyanates, saponins, alkaloids, glucosinolates, vitamins and carotenoids. Flavonoids, alkaloids, tannins, phenolic acids, and saponins are among the phytochemicals found in moringa leaves that have strong anti-cancer effects. Moringa seed oil is a good alternative to olive oil because it has about 76% PUFA. Moringa pods are a good treatment for joint pain, diarrhea and issues with the liver and spleen. The root's bark has anti-inflammatory, anti-ulcer, and heart stimulating properties. Additionally, polyunsaturated fatty acids like omega-3 and omega-6, which support the body's vitality and various cardiovascular systems, are abundant in moringa leaves. Due to its high nutritional value, moringa can be used as an effective remedy for malnutrition as being used in countries like Senegal. Moringa is thought to be a great precursor of hormone lactagogues, which boost milk supply in nursing mothers, because of its phytosterol concentration. It is used to treat malnutrition in children younger than 3 years old” (Mutiar-Titi & Estiasih, 2013; Sekhar et al., 2018). Pregnant women need about six spoonful of leaf powder a day to meet their iron and calcium needs. It can therefore be utilized as a nutraceutical product given its pharmacological and nutritional qualities.

Its high phenol concentration is primarily responsible for its potent antioxidant qualities. (Wani et al., 2024). Fiber-rich pods can both prevent and treat colon cancer of moringa. More than 300 diseases can be cured with *M. oleifera*, which is a traditional herbal medicine used by Indians and Africans (Gopalakrishnan et al., 2016).



Moringa has been found in multiple research to have anti-diabetic properties. *M. oleifera* is safe, dependable, and natural at certain dosages, it can be employed as an anticancer drug. Moringa has been found to decrease acidity in gastric ulcers and hence can be used as an antiulcer agent” (Choudhary et al., 2013).

Conclusion and future prospects

Research on *M. oleifera* has not yet received much attention in India. With numerous nutritional and medicinal applications, drumstick (*Moringa oleifera*) is an incredibly beneficial yet underappreciated super food. It is a powerful tool against malnutrition and chronic illnesses due to its wealth of vitamins, minerals, and bioactive compounds. Global food security and public health could be significantly enhanced by promoting its production, consumption, and industrial use. It could be a good substitute for purifying water. To confirm the main mechanisms of moringa as antidiabetic and anticancer drugs, more research is necessary. More research is needed to determine how environmental conditions affect the nutritional levels of leaves and other portions of *M. oleifera* growing worldwide. Evaluating *M. oleifera* commercial application as a bio-coagulant is yet another area of focus. The tree, which is native to India, has the potential to be a major source of wealth for the country if industries and academics take advantage of its potential as a highly nutritious meal by conducting additional research to support previous findings.