



Health Benefits & Therapeutic Significance Of Moringa Oleifera (Drumstick) Plant.

Authors: Sakshi Suresh Mankar*¹, Sarim Kamran², Surbhi Shailendra Kohle³, Danish Khan⁴, Utkarsha Vidyadhar Chandurkar⁵, Ravi P. Kalsait⁶

1,2,3,4,5 are the students of pharmacy, Central India College of Pharmacy, Lonara, Nagpur-441 111 DBATU University, Lonere, Raigad, Mumbai, Maharashtra, India.

Assistant professor, Central India College of Pharmacy, Lonara, Nagpur.

6 Principal, Central India College of Pharmacy, Lonara, Nagpur.

❖ ABSTRACT:

Moringa oleifera Linn, commonly referred to as the "drumstick tree" or "horseradish tree," has been extensively studied for its numerous health benefits and therapeutic properties. This review aims to summarize the existing literature on the medicinal properties of Moringa oleifera Linn and its potential applications in various health conditions.

Moringa oleifera is rich in essential nutrients, including vitamins, minerals, and antioxidants, making it a valuable dietary supplement. Studies have demonstrated its anti-inflammatory, antioxidant, antimicrobial, and anticancer properties, suggesting its potential in preventing and treating a wide range of diseases. Additionally, Moringa oleifera has been investigated for its effects on various systems of the body, including the cardiovascular, immune, digestive, and nervous systems.

Furthermore, the therapeutic uses of different parts of the Moringa oleifera plant, such as the leaves, seeds, and roots, have been explored in traditional medicine and modern research. These include its use in managing diabetes, hypertension, hyperlipidemia, arthritis, and gastrointestinal disorders, among others.

Overall, the evidence presented in this review underscores the potential of Moringa oleifera Linn as a valuable natural remedy for promoting health and well-being. Further research is warranted to elucidate its mechanisms of action, optimize dosing regimens, and explore its therapeutic potential in clinical settings.

KEYWORDS: Moringa oleifera Linn, health benefits, therapeutic uses, medicinal properties, natural remedies, traditional medicine, dietary supplement.

❖ INTRODUCTION:

The Moringa plant, in particular, has shown promising results in treating conditions such as diabetes, high blood pressure, and inflammation. Moringa has minimal side effects compared to conventional medicine. Its leaves, seeds, and roots contain potent antioxidants and anti-inflammatory compounds that contribute to its therapeutic properties. Additionally, the plant's nutritional value is also highly regarded, as it is rich in vitamins, minerals, and protein. Overall, the Moringa plant continues to be a valuable resource in traditional medicine. It is known to contain high levels of vitamins, minerals, and antioxidants. Its leaves are particularly rich in nutrients such as vitamin C, vitamin A, calcium, and iron. Additionally, studies have shown that Moringa extracts possess anti-inflammatory and immune-boosting properties, making it a valuable ingredient

in traditional medicine and natural remedies. In many cultures around the worldwide, Moringa is used to treat asthma, blood impurities, cholesterol lowering, anti-epileptic, diuretic, anti-ulcer, chest congestion, cholera, blackheads, bronchitis, and hepatoprotective activity.

1. **Synonyms:** Drumstick tree, Saragavo, Saijihan, Benzolive, Horseradish tree, Mulangay, Kelor, Sajna, Marango, Guilandina moringa, Hyperanthera moringa, Moringa pterygosperma Gaertn. Nom. Illeg.
2. **Biological source:** Moringa Oleifera consists of dried long, slender, triangular seed-pods of Moringa Oleifera belonging to Family **Moringaceae**.
3. **Geographical source:** Moringa oleifera, a native tree from sub-Himalayan regions of North West India, is now found in Q Islands, Africa, Arabia, South East Asia, the Pacific & Caribbean Island and South America, traditionally used as a daily vegetable.

▪ **Morphology:**

Colour- Green

Odour- Characteristics

Taste- Characteristics

Shape- Long, Slender

Size- Height is about 10-20m and diameter is 45cm

Leaves & young shoots:

The leaves of this plant have a unique arrangement, with pinnae and pinnules growing opposite each other. The leaflets are 1.2 to 2.0 cm long and 0.6 to 1.0 cm wide; they themselves vary in shape, with elliptic lateral leaflets and obovate terminal ones. Additionally, the petioles of the leaflets differ in length, ranging from 1.5 to 2.5 mm for the lateral

ones and 3 to 6 mm for the terminal ones. The twigs are finely hairy and green, becoming brown. As the twigs mature, they develop a smooth texture and lose their fine hairs. Additionally, the leaflets have a smooth and glossy appearance on the upper surface, contrasting with their paler and matte underside.

Fruits, Flowers & Seeds

The flowers of this plant are not only visually appealing but also emit a pleasant fragrance. They attract pollinators with their bright colors and delicate petals, making them an important part of the plant's reproductive cycle. Individual flowers, set in a basal cup (hypanthium) ca. 3 mm long, are approximately 0.7 to 1 cm long and 2 cm broad, with five unequal yellowish-white, thinly veined, spatulate petals, five stamens with five smaller sterile stamens (staminodes), and a pistil composed of a 1-celled ovary and slender style. Once mature, the pods turn brown and become woody, eventually splitting open to release the seeds. The seeds are small, oval-shaped, and have a glossy black or dark brown outer coat. The seeds of this plant are commonly used for culinary purposes due to their rich flavor and nutritional value. Additionally, the wings on the angles of the seeds aid in their dispersal by wind, allowing for wider distribution of the plant's genetic material.

Bark & Wood:

The bark is whitish-grey, thick, soft, fissured and warty or corky, becoming rough. When wounded, the bark exudes a gum which is initially white in colour but changes to reddish brown or brownish black on exposure. Despite its soft and light nature, the wood of this tree is known for its durability and resistance to decay. It is



commonly used in construction, furniture making, and crafting due to its easy workability and attractive grain patterns.

Rooting habit:

The taproot serves as a storage organ for nutrients and water, allowing the seedling to survive in harsh conditions. As the seedling grows, it will gradually develop a network of lateral roots to anchor itself and absorb nutrients from the surrounding soil. Instead, these trees develop a fibrous root system that consists of numerous thin, branching roots. This fibrous root system allows for better absorption of nutrients and water from the soil, making it more adaptable to different growing conditions.

- **Chemical Constituents:** Isothiocyanates such as 4-{{(2'-O-acetyl- α -L-rhamnosyloxy) benzyl}}



Fig. No.2 Leaves



Fig. No.3 Fruits/Beans

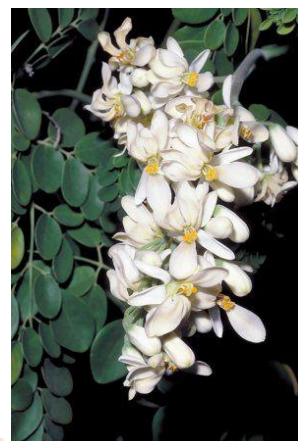


Fig. No.4 Flowers



Fig. No.5 Seeds



Fig. No.6 Bark

isothiocyanates (RBITC; a 2'-acetylated glycosides of benzylisothiocyanate) and a 4'-acetylated variant (seeds) as well as a fully no acetylated 4-(α -L-Rhamnosyloxy) benzyl isothiocyanates.

Nitrate, Pterrygosperma, Crypto-chlorogenic acid, Quercetin, Quercetin 3-O- β D-(600-O-malonyl)-glucoside, and the isomer isoquercetin, Kaempferol and its 3-glucosides Astragalins and its rhamnoglucoside, Procyanidins, 4-O-caffeoylquinic acid, 5-O-caffeoylquinic acid, and glucoside thereof, Protease inhibitors.

Parts	Phytochemical constituents
Roots	4-(α -rhamnopyranosyloxy)-benzylglucosinolate and benzylglucosinolate.
Stem	4-hydroxymellein, vanillin, β -sitosterone, octacosanic acid and β -sitosterol.
Bark	4-(α -L-rhamnopyranosyloxy)-benzylglucosinolate.
Whole gum exudates	L-arabinose, D-glucuronic acid, L-rhamnose, D-mannose, D-xylose, and leucoanthocyanin.
Leaves	Glycoside niazirin, niazirin and three mustard oil glycoside.

❖ Cultivation & Collection:

Some scientific literature may provide more in-depth information on the botanical and cultural practices of *Moringa oleifera*, including its suitable environmental conditions for cultivation, soil requirements, fertilizer recommendations, and water needs. It is recommended to consult these sources for a comprehensive understanding of the subject. Additionally, it is important to note that the yields of *Moringa oleifera* can vary significantly depending on factors such as season, variety, fertilization methods, and irrigation techniques. Some of the suitable environmental conditions for cultivating *Moringa oleifera* include a tropical or subtropical climate with temperatures ranging from 25 to 35 degrees Celsius and a minimum annual rainfall of 600 mm. Additionally, *Moringa* plants require well-drained soil and benefit from regular pruning to promote healthy growth and higher yields.

The collection procedure of *Moringa oleifera* varies depending on the part of the plant being collected:

- Leaves:** The leaves are rich in vitamins, minerals, and antioxidants, making them a popular ingredient in various cuisines and herbal remedies. They can be dried and ground into a powder for convenient storage and use.
- Flower Pods:** The flower pod of *Moringa oleifera* are collected when they are young and tender. They are typically picked by hand.
- Seeds:** The seeds are collected from mature pods. The pods are allowed to dry on the tree before they are harvested. The seeds can then be separated from plant washed with distilled water and then dry under the sunlight.
- Gum:** *Moringa oleifera* gum (MOG) is collected as an exudate from the injured stem site. When initially the exudate is collected, it appears in white colour but, after exposure to sunlight, it becomes reddish-brown or brownish-black. Finally the dried gum is crushed and creates fine particles.
- Oil:** The oil is extracted from the seeds of *Moringa oleifera*. The seeds are first dried and then crushed to a powder. The powder is then packed inside a muslin cloth placed in a thimble of the Soxhlet extractor. The extraction is carried out at 60°C using a thermostatic heating mantle. The solvent in the evaporated oil is then removed by evaporation and the oil gets separated and dried under the oven.

❖ HEALTH BENEFITS:

• SEEDS

- 1) Moringa seeds are rich in vitamins, calcium, iron, protein and essential amino acids.
- 2) They are also a great source of zinc, which can help to regulate blood sugar levels. Moringa seeds are high in fiber, which aids digestion.
- 3) Moringa seeds are a great supplement of calcium and can help those suffering from joint pain.
- 4) Moringa seed extracts show antibacterial activity and are also used as a water purifying agent.
- 5) Furthermore, the seed extract of MO has shown promising results in inhibiting the growth of cancer cells, making it a potential candidate for cancer treatment.
- 6) Additionally, the phytochemicals present in the seed extract have also demonstrated antimicrobial properties, suggesting their potential use in fighting against various infectious diseases.
- 7) Additionally, the seed extract of MO has shown potential as an antitumor promoter due to its ability to inhibit Epstein-Barr virus early antigen induction.
- 8) Moreover, the phytochemicals derived from MO seed extracts have demonstrated effectiveness as mosquito vector control agents, making them valuable for integrated pest management programs aimed at controlling diseases transmitted by mosquitoes.

• LEAVES

- 1) This antibacterial activity of MO leaf extracts suggests their potential use in the development of new antimicrobial agents to combat bacterial infections. Additionally, the wide-spectrum nature of these compounds may help overcome the issue of antibiotic resistance, making them a valuable alternative in the field of infectious disease treatment.
- 2) 1) The consumption of MO leaves can help regulate blood sugar levels and improve insulin sensitivity in animal models. This suggests that incorporating MO leaves into the diet could potentially be beneficial for individuals with diabetes or at risk of developing the disease.
- 3) The antioxidant and therapeutic properties of MO leaves make them a promising natural supplement for both animal and human health.
- 4) The prevention of atherosclerotic plaque formation in artery as well as the lipid lowering activity of the extract has been shown in rabbit fed with high cholesterol diet, suggesting that MO has high therapeutic potential for the prevention of cardiovascular diseases.
- 5) The antibacterial activity of MO leaf extracts suggests their potential use in the development of new antimicrobial agents to combat bacterial infections.
- 6) The wide-spectrum nature of these compounds may help overcome the issue of antibiotic resistance, making them a valuable alternative in the field of infectious disease treatment.

• ROOTS

- 1) MO root extract has also demonstrated potential as a source for antiulcer drugs in the future. This is supported by its antimutagenic and antioxidant properties, which have been observed in studies involving Salmonella typhimurium tester strains and microsomal lipid peroxidation inhibition.
- 2) Furthermore, MO root extract has also been found to possess anti-inflammatory properties. In a study conducted on mice, the extract exhibited significant inhibition of paw edema, indicating its potential as a natural remedy for inflammatory conditions.
- 3) Roots of Moringa are used to treat conditions such as asthma & they are also used to treat various skin disorders.
- 4) Moringa roots can help with digestive disorders. They are used to treat gastritis, an inflammation of the stomach lining.
- 5) In some rural parts of India, women use Moringa roots as a form of permanent contraception.

- **POD HUSK**

- 1) The presence of alkaloids in MO pod husks suggests potential therapeutic properties such as analgesic and anti-inflammatory effects. Moreover, the antimicrobial activity of the extract could be attributed to the synergistic effects of multiple bioactive compounds present in MO pod husks.
- 2) The resistance to conventional antibiotics highlights the need for alternative treatment options, such as the use of MO pod husk extract. Furthermore, further research is warranted to explore the specific mechanisms by which these bioactive compounds exert their antimicrobial effects and to determine their potential for clinical applications.
- 3) The use of MO pod husk extract as an alternative treatment option shows promise in addressing the issue of antimicrobial resistance. Additionally, understanding the specific mechanisms by which these bioactive compounds work can help in developing targeted therapies for multidrug-resistant organisms.
- 4) These findings suggest that MO pod husk extract has the potential to not only combat antimicrobial resistance but also contribute to the development of new treatments for inflammatory conditions and hypertension. Further research is needed to explore the full range of therapeutic benefits offered by these bioactive compounds and their potential applications in modern medicine.

❖ **MEDICINAL PROPERTIES:**

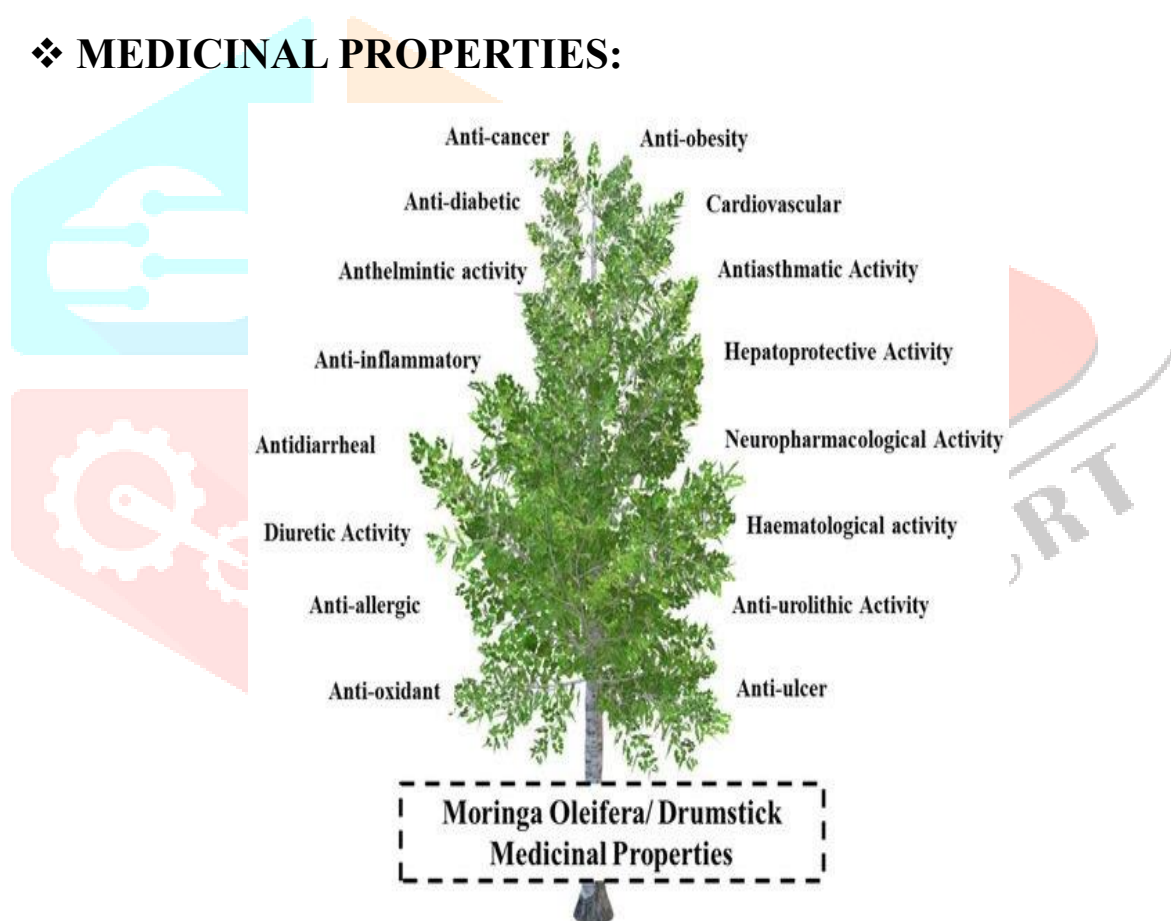


Fig. No.7 Medicinal Properties of M. Oleifera

❖ THERAPEUTIC USES:

- 1) Used Anti-infectious Diseases:** It is clear that MO has a relatively broad anti-microbial spectrum; however, it shows a slightly higher inhibitory effect against gram-negative bacteria. Further research is needed to determine the specific bioactive components responsible for the antimicrobial activity of MO and their effectiveness against different infectious diseases. Additionally, understanding the corresponding relationship between different parts of MO and their effects on specific infectious diseases could provide valuable insights for developing targeted treatments.
- 2) Used in Chronic Inflammation:** Guinea pigs with ovalbumin-induced airway inflammation may exhibit a marked improvement in lung function indices when they are given an n-butanol extract of Moringa seeds. After application, the extract significantly reduced the amount of immune cells, especially neutrophils and eosinophils, in serum or bronchoalveolar lavaged fluid. Lung tissue histology was also used to validate this anti-inflammatory impact. The extract's active component, which was later identified as β -sitosterol, was thought to work by adjusting the ratio of Th1/Th2 cytokines. Still, not much research has been done on how immunocytes react to MO.
- 3) Used in Physicochemical Irritation Induce Immune Disorders:** Physicochemical irritation tend to cause acute stress responses are frequently brought on by physicochemical irritation. With its low cost, wide availability, and no documented adverse effects, MO is a great option for treating these kinds of illnesses. In addition, MO has strong analgesic properties and can be used to mitigate the negative effects of some medications, so trying it as a companion medication can be beneficial.
- 4) Used in Auto-Immune Disorders:** Rheumatoid arthritis (RA) is a common auto-immune disease that is typified by a decrease in anti-inflammatory cytokines (like IL-4 and IL-10), an increase in pro-inflammatory cytokines (like TNF- α , IL-6, and IL-1 β) and inducible inflammation-related enzymes (like lipoxxygenase and cyclooxygenase). Following treatment with a MO methanolic extract, the levels of TNF α , prostaglandin E2, and C-reactive protein in the serum were significantly reduced. The levels of NF- κ B, prostaglandin E2 (PGE2), cyclooxygenase 2 (COX-2), and IL-1 β were markedly downregulated. The levels of I- κ B, IL4, and IL-10 mRNA were significantly upregulated. The histopathological indices and arthritic index in the joints were remarkably restored. Triiodothyronine (T3) production and release are inhibited by MO leaf extract, which has medicinal benefit in controlling hyperthyroidism, an autoimmune-related condition. Natural medications like MO are great substitutes for monotherapies in the treatment of autoimmune illnesses, as they offer greater advantages.
- 5) Used in Diabetes:** Moringa oleifera's potential antidiabetic effects could come from a number of different mechanisms, such as increased insulin secretion, inhibition of α -amylase and α -glucosidase activities, decreased hepatic gluconeogenesis, increased muscle and liver glucose uptake, inhibition of intestinal glucose uptake, and antioxidative qualities. This plant may have antidiabetic properties through reducing inflammation or counteracting oxidative stress, which would lessen insulin resistance. There is very little information in the literature on this plant's ability to prevent diabetes and how its phytochemicals directly affect insulin activation signaling. The presence of small bioactive molecules, such as 4-hydroxyphenylacetone (1), fluoropyrazine (2), methyl-4-hydroxybenzoate (3), vanillin (4), 4- α -L-rhamnopyranosylbenzylisothiocyanate (5), and 3,4-dihydroxy benzonitrile (6), as well as phenolics and flavonoids, such as gallic acid (7) and rutin (8), is thought to be responsible for the antidiabetic properties of Moringa leaves.
- 6) Used as Anti-Ulcer Agent:** Numerous flavonoids, triterpenes, steroids, alkaloids, and numerous other chemical components are present in Moringa oleifera (Ross, Citation 1999). One well-known antiulcer agent found in the leaves is the flavonoid quercetin. Additionally, the leaves contain the flavonoid rutin, which has been shown to have a cytoprotective effect on the stomach. This explains why acetone and methanol leaf extracts have a stronger ulcer-healing effect than petroleum extract. In addition to flavonoids, the plant's leaves also have β -sitosterol and β -carotene, two steroids that are known to prevent the formation of stomach ulcers. This likely explains why petroleum ether extract is active.
- 7) Used as Anti-Asthmatic Agent:** Numerous cellular processes, including as T-lymphocyte activation and B-lymphocyte synthesis of immunoglobulins, have been linked to IL-6. According to our research, the number of inflammatory cells and cytokine levels that were mostly elevated in the model control mice were dramatically reduced in the extract-treated animals. These findings support

the widespread application of *M. oleifera* in the management of allergic disorders related to asthma. These results also suggest that a decrease in cytokine release or synthesis could be the mechanism of action.

❖ MARKETED PREPARATIONS:

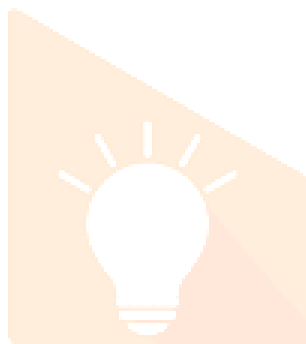
1) Moringa Leaves Powder



2) Moringa Extract/Juice



3) Moringa Noodles



4) Moringa Capsules



5) Moringa Soap



6) Moringa Oil



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