Moringa oleifera: A review on nutritive importance and its potential use as nutraceutical plant

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Abstract
The use of natural plant products with smaller side effects has gained popularity over the years. The foods that can impart health benefits beyond conventional nutrients, there is enormous scope. One such tree which has enormous nutritional and medicinal benefits is Moringa oleifera. Moringa oleifera Lam. belongs to the Moringaceae family, is a perennial deciduous tropical tree and is rich in macro and micro nutrients such as proteins, carbohydrates, calcium, phosphorus, potassium, iron, vitamins, beta carotene and other bioactive compounds that are necessary to the normal functioning of the body and the prevention of some diseases. Many parts of Moringa oleifera including leaves, flowers and seeds, are edible and other parts such as bark, are used in the production of biodiesel and the purification of water. Moringa oleifera also includes anticancer, anti-ulcer, antimicrobial, antioxidant and has immense therapeutic properties.

Keywords: Beta-carotene, flavonoids Moringa oleifera, nutraceutical, pharmacological potential

Introduction
Moringa oleifera Lam. (M. oleifera) belongs to the family Moringaceae and is a cruciferous herb. M. Oleifera is commonly referred to by locals as the drumstick tree and is a prominent staple in various parts of the world (Anwar et al., 2007) [2]. The drumstick tree is a small fast growing ornamental tree which is native to India. The trees are said to have been originated from Agra and Oudh in North Western region of India to South of the Himalayan Mountains (Prabhu et al., 2011) [12]. The tree is claimed to have potential to improve nutrition, increase food security, and encourage rural development (Abou and Nadir, 2014) [1]. M. Oleifera is eaten not only because of its nutritional value, but also because of its medicinal benefits and leaves are rich in vitamin C, vitamin E, beta-carotene, and polyphenols and are a good source of natural antioxidants. A wide range of biological functions, including anti-inflammatory, anti-cancer, hepatoprotective and neuroprotective functions, are documented. Furthermore, numerous studies have shown its therapeutic benefit including anti-diabetes, anti-rheumatoid arthritis, anti-atherosclerosis, anti-infertility, pain relief, anti-depression, and diuretic and thyroid control. The bioactivity of M. oleifera due to the recorded functions over the last decade it has received considerable attention, leading to a growing exploration and understanding of its pharmacological roles and underlying mechanisms (Joshi and Mehta, 2010) [7].

Nutritional importance
Among the different species, M. oleifera contained the highest amounts of β-carotene, ascorbate (Vit C), α-tocopherol (Vit E) and iron, and was the second highest in protein content. Moringa is a good source of many nutrients. There are high concentrations of crude proteins and amino acids in the leaves and other parts of the tree, comparable to soybean. Oligosaccharides and oxalate were reported as anti-nutrient factors in Moringa leaves (Freiberger et al., 1998) [4]. Vitamins such as vitamin A, which is essential for eye & hair health, vitamin C, and other vitamins from the B group. Minerals such as calcium that helps build bones & teeth can cause rickets, bone pain, osteoporosis, etc. Eight ounces of Moringa leaves are said to supply 1000 mg of calcium and dry Moringa powder will supply 4000 mg of calcium, while milk only supplies 300-400 mg of calcium (Gopala et al., 2016) [5]. The body also requires phosphorus, which has a role in the formation of bones and teeth, to make protein
for growth, ATP, maintenance, cell and tissue repair. Moringa's zinc content is also in line with dietary requirements, which is essential for the synthesis of RNA & DNA fiber that helps to maintain a healthy gut. Tannins, alkaloids, phenolic compounds, amino acids, sterols and carbohydrates are bioactive compounds (Masurekar et al., 2014) [9].

Uses of different parts of Moringa Oleifera
1. Drumstick tree leaves are filled and 100 percent edible with nutritious properties. They are a rich source of nutrients such as protein, carbohydrates, fiber, vitamin C, beta carotene and minerals such as calcium, potassium, iron and phosphorus. The leaves contain antioxidant compounds of different kinds, such as ascorbic acid, flavonoids, carotenoids and phenolic compounds, and function as a natural antioxidant (Joshi and Mehta, 2010) [10].

2. Moringa flowers are a good nectar source for the production of honey. They can be consumed raw with salads, can be used for tea making, can be consumed after blanching, etc.

3. Pods contain a molar ratio of 1:1:1:1 of the polysaccharides d-galactose, 6-O-Me-D-galactose, D-galacturonic acid, l-arabinose and l-rhamnose and nitriles, isothiocyanate and thiocarbamates (Masurekar et al., 2014) [9].

4. Antimicrobial activity is also present in seed oil. The antimicrobial activity is due to the benzyl iso-thiocynate compound 4 (alpha-L rhamnosyloxy), whose mode of action involves either inhibiting the essential enzymes or disrupting the cell membrane (Masurekar et al., 2014) [9].

5. The Moringa foliage contains more polyunsaturated fatty acids (PUFA) than saturated fatty acids, which is good for health (Sultana et al., 2017) [14].

Potential pharmacological effects
Anti-cancer and anti-tumour activity
In a research by Berkovich et al., (2013) [13] M. oleifera leaves on the human pancreatic cancer cell line Panc-1 were investigated. The viability of Panc-1 cells was significantly decreased by M. oleifera extracts, either alone or together with cisplatin. Treatment with cold aqueous extracts for human lung cancer cells. M. Oleifera leaves (10 to 200 μg/mL) induced apoptosis and also decreased cancer cell proliferation and invasion, as well as internal reactive oxygen species levels (Jung, 2014) [9].

Antimicrobial activity
The M. Oleifera roots extract have been reported to contain an active pterygospermine antibiotic that has strong antibacterial and fungicidal effects. A deoxy-niazimicine aglycone isolated from the chloroform fraction of ethanol extract. It is known that M. oleifera root bark is responsible for antibacterial and antifungal activities. Although the juice exhibits an antibacterial activity against Staphylococcus aureus from the stem bark. The promising anti-bacterial properties of M. oleifera have a significant inhibitory effect on Gram-positive microbes (Peixoto et al., 2011) [11].

Antioxidant activity
Typically, polyphenol-rich natural compounds have significant antioxidant properties and may mitigate tissue oxidative damage by scavenging free radicals. An extract of methanol with Chlorogenic acid, rutin, quercetin glucoside and kaempferol rhamnoglucoside are present in the M. oleifera leaves, while multiple procyanidin peaks are observed in the root and stem barks. Due mainly to its high content of bioactive polyphenols, the Moringa genus has high antioxidant activity. Extracts of M. oleifera from both mature and tender leaves show good antioxidant activity against free radicals and escape oxidative damage due to polyphenol enrichment (Sreelatha et al., 2009) [13].

Neuroprotective activity
In harsh treatment conditions, M. oleifera has been shown to promote neuronal outgrowth and survival. A 30 μg/mL ethanol extract concentration from the leaves of M. Oleifera in a concentration-dependent will promote the outcome of neurites and neuronal differentiation from primary embryonic neurons. To increase the number and length of dendrites and axonal branches, the length of axons and eventually promote synaptogenesis with M. oleifera leaf extract has been observed. In rats with aluminum chloride-induced temporal cortical degeneration protected against aluminum chloride-induced neurotoxicity of the temporal cortex of rats by minimizing expression of neuron-specific enolase (NSE) and glial fibrillary acid protein with M. oleifera leaf extract at a dose of 300 mg/kg for 28 consecutive days (Hannan et al., 2014) [9].

Anti-inflammation activity
A reduction in carrageenan-induced rat paw edema, which is comparable to aspirin, was seen in M.oleifera seed extract (MSE) enriched with isothiocyanatin. In vitro, its major isothiocyanate (MIC-1) at a dose of 5 μM can reduce inflammatory cytokinesis significantly. In contrast to curcumin, MIC-1 at a dose of 10 μM may also have stronger effects on nuclear factor upregulation (erythroid-derived 2)-like 2 (Nrf2) NAD (PH) target genes: quinone oxidoreductase 1 (NQO1), glutathione S-transferase pi 1 (GSTP1) and heme oxygenase 1 (GSTM1) (HO-1) (Park et al., 2011) [10]. It can be considered as an alternative remedy for inflammatory bowel disease (IBD) and the preventive strategy of its recurrence in acetic acid-induced acute colitis rat model.

Conclusion
Moringa oleifera is an excellent source of antioxidants, including macro- and micro-nutrients. Moringa oleifera leaves are not as common all over the world as other leafy vegetables, such as spinach and fenugreek. The literature available offers a full description of the plant's chemical components, nutritional content, possible uses and pharmacological activities. By performing its strong anti-inflammatory activity, reducing oxidative stress by scavenging free radicals, and enhancing neuroprotective functions. M. oleifera possesses a wide variety of medicinal and therapeutic properties. Due to its protection, M. oleifera can be viewed as a nutraceutical product or food, which will promote the exploration of its ability to cause autophagy in the future for the prevention and treatment of chronic diseases.

References


