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***Moringa oleifera* Lam. A Study of Ethnobotany, Nutrients and Pharmacological Profile.**

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ABSTRACT

Moringa oleifera Lam. (Moringaceae) is traditionally known as mystical miracle tree or the tree of life. Moringa can withstand both severe drought and mild frost conditions and hence widely cultivated across the world. Various parts of this plant such as the leaves, roots, seed, bark, fruit, flowers and immature pods used since ancient times. It used as extremely rich in vital nutrients and medicinal value, known to heal and ease many diseases: from various inflammations to parasitic diseases, diabetes, cardiac, circulatory stimulants, antipyretic, antitumor, anti-inflammatory, antiepileptic, diuretic, antiulcer, antispasmodic antihypertensive, cholesterol lowering, antidiabetic, antioxidant, antibacterial, hepatoprotective, antifertility, antifungal activities and cancer else. The present review is therefore, an effort to give a detailed survey of the literature on its nutritional and pharmacological properties.

Keywords: *Moringa oleifera* Lam, Nutrients, Pharmacologically, Therapeutics.

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INTRODUCTION

Moringa oleifera Lam belongs to aongeneric family of shrubs and tree. Sometimes called the Tree of Life or a Miracle Tree, but rather than this being in reference to its potential medicinal usage this is actually referring to how it is a very valuable food crop (it is drought resistant, grows very fast, and is highly nutritive) and even beyond food it serves many benefits in third world countries such as particularly in India, Pakistan, Philippines, Hawaii and many parts of Africa, having an ability to be used for some crafts (due to being a tree) and cleaning water [1].

Moringa oleifera popularly known as drumstick, because it is long and thin, with triangular pods of seeds. The trees grow best in areas where it is dry and sandy. These kinds of trees grow quickly and they are not easily killed by a lack of water or poor soil. Distributors are working on growing it in Hawaii currently, because the climate is perfect for cultivating the product. *Moringa oleifera* is a shrub and small deciduous tree of 2.5–10 m in height figure 1. When matured, the fruit becomes brown and has 10–50 seeds inside (Vlahof et al., 2002). The plant was reported to contain various amino acids, fatty acids, vitamins, and nutrients (Nesamani, 1999) and its constituents such as leaf, Xower, fruit and bark have been anecdotally used as herbal medicines in treatments for inXammation, paralysis and hypertension. Many reports described *Moringa oleifera* as highly potent anti-inXammatory (Ezeamuzle et al., 1996), hepatoprotective (Pari and Kumar, 2002), antihypertensive (Faizi et al., 1995) and anti-tumor (Murakami et al., 1998). Also, its seed has strong coagulative and antimicrobial properties (Eilert et al., 1981). The seed oil has physical and chemical properties equivalent to that of olive oil and contains a large quantity of tocopherols (Tsaknis et al., 1999). The leaf extracts in rats were found to regulate thyroid status and cholesterol levels (Tahiliani and Kar, 2000; Ghasi et al., 2000). In recent years, many people in Taiwan or China have been using the seed of Moringa as an herbal medicine to treat athlete's foot and tinea and found that it is eVective. For the Worst time, in this communication we provide the evidence that extracts of *Moringa oleifera* have anti-fungal properties [2].



Figure 1: *Moringa oleifera* Plant

Botanical name	:	<i>Moringa oleifera</i>
Family	:	Moringaceae
Hindi Name	:	Sahijan, Munaga
Tamil Name	:	Munagai
English Name	:	Drumstick plant, Moringa, Horseradish tree
Kannada name	:	Nuggemara, Nuggékayi

Vernacular Name:

Hindi	:	Munga ara, Shajmah, Shajna, Segra.
Bengalese	:	Munga ara, Sajna, Sojna, Sujana
Gujarati	:	Midho-saragavo, Saragavo, Saragvo,
Malayalam	:	Sigru, Moringa, Muringa, Murinna, Morunna.
Marathi	:	Sujna, Shevga, Shivga.
Sanskrit	:	Danshamula, Shobhanjana, Sigru Shobhanjan, Sobhanjana.
Tamil	:	Morunga, Murungai, Murunkak-kai.

Urdu	:	Sahajna
Nepal	:	Sitachini
Malaysia	:	KachangKelur, Lemunggai, Meringgai, Semunggai,
English	:	Horseradish tree, Radish tree, Drumstick tree, Mother's Best Friend,
German	:	Behenbaum, Behenussbaum, Flügelsaniger bennussbaum, Pferderettichbaum

PHYSICAL CHARACTER

The tree is slender and grows to a height of 10meters. The branches are droopy. The flowers are bluish white and occur in bunches. Seed pods are long, slender and triangular, resembling drumsticks. Seeds are triangular in shape and have wings [3]. The tree trunk is soft.

Morphology

Flowers: The flowers, which are pleasantly fragrant, and 2.5 cm wide are produced profusely in axillary, drooping panicles 10 to 25 cm long. They are white or cream colored and yellow-dotted at the base show in Figure 2.

Leaves: The alternate, twice or thrice pinnate leaves grow mostly at the branch tips. They are 20-70 cm long, grayish-downy when young, long petiole with 8-10 pairs of pinnae each bearing two pairs of opposite, elliptic or obovate leaflets and one at the apex, all 1-2 cm long; with glands at the bases of the petioles and pinnae show in Figure 3.

Stem and Bark: The stem is normally straight but occasionally is poorly formed. The tree grows with a short, straight stem that reaches a height of 1.5-2 m show in Figure 4

Fruits: The fruits are three lobed pods which hang down from the branches and are 20-60 cm in length. When they are dry they open into 3 parts. Each pod contains between 12 and 35 seeds show figure 5.



Figure 2: Flower of M.O*.

Figure 3: Leaves of M.O*.

Figure 4: Barks M.O*.

Figure 5: Fruits of M.O*.

(M.O* – *Moringa oleifera*)

Seeds: The seeds are round with a brownish semi-permeable seed hull. The hull itself has three white wings that run from top to bottom at 120-degree intervals [4-7].

PHOTOCHEMISTRY

Moringa oleifera is rich in compounds containing the simple sugar, rhamnose called glucosinolates and isothiocyanates. Purified, gum exudate from *Moringa oleifera* has been found to contain Larabinose, galactose, glucuronic acid, and L-rhamnose, mannose, xylose and degraded-gum polysaccharide consisting of L-galactose, glucuronic acid and L-mannose has been obtained on mild hydrolysis of the whole gum with acid. Numerous antibacterial compounds have been isolated from *Moringa oleifera*, including: glucosinolates, rhamnose, pterygospermin, and isothiocyanates. Specifically, these compounds include 4-(4'-O-acetyl-a-

Lrhamnopyranosyloxy) benzyl isothiocyanate [7]. Phytochemical constituents isolated from *Moringa oleifera* show in table 1.

Table 1: Phytochemical constituents isolated from *Moringa oleifera* Lam [8].

Parts	Phytochemical constituents
Roots	4-(α -L-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-galactose, D-glucuronic acid, L-rhamnose, D-mannose, D-xylose and leucoanthocyanin
Leaves	Glycoside niazirin, niazirin and three mustard oil glycosides, 4-[4'-O-acetyl- α -L-rhamnosyloxy) benzyl] isothiocyanate, niaziminin A and B
Mature flowers	D-mannose, D-glucose, protein, ascorbic acid, polysaccharide
Whole pods	Nitriles, isothiocyanate, thiocarbonates, 0-[2'-hydroxy-3'-(2''-heptenyloxy)]-propylundecanoate, 0-ethyl-4-[(α -1-rhamnosyloxy)-benzyl] carbamate, methyl-p-hydroxybenzoate and β -sitosterol
Mature seeds	Crude protein, Crude fat, carbohydrate, methionine, cysteine, 4-(α -L-rhamnopyranosyloxy)-benzylglucosinolate, benzylglucosinolate, moringyne, mono-palmitic and di-oleic triglyceride
Seed oil	Vitamin A, beta carotene, precursor of Vitamin A

Moringa leaves act as a good source of natural antioxidant due to the presence of various types of antioxidant compounds such as ascorbic acid, flavonoids, phenolics and carotinoids

Parts used: Drumstick's root bark, stem bark, leaves, fruits, seeds and roots are used for therapeutic purposes. They have their own unique medicinal qualities.

NUTRITIONAL VALUE OF LEAVES AND PODS

Analyzed value of *Moringa* pods, fresh (raw) leaves and dried leaf powder has shown them to contain the following per 100 grams of edible portion show in Table 2.

Table 2: Nutritional Value of Leaves and Pods [9]

Contents	PODS	LEAVES	LEAF POWDER
Moisture (%)	86.9	75.0	7.5
Calories	26.0	92.0	205.0
Protein (g)	2.5	6.7	27.1
Fat (g)	0.1	1.7	2.3
Carbohydrate (g)	3.7	13.4	38.2
Fiber (g)	4.8	0.9	19.2
Minerals (g)	2.0	2.3	-
Ca (mg)	30.0	440.0	2.003
Mg (mg)	24.0	24.0	368.0
P (mg)	110.0	70.0	204.0
Cu (mg)	3.1	1.1	0.57
Fe (mg)	5.3	7.0	28.2
S (mg)	137.0	137.0	870.0
Oxalic acid (mg)	10.0	101.0	1.6%
Vitamin A - B carotene (mg)	0.11	6.8	16.3
Vitamin B -choline (mg)	423.0	423.0	-
Vitamin B1 -thiamin (mg)	0.05	0.05	2.64
Vitamin B2 -riboflavin (mg)	0.07	0.05	20.5

Vitamin B3 -nicotinic acid (mg)	0.2	0.8	8.2
Vitamin C -ascorbic acid (mg)	120.0	220.0	17.3
Vitamin E -tocopherol acetate (mg)	-	-	113.0
Arginine (g/16g N)	3.6	6.0	1.33%
Histidine (g/16g N)	1.1	2.1	0.61%
Lysine (g/16g N)	1.5	4.3	1.32%
Tryptophan (g/16g N)	0.8	1.9	0.43%
Phenylalanine (g/16g N)	4.3	6.4	1.39%
Methionine (g/16g N)	1.4	2.0	0.35%
Threonine (g/16g N)	3.9	4.9	1.19%
Leucine (g/16g N)	6.5	9.3	1.95%
Isoleucine (g/16g N)	4.4	6.3	0.83%
Valine (g/16g N)	5.4	7.1	1.06%

MEDICINAL PROPERTIES OF MORINGA OLIFERA

Flower: High medicinal value as a stimulant, aphrodisiac, abortifacient, cholagogue; used to cure inflammations, muscle diseases, hysteria, tumors, and enlargement of the spleen; lower the serum cholesterol, phospholipid, triglyceride, VLDL, LDL cholesterol to phospholipid ratio and atherogenic index; decrease lipid profile of liver, heart and aorta in hypercholesterolaemic rabbits and increased [10].

Seed: Seed extract exerts its protective effect by decreasing liver lipid peroxides, antihypertensive compounds thiocarbamate and isothiocyanate glycosids have been isolated from the acetate phase of the ethanolic extract of Moringa pods.

Stem bark: Rubefacient, vesicant and used to cure eye diseases and for the treatment of delirious patients, prevent enlargement of the spleen and formation of tuberculous glands of the neck, to destroy tumors and to heal ulcers. The juice from the root bark is put into ears to relieve earaches and also placed in a tooth cavity as a pain killer, and has anti-tubercular activity [11].

Leave: Purgative, applied as poultice to sores, rubbed on the temples for headaches, used for piles, fevers, sore throat, bronchitis, eye and ear infections, scurvy and catarrh; leaf juice is believed to control glucose levels, applied to reduce glandular swelling.

Root: Antilithic, rubefacient, vesicant, carminative, antifertility, anti-inflammatory, stimulant in paralytic afflictions; act as a cardiac/circulatory tonic, used as a laxative, abortifacient, treating rheumatism, inflammations, articular pains, lower back or kidney pain and constipation [12].

Gum: Used for dental caries, and is astringent and rubefacient; Gum, mixed with sesame oil, is used to relieve headaches, fevers, intestinal complaints, dysentery, asthma and sometimes used as an abortifacient, and to treat syphilis and rheumatism [13].

PHARMACOLOGICALLY USES

Chemical compounds isolated from *Moringa oleifera* have been shown to contain useful pharmacological properties with prospective medicinal applications. A list of possible medical applications conferred by *Moringa oleifera* plant parts includes [14].

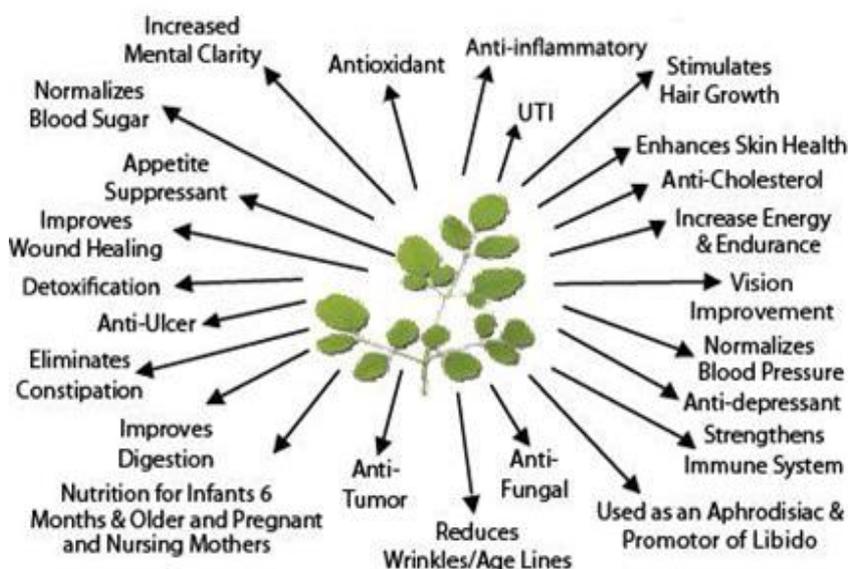


Figure 6: Flow Chart of Medicinal Uses of *Moringa Oleifera*

Moringa seeds as coagulant: *Moringa* seeds are one of the best natural coagulants discovered so far (Ndabigengesere and Narasiah, 1998). Crushed seeds are a viable replacement of synthetic coagulants (Kalogoet *et al.*, 2000). In Sudan, seed crude extract is used instead of alum by rural women to treat the highly turbid Nile water because of a traditional fear of alum causing gastrointestinal disturbances and Alzheimer’s disease (Crapper *et al.*, 1973; Miller *et al.*, 1984; Martyn *et al.*, 1989; Muyibi, 1994) [15].

Moringa seeds as biosorbent: *Moringa* seeds could be used as a less expensive biosorbent for the removal of cadmium (Cd) from aqueous media (Sharma *et al.*, 2006). The aqueous solution of *Moringa* seed is a heterogeneous complex mixture having various functional groups, mainly low molecular.

Antihypertensive: The widespread combination of diuretic along with lipid and blood pressure lowering constituents make this plant highly useful in cardiovascular disorders. *Moringa* leaf juice is known to have a stabilizing effect on blood pressure. Nitrile, mustard oil glycosides and thiocarbamate glycosides have been isolated from *Moringa* leaves, which were found to be responsible for the blood pressure lowering effect [16].

Cholesterol lowering: *Moringa* fruit has been found to lower the serum cholesterol, phospholipids, triglycerides, low density lipoprotein (LDL), very low density lipoprotein (VLDL) cholesterol to phospholipid ratio, atherogenic index lipid and reduced the lipid profile of liver, heart and aorta in hypercholesteremic rabbits and increased the excretion of fecal cholesterol [17,18].

Antibacterial and Antifungal Activities: *Moringa* roots have antibacterial activity and are reported to be rich in antimicrobial agents. These are reported to contain an active antibiotic principle, pterygospermin, which has powerful antibacterial and fungicidal effects [19].

Antitumor and Anticancer Activities: *Moringa* leaves to be a potential source for antitumor activity. *O*-Ethyl-4-(α -L-rhamnosyloxy) benzyl carbamate together with 4(α -L-rhamnosyloxy)-benzylisothiocyanate, niazimicin and 3-*O*-(6'-Oleoyl- β -D-glucopyranosyl)- β -sitosterol have been tested for their potential antitumor promoting activity using an *invitro* assay which showed significant inhibitory effects on Epstein–Barr virus early antigen. It has been found that niaziminin, a thiocarbamate from the leaves of *Moringa oleifera*, exhibits inhibition of tumor-promoter-induced Epstein–Barr virus activation [20].

Antidiabetic Activity: An extract from the *Moringa oleifera* leaf has been shown to be effective in lowering blood sugar levels within 3hrs ingestion, though less effectively than the standard hypoglycemic drug, glibenclamide [21].

Antipyretic Activity: The antipyretic activity of ethanolic, petroleum ether, solvent ether and ethyl acetate extracts of seeds was screened using yeast induced hyperpyrexia method. Paracetamol I.P (200mg/ kg) was used as standard for comparison. The ethanolic and ethyl acetate extracts of seeds showed significant antipyretic activity in rats [22].

Anti-asthmatic Activity: A study was carried out to investigate the efficacy and safety of seed kernels of *Moringa oleifera* in the treatment of bronchial asthma. The results showed an appreciable decrease in severity of symptoms of asthma and also simultaneous improvement in respiratory functions [23].

In Blindness and Eye Infections: Though there are many causes of blindness Vitamin A deficiency causes impaired dark adaption and night blindness. Eating *Moringa oleifera* leaves, pods and leaf powder which contain high proportion of Vitamin A can help to prevent night blindness and eye problems in children. Ingesting drumstick leaves (Bcarotene and leutin) with oil helps in improving Vitamin A nutrition and perhaps delays the onset of cataract. Also the juice can be instilled into eyes in cases of conjunctivitis [24].

Cardiac and Circulatory Stimulant: All parts of the tree are reported to be used as Cardiac and circulatory stimulant. Moringinine acts on the sympathetic nervous system and act as a cardiac stimulant [25].

Antioxidant Activity: Antioxidant activity reported in oil from the seeds is higher than BHT and alpha Tocopheryl. Aqueous methanol (80%) and ethanol (70%) extracts of freeze dried leaves showed radical scavenging and antioxidant activities. The drumstick leaves are found to be a potential source of natural antioxidants [26].

Anti-fertility Activity: An aqueous extract of *Moringa oleifera* roots was investigated for its estrogenic, anti-estrogenic, progestational and antiprogestational activities. This estrogenic activity was supported by stimulation of uterine histo-architecture. The antifertility effect of the extract appears to be due to multiple attributes [27].

Analgesic, Antipyretic: Studies have shown that leaf extract poses both peripheral and central analgesic activity. The possible mechanism behind the analgesic activity of extract is through the antagonism of NMDA receptors [28].

Wound healing activity: The leaf extract also poses wound healing activity. The leaf extract showed significant increase in wound closure rate, skin breaking strength, granuloma breaking strength, hydroxyproline content, granuloma dry weight and decrease in scar area [29].

Cosmetic Use: Various parts of *Moringa olifera* have cosmetic value. Cognis Laboratoires Serobiol ogiques team developed Puricare TM and Purisoft TM, two active ingredients based on botanical peptides from the seeds of *Moringaolifera* tree that purify hair and skin and offer protection against the effects of pollution. *Moringa* seed oil, known as Behen oil is widely used as a carrier oil in cosmetic preparations [30].

CNS Activity: Studies have shown that leaf extract restores the monoamine levels of brain regions to near control levels. The leaf extract contains flavonoids which can easily cross the blood brain barrier and exert various effect on CNS viz memory, cognition and neurodegeneration. Triterpenoid, saponins, flavonoids have an agonistic action on GABAA receptor complex and hence may act like benzodiazepine like molecules. Thus these compounds attribute for the CNS depressant and muscle relaxant activity of *Moringa* leaf extract [31].

CONCLUSION

In view of its multiple uses, the *Moringa oleifera* plant needs to be widely cultivated in most of the areas where climatic conditions favor its optimum growth. In this way, a maximum yield of its different useable parts could be achieved to derive the maximal number of commodities of a multifarious nature for the welfare of mankind. The tree as a native to India can become a great source of income for the nation if this potential

for highly Therapeutically and nutritional food is exploited by the industries and researchers by undertaking further research to corroborate earlier studies.

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