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**MORINGA OLEIFERA LAM., A WONDER PLANT CURING
MULTIPLE AILMENTS, ITS PHYTOCHEMISTRY AND ITS
PHARMACOLOGICAL APPLICATIONS**

SHIRIN QURESHI* AND HITESH SOLANKI**

***RESEARCH SCHOLAR, DEPARTMENT OF BOTANY, GUJARAT
UNIVERSITY, AHMEDABAD- 380 009.**

****PROFESSOR, DEPARTMENT OF BOTANY, GUJARAT
UNIVERSITY, AHMEDABAD- 380 009.**

Email: qureshi.shirin@yahoo.co.in

ABSTRACT:

Importance of plants for medicinal purposes is known since long. Moringa oleifera is one such plant which has been named as “Miracle Tree”. Most commonly found in the tropical and subtropical regions. It has all the essential amino acids, vitamins, calcium and all the nutrition required packed in the leaves. It has been considered as a divine gift to mankind. Moringa has also been called “never die” because of its ability to survive harsh weather and drought. The aim of this review is to cover all the properties of every part of the plant used. The fruits are eaten and have been used in making curries all over India. However, the use of leaves and bark as a cure to diseases is not as much known as the fruits.

KEYWORDS: *Miracle, Nutrition, Moringa, Leaves, Diseases.*

INTRODUCTION:

In the recent past there has been a tremendous increase in the use of plant based health products in developing as well as developed countries resulting in an exponential growth of herbal products globally. An upward trend has been observed in the research on herbals. Herbal medicines have a strong traditional or conceptual base and the potential to be useful as drugs in terms of safety and effectiveness leads for treating different diseases. World Health

Organization has made an attempt to identify all medicinal plants used globally and listed more than 20,000 species. In the present era of drug development and discovery of newer drug molecules many plant products are evaluated on the basis of their traditional uses. (Srivastav *et al.*, 2011). *Moringa* is one such genus whose various species have not been explored fully despite the enormous reports concerning the various parts of a few species' potentials such as: cardiac and circulatory stimulants; antitumor; antipyretic; antiepileptic; antiinflammatory; antiulcer; antispasmodic; diuretic antihypertensive; cholesterol lowering; antioxidant; antidiabetic; hepato- protective; antibacterial and antifungal activities. These are also being used for treatment of different ailments in the indigenous system of medicine. (Arora *et al.*, 2013).

Geographical source:

It is distributed mainly in India, Ethiopia, the Philippines and the Sudan, and is being grown in West, East and South Africa, tropical Asia, Latin America, the Caribbean, Florida and the Pacific Islands. (Fahey, 2005).

Morphology:

Moringa oleifera Lam.(Family: Moringaceae) is a small or middle sized tree, about 10 m in height, cultivated throughout India. (<http://www.ttiitn.com/M/pci.html>) It is found wild and cultivated throughout the plains, especially in hedges and in house yards, thrives best under the tropical insular climate, and is plentiful near the sandy beds of rivers and streams (Anwar *et al.*, 2007) It has drumstick-like fruits, small white flowers and small and tear- drop shaped round leaves, which are cooked and eaten as vegetable. (Nambiar, 2006) *Moringa* provides wind protection and shade. It grows very quickly and if cuttings are planted close together they will form fence that livestock cannot get through in just three months. (Karthika *et al.*, 2013).

Traditional Uses:

For centuries, people in many countries have used moringa leaves as traditional medicine for common ailments. Clinical studies have begun to suggest that atleast some of these claims are valid. With such great medicinal value being suggested by traditional medicine, further clinical testing is very much needed at this time. If studies conclude that even some of the claims are correct, these leaves could become invaluable resource for people in areas where other forms of treatment are scarce. In Guatemala, it is used for skin infections and sores. In India, it is used to cure anaemia, anxiety, asthma, blackheads, blood impurities, bronchitis, catarrh, chest congestion, cholera, conjunctivitis, cough, diarrhoea, eye and ear infections, fever, glandular swelling, headaches, abnormal blood pressure, hysteria, pain in joints,

pimples, psoriasis, respiratory disorders, scurvy, semen deficiency, sore throat, sprain, tuberculosis. In Malaysia, it is used as a cure for intestinal worms. In Nicaragua, it is used to cure headache, skin infections, sores. In Philippines, it is used to cure anaemia, glandular swelling, and lactation. In Puerto Rico it is used to cure intestinal worms. In Senegal it is used to cure diabetes, pregnancy, skin infections, sores. In Venezuela, it is used to cure intestinal worms. In other countries, it is used to cure colitis, diarrhoea, dropsy, dysentery, gonorrhoea, jaundice, malaria, stomach, ulcers, tumour, urinary disorders, wounds. (Trees for life journal),

Phytochemistry:

This plant family is rich in compounds containing the simple sugar, rhamnose, and it is rich in a fairly unique group of compounds called glucosinolates and isothiocyanates. For example, specific components of Moringa preparations that have been reported to have hypo-tensive, anticancer, and antibacterial activity include 4-(4'-O-acetyl- α -L-rhamnopyranosyloxy)benzyl isothiocy-anate, 4-(α -L-rhamnopyranosyloxy)benzyl isothiocy-anate, niazimicin, pterygospermin, benzyl isothiocyanate, and 4-(α -L-rhamnopyranosyloxy) benzyl glucosinolate. While these compounds are relatively unique to the Moringa family, it is also rich in a number of vitamins and minerals as well as other more commonly recognized phytochemicals such as the carotenoids (including β -carotene or pro-vitamin A). (Fahey, 2005) *Moringa oleifera* leaves contain 2 nitrile glycosides, niazirin and niazirin, and 3 mustard oil glycosides, 4[(4'OacetylalphaLrhamnosyloxy) benzyl] isothiocyanate, niaziminin A, and niaziminin B, which are reported to be responsible for hypotensive activity. In addition, betasitosterol, glycerol1(9octadecanoate),30(6'-O-oleoyl-beta-D-glucopyranosyl) beta-sitosterol, and beta-sitosterol-3-O-beta-D-glucopyranoside have also been identified. Most of them have anticancer properties. (Bose, 2007).

Nutritional Value:

Fresh Leaves	Dried Leaves
4 times the Vitamin A of Carrots	10 times the Vitamin A of Carrots
7 times the Vitamin C of Oranges	½ times the Vitamin C of Oranges
4 times the Calcium of Milk	17 times the Calcium of Milk
3 times the Potassium of Banana	15 times the Potassium of Banana
¾ the iron of spinach	25 times the iron of spinach
2 times the protein of yogurt	9 times the Protein of Yogurt

*Source: www.treesforlife.org

Products of Moringa oleifera:

There are a number of preparations made from Moringa trees and exported from India, namely fresh drumstick fruit, Drumstick powder, Moringa oil, Moringa seed, Moringa leaf powder, Moringa leaf, Moringa pickle, Moringa tea powder, Moringa fruit powder, Moringa seed kernel, Moringa cake powder and Moringa root and many more. (Nambiar, 2006)

Pharmacological actions:

Antidiabetic activity/Hypoglycemic activity/Hyperglycemia: Blood sugar lowering activity was studied by Edoga *et al.* (2013). Their studies showed that the aqueous extract of *M.oleifera* leaves do possess a significant dose-dependent hypoglycaemic activity in normoglycemic and alloxan-induced diabetic rats and almost as effective as the standard drug tolbutamid. Studies by Luangpiom *et al.* (2013) showed that the aqueous leaves extract of *Moringa oleifera* Lam. revealed anti-hyperglycemic activity in normal mice and improved the glucose tolerance impairment in mildly diabetic mice. Studies by Michael Pleo and Howell Ho (2009) suggested blood sugar levels of people in Normal group were not significantly changed 2 hours after taking tea. However, in hyperglycaemic individuals, the blood sugar levels significantly dropped after 2 hours. Their results pointed out to the benefit of using *M.oleifera* tea in the treatment of hyperglycemia.

Hepatoprotective activity: Efiang *et al.*, (2013) studied the hepatoprotective properties of combined extracts of *M. oleifera* and *Vernonia amygdalina* in streptozotocin induced albino Wistar diabetic rats and concluded that single and combined extracts of *M. oleifera* and *Vernonia amygdalina* has hepatoprotective effects and may be safer in preventing diabetes induced damage to the liver.

Anti-bacterial/Antibiotic activity: Rahman *et al.*, 2009 suggested that the fresh leaf juice, powder from fresh leaf juice, cold water extract of fresh leaf, each of 1175µg disc⁻¹ displayed a potential antibacterial activity against all the tested four Gram-negative bacteria; *Shigella shinga*, *Pseudomonas aeruginosa*, *Shigella sonnei* and *Pseudomonas sp.* And six gram-positive bacteria. Highest zones of inhibition were found in powder from fresh leaf juice against all the bacteria tested which was more than one and a half to twice as much effective as known antibiotic tetracycline (30µg/disc). Vinoth *et al.* (2012) showed that ethanolic extract was active against *Salmonella typhii*, *Staphylococcus aureus* whereas the aqueous extract exhibited an inhibitory effect on *Staphylococcus aureus* only. Abraham *et al.* (2014) suggested that extracts of *M. oleifera* had great antimicrobial effect on the various isolates, acetone extract of *M. oleifera* had a greater antibacterial property than crude extract and higher the concentration of extract, the higher its antibacterial property.

Doughari *et al.* (2007) showed that ethanolic extracts of *M. oleifera* highest activity while the aqueous extracts showed the least activity. Mrudula *et al.*, (2014) found that *C. Asiatica* showed the highest amount of phytochemicals (2.5% polyphenols, 0.741% flavonoids and 8% tannins) and also exhibited excellent antioxidant capacity and radical scavenging ability which was determined by IC₅₀ values. Kiran Singh (2014) showed that the aqueous, ethanol and methanol extracts of the plant leaves show an inhibitory effect on the growth of the tested bacteria. Both ethanol and methanol extract showed a significantly higher ($P < 0.05$) inhibitory effect at higher concentration of 120mg/ml. The powder from the leaves of *Moringa* show potential antibacterial activity against tested gram +ve bacteria; *staphylococcus aureus* and gram -ve bacteria i.e. *E.coli* and *Pseudomonas aeruginosa*.

Anti-viral activity: Nworo *et al.*, (2013) studied the extracts of *M. oleifera* showing inhibitory activity against early steps in the infectivity of HIV-1 lentiviral particles in a viral-vector-based screening which showed that IC₅₀ concentration of extract inhibited viral infectivity by 50% and TC₅₀ concentration of extract that is cytotoxic to 50% of the cells. Chollom *et al.*, (2010) performed the phytochemical analysis and showed that methanolic extract had higher phytochemical constituents compared to aqueous extract and ether extract. Methanol extract of leaves showed the presence of saponins, alkaloids, glycosides, tannins, carbohydrates, flavonoids, resins, proteins.

Anti-oxidant Activity: Das *et al.*, (2012) suggested that *Moringa* leaf extract treatment protected HFD-induced liver damage as indicated by histopathology and liver enzyme activity compared to HFD (High fat diet) fed group. Also, early signs of HFD-induced fatty liver were also alleviated by *Moringa oleifera* leaf extract. Moreover, significant increase in endogenous antioxidant parameters and lower lipid peroxidation were found in liver. Of all *moringa* has both preventive and also curative hepatoprotective activity.

Anti-cancer activity: Krishnamurthy *et al.*, (2015) employed the bioassay guided fractionation to isolate the anticancer compounds/ fractions from the leaves. Although no anticancer compounds could be isolated from the leaves, they had successfully isolated and characterized a potential anticancer fraction. The qualitative phytochemicals study results revealed the presence of steroids and phenolic compounds. Il Lae Jung (2014) suggested that soluble cold distilled water (4°C, conc., 300 µg/ml) from *M.oleifera* induced apoptosis, inhibited tumour cell growth and lowered the level of internal reactive oxygen species (ROS) in human lung cancer cells as well as other several types of cancer cells, suggesting that the treatment of cancer cells with *M.oleifera* significantly reduced cancer cell proliferation and invasion. The *Moringa oleifera* extract showed greater cytotoxicity for tumour cells than for

normal cells, strongly suggesting that it could potentially be an ideal anticancer therapeutic candidate specific to cancer cells.

Anti-anxiety activity: Studies were done to investigate the anxiolytic activity of ethanolic extract of *Moringa oleifera* extract in Swiss Albino mice by Bhat and Joy (2014). Their studies showed that ethanolic extracts of the leaves of *M.oleifera* (200 mg/kg) demonstrated significant ($P<0.001$) anxiolytic activity in EPM and LDA models of anxiety. They concluded that ethanolic extract of *M.oleifera* leaves may have produced its anxiolytic effects via multiple mechanisms.

Anti-depressant activity: The studies done by Adewale *et al* (2013) suggest that the ethanol extract of *Moringa oleifera* leaves possesses CNS depressant and anticonvulsant activities possibly mediated through the enhancement of central inhibitory mechanism involving release γ -amino butyric acid (GABA).

Conclusion: The studies suggest that the *Moringa oleifera* is a miracle tree with the versatile properties and can cure multiple diseases. Hence, use of the whole plant as a food in day-to-day diet is advisable. Since, this tree is able to survive in harsh weather, it can be grown and cultivated for its use on day to day basis.

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