



Review Article

Pharmaceutical Applications Of *Moringa oleifera* Lam

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ABSTRACT

Medicinal plants have been used for centuries across cultures for their therapeutic properties. In ancient days treatment of disease and healing of wound was mainly done by using medicinal plants. As a traditional method they used the bark of trees, fruit peels, seeds and other parts of plant as medicinal purpose. Medicinal plants which are abundant in nature is a great advantage for its availability. Every portion of the *Moringa oleifera* tree is useful for both economic and commercial purposes, and the tree has a high nutritional value. They are the plants which are the most widely cultivated species in Moringaceae family. Different parts of the plant contain nutrients, vitamins, and are highly rich in protein and iron. In addition to its therapeutic benefits, *Moringa oleifera* is particularly significant plant components that have distinct biological activities include antioxidant, anti-inflammatory, antimicrobial, antifungal, antihypertensive, antidiabetic, and anticancer properties. These components include leaves, roots, seeds, bark, fruit, flowers, and immature pods. Extraction methods are carried out to get the extract from different parts of the plant and it varies based on the part of the plant which is used for extraction. The remains obtained after extraction can be used as fertilizer which is highly nutritious for plants. Other than pharmaceutical and medicinal applications, the seed extract of moringa is used for water purification and waste water treatment. They are store house of different kinds of phytochemicals and nutrient rich source which makes it a good medicinal agent. Due to its great properties they are considered to be suitable for both human consumption and commercial purpose.

INTRODUCTION

The *Moringa oleifera*, which belongs to the Moringaceae family, is a native tropical and subtropical tree commonly known as the horse radish tree or drumstick tree. On account of its

nutritional and therapeutic qualities, *Moringa oleifera* is the most well-known and extensively grown species in this family (Ramachandran et al., 1980). Habitat of this plant includes parts of South Asia, including India, Bangladesh, and

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Pakistan, as well as some regions in Africa and South America. *Moringa oleifera* tree has the ability to tolerate drought conditions, which makes it suitable for arid and semi-arid regions (Fuglie 1999). Its growth can't be seen in areas with cold winters because of its sensitive nature to frost. It is widely cultivated and can be grown in many parts of the world, including tropical and subtropical regions, as long as it receives adequate sunlight and water. For its usefulness in food, industry, agriculture, and medicine, the moringa plant has long been recognized as one of the most valuable crops, especially in impoverished nations (Patel et al., 2001). *Moringa* thrives in warm climates. They are plants growing in an area with temperatures above 77°F (25°C). Well-draining soil is crucial for its growth and development. *Moringa* prefers sandy or loamy soil with a considerable acidic to neutral pH (6.3-7.0). Plant seeds directly or transplant seedlings. Space the plants about 6-10 feet apart which helps them to attain more growth. *Moringa* needs regular watering, especially during the first few months. Once established, it is drought tolerant. *Moringa* are more stable in sunlight. It must receive at least 6 hours of sunlight daily for their establishment. *Moringa* generally grows well in poor soils, but adding organic matter during planting can be beneficial. *Moringa* leaves, pods, and seeds are edible. Nutrient rich leaves, flowers pods, root are used for pharmaceutical applications and seeds can be used for oil extraction. The various parts of the *Moringa oleifera* plant have numerous benefits. The flower, seeds, fruits, leaves, bark, root etc., have much nutritional value. Health benefits of *Moringa* plant include inflammation reduction, improve immunity, removes toxins, aids digestion, fight cell damage and so on. Other than health benefits *Moringa* plant shows its great action in agriculture, soil control, water purification, industrial application, cattle feed source of essential nutrients like iron and protein (Dillard et

al., 2000). *Moringa oleifera* seeds are rich in oleic acid and have high oil content. Ben oil is the term used to describe the oil that is derived from seed. Compared to other parts of plant, the *Moringa* leaves have a big nutritional value. They are rich in various compounds including vitamins, minerals, antioxidants and amino acids. They are also the rich for its antioxidant property. The flowers of *Moringa oleifera* are famous for its antibacterial and anti-inflammatory effect (Doughari et al., 2007). It also provides a sweet fragrance and unique flavor which have more application in food industry.

PHYTOCHEMICAL CONSTITUENTS OF *Moringa oleifera*

Moringa oleifera are rich in phytochemicals such as flavonoids, alkaloids, glucosinolates, phenolic acids, saponins and triterpenoids.

FLAVONOIDS :-

The flavonoids found in the *Moringa* plant include quercetin, kaempferol, chlorogenic acid, and beta-carotene. The flavonoid content of *Moringa oleifera* varies depending on the section of the plant. Generally the leaves of *Moringa* plant contain higher concentration of flavonoids as compared to other parts of the plant. The flavonoid rich *Moringa* leaves are consumable and can be included in our diet. Flavonoids function as a cardio protective agent, regulate blood sugar level, boost immune function, provide healthy skin and important for vision (Rhoades et al., 1979).

ALKALOIDS:-

It was discovered that the alkaloid taken from *Moringa oleifera* leaves had an adverse inotropic effect on the heart without changing heart rate (Dangi et al., 2001). The isolated frog heart was used to test the effects of the alkaloid extract. The alkaloids that are mostly derived from the leaves of *Moringa oleifera* possess strong calcium channel blocking abilities.

GLUCOSINOLATES:-



Glucosinolates are secondary metabolites which are crucial for insect-plant interactions and can act as feeding deterrent or as attractant (Fahey et al., 2018). Biotransformation of Moringa glucosinolates results the formation of isothiocyanates. The use of glucosinolate and isothiocyanates found to be useful for the prevention and improvement of some chronic disease (Hasanpasha et al., 2023)

PHENOLIC COMPOUND:-

Phenolic compound extracted from Moringa oleifera seeds are good source of antioxidant and antibacterial activities in both food and pharmaceutical industries (Govardhan Singh et al., 2013). The polyphenols present in the Moringa oleifera leaves, when extracted, have effectiveness against neurodegenerative illnesses by inhibiting caspase-3 activity, activating AchE, and lowering DNA damage. The highly nutritious leaves of the Moringa oleifera plant are a great source of vitamins, potassium, and beta carotene. Vitamin A-rich Moringa oleifera leaves are very beneficial for immune system function, cell differentiation, eyesight, reproduction, and embryonic growth and development (Mohamed et al., 2021).

SAPONINS:-

Sharma and Paliwal (2013) had performed the isolation of saponins from Moringa oleifera dried pods and done their characterisation studies. Cheung et al., 2005 studied the activity of Saponins on tumor cells which have the ability to kill tumor cells by triggering tumor cell death via different signalling pathways, by activating death receptors. Their studies also proved the effect of saponins which are effective against drug resistant cancer cells (Jung et al., 2005).

DIFFERENT PARTS OF *Moringa* PLANT AND THEIR APPLICATIONS

LEAF:-

The aqueous extract of Moringa oleifera leaves have many application in both food and pharmaceutical industry. The method used for the

extraction is different. Solvent extraction is commonly used for the extraction method. Alcohol like methanol and ethanol are commonly used for phytochemical extraction from Moringa leaves. There may be different in the yield of phytochemical based on the solvent used for extraction. Methanol extract showed highest level of phenolic content and flavonoids (Sobhy et al., 2015). The highly nutritious leaves of the Moringa oleifera plant are an excellent source of vitamins, potassium, and beta carotene. Vitamin A-rich Moringa oleifera leaves are very beneficial for immunological function, cell differentiation, embryonic growth and development, vision, and reproduction. (Alvarez et al., 2014). They are also famous in its hypolipidemic effects. Phenolic compounds as well as flavonoids obtained from leaf extract have important role in lipid regulation (Adedapo et al., 2015). They are able to inhibit the activity of both lipase and cholesterol esterase and show hypolipidemic activity (Toma et al., 2012). Due to the antioxidant property of Moringa leaves they are used in the treatment of inflammatory diseases, cancer, hypertension and cardiovascular disease. Siddhuraju and becker (2003) had performed the antioxidant and radical-scavenging properties of the freeze-dried Moringa oleifera leaf extracts in both aqueous and aqueous ethanol extracts. It is established that the inactivation of lipid free radicals by the phenolic compounds in the aqueous and aqueous ethanol extracts of freeze-dried Moringa oleifera leaves mediates their radical scavenging and antioxidant qualities. It is well recognized that phenolic compounds function as a main antioxidant by inactivating lipid free radicals.

SEED:-

Seed extract from Moringa oleifera have a potential as anti-microbial agents. It plays an important role in flocculation and is used in water purification. The seed proteins are small, cationic and are difficult to denature in solution (Olsen A



1987). Seed peptides obtained from *Moringa oleifera* show antibacterial activity against human pathogens including *Pseudomonas aeruginosa* and *Streptococcus* (Suarez et al., 2005). Santos et al., (2005) studied the use of seed flour from *Moringa oleifera* as a natural coagulant for water treatment. Rashid et al., (2008) evaluated following oil extraction, the use of seed cake as fertilizer. Additionally, the oil extraction seed cake can be utilized as a natural coagulant in the treatment of wastewater. The seeds of *Moringa oleifera* as a good antioxidant which have the ability to reduce the oxidative damage associated with ageing and cancer. It is found that the concentration of calcium, zinc, iron, lipids, carbohydrates, fibers, and ash increased after roasting *Moringa oleifera* seeds (Mbah et al., 2012). Abiodun et al., (2012) studied the difference between the defatted cake and undefatted flour of *Moringa* seeds. The defatted cake has more nutrients than the defatted flour.

ROOT :-

Anitha et al., (2011) revealed *Moringa oleifera* root extract have antimicrobial activity through her studies. *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and *Escherichia coli* are inhibited by a root extract that was produced by utilizing petroleum ether as a solvent. The extract obtained by using chloroform as solvent was active against *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Escherichia coli*, *Proteus mirabilis*. From their studies they proved the antimicrobial activity of *Moringa oleifera* at different concentration towards various pathogenic organisms. Oral administration of an aqueous extract of *M. oleifera* roots to rats resulted in an anti-implantation effect via altering the hormone balance required for gestation in a dose-dependent way (Shukla et al., 1988). After ethylene glycol therapy, calculogenic rats' kidneys showed decreased levels of increased urine oxalate and stone-forming component deposition. These effects were

mitigated by the use of moringa root wood (Karadi et al., 2006).

CONCLUSION:

The plant *Moringa oleifera* is a promising one, found all over the world and having both culinary and non-food applications. It is important to produce better varieties for improving the quality and yield of seed and plant. Many studies proved the nutritious and beneficial value of *Moringa* plant. But still there are many unanswered questions in which how it's over consumption effect the human body and its side effects. Now also it's not clear how. Furthermore, it's unclear how consuming these goods affects the risk of disease, growth, body composition, and nutritional status in populations in developing nations. Different parts of *Moringa* plant contain many phytochemicals which have high pharmaceutical and commercial application. Studies revealed the presence of secondary metabolites present in different parts of *Moringa* plant. The *Moringa* plant has various potential in future applications including nutritional supplement, water purification, medicinal uses, biofuel production, livestock feed, cosmetics and skincare, soil improvement, climate resilience. Many studies and research are on-going in the phytochemical analysis of *Moringa* plant. Not only in pharmaceutical industry but also it is used as a food preservative agent because of its antimicrobial property. The use of *Moringa oleifera* seed oil is well known as a natural bio pesticide. From the ancient days itself people used *Moringa Oleifera* as a medicinal plant due to its various properties. Medicinal plants are commonly used for skin care, culinary purpose, as supplements, aromatherapy, traditional practices etc. When using medicinal herbs, care must be taken to avoid any potential interactions. When in doubt, medical professionals should be consulted. Use of medicinal plants become more popular because of its easy availability, natural healing property,



fewer side effects, rich source of bioactive compounds etc.

REFERENCES:-

1. Ramachandran, C., Peter, K.V. and Gopalakrishnan, P. K. Drumstick (*Moringa oleifera*): A multipurpose Indian vegetable. *Econ Bot* 34, 1980, 276–283.
2. Fuglie, L. J. *The Miracle Tree: Moringa oleifera: Natural Nutrition for the Tropics*. Church World Service, Dakar1, 1999, 68.
3. S Patel 1*, A S Thakur 2, A Chandy 2 and A Manigauha 3.1 Career College, Govindpura, BHEL, Bhopal, India – 462023 .2 School of Pharmacy, Chouksey Engineering College, Bilaspur, India- 495007 .3 NRI Institute of Pharmacy, Sajjan Singh Nagar, Raisen Road, Bhopal, India – 402021.
4. Dillard, C. J and German, J. B. *Phytochemicals: nutraceuticals and human health: A Review*. *J Sci Food Agric* 80, 2000, 1744–1756.
5. Doughari, J. H., Pukuma, M. S. and N. De. Antibacterial effects of *Balanites aegyptiaca* And *Moringa oleifera* Lam. On *Salmonella typhi*. *African Journal of Biotechnology* 6(19), 2007, 2212-2215.
6. Rhoades, David F. *Evolution of Plant Chemical Defense against Herbivores*. In Rosenthal, Gerald A., and Janzen, Daniel H. *Herbivores: Their Interaction with Secondary Plant Metabolites*. New York 1979; Academic Press. P. 41.
7. Dangi, S. Y., Jolly, C. I., & Narayanan, S. (2002). Antihypertensive Activity of the Total Alkaloids from the Leaves of *Moringa oleifera*. *Pharmaceutical Biology*, 40(2), 144–148.
8. Fahey JW, Olson ME, Stephenson KK, Wade KL, Chodur GM, Odee D, Nouman W, Massiah M, Alt J, Egner PA, Hubbard WC (2018) The diversity of chemoprotective glucosinolates in Moringaceae (*Moringa* spp.). *Sci Rep* 8(1):7994.
9. Hasanpasha N. Sholapur, Basanagouda M. Patil, Fatima Sanjeri Dasankoppa. Procyanidin Dimer from the Stem Bar' of *Moringa oleifera* (Lam.) Attenuates Insulin Resistance in Rats. *Journal of Biologically Active Products from Nature* 2023, 13 (5) , 469-489.
10. Govardhan Singh, R.S.; Negi, P.S.; Radha, C. Phenolic composition, antioxidant and antimicrobial activities of free and bound phenolic extracts of *Moringa oleifera* seed flour. *J. Funct. Foods* 2013, 5, 1883–1891.
11. Mohamed Ahmed Hassan a b, Tao Xu a d e, Yang Tian c, Yongheng Zhong a d e, Fatma Abo Zakaib Ali f, Xuan Yang a d e, Baiyi Lu a d e Health benefits and phenolic compounds of *Moringa oleifera* leaves: A comprehensive review December 2021.
12. Sharma V, Paliwal R, Pracheta, Sharma S. Phytochemical Analysis and evaluation of antioxidant activities of hydro-Ethanollic extracts of *Moringa oleifera* lam. Pods. *J of Pharm Res* 2011; 4(2): 554-557.
13. Cheung JYN, Ong RCY, Suen YK, Ooi V, Wong HNC, Mak TCW, Fung KP, Yu B, Kong SK. Polyphyllin D is a potent apoptosis Inducer in drug-resistant HepG2 cells. *Cancer Lett* 2005; 217: 203-211.
14. Jung HJ, Kim SG, Nam JH, Park KK, Chung WY, Kim WB, Lee KT, Won JH, Choi JW, Park HJ. Isolation of saponins with the Inhibitory effect on nitric oxide, prostaglandin E2 and tumor Necrosis factor-alpha production from *Pleurospermum Kamtschaticum*. *Biol Pharm Bull* 2005; 28(9):1668-71.
15. Sobhy A. El Sohaimy1*, Gamal M. Hamad1, Sameh E. Mohamed1, Mohamed H. Amar2 and Rashad R. Al-Hindi3.1Food Technology Department, Arid Lands Cultivation Research



- Institute, City for Scientific Research and Technological Applications, Alexandria, Egypt
16. Alvarez R., Vaz B., Gronemeyer H., de Lera A.R. Functions, therapeutic applications, and synthesis of retinoids and carotenoids. *Chem. Rev.* 2014;114:1–125. Doi: 10.1021/cr400126u.
 17. Adedapo A.A., Falayi O.O., Oyagvemi A.A., Kancheva V.D., Kasaikina O.T. Evaluation of the analgesic, anti-inflammatory, anti-oxidant, phytochemical and toxicological properties of the methanolic leaf extract of commercially processed *Moringa oleifera* in some laboratory animals. *J. Basic Clin. Physiol. Pharmacol.* 2015;26:491–499. Doi: 10.1515/jbcpp-2014-0105.
 18. Toma A., Makonnen E., Debella A., Tesfaye B. Antihyperglycemic Effect on Chronic Administration of Butanol Fraction of Ethanol Extract of *Moringa stenopetala* Leaves in Alloxan Induced Diabetic Mice. *Asian Pac. J. Trop. Biomed.* 2012;2:S1606–S1610. Doi: 10.1016/S2221-1691(12)60461-4.
 19. Siddhuraju, P. and Becker, K. Antioxidant properties of various solvent extracts of Total phenolic constituents from three different agro-climatic origins of drumstick tree (*Moringa oleifera* Lam.). *J Agric Food Chem* 15, 2003, 2144–2155.
 20. Olsen A (1987). Low technology water purification by bentonite clay And *Moringa oleifera* seeds flocculation as performed in Sudanese village: effects of *Schistosoma Mansoni* cercariae. *Water Res.* 21: 81-92.
 21. Suarez, M., Haenni, M., Canarelli, S., Fisch, F., Chodanowski, P., Servis, C., Michielin, O., Freitag, R., Moreillon, P., and Mermoud, N. (2005). Structure-Function Characterization and Optimization of a Plant-Derived Antibacterial Peptide. *Antimicrobial Agents and Chemotherapy.*, 49 (9), 3847-3857.
 22. Santos, A.F.; Argolo, A.C.; Coelho, L.C.; Paiva, P.M. Detection of water soluble lectin and antioxidant component from *Moringa oleifera* seeds. *Water Res.* 2005, 39, 975–980.
 23. Mbah, B. O. , Eme, P. E. , & Ogbusu, O. F. (2012). Effect of cooking methods (boiling and roasting) on nutrients and anti-nutrients content of *Moringa oleifera* seeds. *Pakistan Journal of Nutrition*, 11(3), 211–215.
 24. Abiodun, O. A. , Adegbite, J. A. , & Omolola, A. O. (2012). Chemical and physicochemical properties of *Moringa* flours and oil. *Global Journal of Science Frontier Research*, 12(1), 13–17.
 25. Anitha Jabamalai Raj, Velliyur Kanniappan Gopalakrishnan, Sangilimuthu Alagar Yadav, Sudarsanam Dorairaj ; Antimicrobial activity of *Moringa oleifera* (Lam.) root extract. *Journal of Pharmacy Research* 4 (5), 1426-1427, 2011
 26. Shukla S, Mathur R, Prakash AO (1988) Antifertility profile of the aqueous extract of *Moringa oleifera* roots. *J Ethnopharmacol* 22:51–62
 27. Karadi RV, Gadge NB, Alagawadi KR, Savadi RV (2006) Effect of *Moringa oleifera* Lam root-wood on ethylene glycol induced urolithiasis in rats. *J Ethnopharmacol* 105:306–311.

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