

A REVIEW ON PHARMACOLOGICAL ACTIVITY OF *Moringa oleifera* Lam. MULTIPURPOSE TREE

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ABSTRACT

The intention of this literature evaluation was once to grant increase lookup information for the future scientists to find out new drug molecules from the medicinal plant, *Moringa oleifera* Lam. (Moringaceae). The plant provides a wealthy and uncommon mixture of zeatin, quercetin, beta-sitosterol and kaempferol. In addition to its excessive dietary value, *Moringa oleifera* Lam is very important for its medicinal value. Various components of this plant such as leaves, roots, seed, bark, fruit, flora and immature pods act as cardiac and circulatory stimulants, possess antitumor, antipyretic, anti-inflammatory, antiulcer, antispasmodic, diuretic, antihypertensive, cholesterol lowering, antioxidant, anti-diabetic, hepatoprotective, antibacterial and antifungal activities, and are being employed for the cure of extraordinary illnesses in the indigenous gadget of medicine. This assessment offers the scientific information concerning pharmacological potentials of *Moringa oleifera* Lam. (Moringaceae).

Keyword : - *Moringa oleifera* Lam., Anti-anemic, Analgesic, Anti-diabetic, Antioxidant, Antibacterial, Antifungal, Antihypertensive.

1. INTRODUCTION :- *Moringa oleifera* Lam. (Moringaceae) is a highly valued plant, distributed in many countries of the tropics and subtropics. It has an extensive range of medicinal uses with rich nutritional and pharmaceutical value. Different parts of this plant contain a profile of important minerals, and are a rich source of protein, vitamins, beta-carotene, amino acids and various phenolics³. In some parts of the world *M. oleifera* is referred to as the 'drumstick tree' or the 'horse radish tree', whereas in others it is known as the kelor tree⁸. *Moringa oleifera* is an important food commodity which has had enormous attention as the 'natural nutrition of the tropics'. The leaves, fruit, flowers and immature pods of this tree are used as a highly nutritive vegetable in many countries. Moringa is said to provide 7 times more vitamin C than oranges, 10 times more vitamin A than carrots, 17 times more calcium than milk, 9 times more protein than yoghurt, 15 times more potassium than bananas and 25 times more iron than spinach⁹. About 6 spoonful of leaf powder can meet a woman's daily iron and calcium requirements, during pregnancy. This study provides an overview on the cultivation, nutritional values, medicinal properties for commercial use and pharmacological properties of moringa. There are no elaborate reports on treatment of diabetes and cancer using moringa. *Moringa oleifera* are used for their counter-irritant activity¹¹, anti-inflammatory¹², Hypotensive¹³, antihypertensive¹⁴, diuretic¹⁵, antimicrobial¹⁶, antioxidant¹⁷, anti-diabetic¹⁸, anti-hyperlipidemic¹⁹, antineoplastic²⁰, antipyretic²¹, antiulcer²², cardioprotectant²³, and hepatoprotectant^{24,25} activities.

2. Taxonomic classification of *Moringa oleifera* :-

Kingdom	Plantae
Subkingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Dilleniidae
Order	Capparales
Family	Moringaceae
Genus	Moringa
Species	oleifera

3. BOTANICAL DESCRIPTION :-**3.1 Synonyms :-**

Latin	-	<i>Moringa oleifera</i>
Sanskrit	-	Subhanjana.
Hindi	-	Sainjna.
Gujarati	-	Suragavo.
Tamil	-	Morigkai.
Telugu	-	Mulaga, Munaga.
Malayalam	-	Murinna, Sigru.
Punjabi	-	Sainjna, Soanjna.
Unani	-	Sahajan
Ayurvedic	-	Akshiva, Haritashaaka, Raktaka, Tikshnagandhaa.
Arabian	-	Rawag.
Spanish	-	Angela, Ben, Moringa.
Portuguese	-	Moringa, Moringueiro.
English	-	Drumstick tree, Horseradish tree, Ben tree.



4. Pharmacological properties of *Moringa oleifera* :-

4.1 Antibacterial and Antifungal Efficacy:-

A good sized reduction in the boom of take a look at microorganism was once determined by distillate of *M. oleifera* suggesting antibacterial effect. Among microorganism tested, greater inhibition was once observed in case of *E. coli* accompanied by using *S. aureus*, *K. pneumoniae*, *P. aeruginosa* and *B. subtilis*. Inhibition of fungi used to be additionally located as decreased colony diameter in plates poisoned with distillate as in contrast to manipulate plates.¹ More inhibition of *A. niger* was once located accompanied by *A. oryzae*, *A. terreus* and *A. nidulans*. The antimicrobial exercise and antifungal things to do of steam distillate of *M. oleifera* may be maybe due to the essential oil fraction of the plant cloth current in the distillate fraction.²

4.2 Analgesic activity:-

The alcoholic extract of seed of *Moringa oleifera* Lam confirmed effective analgesic exercise which is related to at the dose of 25mg/kg of body weight. From this find out about it can be concluded that the seed of *Moringa oleifera* marked analgesic undertaking and is equipotent to wellknown drug (Aspirin)⁴.

4.3 Hepatoprotective activity:-

The hepatoprotective impact of an ethanolic extract of *M. oleifera* leaves on liver injury caused by using antituber as isoniazid (INH), rifampicin (RMP), and pyrazinamide (PZA) in rats. Oral administration of the extract show protective motion made evident by means of its impact on the ranges of glutamic oxaloacetic transaminase , Alkaline phosphatase, and bilirubin in the serum; peroxidation tiers in liver. This statement used to be supplemented with the aid of histopathological examination of liver to find out about confirmed that remedy with *Moringa oleifera* extracts or silymarin appears recovery from hepatic harm precipitated by way of antitubercular drugs⁴.

4.4 Antimicrobial study:-

Leaves, roots, bark and seeds of *Moringa oleifera* showed in-vitro antimicrobial activity against bacteria (*Bacillus cereus*, *Candida albicans*, *Streptococcus faecalis*, *Staphylococcus Aureus*, *Staphylococcus epidermidis*, *Bacillus*

subtilis, Shigellashinga, Shigellasonnei, Pseudomonas aeruginosa, E.Coli and Aspergillus niger), yeast, dermatophytic and Helminthes in a disk diffusion technique. It was also reported that *Moringa oleifera* exhibit antifungal activity in both Dilution and agar plate methods against Trichophyton rubrum And Trichophyton mentagrophytes, Epidermophyton Xoccosum, and Microsporium canis, Fusarium solani and Rhizopus solani. 4-(-L-rhamnopyranosyloxy) benzyl Isothiocyanate 4,4-(-L -rhamnopyranosyloxy) Benzylglucosinolate and Pterygospermin are the responsible Chemical constitutes responsible for its anti-biotic activity¹⁰.

4.5 Anti-inflammatory activity:-

A crude methanol extract of the root of the plant *Moringa oleifera* Lam. was screened for anti-inflammatory rat paw edema and the rat 6-day air pouch inflammatory models. Following oral administration, the carrageenan-induced rat paw edema in a dose-dependent manner, with 50% inhibitory concentration (IC 50 50% inhibition) of 660 mg/kg. On the 6-day air pouch acute inflammation induced with carrageenan, the more potent, with IC 50 values of 302.0 mg/kg and 315.5 mg/kg, for the inhibition of cellular accumulation and respectively. Maximum inhibitions obtained with 600 mg/kg were 83.8% and 80.0%, respectively. When inflammation was induced in the 6-day air pouch model using Freund's complete adjuvant, the extract was though less than in acute inflammation. In contrast, a moderate dose of indomethacin (5 mg/kg) inhibited the delayed form of air pouch inflammation. Acute toxicity tests in mice suggest very low toxicity. Thus, respectively the root of *Moringa oleifera* contains anti-inflammatory principle that may be useful in the treatment of both chronic inflammatory conditions⁴.

4.6 Anti-arthritic activity:-

The anti-arthritic activity of a hydroalcoholic extract of *Moringa* flowers was adjuvant induced arthritis in Wistar rats. Decreases in body weight, paw edema volume (primary lesion), non-injected sites of left hind paw, and arthritic index (secondary lesion) in diseased animals were reduced by MOFE as compared with untreated control animals. The effects of MOFE were also noted in decreasing the Rheumatoid Factor (RF) and levels of the cytokines, tumor necrosis factor and interleukin-1. Histopathological animals in the drug treatment group showed a protective effect that was reflected by less in filtration of lymph angiogenesis as compared with sections from arthritic animals. This study suggests that *Moringa oleifera* potential against established arthritis⁷.

4.7 Antiasthematic activity :- Studies were also conducted to investigate the efficacy and safety of seed kernels of *Moringa oleifera* in the bronchial asthma. Twenty patients of either sex with mild-to-moderate asthma were given finely powdered in dose of 3 g for 3 weeks. The clinical efficacy with respect to symptoms and respiratory functions were a spirometer prior to and at the end of the treatment. Hematological parameters were not changed markedly by *M. oleifera*. However, the majority of patients showed a significant increase in hemoglobin (Hb) values sedimentation rate (ESR) was significantly reduced. Significant improvement was also observed in severity of asthmatic attacks. Treatment with the drug for 3 weeks produced significant improvement in force forced expiratory volume in one second, and peak expiratory flow rate values by $32.97 \pm 6.03\%$, 30.05 ± 8.1 11.75%, respectively, in asthmatic subjects. Improvement was also observed in % predicted values. None showed any adverse effects with *M. oleifera*. The results of the present study suggest the usefulness of *M. oleifera* in patients of bronchial asthma⁶.

4.8 Anticancer activity :- Studies were also concluded to evaluate the anticancer potential of 11 plants used in Bangladeshi folk medicine were tested for cytotoxicity using the brine shrimp lethality assay, sea urchin eggs assay, hemolysis assay and tumor cell lines. The extract of *Oroxylum indicum* showed the highest toxicity on all tumor cell lines tested, 19.6 µg/ml for CEM, 14.2 µg/ml for HL-60, 17.2 µg/ml for B-16 and 32.5 µg/ml for HCT-8. On the sea urchin eggs progression of cell cycle since the frist cleavage (IC50 = 13.5 µg/ml). The extract of *Aegle marmelos* exhibit used assays, but in a lower potency than *Oroxylum indicum*. In conclusion, among all tested extracts, only *Oroxylum indicum*, *Moringa oleifera* and *Aegles marmelos* could be considered as potential sources of anticancer Further studies are necessary for chemical characterization of the active principles and more extract evaluations⁵.

4.9 Cholesterol lowering :- The crude extract of *Moringa* leaves has a significant cholesterol lowering action in the serum of high fat diet feed rats which might be attributed to the presence of a bioactive Phytoconstituents, i.e. β -sitosterol. *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 cholesterol⁸.

4.10 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. Most of these compounds, bearing thiocarbamate, carbamate or nitrile groups, are fully acetylated glycosides, which are very rare in nature. Bioassay guided fractionation of the active ethanol extract of Moringa leaves led to the isolation of four pure compounds, niazinin A, niazinin B, niazimicin and niazinin A + B which showed a blood pressure lowering effect in rats mediated possibly through a calcium antagonist effect⁸.

4.11 Antispasmodic, Antiulcer and Hepatoprotective Activities :- *M. oleifera* roots have been reported to possess antispasmodic activity. Moringa leaves have been extensively studied pharmacologically and it has been found that the ethanol extract and its constituents exhibit antispasmodic effects possibly through calcium channel blockade. The antispasmodic activity of the ethanol extract of *M. oleifera* leaves has been attributed to the presence of 4-[α -(L-rhamnosyloxy) benzyl]- *o*-methyl thiocarbamate (trans), which forms the basis for its traditional use in diarrhea. Moreover, spasmolytic activity exhibited by different constituents provides pharmacological basis for the traditional uses of this plant in gastrointestinal motility disorder. The methanol fraction of *M. oleifera* leaf extract showed antiulcerogenic and hepatoprotective effects in rats. Aqueous leaf extracts also showed antiulcer effect indicating that the antiulcer component is widely distributed in this plant. Moringa roots have also been reported to possess hepatoprotective activity. The aqueous and alcohol extracts from Moringa flowers were also found to have a significant hepatoprotective effect, which may be due to the presence of quercetin, a well known flavonoid with hepatoprotective activity⁸.

4.12 Anti-oxidant Effect :- The antioxidant property of Moringa may be due to the presence of phenolic compounds that was confirmed by phytochemical screening of the hydro-ethanolic extract. In this respect, Moringa pods contain important bioactive compounds including glucosinolates, isothiocyanates, thiocarbamates, and flavonoids. These compounds quench ROS, chelate metal ions and regenerate membrane-bound antioxidants. β -carotene, the major component reported from the drumsticks of the plant and vitamin A and C present in *M. oleifera* serve as an explanation for their mode of action in the induction of antioxidant profiles in the present investigation. The biochemical basis of the chemopreventive potency of *M. oleifera* extract may be attributed to the synergistic action of the constituents of the extract and the induction of Phase-II enzymes (GSTs) and antioxidant enzymes, which might be implicated in the anticarcinogenic activity. The aqueous extract of *Moringa oleifera* exhibited strong scavenging effect on 2, 2-diphenyl-2-picryl hydrazyl (DPPH) free radical, superoxide, nitric oxide radical and inhibition of lipid per oxidation. The free radical scavenging effect of *Moringa oleifera* leaf extract was comparable with that of the reference antioxidants. The extracts of *Moringa oleifera* both mature and tender leaves have potent antioxidant activity against free radicals, prevent oxidative damage to major biomolecules and afford significant protection against oxidative damage¹.

4.13 CNS activity:- Treatment with *Moringa oleifera* leave extract restores mono amine levels of brain which may be useful in Alzheimer's disease. Methanolic extract of *Moringa oleifera* root bark was tested on frog and guinea pig and it shown local anaesthetic activity in both animal models.

4.14 Mutagenic activity: A mutagenic compound was isolated from roasted seeds of *Moringa oleifera* Lam. Its structure has been elucidated as 4-(α -L-rhamnosyloxy) phenylacetonitrile. The results of the Micronucleus Test, an in vivo method, number of micronucleated polychromatic erythrocytes (PCE)/1000 PCE for this compound is higher than the control, dimethylsulfoxide, and approximates that of the positive control, tetracycline. This indicates that 4-(α -L phenylacetonitrile is a genotoxic compound²⁶.

4.15 Wound Healing Activity: The aqueous extract of leaves of *M. oleifera* was investigated for its wound healing activity. The extract was studied at dose level of 300 mg/kg body weight using resutured incision, excision, and dead space wound models in rats. The prohealing actions seem to be due to increased collagen deposition as well as better alignment and maturation. From the study results obtained, it may be concluded that the aqueous extract of *M. oleifera* has significant wound healing property²⁷.

4.16 Anti-epileptic Activity :- Methanolic extract of *Moringa oleifera* leaves were investigated its anti-convulsant activity using pentylenetetrazole (PTZ) and maximum electric shock (MES) on male albino mice²⁸.

4.17 Antiuro lithiatic Activity :- The effect of oral administration of aqueous and alcoholic extract of *M. oleifera* root-wood on calcium oxalate urolithiasis has been studied in male Wistar albino rats. Ethylene glycol feeding resulted in hyperoxaluria as well as increased renal excretion of calcium and phosphate. Supplementation with aqueous and alcoholic extract of *M. oleifera* root-wood significantly reduced the elevated urinary oxalate, showing a regulatory action on endogenous oxalate synthesis. The increased deposition of stone forming constituents in the kidneys of calculogenic rats was also significantly lowered by curative and preventive treatment using aqueous and alcoholic extracts. Thus the results indicate that the root-wood of *M. oleifera* is endowed with antiuro lithiatic activity³¹.

4.18 Cosmetic Use :- Various parts of *Moringa oleifera* have cosmetic value. Cognis Laboratoires Serobiologiques team developed Puricare TM and Purisoft TM, two active ingredients based on botanical peptides. From the seeds of *Moringa oleifera* tree that purify hair and skin and offer protection against the effects of pollution^{32,33}. Moringa seed oil, known as Behen oil is widely used as a carrier oil in cosmetic preparations. The healing properties of moringa oil were documented by ancient cultures. Moringa oil possesses exceptional oxidative stability which may explain why the Egyptians placed vases of Moringa oil in their tombs. It is high in oleic acid and similar in composition to olive oil. Moringa oil is light and spreads easily on the skin. It is good oil for use in massage and aromatherapy applications^{34,35}.

4.19 Other promising uses:-

A) Plant growth enhancer :- Several lab-experimentation has shown that Moringa spray has marked beneficial effects on crops plants. The effects of sprays accelerated the growth of young plants that became firmer more resistant to pests and disease, longer life-span, heavier roots, stems and leaves and large fruits with increased yield (20–35%). Moringa fermented leaf juice was also tested for its growth promoting attributes in Brassica oleracea and the results were promising. There are prospects of widespread introduction and utilization of drumstick fermented leaf juice (DFLJ) by the Agriculture sector. It also implies that it may be worthwhile for small margin farmers to take up the production of drumstick fermented leaf juice for healthy cultivation and merge into the Organic Integrated Nutritional Management (OINM) programme in India and other countries. This practice would not only alleviate plant macro and micro-nutrient deficiencies but also enrichment of soil for several crops. Introducing DFLJ as an organic nutritional source for different crops will ensure sustainable agriculture and the farmers may stop the use of expensive inorganic fertilizer²⁹.

B) Bio-pesticide :- Bio-pesticides, being a promising alternative to conventional pesticides are eco-friendly, cost-effective and are ineffective to non-target organisms as birds, insects, and mammal. When used in Integrated Pest Management (IPM) programs, bio-pesticides can significantly reduce the use of conventional pesticides without affecting the crop yield. Moringa seed oil have the potential to be deployed as a bio-pesticide. The aqueous Moringa seed extract (AMSE) and leaf extracts have been reported to exhibit as insect repellent and fungicidal properties³⁰.

5. CONCLUSION:-

Moringa oleifera Lam. an important medicinal plant, is one of the most widely cultivated species of the family Moringaceae. Leaves, barks, roots, stems, buds, flowers etc. have been used for different human ailments. Pharmacologically reported effects include anti-bacterial, antifungal, anti-inflammatory and analgesic, antioxidant, hypotensive, anti-ulcer, anaesthetic, cardio-protective, antiuro lithiatic activity and wound healing activity etc. This review summarizes only some pharmacological activities of *Moringa oleifera* which can be investigated further to isolate active compounds for novel herbal medicine.

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