Pharmacological And Pharmaceutical Potential Of Moringa oleifera: A Review.

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ABSTRACT

Moringa oleifera Lam. (Moringaceae) is a highly valued plant, distributed in many countries of the tropics and subtropics. Moringa is nature’s medicine cabinet. It is best known as excellent source of nutrition and a natural energy booster. Different parts of this plant are being employed for the treatment of different ailments in the indigenous system of medicine. This review focuses on the pharmacological action and pharmaceutical application along with other uses of different parts of this tree.

Keywords: Moringa oleifera, pharmacology, gelling agent, cosmetic.

INTRODUCTION

There are about thirteen species of Moringa trees in the family Moringaceae. Moringa oleifera Lam. (synonym: Moringa pterygosperma Gaertn.) is the most widely known species but other species deserve further research as to their uses (1). Moringa oleifera is commonly known as drumstick. It is found widely in the sub Himalayan range and commonly cultivated in all places of India. It is a very popular backyard tree that grows to over 9 m height. It has soft, white corky trunk and branches bearing a gummy bark. Each tripinnately compound leaf bears several small leaflets. The flowers are white and the three winged seeds are scattered by the wind. The flowers, tender leaves and pods are eaten as vegetable. The leaves are rich in iron and therefore highly recommended for expectant mothers. Since all essential amino acids are present, Moringa may be rightly called a complete food for total nutrition (2).

Pharmacological Importance:

**Analgesic activity:** The experimental studies using hot plate and tail immersion method have shown that alcoholic extract of leaves and seeds of Moringa oleifera possess marked analgesic activity (3). According to the authors it is equipotent to standard drug (Aspirin 25mg/kg).

**Anti-inflammatory activity:** Poultice of leaves is beneficial in glandular swellings. The root extract exhibited significant anti-inflammatory activity in Carragenan induced rat paw edema (4, 5).

**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 (6).

**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 (7).

**Wound healing properties:** Three wound models viz excision wound, incision wound and dead space wound were selected for assessing wound healing activity of ethanolic and ethyl acetate extracts of leaves. Ethyl acetate extracts (10% extract in the form of ointment) showed significant wound healing activity that is comparable with the standard vicco turmeric cream. Phytosterols and phenolic compounds present in these extracts promote the wound healing activity (6).

**Antidiabetic activity:** An extract from the moringa leaf has been shown to be effective in lowering blood sugar levels within 3hrs ingestion, though less effectively than the standard hypoglycemic drug, glibenclamide (8).

**Hepatoprotective activity:** The methanolic and chloroform extracts of leaves of Moringa oleifera have shown very significant hepatoprotection against CCl4 induced hepatotoxicity in albino rats in reducing serum total bilirubin, direct bilirubin, SGPT, and SGOT levels. Moringa roots have been reported to possess hepatoprotective activity. The aqueous and alcoholic 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 flavanoid with hepatoprotective activity (9, 10).

**Antitumour and anticancer activity:** Few isolated bioactive compounds from the seeds were tested for antitumour promoting activity using 7, 12-dimethylbenzanthracene (DMBA) as initiator and 12-o-tetradecanoyl-phorbol-13-acetate (TPA) as tumour promoter. From the results, niazimicin, a thio carbamate from the leaves of Moringa oleifera was found to be a potent chemopreventive agent in chemical carcinogenesis (11). The seed extracts have also been found to be effective on hepatic carcinogen metabolizing enzymes, antioxidant parameters and skin papillomagogenesis in mice. A seed ointment had significant wound healing activity that is comparable with the standard vicco turmeric cream. Phytosterols and phenolic compounds present in these extracts promote the wound healing activity (6).

**Antimicrobial activity:** Moringa roots are reported to be rich in antimicrobial agents. The active antibiotic principle, pterygospermin, has
powerful antibacterial and fungicidal effects. The root extract also possess antimicrobial property due to the presence of 4-alpha-L-rhamnosylxybenzyl isothiocyanate. The minimal bactericidal concentration in vitro is 40 micromol/l for *Mycobacterium phlei* and 56 micromol/l for *Bacillus subtilis* (14). An aqueous extract made from seeds was found to be effective against *Ps. aeruginosa*, *S. aureus* and *E. coli*. An extract from leaves was found to be effective at inhibiting the growth of fungi *Basiidiobolus haaptosporus* and *B. ranarums*, *Spirochin*, found in root, is effective against both gram positive and gram negative bacteria. Anthonine also found in root bark, is highly toxic to the cholera bacterium (15). The antimicrobial activity of different *Moringa oleifera* seeds extracts were tested against *Scenedesmus obliquus* (green algae), *Escherichia coli* ATCC 13706, *Pseudomonas aeruginosa* ATCC10145, *Staphylococcus aureus* NAMRU 3 25923, *Bacillus stertotherophilus* (bacterial strains) and *Herpes Simplex* virus type 1 (HSV 1) and Polio virus type 1 (sabin vaccine)., Although, *Ps. aeruginosa* was more resistant to all *M. oleifera* extracts, *B. stertotherophilus* was more sensitive than other organisms to all extracts. The effect of aqueous methanolic extract and fixed oil on HSV1 was highly similar, 52.22% and 45.2% (16).

**Anthypertensive, diuretic and cholesterol lowering activities:**
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 (12). Moringa roots, leaves, flowers, gum and the aqueous infusion of seeds have been found to possess diuretic activity (17). The crude extract of Moringa leaves has a significant cholesterol lowering action in the serum of high fat diet fed rats which might be attributed to the presence of a bioactive phytoconstituent, ie, b-sitosterol (18).

**Antispasmodic, Antiulcer and Anthelmentic activities:**
Moringa roots and leaves have been reported to possess antispasmodic activity. This activity of leaves has been attributed to the presence of 4- (alpha-L-rhamnosylxybenzyl)-o-methyl thiocarbamate possibly through calcium channel blockade. The spasmolytic activity exhibited by different constituents provides pharmacological basis for traditional uses of this plant in gastrointestinal motility disorder (19). The methanolic extract was found to possess significant protective actions in acetylcholine-induced chronic gastric lesions was also observed with the extract-treated animals (20). The flower and leaves also are considered to be of high medicinal value with anthelmentic activity (21).

**In blindness and eye infections:**
Though there are many causes of blindness Vitamin A deficiency causes impaired dark adaption and night blindness. Eating moringa 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 (B-carotene and leutin) with oil helps in improving Vitamin A nutrition and perhaps delays the onset of cataract (22). Also the juice can be instilled into eyes in cases of conjunctivitis.

**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 (23).

**Antioxidant activity:**
Antioxidant activity reported in oil from the dried 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 (24, 25).

**Antifertility activity:**
The aqueous extract of root and bark at a dose of 200mg/kg and 400mg/kg, respectively showed post-coital antifertility effect in rat and also induced foetal resorption at late pregnancy (26). An aqueous extract of *Moringa oleifera* roots was investigated for its estrogenic, anti-estrogenic, progestational and antimprogestational activities. Doses up to 600 mg/kg of the extract orally failed to induce a decidual response in the traumatized uterus of ovariectomized rats. The antifertility effect of the extract appears to be due to multiple attributes (27).

**Pharmaceutical application**

**Gelling agent:**
A study was carried out to find the gelling potential of gum exudate from the stem of *Moringa oleifera*. Nicolafen sodium gel were formulated with concentration of mucilage ranging from 5.5 to 8.5%w/w. Better gel characteristics were observed at the concentration of 8%. It is also reported that because the pH of the gum is below 5.77 and the viscosity of the formulation with 8.5w/gum is 4.6x106cps, it is ideal for topical application (28).

**Suspending agent:**
A comparative study of gums of *Moringa oleifera* and tracaganth were reported. Zinc oxide suspensions were prepared with gum of *Moringa oleifera* and tracaganth. Their sedimentation profile, redispersibility, degree of flocculation and rheologic behaviour were compared. The results revealed that the suspending properties of *Moringa oleifera* gum are comparable with that of gum tracaganth (29).

**Detoxification/water purification:**
Studies have shown Moringa’s ability to remove hazardous materials from water. After oil extraction of Moringa seeds the left press cake contains water soluble proteins that are as effective coagulants for water purification. The charged protein molecules can serve as nontoxic natural polypeptides to settle mineral particles and organics in the purification of drinking water, vegetable oil, depositing juice and beer. As been reported, Moringa seeds show similar coagulation effects to alum. It is also reported that a recombinant protein in the seed is able to flocculate gram positive and gram negative bacterial cells. Moringa seeds could be used as a biosorbent for the removal of cadmium from aqueous media. Thus water purifying attributes of Moringa seeds are as coagulant, microbial elimination and as a biosorbant (12).

**Surfactant behavior:**
A study on interfacial properties and fluorescence of a coagulating protein extracted from Moringa seeds and its interaction with sodium dodecyl sulphate (SDS) was carried out. The study reported that 1) the protein extracted from Moringa seeds has significant surfactant behavior; 2) the coagulant protein interacts strongly with SDS and the protein might have specific binding sites for SDS; 3) there is formation of protein-SDS complex (30).

**Film forming property:**
Studies reported that gum has enormous potential for use in the preparation of polymeric films as drug delivery systems. The films prepared using gum of *Moringa olifera* (5 parts of 10%/w/w of mucilage of gum of M.O. with different proportion of plasticizers) were evaluated for parameters like water uptake, tensile strength, folding endurance and water vapour transmission rate. The results obtained are comparable with films made from other polymers and concluded that the gum can be used for preparing polymeric drug delivery systems and as a film coating agent in tablets as it has low vapour transmission rate and satisfactory tensile strength (31).

**As stabilizer:**
Plant phenolics have gained considerable interest in recent years for their potential effects against food related microorganisms. Phenolic extract obtained from the leaves of *Moringa oleifera* & *Morus indica* showed stabilizing activity. In the present study effect of addition of fenolic extract from leaves of *M. olifera* and *M.indica* on the shelf life of pineapple juice stored at 4 degree C was
investigated by monitoring the changes in titrable acidity and sensory parameters for 8 weeks. Results indicated that the extracts of natural phenolics can be used to improve the quality and safety of foods (32).

**Cosmetic use:** Various parts of *Moringa oleifera* have cosmetic value. Cognis Laboratoires Serobiologiques team developed PuricareTM 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 (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 a good oil for use in massage and aromatherapy applications. It can be used in body and hair care as a moisturizer and skin conditioner. Other uses include soapmaking and for use in cosmetic preparations such as lip balm and creams. (34). *Moringa oleifera* butter, a semisolid fraction of *moringa* oil, is used in baby products to contribute a free radicle resistant emollient with exceptionally long lasting skin softening and soothing effects (35).

**CONCLUSION:**

The multiple benefits of *Moringa oleifera* made it a true miracle of nature. Numerous studies have been conducted on different parts of *Moringa oleifera*, but this plant has not yet developed as a drug by pharmaceutical industries. In view of the edible nature of the plant, more research work can be done on humans so that a drug with multifarious effects will be available in the future market.

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