



PHARMACOLOGICAL ACTION OF *MORINGA OLIEFERA*: A SYSTEMATIC REVIEW

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Abstract

Moringa oleifera, commonly referred to as the "tree of life" or "miracle tree," holds significant importance as a valuable herbal plant due to its extensive range of medicinal and non-medicinal advantages. In traditional practices, this plant has been utilized for treating injuries, alleviating pain, healing ulcers, addressing liver and heart issues, managing cancer, and reducing inflammation.

Pharmacological investigations have substantiated the hepatoprotective, cardioprotective, and anti-inflammatory properties of extracts derived from different components of the plant. Notably, bioactive elements have been identified in all segments of the plant. To date, over a hundred compounds from various parts of *Moringa oleifera* have been identified, encompassing alkaloids, flavonoids, anthraquinones, vitamins, glycosides, and terpenes.



INTRODUCTION

Moringa oleifera, often referred to as the "miracle tree," flourishes across nearly all tropical and subtropical areas worldwide. However, its origins are traced back to Afghanistan, Bangladesh, India, and Pakistan.^[1] The *Moringa* genus encompasses 13 different species, including (*Moringa oleifera*, *Moringa arborea*, *Moringa rivae*, *Moringa ruspoliana*, *Moringa drouhardii*, *Moringa hildebrandtii*, *Moringa concanensis*, *Moringa borziana*, *Moringa longituba*, *Moringa pygmaea*, *Moringa ovalifolia*, *Moringa peregrina*, and *Moringa stenopetala*.) Among these, *Moringa oleifera* has gained significant recognition for its applications in nutrition, biogas generation, and fertilizer production, among others.^[2] Virtually every component of the tree is utilized for its vital nutrients. The leaves of *Moringa oleifera* possess a notable abundance of beta-carotene, minerals, calcium, and potassium.^[3] Dried leaves contain approximately 70% oleic acid, rendering them suitable for crafting moisturizing products.^[4] The powdered leaves are utilized in the preparation of various beverages, with "Zija" being the most prevalent choice in India.^[5] The bark of the tree is highly regarded for its therapeutic potential in addressing diverse conditions like ulcer^[6] toothaches, and hypertension.^[7] Roots, on the other hand, are observed to play a part in alleviating toothaches, treating helminthiasis^[8], and addressing paralysis^[9]. The objective of this current review is to provide a comprehensive overview of the latest understanding concerning the pharmacological actions and characteristics of *Moringa oleifera*.

CHEMICAL CONSTITUENTS

Moringa oleifera contains a variety of chemical constituents, including:

1. **Vitamins:** *Moringa* is rich in vitamins such as vitamin A (beta-carotene), vitamin C, vitamin E, and various B vitamins.
2. **Minerals:** It contains minerals like calcium, potassium, iron, magnesium, and phosphorus.
3. **Amino Acids:** *Moringa* leaves contain essential amino acids, which are the building blocks of proteins.
4. **Antioxidants:** *Moringa* contain flavonoids, quercetin and chlorogenic acid which have antioxidative property which helps to combat oxidative stress.
5. **Phytochemicals:** Isothiocyanates and glucosinolates are having potential benefits.
6. **Beta-Carotene:** *Moringa* leaves are particularly rich in beta-carotene which converts vitamin A in body.
7. **Fatty Acids:** The seeds of *Moringa* contain a high amount of oleic acid, a monounsaturated fatty acid.
8. **Alkaloids:** Alkaloids like moringine and isothiocyanates are present in different parts of the plant.
9. **Phytosterols:** *Moringa* contains plant sterols like sitosterol and stigmasterol with potential health benefits.
10. **Saponins:** These compounds are known for their potential immune-boosting and anti-inflammatory properties.
11. **Terpenes:** Limonene and alpha-pinene contribute to the plant's aroma and have various biological activities.
12. **Glycosides:** *Moringa* contains glycosides, which are sugar-bound compounds with potential therapeutic effects.
13. **Phenolic Acids:** Chlorogenic acid and caffeic acid are phenolic acids that possess antioxidant properties.

These chemical constituents contribute to the diverse potential health benefits of *Moringa oleifera*. It's important to note that the concentrations of these compounds can vary depending on factors such as the plant's growth conditions, part of the plant used, and processing methods.^[10]

PHARMACOLOGICAL USES

Recent research in pharmacology has unveiled that various extracts derived from *Moringa oleifera* showcase diverse pharmacological properties. These encompass antimicrobial effects, facilitation of

wound healing, ^[11] antifungal properties, ^[12] anti-inflammatory actions ^[13] antioxidant capabilities, ^[14] potential anticancer attributes, ^[15] contributions to fertility, ^[16] and additional pharmacological activities as outlined below.

EFFECTS OF MORINGA OLIEFERA ON PREVENTION OF CHRONIC DISEASES.

1. Antioxidant

The high antioxidant activity of *Moringa* species is attributed to their high phenolic content. Phenolic chemicals work as antioxidants by providing or receiving electrons to stabilize radicals generated in cells. *M. peregrina* seed oil, according to, displayed substantial antioxidant activity in comparison to the popular antioxidants BHA (Butylated Hydroxyanisole) and -tocopherol. ^{[17][18]}

2. Anticancer

The major method by which *Moringa* species fight cancer is via apoptosis, which stops proliferation. By controlling caspase 9 and caspase 3 while lowering the mitochondrial membrane potential of the cells, methanol crude extracts of *M. concanensis* root bark reduced the growth of hepatocellular carcinoma (Hep-G2) cells through intrinsic mechanisms. In addition to killing about 22% of cancer cells, *M. oleifera* leaf extract also reduced the growth of B16F10 melanoma cells. ^{[17][19]}

3. Hypolipidemic Effect

Numerous bioactive substances discovered in MO leaves might affect lipid homeostasis. Both flavonoids and phenolic chemicals play significant roles in regulating lipid levels. ^[21] They are engaged in binding bile acids by generating insoluble complexes and increasing their fecal excretion, which reduces plasma cholesterol concentrations, and inhibiting pancreatic cholesterol esterase activity, which delays and reduces cholesterol absorption. ^[22] Due to the inhibition of both lipase and cholesterol esterase, MO extracts have demonstrated hypolipidemic action, indicating its potential for the treatment and prevention of hyperlipidaemia. ^{[20][23]}

4. Hypotensive Effect

Numerous bioactive substances found in MO leaves, such as nitrile, mustard oil glycosides, and thiocarbamate glycosides, have been utilized to stabilize blood pressure. The four extracted, pure chemicals from the MO leaves' ethanol extract—niacinin A, niacinin B, niiazimicin, and niacinin A + B—showed a blood pressure-lowering effect in rats, potentially via a calcium antagonist function. ^{[24][25]} In rats with spontaneous hypertension, MO was found to minimize vascular oxidation, according to a recent study ^{[20][26]}.

5. Effect on Ocular diseases

Vitamin A insufficiency is the main contributor to blindness, which can range from decreased dark adaption to night blindness. High levels of vitamin A found in MO leaves, pods, and leaf powder can aid in preventing night blindness and other eye issues. Additionally, eating leaves with oils increased vitamin A nutrition and slowed cataract formation. ^{[20][24]}

6. Anaemia

Most of the necessary nutrients for optimal health have been discovered to be present in *moringa oleifera* leaf powder. Iron, vitamin A (carotenoid), and vitamin C are all abundant in the leaf powder and are crucial for the metabolism of iron. The fact that *Moringa* is abundant in all essential amino acids, the building blocks of proteins required for cell growth, gives it an edge in the fight against different nutritional issues. According to safety review studies on *moringa*, there is no toxicity when ingested in big amounts. *Moringa* leaf powder's nutritional capacity makes it a crucial component in enhancing the nutrient diversity in supplementary foods for kids. Many research determine how utilizing *M. oleifera* leaf powder in supplemental foods would help children between the ages of 6 and 24 months experience less anaemia. ^[27]

DISCUSSION:

The therapeutic properties of *M. oleifera* are due to the presence of alkaloids, phenolic acid, glycosides, sterols, glucosinolates, flavonoids, terpenes, and fatty acids. *M. oleifera* is also abundant in substances like vitamins, minerals, and carotenoids, which raises its therapeutic usefulness and acceptance as a superfood. Pharmacological research demonstrates that the plant's active ingredients have successfully treated a number of disorders, including cancer, hypertension, diabetes, obesity, and neuropathic pain. The plant has shown to be a cost-effective substitute in addition to its usage in medicine and as an efficient biostimulant for farmers in their crops.

CONCLUSION:

The *Moringa oleifera* plant, sometimes known as the drumstick plant, is a rich source of phytochemicals with anti-inflammatory and disease-preventive qualities. Overall, *M. oleifera* looks to be a phytopharmaceutical and functional food that, if taken regularly, may be able to treat a variety of chronic diseases in humans and may be utilized by medical professionals as a safer option to treat a variety of disorders.

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