

Exploring *Moringa Concanensis*: A Hidden Plant with Medicinal and Pharmacological Properties

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ABSTRACT

The use of plant-based medicine has gained popularity as it is a natural method to combat present-day health problems. The *Moringaceae* family's *Moringa concanensis* has been part of traditional Indian system of medicine for its healing abilities. This review through a light on the available scientific studies regarding *Moringa concanensis*, its phytochemicals and therapeutic applications. The plant contains numerous active compounds including flavonoids and phenolics along with tannins and alkaloids which exhibit strong biological effects. The plant demonstrates multiple pharmacological benefits that range from diabetes treatment to antioxidant, anti-inflammatory, anticonvulsant, anti-cancer, antimicrobial activities and immune support. The various reports demonstrated that *Moringa concanensis* have the potential for natural therapeutic agent development. The different plant parts such as leaves, seeds, bark, and roots contain unique medical qualities which show potential for specific therapeutic uses. However, the specific active constituents of this plant responsible for the therapeutic activities remains unclear today. Extensive work still needed to determine its therapeutic capacity, safety, and efficacy which have yet to be thoroughly studied.

KEYWORDS: *Moringa concanensis*, phytochemicals, traditional uses, pharmacological activities.

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I. INTRODUCTION

Throughout thousands of years plants have served as the core element of traditional healing methods through which multiple therapeutic approaches have been passed between generations. Indian biodiversity reaches about 8000 different medicinal plant species that represent a significant portion of all flowering plants found in the country. The traditional systems of Ayurveda as well as Unani and Siddha medicine have been established on this deep knowledge base which originated across centuries. Medicinal plants serve as essential resources for healthcare needs and economic development in numerous global communities. The main benefit of natural medicines rise from their lower side effects which result from their abundant antioxidant levels. This suggests that medicinal plants can offer protective benefits against diseases while maintaining therapeutic effectiveness (Ragavendran et al., 2011).

The plant *Moringa concanensis* Nimmo, is a tree characterized by its smooth, hairless (glabrous) nature, with the exception of its young growth and flower clusters

(inflorescence) (Ravichandran et al., 2009). In order to maintain biodiversity, it is necessary to use medicinally valuable plants in a sensible manner. There are roughly thirteen species of the genus *Moringa*, which are grown in various parts of Asia and Africa (Patil et al., 2022).

Moringa concanensis Nimmo grows naturally in Perambalur district of Tamil Nadu under the names Kattumurungai and Peyimurungai by local people. Research on the traditional health benefits of this plant remains insufficient despite its widespread occurrence throughout the region. Local communities possess unrecorded therapeutic knowledge about the plant's beneficial properties that face extinction unless recorded through systematic methods (Balamurugan et al.2013).

A. Plant Profile

Moringa concanensis is commonly known as drumstick plant. The taxonomical classification and vernacular names are given in the table 1 and 2.

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1) Morphology:

It is an evergreen tree with a broad, branches and typically grows to a height of 8 feet. The leaves are alternate, bipinnate, obovate in shape, hard to touch and tend to fall off easily. The flowers are large, hermaphroditic, arranged in irregular panicles and white in colour. The calyx is thin and covered with hairs, and its segments are oblong and white. The petals are oblong, yellow in colour with red veins. There are five fertile stamens and four to five staminodes. The fruit is straight, three-angled capsule, slightly constricted between the seeds, green with brownish tinge. The seeds are pale white or yellow in colour. *Moringa concanensis* and its various parts are illustrated in Figure 1. (Metri et al., 2024).

2) Traditional Uses:

It is one of the important traditional plant used in Ayurveda and Unani system of medicine. Tribes in the Nilgiris region use it as an anti-fertility remedy and for treating conditions like eye care, leucorrhea, thyroid issues, fatigue, diabetes, and spinal cord pain (Ravichandran et al., 2009; Patil et al., 2022). All parts of the plant are used in traditional medicine to treat venomous bites, ascites, rheumatism, skin diseases, ulcers, dysentery, and blood pressure issues (Christian et al., 2022). In Ayurveda and Unani medicine, its leaves help with blood pressure, spleenomegaly, diabetes, skin tumors, and menstrual pain (Anitha et al., 2018). The entire plant treats ascites, rheumatism, and poisonous bites (Rao et al., 2008).

TABLE 1: TAXNOMICAL CLASSIFICATION (SINGH ET AL., 2013)

Category	Classification
Kingdom	Plantae
Division	Tracheophyta
Class	Magnoliopsida
Order	Brassicales
Family	Moringaceae
Genus	Moringa
Species	concanensis

TABLE 2: VERNACULAR NAMES OF THE PLANT (MAHMOOD ET AL., 2010)

Language	Local Name(s)
Hindi	Jangli, Sargua, Senjana
Telugu	Konda munaga
Kannada	Nugge, Kadu nugge
Malayalam	Muringa
Marathi	Mashinga, Ran Shevga
Sanskrit	Bahupatraka, Garbhapatka, Bahupallava
Tamil	Kattumurungai
Gujarati	Jangli Saragavo

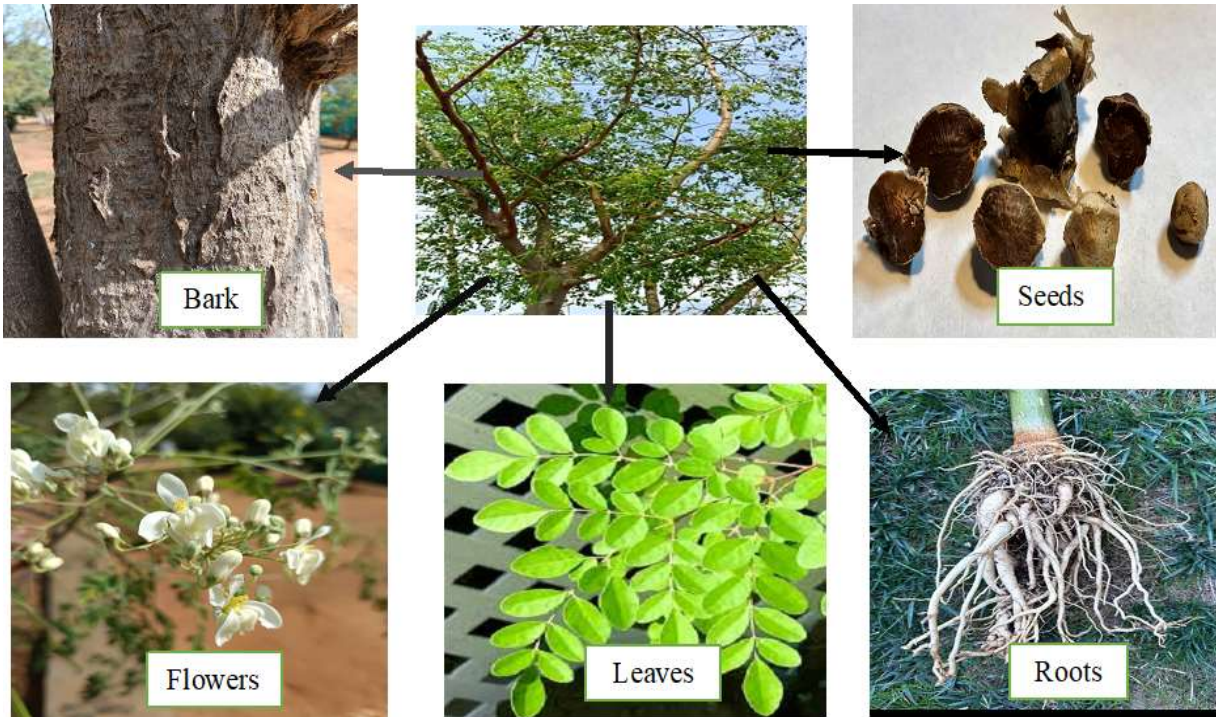


FIGURE 1: VARIOUS PARTS OF MORINGA CONCANENSIS

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II. REVIEW METHOD

The literatures were systematically reviewed from various scientific databases such as Springer, Elsevier, Science Direct, PubMed, Google Scholar, etc., by using the keywords like *Moringa concanensis*, traditional uses, phytochemical screening, and pharmacological activities. The articles published between 2007 and 2024 were searched to collect the data.

III. PHYTOCHEMICAL SCREENING

Phytochemical analysis of alcoholic extract of *Moringa concanensis* leaves revealed the presence of steroids, triterpenoids, reducing sugar, alkaloids, carbohydrates, amino acids, phenolics, flavonoid, saponins, and tannins (Ayyanar et al., 2024), (Balamurugan et al., 2013), (Dodiya et al., 2024). The plant has been reported to contain cardiac glycosides identified and isolated digoxin, a cardiac glycoside from the chloroform extract of leaves of *Moringa concanensis* (Patil et al., 2022). Methanolic extract of seed showed the highest concentration of phytochemicals, including phenolics, flavonoids, tannins, flavanols, proanthocyanins, and vitamin E. GCMS analysis of the alcoholic extract of pod husk identified the main

compounds, oleic acid, α -tocopherol, campesterol, quercetin (Fig 2) 2,5-dimethylfuran-3,4(2H,5H)-dione, oleic acid, campesterol, and pyranone (Amalraj et al., 2024, Krupa et al., 2022,). Many studies evidenced the plant’s richness in phenols and flavonoids by estimating them quantitatively. The bark of the plant has been reported to contain isoquercetin, quercetin, astragalín, and caffeic acid, identified through UPLC-QTOF/MS (Santhanam et al., 2022).

Many studies evidenced the plant’s richness in phenols and flavonoids by estimating them quantitatively. Methanol and ethyl acetate extracts of the leaves showed the highest total flavonoid (123.22 and 130 mg QE/g) content compared to seed and (10.08 w/w) and flower samples (15.12 w/w). The phenolic content also found to be high in leaves 152.81 and 136.52 mg GAE/g) compared to seed (30.18 w/w). The methanol extract of the flower showed highest alkaloid (5.86 W/w) and carbohydrate (7.49 w/w) content compared to the extract of the seed containing 4.37 w/w and 2.15 w/w respectively (Santhi et al., 2016), Ayyanar et al., 2024). The phytochemical composition and pharmacological activities of *Moringa concanensis* is given in Table 3.

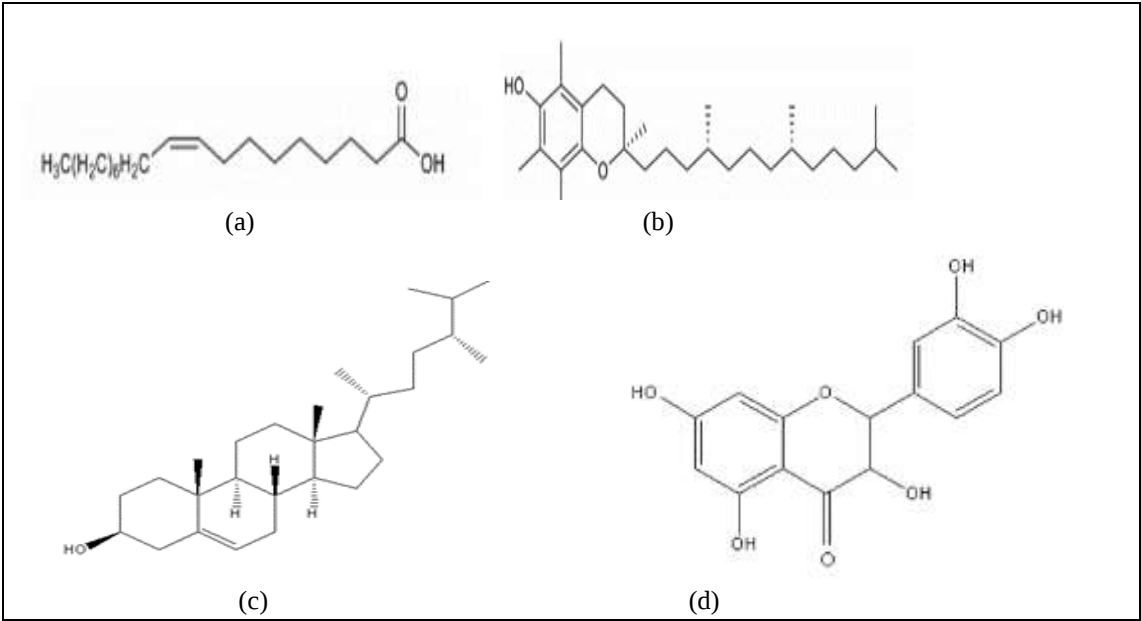


FIGURE 2: STRUCTURES OF SOME PHYTOCONSTITUENTS OF MORINGA CONCANENSIS IDENTIFIED BY GCMS. (A) OLEIC ACID (B) A-TOCOPHEROL C) CAMPESTEROL (D) QUERCETIN (KRUPA ET AL., 2022)

TABLE 3: PHYTOCHEMICAL COMPOSTION AND PHARMACOLOGICAL ACTIVITIES OF MORINGA CONCANENSIS

Plant Part	Solvent used for extraction	Identified Compounds	Quantitative/quantitati ve analysis	Biological Activities	References
Leaves	Chloroform	Digoxin (cardiac glycoside)	Isolated and characterized	-	Patil et al., 2022

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Leaves	Ethanol	Alkaloids, Saponins, Tannins	Qualitative presence	Antioxidant	Santhi et al., 2016
Leaves	Aqueous	Amino acids, Reducing sugars	Qualitative presence	-	Dodiya et al., 2024
Leaves	Methanol, Ethyl Acetate	Flavonoids, Phenolics	123.22-130.83 mg QE/g (flavonoids), 136.52-152.81 mg GAE/g (phenolics)	Antioxidant, Antibacterial	Ayyanar et al., 2024
Seeds	Methanol	Phenolics, Flavonoids, Flavanols	Quantified (specific values not stated)	Antioxidant, Enzyme inhibition	Krupa et al., 2022
Seeds	Petroleum Ether	Fatty acids, Sterols	GC-MS analysis	-	Krupa et al., 2022
Pod Husks	Alcoholic*	Oleic acid, α -Tocopherol, Quercetin	GC-MS identification	Antioxidant (in vitro/in silico)	Amalraj et al., 2024
Bark	Ethanol	Steroids, Triterpenoids, Tannins	Qualitative analysis	Antimicrobial	Balamurugan et al., 2013
Flowers	Methanol	Carbohydrates, Alkaloids	5.86% alkaloids, 7.49% carbohydrates	-	Ayyanar et al., 2024

IV. PHARMACOLOGICAL ACTIVITIES

Moringa concanensis possesses variety of pharmacological activities (Figure 3).

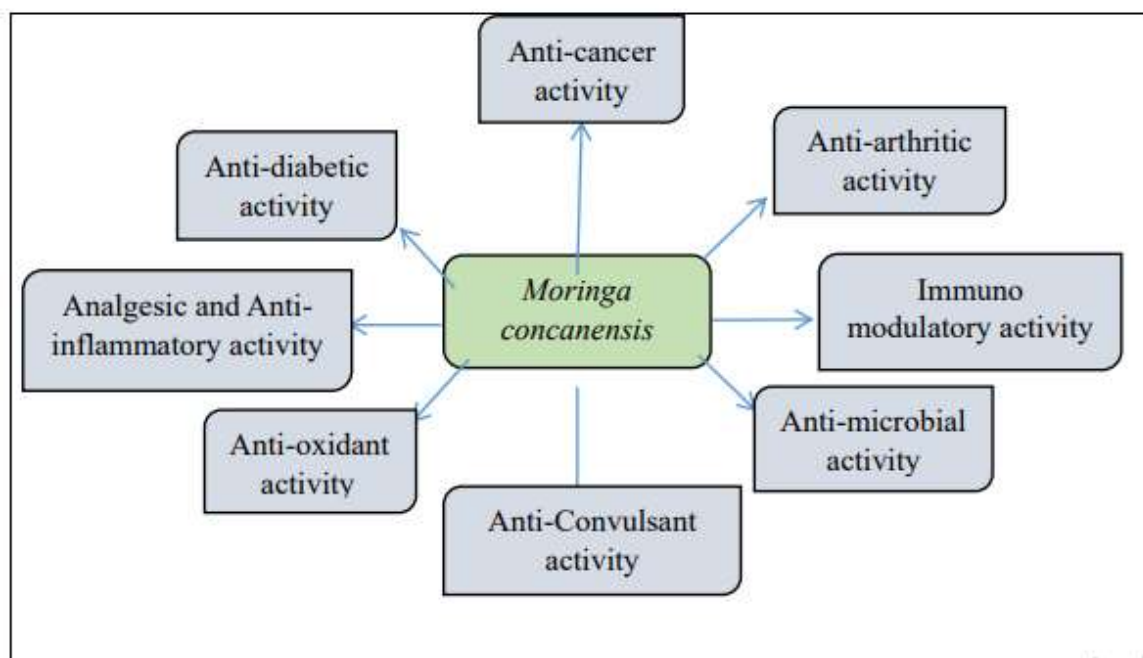


FIGURE 3: VARIOUS PHARMACOLOGICAL ACTIVITIES OF *MORINGA CONCANENSIS*

A) Anti-diabetic activity

Ethanollic extract of leaves of *Moringa concanensis* showed efficient anti-diabetic activity in alloxan-induced diabetic rats. The activity of the extract was due to its involvement in the the insulin secretion by beta pancreatic

cells (Singh et al., 2021) The study investigated *in vitro* and *in vivo* antidiabetic effects of ethanolic extract of *Moringa concanensis* (EEMC) leaves on 3T3-L1 cells and STZ-NA (Streptozotocin-Nicotinamide) induced diabetic rats respectively to understand the mechanism of action of the

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extract. *In vitro* studies, the extract enhanced the expression of C/EBP- α , PPAR- γ , Glut-4, t-SREBP, adipogenin, FAS and LAL genes in 3T3-L1 cells through Akt signalling. *In vivo* STZ-induced diabetic model, the extract showed significant hypoglycaemic activity by increasing the body weight and insulin and reducing the sugar and lipid profile level (Balakrishnan et al., 2018). EEMC was also studied to understand the protection of tissues of liver, kidney and other organs against oxidative stress in STZ induced diabetic rats. It was discovered that the extract worked well to shield organs from hypoglycemia. This increases enzyme activity while decreasing MDA activity. Its upregulation of PPAR and GLUT4 expression indicates its resistance to oxidative stress. The extract helps maintain the liver, pancreas, and kidney tissues by protecting them from oxidative damage. Preserve glucose equilibrium (Balakrishnan et al., 2019).

B) Anti-convulsant activity

The ethanolic extract of leaves demonstrated significant anticonvulsant activity against seizures induced by maximal electroshock (MES) and pentylenetetrazole (PTZ), in Swiss albino mice. The extract delayed in onset of seizures and decrease in seizure duration a dose-dependent manner. These effects of the extract were due to inhibition of neuronal excitability or modulation of GABA neurotransmission. The extract was found to be safe as it did not show any signs of toxicity, supporting its possible use in the herbal formulation development for the treatment of epilepsy and related neurological disorders (Joy et al., 2013).

C. Anti-oxidant activity

Methanolic extract of *Moringa concanensis* exhibited strong antioxidant activity while chloroform extract showed UV protection with high antioxidant activity and low cytotoxicity indicating its application in medicinal and cosmetic use (Krupa et al., 2022). The extract protected the goat liver from oxidative damage by scavenging free radicals produced by H₂O₂ and DPPH. (Balakrishnan et al., 2018). The activity was attributed to the presence of flavonoids, polyphenols, and ascorbic acid in the extract (Dey et al. 2014).

D. Immuno-modulatory activity

Delayed-type hypersensitivity (DTH), phagocytic assay and cyclophosphamide induced immunosuppression models were used to evaluate immuno-modulatory activity of whole plant of *Moringa concanensis* and isolated compound. The results showed that the extract and isolated compound at tested doses significantly increased the platelets count and WBC, and also phagocytosis index in mice compared to those treated with cyclophosphamide. However the isolated compound demonstrated exceptional immune-modulatory effect, compared to the whole plant extract to strengthen both the innate and adaptive immune systems (Shantilal et al., 2020).

E. Anti-arthritic activity

The study used a rat model of arthritis caused by Complete Freund's Adjuvant (CFA) to examine the anti-arthritic properties of *Moringa concanensis*' hydro-alcoholic root extract. Comparable to methotrexate, the extract significantly decreased the physical and biochemical markers of arthritis in rats at given dose of 200 mg/kg and 400 mg/kg. The anti-arthritic effects were further confirmed by histopathological study which was comparable to the standard methotrexate. The study concluded the activity of the extract was due to the presence of terpenoids in the roots and supporting its potential to use in the management of arthritis (Mukherjee et al., 2024).

F. Analgesic and anti-inflammatory activity

The extract of the fruits showed a remarkable anti-inflammatory and analgesic effect in mice at the dose of 200 and 400 mg/kg. (Rao et al., 2008). The activity was likely due to the inhibition of prostaglandin production, a key mediator of inflammation and blockage of cyclooxygenase. The activity was due to richness of plant in flavonoids and alkaloids (Jayabharathi et al., 2011).

G. Anti-cancer activity

The anticancer activity of leaf and bark of the plant was investigated using MTT assay on HepG2 cell lines. The leaf extract of *Moringa concanensis* shows anticancer potential against MCF-7 breast cancer cells and may lead to new natural treatments (Vijayakumar et al., 2017). Both leaf and bark extracts exhibit anticancer activity against HepG2 cell lines, with the leaf extract being more potent (Balamurugan et al., 2014). Root bark extracts induce cytotoxicity and apoptosis in HepG2 cells by reducing antioxidant enzyme activity and increasing reactive oxygen species (Vijayarajan et al., 2016).

H. Anti-microbial activity

Moringa concanensis exhibited the strong antibacterial and antifungal activity due to the presence of active constituents' tannins, flavonoids, phenolic compounds, alkaloids, saponins, and glycosides. Leaf extracts tested against *Bacillus cereus*, *Enterobacter aerogenes*, *Bacillus subtilis*, *Aspergillus niger*, *Aspergillus flavus* and *Helminthosporium* showed significant antimicrobial effects, particularly with the chloroform extract. These compounds act by disrupting microbial membranes, inhibiting DNA replication, and affecting enzyme activity. The findings highlight the broad-spectrum antimicrobial potential of the plant and it supported traditional use in treating infections, suggesting its relevance in the development of natural antimicrobial agents for pharmaceutical or therapeutic applications (Yadav et al., 2021).

IV. CONCLUSION

Moringa concanensis demonstrates significant pharmacological potential, with proven anti-diabetic,

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antioxidant, anti-inflammatory, anti-cancer, and antimicrobial properties. Rich in bioactive compounds, it has traditionally been used in indigenous medicine to treat various ailments. However, despite its therapeutic promise, further research is needed to fully quantify its bioactive constituents and standardize its medicinal applications. With additional clinical studies, *Moringa concanensis* could become a valuable plant-based resource for modern pharmaceutical and therapeutic development.

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