

PHARMACOLOGICAL IMPORTANCE OF *MORINGA CONCANENSIS* NIMMO LEAF: AN OVERVIEWAMERENDRA SINGH^{1*}, JAI NARAYAN MISHRA¹, SANTOSH KUMAR SINGH²¹Department of Pharmacy, Kailash Institute of Pharmacy and Management, Gida, Gorakhpur, Uttar Pradesh, India. ²Department of Pharmacy, Suresh Gyan Vihar University, Jagatpura, Jaipur, Rajasthan, India. Email: amesingh72@gmail.com

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ABSTRACT

In the current years, the use of traditional medicine is increasing and gaining popularity. The extracts of *Moringa concanensis* Nimmo leaves have reported many medicinal uses. In the previous few decades, a massive quantity of scientific facts concerning plants, crude extracts, and quite a number supplies from plant life as medicinal dealers has come to light. *M. concanensis* is a plant whose components are oftentimes used in the medicinal treatments. There are good sized anecdotal facts about the organic undertaking of *M. concanensis* which includes anticancerous, antibacterial, antifungal, analgesic, and anti-inflammatory type of activities. The leaves of *M. concanensis* had been located to contain a higher quantity of triterpenoids and flavonoids. The existing assessment includes the phytochemical, ethnopharmacological, and pharmacological reviews of *M. concanensis*. The future scope of the plant has been emphasized with a view to isolate bioactive moieties which should be used for multifarious biological activities.

Keywords: *Moringa concanensis*, Alkaloids, Flavonoids, Terpenoids, Diabetes, Inflammation, Thyroid.

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INTRODUCTION

India has identified >2500 plant lives which are of medicinal values. Medicinal flora has been used in traditional for various years. The medicinal plants are of excellent significance to the different sorts of human ailments without facet effects [1]. Plants have gorgeous manageable uses particularly traditional and pharmacopoeial pills and more than a few compounds. This indicates higher percentage of the plant and their derived residue of compounds. In the cutting-edge scenario, many plants proved as scientifically their medicinal houses and its importance [2]. The plant *Moringa concanensis* (Moringaceae) has a single genus with 13 species which have been recorded in India. It is an evergreen tree, extensively dispensed on drylands and commonly acknowledged as Kattumurungai or Peyimurungai in Tamil. The complete plant carries distinct types of phytoconstituents, and they are used dietary and medicinal benefits. The extraordinary components of the plant life are used in one-of-a-kind kinds of ailments and a range of human diseases such as anti-inflammatory, antifertility agent, analgesic, and antimicrobial reduces cholesterol, pores and skin tumor, diabetes, and eye care and so on [3-6]. People used to prefer herbal drugs in the ancient times. These drugs are less expensive and have negligible side effects. They eliminate the disease from the patient's body and also enhance the vigor and immunity besides playing an appreciable role toward suppressing untoward immune reactions. The major current indications for immune suppression include organ transplantation, prevention of Rh hemolytic disease of newborn, and treatment of autoimmune diseases. The trend toward alternative care and herbal self-medication presents a new challenge to pharmacists. Through the half of this century, many herbs were considered as conventional medicines. For instance, febinace garlic, ginger, and *Ginkgo biloba* plants are an essential and integral component of the world of prescription medicine and have the ability to make flavonoids, proteins, alkaloids, and steroids which are in turn used to cure many diseases [7].

Natural products have been a major source of drugs for centuries, with more than 25% of pharmaceutical products are in use today. Interest in natural product research remains strong. This can be attributed to several factors, including unmet therapeutic needs that drive new drug discovery, the remarkable diversity of both chemical structures and biological activities of naturally occurring secondary metabolites, the utility of bioactive natural products as biochemical and molecular

probes, the development of novel and sensitive techniques to detect biologically active natural products, improved techniques to isolate, purify, and structurally characterize these active constituents, advances in solving the demand for bulk supply of complex natural products, and the success of herbal remedies in the global marketplace. Enormous opportunities exist for multidisciplinary research that joins the forces of pharmacognosy and natural products chemistry, molecular and cellular biology, medicinal and analytical chemistry, biochemistry, pharmacology, and pharmaceuticals to exploit the vast diversity of chemical structures and biological activities of natural products [8].

The plant *M. concanensis* Nimmo (Moringaceae) is locally known as Kattumurungai by tribal peoples of The Nilgiris in the region of Tamil Nadu state. The plant is a tree, glabrous except the young parts and inflorescence. Flowers in lax divaricated thin pubescent panicles reaching 45 cm long, segment white, oblong reflexed. Petals are yellow, veined with red, oblong or oblong-spathulate, the lower about 1.5 cm long. Capsules are straight, acutely triquetrous, slightly constricted between the seeds. *M. concanensis* Nimmo looks like Seeds white or pale yellow, 3 angled, 3 winged wings very thin, hyaline [7]. The plant *M. concanensis* Nimmo has been widely used as antifertility agent for decades by tribals of Nilgiris hill region. The tribals of Nilgiris, the hill region of the Western Ghats in Tamil Nadu, were known to practice traditional medicine, and our interaction with these tribals has given us the leads to several research projects with the possible presence of a therapeutic rationale in their claims. Most of the reports showed that the many chemical constituents presence of ascorbic acid [9], myristic acid, palmitic acid, oleic acid, stearic acid, arachidic acid and linoleic acid [10] from the fruits of *M. concanensis* and seed, respectively.

Extractions have been carried out on dried leaves of *M. concanensis* using a number of solvents such as ethanol, acetone, ethyl acetate, methanol, water, petroleum ether, and chloroform (in order of growing polarity of the solvents); thereupon, phytochemical screening was carried out on the more than a few extracts to perceive the phytoconstituents. Such studies have revealed the presence of alkaloids, volatile oils, flavonoids, steroid triterpenoids, anthracene glycosides, saponins, tannins, xanthoproteins, amino acids, and cardiac glycosides. 9-Octadecenoic acid, hexadecanoic acid, docosanoic, eicosanoic acid, oleic acid, 11-octadecanoic acid, and cyclopropanoic acid are some of the constant oils that have been observed to be existing in the plant extracts [11-13].

Plant profile

Trees; branchlets warty, tomentose. Leaves alternate, 2-pinnate, 100×80 cm; pinnae 5–8 pairs, opposite; leaflets odd-pinnate, 4–6 pairs, opposite, broad-ovate or elliptic, 1–3 × 1–2 cm, chartaceous, glaucous below, base rotund, margin entire, apex obtuse, retuse, apiculate; petiole to 8 cm, pulvinate; petiolule 2 mm. Panicles ca. 20 cm, lax, divaricate, pubescent; peduncle to 6 cm; bracts and bracteoles linear 1–2 mm; pedicel jointed, to 1 cm. Flowers 1.5 cm across. Calyx -lobes 5, oblong, subequal, 0.8–1.2×0.4–0.6 cm, tomentose. Petals 5, white, with purple streaks, oblong-obovate, 1.5×0.5 cm, unequal. Fertile stamens 5; filaments 4–6 mm, pubescent; anthers 2 mm; staminodes declinate. Ovary stipitate, tomentose, 3 mm; ovules numerous on 3 parietal placentae; style slender; stigma truncate, perforate. Capsule to 60×1.5 cm, beaked; seeds numerous, 3-angled, 2×1.5 cm; wings hyaline [14].

Taxonomy of *Moringa concanensis*

Kingdom : Plantae
Phylum : Tracheophyta
Class : Magnoliopsida
Order : Capparales
Family : Moringaceae
Genus : *Moringa*

Species : *Moringa concanensis* Nimmo

Pharmacological activities of *M. Concanensis* Nimmo

In addition, it has been observed that asafoetida possesses a wide range of pharmacological activities which are scheduled in Fig. 1.

Anti-inflammatory activities

Inflammation is a protective response of our physique to hazardous stimuli such as allergens and/or damage to the tissues; on the other hand, uncontrolled inflammatory response is the primary cause of a widespread continuum of disorders including allergies, cardiovascular dysfunctions, metabolic syndrome, cancer, and autoimmune illnesses imposing a big economic burden on people and as a result on the society [15]. There are quite a number of drugs for controlling and suppressing inflammatory crisis; steroids, nonsteroid anti-inflammatory drugs, and immunosuppressant are the sensible examples of these medicines which are related with unfavorable effects, while in exercise, our intention is to apply minimal wonderful dose by means of the absolute best efficacy with the least unfavourable effects. Thus, we want to apply herbal anti-inflammatory factors within medication therapy to gain expanded pharmacological response and the lowest degree of unwanted side effects [15,16]. Herbal drugs are merchandising subjects in medicinal drug, and of course, we have to increase our know-how about them [17].

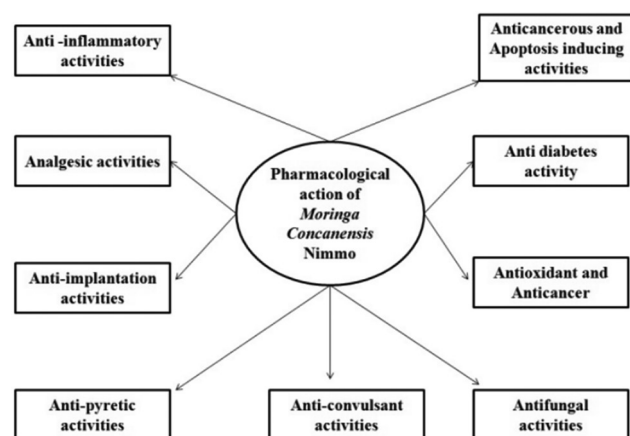


Fig. 1: Pharmacological activities of asafoetida

The ethanolic extract of flowers and tender fruits of *M. concanensis* showed the anti-inflammatory activity. The result of anti-inflammatory find out about in rats showed that it exhibited extensive anti-inflammatory activity. The maximum proportion inhibition of infection was 78.4% recorded with 200 mg/Kg of flower extract. The maximum percentage inhibition of infection was 44.08 recorded with 400 mg/Kg of soft fruit extract [18,19].

Anticancerous and apoptosis-inducing activities

The development or identification of compounds capable of killing transformed or cancer cells, except being toxic to their regular counterparts, is of utmost importance and has gained the increasing pastime of scientists worldwide. Since antiquity, plant life has been viewed prosperous sources of chemicals, with giant therapeutic potential. During recent years, some of these plant-derived compounds or phytochemicals have been proven to be quite in position anticancer agents, in addition to being effective in opposition to many different illnesses [20-23].

Cancer, following cardiovascular diseases, is the principal motive of mortality and morbidity in Europe. The key characteristics of this aggressive disease are uncontrolled increase and the unfold of converted cells [24]. Each year, hundreds of thousands of people are identified with cancer, whereas about 3.5 million cancer-related deaths are annually recorded international [25,26]. Specifically, only in Europe, about 3.45 million new instances of cancer were said in 2012, except non-melanoma skin cancer, whereas about 1.75 million deaths passed off [27].

Throughout history, plant extracts and their purified lively components have been the backbone of most cancers chemotherapeutics [28]. It is estimated that over 70% of anticancer compounds are either natural products or herbal product-derived supplies [29].

Studies have been carried out to analyze the anticancerous activity of the ethanolic extract of leaf and bark of *M. concanensis*. Cell increase inhibiting properties of leaves and crude bark extracts had been analyzed the use of 3-(4,5-5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide assay. The ethanolic extract was once observed to be non-toxic to everyday cells while having significant cytotoxicity on HepG2 cell line. The extract lowered the viability of HepG2 cell in a dose-structured manner [30].

Analgesic activities

Pain is a disabling accompaniment of many medical conditions and pain management is one of the most important therapeutic priorities [31]. Pain has been formally described as a disagreeable sensory and emotional trip associated with actual or attainable tissue damage. It is usually a warning sign and primarily protective in nature but regularly reasons a lot of soreness and leads to many adverse effects [32]. Analgesics are drugs used to treat or minimize pain, and the classical analgesic drugs quite opiate and non-steroidal anti-inflammatory drugs have their foundation in natural merchandise; however, many artificial compounds that act by way of the same mechanism have been developed and are associated with serious damaging effects such as ulceration, gastrointestinal bleeding, additive potential, drowsiness, respiratory distress, nausea, and so forth [33,34]. Based on these, therefore, there is a need for the search for bioactive compounds from natural merchandise specifically from medicinal plants for use as choice analgesics with little or no side effects [35].

The ethanolic extract of the flora of *M. concanensis* showed the presence of alkaloids, flavonoids, carbohydrates, phytosterols, fixed oils, and fats. The extract showed that considerable analgesic activity evaluated the usage of hot plate approach and tail flick methods. The ethanolic extract of tender fruits of *M. concanensis* confirmed advantageous analgesic endeavor in albino rats. The ethanolic extract produced a tremendous discount in writhing episodes triggered by acetic acid (0.6%) and share safety at 200 and 400 mg/Kg used to be 22.73% and 51.63% [18,19].

Antipyretic activities

Fever is a surrogate marker for disorder undertaking in many infectious and inflammatory disorders. According to the classical view, the genesis of fever is precipitated by means of inflammatory mediators (i.e., cytokines, namely interleukin-1, interleukin-6, tumor necrosis factor, and others) that are predominantly released by activated peripheral mononuclear phagocytes and different immune cells [36,37]. Due to the fact that direct get admission to of the large hydrophilic cytokine proteins to the temperature-controlling brain buildings within the pre-optic/anterior hypothalamic areas is prevented by means of the blood-brain barrier, the mechanisms described under have been cautioned for producing pyrexia [38]. The ethanolic extract of the flora of *M. concanensis* also showed antipyretic activity. The end result is to find out that the tremendous antipyretic activity in rats. The temperature diminished up to 2.190°C with a dose of 200 mg/Kg of aforementioned plant extract [18].

Anti-implantation activities

The management of population increase is very essential in populated nations such as India and China, and for this reason, manipulation is an trouble of world and countrywide public fitness concern. Current strategies of contraception result in an unacceptable rate of undesirable pregnancies and having facet consequences also. Thus, there is a need to change these marketers using secure and advantageous dealers such as plant-based totally contraceptive retailers [39]. Many plants/plant extracts have been used as antifertility agents in folklore and common drugs except producing obvious poisonous consequences [40]. The rapid rise in population has induced serious problems in the economic boom and all-round human development in growing countries. The family planning has been promoted through numerous techniques of contraception, but due to serious unfavorable consequences produced through synthetic steroidal contraceptives [41], interest has now been focused on medicinal plants for viable contraceptive effect. The aqueous extract of the roots of *M. concanensis* confirmed the fine preventing implantation recreation on the albino rats [42].

Anticonvulsant activities

There is renewed global hobby in the use of plants to relieve or cure exceptional diseases such as neurological disorders such as epilepsies, which have a high incidence in the world population [43]. Herbs may have antiepileptic effects in several ways. Some herbs may additionally increase brain levels and/or the binding of nerve transmitter gamma-aminobutyric acid (GABA), which quiets nerve exercise [44]. The Labiatae (Lamiaceae) is one of the greatest and most exceptional families of flowering plants, with about 220 genera and almost 4000 species global [45]. Due to the high charge of species range and endemism in Labiatae, many species are used in standard and people medicinal drug in Iran [46]. A broad variety of compounds such as terpenoids, iridoids, phenolic compounds, and flavonoids have been reported from the contributors of the family [47,48].

The ethanolic extract of the leaves of *M. concanensis* was once evaluated for its anticonvulsant activity. It abolished each maximum electroshock and pentylenetetrazole seizures. Hence, it may additionally possess sodium channel blockade, N-methyl-D-aspartate (NMDA) blockade, calcium channel blockade, or GABA agonist activity. The anticonvulsant activity of *M. concanensis* can also be due to the antioxidant property. [10]. The ethanol, chloroform, and aqueous extract showed giant endeavor toward *Salmonella typhi*. The ethanol extract used to be greater activity than the popular against *S. typhi*. The antibacterial undertaking of aqueous extract confirmed most quarter inhibition (9 mm) against *Escherichia coli* and showed minimal inhibitory area (4 mm) in opposition to *Pseudomonas p.8,8,7,5,5*. It confirmed 4 mm inhibitory area toward *Lactobacillus brevis*, *Micrococcus luteus*, and *Staphylococcus sp* [49].

Antifungal activities

In many growing countries, the regular remedy is one of the essential health-care systems [50,51]. Herbs are extensively exploited in

the standard remedy, and their curative potentials are properly documented [52]. About 61% of new capsules developed between 1981 and 2002 have been primarily based on natural products, and they have been very successful, particularly in the areas of infectious ailment and cancer [53]. Recent trends, however, exhibit that the discovery price of energetic novel chemical entities is declining [54].

Natural products of greater plants may additionally supply a new supply of antimicrobial agents with perhaps novel mechanisms of action [55,56]. The results of plant extracts on microorganism have been studied through a very massive number of researchers in unique components of the world [57]. Much work has been accomplished on ethnomedicinal vegetation in India [58]. Plants are prosperous in a large range of secondary metabolites such as alkaloids, flavonoids, terpenoids, glycosides, and tannins, which have been found *in vitro* to have antimicrobial properties [59,60]. Bark of *M. Concanensis* is used to determined anti-fungal activity. It showed a maximum area of inhibition (6 mm) in opposition to *A. oryzae* and confirmed minimal inhibition area (4 mm) in opposition to *Aspergillus flavus*, *Candida albicans*, and *Aspergillus sojae* [11].

Antioxidant and anticancer

Cancer is a dreadful ailments characterized through irregular proliferation of the cells [61]. Cancer is one of the primary health issues of the World Concern [62]. Cancer records venture that, through 2030, there will be 26 million new cases and 17 million deaths per 12 months [63]. Lung, breast, and colon cancers are the three most common cancers worldwide, with an increasing annual incidence [64]. In Worldwide, breast most cancers are the 2d leading motive of the loss of life in female [65]. Cancer is handled conventionally by the way of immunotherapy, chemotherapy, radiotherapy, surgical procedure, and molecular focused on or combination of these strategies [66]. About 69% of drugs accredited for anticancer medicinal drugs between 1940 and 2002 are both herbal products or developed primarily based on knowledge gained from herbal products, and phytotherapeutics might also make a contribution much to it [67].

Antioxidants intrude with the oxidative processes by scavenging free radicals, chelating free catalytic metals and by means of acting as electron donors [68]. The natural antioxidant mechanisms may additionally be insufficient in a variety of stipulations, and therefore, dietary consumption of antioxidant compounds is necessary [69]. Antioxidant compounds in meals play an important role as a fitness protecting factor. Scientific evidence suggests that antioxidants minimize the chance for chronic ailments consisting of cancer and heart illnesses [70-73].

Many investigations are focused on the 2,2-diphenylpicrylhydrazyl radical scavenging activity and anticancer effect of the methanolic extract of *M. concanensis* Nimmo leaves against breast cancer (MCF-7) mobile line. The anticancer activity of the crude methanolic leaf extract of *M. concanensis* against MCF- 7 cellphone line was once examined by means of 3-[4,5-dimethylthiazol-2-yl]-2,5 diphenyl tetrazolium bromide assay. *M. concanensis* leaves possess extremely good anticancer property which can also lead to improvement of novel compounds as herbal phytomedicine [74,75].

Antidiabetic activity

Despite the presence of many methods, strategies, and medicines, the administration of type 2 diabetes mellitus (DM) remains unsatisfactory [76]. The growing occurrence of diabetes in both developed and growing international locations has challenged scientists to the discovery of a variety of therapeutic sellers that can be used to ensure effective treatment and administration of diabetes [77]. Furthermore, with the growing incidence of DM in the rural population of Africa, many drugs have been formulated for the administration of this persistent hyperglycemic disorder. However, there are obstacles in the use of antihyperglycemic medications, resulting from the aspect effects, high cost, confined motion, and secondary failure rates.

There is a clear want for the improvement of indigenous, inexpensive herbal sources for diabetic treatment [78]. There is in modern times no treatment for diabetes, and the tablets accessible for the cure and management of this disorder are nonetheless unable to impair insulin deficiency. Less privileged diabetic sufferers are unable to buy high-priced drugs to manage this conditions or keep their lifestyle [79].

Moringa oleifera plant has been used in folklore remedy for the cure of diabetes and different illnesses [80]. Many indigenous plants such as *Vernonia amygdalina* [81] and *Garcinia kola* [82] contain terpenoids, glycosides, alkaloid, flavonoids, and carotenoids which have all been proven to comprise antidiabetic activities [83]. Ayurvedic medicine makes use of natural flora to promote self-healing and obtain proper fitness and longevity. Researchers have indicated that *M. oleifera* can provide the nutrients and therapeutic substances to prevent, mitigate, or deal with many diseases or conditions [84]. This plant has been reported to possess antidiabetic, antioxidant, and other medicinal properties which may additionally be beneficial in managing diabetes and its associated complications and should perhaps act as an high-quality remedy for the management of diabetes in particular in low-income African communities [85-87].

CONCLUSION

The aforementioned studies make it clear that *M. concanensis* is a frequently available plant having multifarious medicinal properties, a great deal like its extra famous counterpart: *M. oleifera*. Much of the medicinal uses of *M. concanensis* are regular and anecdotal, but most of these medicinal homes have been backed up with scientific research and stringent laboratory tests. However, some of its medicinal powers, like its antidiabetic activity, nonetheless stay to be evaluated and it is high time that such studies are carried out in hope of finding better drugs to remedy and manipulate diabetes.

AUTHORS' CONTRIBUTIONS

All the authors have contributed equally.

CONFLICTS OF INTEREST

The authors have none to declare.

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