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MORINGA OLEIFERA: AN OVERVIEW OF ITS PHARMACOLOGICAL PROPERTIES

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Abstract:

The genus Moringaceae includes munga, also known as *Moringa oleifera* Lam. The plant *Moringa oleifera* Lam. is used extensively as a nutritional supplement and has valuable pharmacological properties including anti-asthmatic, anti-diabetic, hepatoprotective, anti-inflammatory, anti-cancer, anti-microbial, anti-oxidant, cardiovascular, anti-ulcer, CNS activity, anti-allergic, wound healing, analgesic, and antipyretic action. This plant has important medicinal properties in every part. It is a good supply of vitamin A and vitamin C. Alkaloids, protein, quinine, saponins, flavonoids, tannin, steroids, glycosides, fixed oil, and lipids are just a few examples of the various active phytoconstituents that are present. The shrub is a evergreen perennial tree. Tropical areas are where you can find this shrub as well.

Introduction:

The cruciferous plant *Moringa oleifera* Lam. (*M. oleifera*) is a member of the Moringaceae family [10]. Locals refer to *M. oleifera* as the drumstick tree or the horse-radish tree, and it is an ubiquitous food worldwide [10]. It is found in the sub-Himalayan tract of India including Bangladesh and Pakistan [5][45]. *M. oleifera* is eaten for both its nutritional and therapeutic qualities [7]. Beta-carotene, vitamin C, vitamin E, and polyphenols are abundant in *M. oleifera* leaves, which are also an excellent source of natural antioxidants [5][6]. A wide range of biological functions, including anti-inflammatory, anti-cancer, hepatoprotective, and neuroprotective functions, are currently reported to be improved by *M. oleifera* [23]. Numerous studies have also demonstrated its therapeutic benefits, including those for the treatment of diabetes, rheumatoid arthritis, atherosclerosis, infertility, pain relief, anti-depression, thyroid and diuretic control [28][29]. Large and uncommon combinations of zeatin, quercetin, beta-sitosterol, kaempferol, and caffeoyl guinic acid are found in munga vegetable. Iron, potassium, calcium, copper, zinc, magnesium, manganese, and other essential elements are found in *Moringa oleifera* [30]. Various plant components, including the bark, leaves, seeds, blossoms, roots, and immature pods, includes a significant number of valuable phytoconstituents, including reducing sugars, terpenoids, alkaloids, tannins, and steroidal aglycones [9][13]. The essential amino acids found in plant leaves help to create robust, healthy bodies [3]. Because of its ability to purify water and high nutritional value, *M. oleifera* leaves have been used in traditional medicine systems for millennia [31]. This includes the ayurvedic system of medicine, which is associated with the treatment or prevention of diseases with the use of traditional natural herbs and plant-based medicine. Plant leaves are small and challenging to collect [41]. Leaf's rich nutrient profile includes vitamins, minerals, and vital amino acids and are also abundant source of antioxidants, including chlorogenic acid, quercetin, beta carotene, and vitamin C [40][22].

Taxonomical Classification:

KINGDOM	Plantae
DIVISION	Magnoliophyta
CLASS	Magnoliopsida
SUB-CLASS	Dilleniidae
ORDER	Capparales
FAMILY	Moringaceae

GENUS	Moringa
SPECIES	oleifera

The plant *Moringa oleifera* Lam. is notable for its isothiocyanates, which have anti-bacterial activity and may help to rid your body of *H. pylori*, a bacteria linked to gastritis, ulcers, and gastric cancer [24][28]. It is also noteworthy for its high fibre content, which, as the epoch times put it, acts like a mop in your intestines to clean up any extra grime left over from a greasy diet [33]. Due to these reported functions, *M. oleifera*'s bioactivity has received a lot of attention over the past ten years, which has sparked an increased interest in and investigation of its pharmacological functions and underlying mechanisms [29]. In this overview, we highlight recent developments in research pertaining to its pharmacological or nutraceutical functions and associated mechanisms of action [4][22]. In this review, we will give an outline of its pharmacological potential benefits for human wellbeing [36].

Anti-microbial properties:

According to reports, extracts from the *M. oleifera* plant's seeds, stem bark, leaves, and root bark can exhibit antimicrobial potential [37]. Several studies have been performed to assess the antimicrobial activity of *Moringa* species [38]. For instance, the water-soluble lectin isolated from the extract of *M. oleifera* seeds inhibits multiple species of pathological bacteria's ability to develop, survive, and have permeable cells [35]. The extract of *M. oleifera* stems is also said to contain pterygospermin, an active antibiotic with potent antibacterial and fungicidal properties [39][27]. Micro-organism resistant *M. oleifera* seeds, stems, bark, and leaves exhibit anti-bacterial and anti-fungal properties [26]. The plant exhibits in vitro resistance to dermatophytes, yeast, bacteria, and helminths using the disc-diffusion technique [14][18].

Anti-Inflammatory:

A physiological reaction called inflammation helps the body fight illness and repair tissue damage [13]. However, persistent chronic inflammation can result in the onset of conditions like diabetes, cancer, inflammatory diseases, cardiovascular diseases, sepsis, colitis, and arthritis that are linked to persistent chronic inflammation [16]. Target cells' expression or activity of inducible NO synthase (iNOS), cyclooxygenase-2 (COX-2), and microsomal PGE synthase-1 (mPGES-1) is stimulated or increased by inflammatory cytokines like interleukin-1 beta (IL-1beta), tumour necrosis factor alpha (TNF-alpha), and nitric oxide (NO), as well as prostaglandin E2 (PGE-2) [16]. Root and bark extracts in methanolic and liquid form, as well as blossoms and leaf extracts in methanol, and an ethanolic extract of the seeds all have anti-inflammatory properties [15].

Antioxidant properties:

Strong in-vitro antioxidant and radical scavenging activity is shown by aqueous and alcoholic extracts (methanolic and ethanolic) of *Moringa oleifera* stems and leaves [20]. As an abundant source of antioxidant compounds, its leaves may shield animals from diseases brought on by oxidative stress [19][17]. Administration of an extract from *M. oleifera* leaves appears to stop the oxidative harm brought on by a high-fat diet [20].

Hepatoprotective properties:

It was determined that the ethanolic extract of *Moringa oleifera* leaves and the alcoholic extract of the seed have in-vivo hepatoprotective activity against isoniazid, rifampicin, and pyrazinamide-induced liver damage [11][14]. The effects of doses of the crude extract (CE) on the liver and kidney functions, as well as hemological and hepato-renal functions of the methanolic extract of *Moringa oleifera* roots, were also described [16]. Typically, polyphenol-rich natural compounds have potent antioxidant qualities and can reduce oxidative damage by acting as free radical scavengers [7].

Anti-Cancer activity:

In the United States and across the globe, cancer is one of the main causes of mortality [1][15]. Effective therapeutic strategies have been used to treat a variety of cancer types, but the need for more effective treatment choices is now being driven by resistance and/or toxicity [3]. The precursor form of isothiocyanates, glucosinolates, which has been characterized as a powerful anticancer compound, is found naturally in an intact plant [6]. When the intact plant is disturbed, glucosinolates are hydrolyzed in a reaction facilitated by the enzyme myrosinase to generate isothiocyanate [3][18].

There has been a lot of research done on isothiocyanates' potential cancerous effects. According to Xiao et al., the growth of both androgen independent (PC-3) and androgen-reliant (LNCaP) human prostate cancer cells is inhibited by allyl isothiocyanates (AITC). It was stated that ethanolic extracts of *Moringa oleifera*'s leaves and seeds exhibit strong anti-tumor action. Compounds linked to thiocarbamate and isothiocyanate were discovered and functioned as tumor promoter inhibitors [18]. Interestingly, three known thiocarbamate and isothiocyanate related compounds that work as inhibitors of tumor promoter teleocidin B-4-induced Epstein-barr virus were present, which contributed to the in-vivo antitumor activity [18].

Anti-Diabetic activity:

The pharmacological actions of the leaves of *M. oleifera* have been described for the conventional treatment of diabetes mellitus (DM), a chronic metabolic disorder [9]. A previous study found that *M. oleifera* can reduce glucose intolerance, and this study supports this finding by showing that supplementing with the aqueous extract of *M. oleifera* leaves at a dose of 100 mg/kg can improve insulin sensitivity, boost total antioxidant capacity (TAC), and improve immune tolerance [9][40]. Can also lessen difficulties brought on by diabetes [21]. Similar to this, its fruit powder's methanol extract is abundant in N-benzyl thiocarbamates, N-benzyl carbamates, and benzyl nitriles, which can cause pancreatic beta cells to release insulin, which in turn reduce the activity of cyclooxygenase and inhibit lipid peroxidation [29].

Conclusion:

The genus of Moringaceae family, *Moringa oleifera* has a wide range of pharmacological properties [36]. Additionally, the majority of plant components, including seeds, leaves, flowers, and roots, are used in the therapy of numerous diseases [29]. Aqueous, ethanolic, and methanolic extracts are reportedly frequently used for research, identifying, and estimation purposes [33]. In the future, the active ingredients can be separated and created into dosage forms and transport systems that are appropriate [38]. Additionally, in vivo research based on animal models can be carried out in the future for improved results [48].

Through the execution of its powerful anti-inflammatory activity, inhibition of the activation of the NF- κ B and PI3K/Akt pathways, mitigating oxidative stress by scavenging free radicals, and enhancing neuroprotective roles, *M. oleifera* possesses a broad variety of medicinal and therapeutic properties [38]. *M. oleifera* can also control blood sugar levels and lower the chance of developing cancer, though the underlying mechanisms need more research [23][46]. As a result, *M. oleifera* offers the possibility of preventing or treating a number of chronic illnesses [27][39].

Conflict of Interest:

There are no conflicts of interest, according to the writers.

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