Phytoconstituents and Medicinal Potential of *Moringa oleifera*

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***Abstract*: *Moringa oleifera (Moringaceae),* commonly recognized as Moringa, is a medicinal plant, is native to northwestern India, and is widely cultivated in tropical and subtropical areas. The leaves, tender pods, and seeds can serve as an appreciated source of nutrients for entire age groups. This phytochemicals and pharmacological action display biological activities like anti-diabetic, anti-cancer, anti-allergic, anti-obesity, cardiovascular activity with its high nutritive values, every parts of the tree are appropriate for either nutritional or marketable purposes. The leaves are rich in minerals, vitamins, and other important phytochemicals. Extracts from the leaves are used to treat malnutrition, augment breast milk in lactating mothers as well as the therapeutic uses of this plant. *M. oleifera* has varied traditional and pharmacological uses in various pathophysiological conditions. We will review the numerous belongings of *M. oleifera* (Moringaceae) and effort on its numerous therapeutic properties.**

***Keywords*: *Moringa oleifera*, Anti-diabetic, Anti-cancer, Cardiovascular activity, Phytochemicals.**

1. INTRODUCTION

Moringa oleifera is a medicinal plant also known as the drumstick tree, the miracle tree, the ben oil tree, or the horseradish tree. Moringa has been used for centuries due to its health benefits and nutrition values. It also has antifungal, antiviral, antidepressant, and anti-inflammatory properties to treat many diseases.[1]It is belonging to the family of *Moringaceae* is an effective remedy for malnutrition. Moringa is rich in nutrition with the presence of variations of important phytochemicals present in their leaves, pods, and seeds. The Nutrition values of moringa are said to deliver 7 times extra vitamin C than oranges, 10 times more vitamin A than carrots, 17 times extra calcium than milk, 9 times extra protein than yogurt, 15 times extra potassium than bananas, and 25 times extra iron than spinach.[2] *M. oleifera* is full-grown in any tropical or subtropical areas of the world with a temperature of 25–35 °C. It involves sandy or loamy soil with a slightly acidic to slightly alkaline pH and a net rainfall of 250–3000mm.[3] Soil is a significant factor responsible for the growth, strength, and Nutrition values of plants.[4] Every part of *the M. oleifera* plantis considered as a storage house loaded with important nutrients and antinutrients. The leaves of *M. oleifera* are rich in minerals like calcium, potassium, zinc, magnesium, iron, and copper.[5] Moringa has a lot of important minerals for growth and growth among like calcium is one of the important minerals for human growth. While 8 ounces of milk can offer 300–400 mg, moringa leaves can offer 1000 mg and moringa powder can provide more than 4000 mg. Moringa powder can be used as an additional for iron tablets, for treating anemia. Beef has only 2 mg of iron through moringa leaf powder has 28 mg of iron. It has been described that moringa comprises more iron than spinach.[6] The different result show a qualified to the fact that the location, climate, and the environmental factors may affect the nutrient contented of the tree.[7]*M. oleifera* is a fast-growing, deciduous tree that can influence the height around 10–12 m (32–40 ft) and trunk diameter is around 45 cm (1.5 ft).[8] The bark has a whitish-grey color and is enclosed by a thick cork. Young shoots have purplish or greenish-white color, hairy bark. The tree looks like an open crown of drooping, fragile branches and the leaves build up a feathery foliage of tripinnate leaves. The flowers are fragrant and hermaphroditic, enclosed by five unequalsthinly veined with the yellowish-white color of petals. The flowers are about 1.0–1.5 cm (1/2") long and 2.0 cm (3/4") wide. They grow in the shape of slender, hairy stalks in dispersal or drooping flower clusters which have a length around 10–25 cm. Flowering initiates within the first six months after planting. In seasonally cool areas, flowering only occurs once a year between (April and June). In more constantwith periodic temperature and thecontinuous rainfallresults flowering can happen twice or even all year-round. The fruit is a hanging, three-sided brown pod of 20–45 cm size which clutches dark brown, globular seeds with a diameter of around 1 cm. The seeds have three whitish papery wings and are circulated by wind and water.[9]

1.1 Production area

India is the largest producer of moringa plants considered as a medicinal plant with an annual production rate of 1.2 million tonnes of fruits from an area around 380 km^2. Moringa is alsogrown in home gardens like as living fences in South Asia and Southeast Asia.It is commonly sold as a product in local markets. In the Philippines and Indonesia, it is commonly grown for their leaves which are used as food material.It isdynamically cultivated by the World Vegetable Center in Taiwan. In the center of vegetable researchcommonly, moringa grown in the wild or is cultivated in Central America and the Caribbean, northern countries of South America, Africa, South & Southeast Asia, and various countries of Oceania. As of 2010, cultivation in Hawaii, for commercial circulation in the United States, was in its early phases. [10]Moringaceae is an only genus family of shrubs and trees, which include of 13 species, distributed in the Indian Subcontinent *(M. oleifera and M.concanensis),* Kenya *(M.longituna and M.rivae),* northeastern and Southwestern Africa (*M. stenopetala),* Arabia, and Madagascar *(M.drouhardii and M.hildebrantii).*[11]

1.2 Malnutrition relief

The medicinal plants*M.oleifera*have been used to fight malnutrition, specifically among infants and nursing mothers.[12] Since moringa thrives in arid and semiarid environments.It may provide versatile, nutritious food sources throughout the year.[13] Moringa leaves has been proposed as rich iron in food source to combat iron deficiency.[14] In further studies, it is desirable to test applied applications for using this dietary source and its iron bioavailability.

1.3Yield and harvest

M. oleifera can be cultivated for its leaves, pods, and its kernels for oil extraction and some treatment in water purification. This yield is wide, depending on the period, variety, fertilization, and irrigation regimen. Moringa yields best under thewarm, dry environment with some supplemental fertilizer and irrigation factor.Garnering is completedphysically with knives, sickles, and stabs with attached hooks.[10] Pollarding, coppicing, and lopping or pruning are recommended for encouraging branching, increasing production, and simplify harvesting for better result.[15]

2. PHYTOCHEMICALS

Phytochemicals are chemicals of plant source[16] Phytochemicals (from Greek *phyto*n, meaning "plant") are the chemicals produced by plants through primary or secondary metabolism.[17][18] They usuallyshow biologicalactivity in the plant host. They play an important role in plant growth or defense against competitors, pathogens, or predators.[17]Phytochemicals are usually regarded as research compounds rather than vital nutrient ionbecause it express their likely health effects which has not been established yet.[19][20]

2.1 Phytochemical constituents

Different parts of the plant of *Moringa oleifera* has been established as being good sources of unique glucosinolates, flavonoids and phenolic acids [21] carotenoids, tocopherols, polyunsaturated fatty acids (PUFAs), have highly bioavailable minerals. [22] Among glucosinolates, 4-O-(a-L-rhamnopyranosyloxy)-benzyl glucosinolate (glucomoringin) is the most predominant present in the stem, leaves, flowers, pods, and seeds of *M. oleifera*. [23] Although in the roots, benzyl glucosinolate (glucotropaeolin) is the most prominent. The maximum content of glucosinolate is found in the leaves and seeds. The enzymatic catabolism of glucosinolates by the endogenous plant enzyme myrosinase produces isothiocyanates, nitriles, and thiocarbamates are known as strong hypotensive (blood pressure lowering) and spasmolytic (muscle relaxant) effects.[24] Among flavonoids, flavonol glycosides (glucosides, rutinosides, and malonyl glucosides) of quercetin > kaempferol > isorhamnetin are mostly found in various parts of the tree, except in the roots and seeds. In the leaves, the amount of quercetin and kaempferol was found to be in the range of 0.07–1.26 and 0.05–0.67 %, respectively. Also, with the different varieties, the Indian varieties (PKM-1 and PKM-2 Moringa seeds) have shown a higher total content of quercetin and kaempferol, compared to the African indigenous samples.[25] The potent antioxidant activity of *Moringa oleifera* is attributed to the high concentration of these polyphenols of late, seven major cultivars of this plant from Pakistan have been characterized for their polyphenolic, nutrient, and antioxidant potential. The quercetin, apigenin, and kaempferol derivatives were recorded as the major flavonoids in the hydromethanolic extracts of the Moringa foliage, corresponded to 47.0, 20.9, and 30.0 % of the total flavonoids (on an average), respectively. The variable in the concentrations of phenolics with the antioxidant capacity of the tested foliage established ‘Pakistan Black’ and ‘Techiman’ as the most nutritive cultivars, compared to the other major cultivars of this *Moringa oleifera* from Pakistan.[26] 5-Formyl-5,6,7,8-tetrahydrofolic acid (5-HCO-H4folate; 502.1 µg/100 g DW), 5,6,7,8-tetrahydrofolic acid (H4folate; 223.9 µg/100 g DW), 5-Methyl-5,6,7,8-tetrahydrofolic acid (5-CH3-H4folate; 144.9 µg/100 g DW), and 10-Formylfolic acid (10-HCO-folic acid; 29.0 µg/100 g DW) are the major forms of folates found in the foliage of this *Moringa oleifera*.[27] Additionally, these forms are highly bioavailable in animals, compared to other folate-rich foods, such as green leafy vegetables. Relative bioavailability, designed as the response of Moringa folates related to the response of synthetic folic acid in a rat model, was recorded as 81.9 %. In the calculations of the recommended dietary allowances (RDA), only 50 % of natural folate is assumed to be bioavailable. Thus, it is suggested that *M. oleifera*-based food can be used as a significant source of folate, because of significantly advanced bioavailability in animals. Folate is one of the most important water-soluble vitamins, plays an essential role in various cellular metabolisms, including oxidation and reduction of one-carbon units.[28] Folate deficiency causes severe chronic diseases and developmental disorders, including neural tube defects (NTDs) during pregnancy.[29] Thus, a folate-sufficient diet is strongly recommended during pregnancy to prevent NTDs and other chronic dysfunctions.

The foliage, flowers, and immature pods (fruits) of various commercially grown Indian cultivars of *M. oleifera* have been categorized by the content of carotenoids.[21] All-E-lutein the major carotenoid in foliage and immature pods (fruits), accounting for 53.6 and 52.0 % of the total carotenoids, respectively. Other carotenoids, such as all-E-luteoxanthin, 13-Z-lutein, all-E-zeaxanthin, and 15-Z-β-carotene have also been found in negligible quantities. Among various issues, the highest content of total carotenoids is recorded in leaves (44.30–80.48 mg/100 g FW), followed by immature pods (29.66 mg/100 g FW), and flowers (5.44 mg/100 g FW). Among the various Indian cultivars, the highest content of all-E-zeaxanthin, all-E-β-carotene, and total carotenoids were recorded in the Bhagya (KDM-1) cultivar.[21] The M.oleifera leaves are a rich source of α-tocopherol (vitamin E), accounting for 17.3 mg/100 g FW in the PKM-1 cultivar with evidence from various studies, the foliage of M.oleifera is recognized as a rich source of carotenoids and tocopherols. These vitamins are significantly degrading through dehydration and the other processes that occur in the Moringa foliage. [30] Thus, experiments have also been conducted toward improve the content of these vitamins in the foliage of *M. oleifera* [31], and interestingly, foliar administration of biotic elicitors (carboxymethyl chitosan and chitosan) and signaling molecules (methyl jasmonate and salicylic acid) is potentially beneficial for the improvement of major carotenoids and α-tocopherol in the foliage of field-grown *M. oleifera* trees. Elicitation with 0.1 mM salicylic acid (SA) has been found to accumulate 49.7 mg/100 g FW of α-tocopherol, which represents a 187.5 % increase, compared to the untreated control. There is

an excellent perspective for the enhancement of these vitamins in the foliage that can be useful for improving the nutraceutical benefits of this tree.

The *M. oleifera* leaves are also established as a rich source of omega-3 (ω-3) and omega-6 (ω-6) polyunsaturated fatty acids (PUFAs), in the form of α-linolenic acid (C18:3, ω-3, 49–59 %), and linoleic acid (C18:2, ω-6, 6–13 %). Palmitic acid (C16:0) is verified in the major saturated fatty acid, accounting for 16–18 % of the total fatty acids in the Moringa leaves. Immature pods and flowers are characterized by a higher content of total monounsaturated fatty acids (MUFAs, 16–30 %) and are low in PUFAs (34–47 %), compared to the leaves.[32] In contrast, the seeds and seed oil have a high content of oleic (18:1, 70–80 %), palmitoleic (16:1, 6–10 %), stearic (18:0, 4–10 %), and arachidic acid (20:0, 2–4 %), and a lower content of oleic, linoleic, and linolenic acid.[23] This seed oil contains an identical fatty acid profile such as olive oil except for linoleic acid.[34] To obtain the highest production of oil from seeds, the solvent-assisted extraction using chloroform and methanol in the ratio of 3:1 at 100 °C is seen to be maximum favorable. However, oil extracted with these solvents is not suggested for human consumption because of their residual amount of these toxic substances. Thus, hexane is regularly used in the extraction of oil from Moringa seeds, because of its efficiency and ease of recovery. The thermogravimetric analysis (TGA) analysis revealed that the oil degrades at a temperature of about 425–450 °C. [33] In terms of health effects, the *M. oleifera* leaves, immature pods, flowers, seeds, and seed oil has a low saturated fatty acid (SFAs) content and high monounsaturated fatty acids(MUFA) and polyunsaturated fatty acids (PUFA) content that can enhance the health benefits of Moringa-based foods. The facts of fatty acids from seeds are given in the methyl esters (Biodiesel) unit.

Potassium (K), calcium (Ca), and magnesium (Mg) are the major minerals found in the *M. oleifera* tissues. The highest content of K is found in the vegetative parts and immature pods, whereas, leaves and seeds are a rich source of Ca and Mg, respectively.[20] *M. oleifera* is also recorded as having a rich source of iron (Fe) (17.5 mg/100 g DW). In a bioavailability study directed on a rat model, Fe from the Moringa leaf was found to be superior compared to ferric citrate, in overcoming iron deficiency. [34] Significantly changed in the expression (up to 100-fold) of liver hepcidin antimicrobial peptide (HAMP) and other liver iron-responsive genes are also recorded in response to the Fe deficiency, suggesting that the relative expression of liver hepcidin (HAMP). mRNA can be used as the most sensitive molecular marker to detect iron-deficiency in animals. The results of animal bioavailability studies suggest that Moringa foliage can be used as a significant source of iron, because of its significant toward higher bioavailability.

Full-fat and defatted *M. oleifera* kernels are recorded as being rich in protein content and account for 36.18 and 62.76 %, respectively. The concentrations of the other proximate constituents were found to be higher in defatted flour, compared to full-fat flour. Defatting also increased water absorption, fat absorption, foaming capacity, and foam stability of flour.[35] The author suggested that the *M. oleifera* kernel flour could be used as a valuable source of protein in food product formulation. In the proximate studies from Brazil, the dehydrated leaf powder was recorded to contain 44.4 % carbohydrate, 28.7 % crude protein, 10.9 % ash, 7.1 % fat, 103.1 mg/100 g iron, and 3.0 mg/100 g calcium. Similarly, the protein profile showed 70.1 % insoluble proteins, 3.5 % glutelin, 3.1 % albumin, 2.2 % prolamin, and 0.3 % globulins. Antinutritional compounds, such as tannins (20.7 mg/g), trypsin inhibitor (1.45 TIU mg/g; Trypsin Inhibitor Units), nitrates (17 mg/g), and oxalic acids (10.5 mg/g) were also predictable.

Oyeyinka and Oyeyinka [36] recently review the possibilities of food fortification with *M. oleifera* leaf, seed, and flower powder to improve the nutritional values. Authors describe the fortification possibilities in various staple foods such as Amala (stiff dough), ogi (maize gruel), bread, biscuits, yogurt, and cheese for making soups.

3. MEDICINAL POTENTIAL

M. oleifera is often mentioned to as a panacea and can be used to cure more than 300 diseases. Moringa hasbeen long used in herbal medicine by Indians and Africans. The presence of phytochemicals varieties it a good medicinal agent. In this section, the effect of moringa on diseases like diabetes and cancer are reviewed.

3.1. Anti-diabetic properties

Moringa has been exposed to cure both Type 1 and Type 2diabetes. Type 1 diabetes is one where the patients suffer from non-production of insulin, which is a hormone that maintains the bloodglucoselevel at the required normal value. Type 2 diabetes is linked with insulin resistance. Type 2 diabetes might also be due to Beta-cell dysfunction, which fails to sense glucoselevels, hence decreases the signaling to insulin, resulting in high blood glucose levels [37]. Some studies have shown that moringa can act as an anti-diabeticagent. A study has shown that the aqueous extracts of *M. oleifera* can medicate streptozotocin-induced Type 1 diabetes and also insulin resistant Type 2 diabetes in rats [38]. In another study, the researchers fed the streptozotocin (STZ)induceddiabetes rats with Moringa seed powder and noticed that the fasting blood glucose dropped. [39] Also when the rats were treated with about 500 mg of moringa seed powder/kg body weight, the antioxidant enzymes increased in the serum. This shows that the antioxidants are present in moringa can bring down the Reactive Oxygen Species caused in the Beta-cells due to the STZ induction [40] STZ causes. ATP dephosphorylation reactions and helps xanthineoxidase in the formation of superoxide's and Reactiveoxygenspecies (ROS) in Beta cells[41]in hyperglycemic patients, the beta cells get destructed. Therefore, high glucose enters the mitochondria and releases reactive oxygen species. Since beta cells have a low number of antioxidants, this in turn causes apoptosis of the beta cells. [42] This reduces insulinsecretion leading to hyperglycemia and in turn diabetes mellitus Type-2. The flavonoids like quercetin and phenolics have been attributed as antioxidants that bring about a scavenging effect on ROS. It can be hypothesized that the flavonoids in Moringa scavenge the ROS released from mitochondria, thereby protecting the beta cells and in turn keeping hyperglycemia under control.[43] These AGEs bind to RAGE which gets expressed on the surface of immune cells. This interaction leads to increased transcription of cytokines like interleukin-6 and interferons. At the same time, the celladhesionmolecules are expressed on the surface endothelium of arteries. [44] This facilitates trans endothelial migration which causes inflammation in the arteries and leads to atherosclerosis. Moringa is used as an anti-atherosclerotic agent. [45]The anti-atherogenic nature can be reported for by the antioxidant properties of moringa.

3.2. Anticancer properties

Cancer is a common disease and one in seven deaths is attributed due to improper medication and facilities toward cancer. Around 2.4 million cases are prevalent in India, while there are no specific reasons against cancer development. Some factors are responsible like smoking, lack of exercise, and radiation exposure that can lead to the disease.[46 Researches show that the reactive oxygen species induced in the cells leads to apoptosis. This is further proved by the up-regulation of caspase 3 and caspase 9, which are part of the apoptotic pathway [47]. Moreover, the ROS production by moringa is specific and targets only cancer cells, making it an ideal anticancer agent[47] also displayed that the extracts increased the appearance of glutathione-S-transferase, which inhibits the expression of antioxidants. Anticancer agents targeting cancer using ROS induction are common, but these substances should also be able to attack the antioxidant enzymes [48]. However, Moringa leaf extracts are antioxidants and anticancer agents that induce ROS. The exact behavior of the two contrary attributes of the leaves is yet to be explored. The compounds of the leaves that are held responsible for the anticancer activities are glucosinolates, niazimicin, and benzyl isothiocyanate [49]. Benzyl isothiocyanate is linked with cancer. Research shows that BITC causes intracellular ROS, which leads to cell death. This could be one of the explanations for moringa to be a good anticancer agent [50].

In pharmacology, the term mechanism of action (MOA) refers to the specific biochemical interaction through which a drug substance produces its pharmacological effect.[51] A mechanism of action usually includes mention of the specific molecular targets to which the drug binds, such as enzyme or receptor.[52] Receptor sites have specific affinities for drugs based on the chemical structure of the drug, as well as the specific action that occurs there.

3.3 Analgesic, anti-inflammatory, and Anti-pyretic activities

Almost every part of this medicinal plant *Moringa oleifera* has been found to exhibit analgesic activity in different animal models. Extract of leaves, seeds, and bark showed significant analgesic activity in both central (hot plate method) and peripheral models (acetic acid-induced writhing method) in a dose-dependent manner,[53] and extracts of leaves exhibited analgesic potency similar to that of indomethacin[54] and antimigraine properties in a dose-dependent manner.[55] Topical applications showing efficacy against multiple sclerosis–induced neuropathic pain.[56]The anti-inflammatory activity of leaf extract has been observed in a carrageenan-induced paw edema model.[57] Extracts of bark showed anti-inflammatory activity comparable to diclofenac in the same model. Anti-inflammatory properties of the root have also been reported.[58] The mechanism underlying the anti-inflammatory activity may be attributed to the regulation of neutrophils and the c-Jun N-terminal kinase pathway.[59] Active ingredients that contribute to the anti-inflammatory property are tannins, phenols, alkaloids, flavonoids, carotenoids, β-sitosterol, vanillin, hydroxymellein, moringine, moringinine, β-sitostanol, and 9-octadecenoic acid.[60]Leaf extract showed significant antipyretic activity in Brewer's yeast–induced pyrexia model.[61] Ethanol and ethyl acetate extracts of seeds also showed significant antipyretic activity.[62]

3.4 Neuropharmacological activity

Aqueous extract of leaves has shown protection against Alzheimer's disease in a colchicine-induced Alzheimer's model using behavioral testing (radial Y arm maze task).[63] It protected against Alzheimer's disease by altering brain monoamine levels and electrical activity.[64] Another study shows the using toluene-ethyl acetate fraction of methanolic extract of leaf showed potent nootropic activity.[65] Leaf extract contains vitamins C and E, which play a significant role in improving memory in patients with Alzheimer's disease.[66]

Anticonvulsant activity of leaves was shown in both pentylenetetrazole and maximum electric shock models using male albino mice.[67] Aqueous extract of root suppressed penicillin-induced epileptic seizures in adult albino rats.[68] Ethanolic extract of leaves exhibited both central nervous system depressant and muscle relaxant activities in actophotometer and rotarod apparatuses, respectively,[69] and also exhibited significant anxiolytic activity in staircase test and elevated plus maze test in a dose-dependent manner.[70]

3.5 Cardiovascular activity

Extract of *M. oleifera* leaf significantly reduced cholesterol levels and displayed a protective role on hyperlipidemia induced by iron deficiency in male Wistar rats.[71] The antihypertensive effect of leaf extract on spontaneously hypertensive rats was shown, in addition to reduced chronotropic and inotropic effects in isolated frog hearts.[72] Active constituents for hypotensive action are diazinon A, diazinon B, and niazimicin.[73] Extract of leaves also showed cardioprotective effects against isoproterenol-induced myocardial infarction in male Wistar albino rats; the mechanism underlying this cardioprotective activity was found to be the antioxidant effect, prevention of lipid peroxidation, and protection of histopathological and ultrastructural disturbances caused by isoproterenol.[74] A study was done of *Moringa oleifera* Lam. on various tissue systems and it showed a reduction in inflammation and lipid accumulation.[75]

3.6 Anti-allergic activity

Ethanolic extract of seeds inhibited passive cutaneous anaphylaxis induced by anti-immunoglobulin G (IgG) antibody and histamine release from mast cells; the mechanism underlying this action could be membrane-stabilizing action [76] and also reduced scratching frequency in an Ovalbumin sensitization model.[77]

3.7 Antiasthmatic activity
Extract of seeds showed protection against asthma as investigated in various models; the proposed mechanism for this effect was a direct bronchodilator effect combined with anti-inflammatory and antimicrobial actions[78]and inhibition of the immediate hypersensitive reaction.[79] Ethanol extract of seeds tested against ovalbumin-induced airway inflammation in guinea pigs shows a significant increase in respiratory parameters and reduction in interleukins in bronchoalveolar lavage.[80]

3.8 Anti-obesity activity
Significantly the reduction in body mass index was observed after oral treatment with leaf powder compared with their in obese control.[81]Treatment of hypercholesterolemia rats with methanolic extract of *M.Oleifera* leaf for 49 days showed a remarkable reduction in total cholesterol, triglycerides, and body weight, moreover, liver biomarkers, organ weight, and blood glucose levels are also decreased.[82] Mechanisms include the downregulation of mRNA expression of leptin and resistin and upregulation of adiponectin gene expression in obese rats.[83]

3.9 Anti-urolithiasis activity
Aqueous and alcoholic extracts of this plant showanti-urolithic activity in a hyperoxaluria-induced rat model[84] and ethylene glycol–induced urolithiasis model.[85]

3.10 Diuretic activity
Leaves, flowers, seeds, roots, and bark extracts of *M. oleifera*increase urine output in rats, extract of leaf showed a dose-dependent diuretic action greater than control but less than hydrochlorothiazide. Campesterol, stigmasterol, β-sitosterol, and avenasterol were responsible for this activity.[86]

3.11 Wound-healing activity
Extracts of the leaf, dried pulp, and seeds showed a significant increasein hydroxyproline content, wound-closure rate, granuloma-breaking strength, and granuloma dry weight, and in a decrease in scar area and skin-breaking strength in incision, excision, and dead space wound models in rats.[87] Improvement in tissue regeneration, decreased wound size, down regulated inflammatory mediators, and upregulated vascular endothelial growth factor in wound tissues and remarkable antiproliferative and anti-migratory effects on normal human dermal fibroblasts.[88]

CONCLUSION
This review highlights the benefits of *M. oleifera*as a medicinal plant and good source of nutrients. *M. oleifera*is highly distributed in the field of pharmacological and ethnomedicaluses. This plant contain a profile of important minerals, amino acid and various phenolic groups. It shows the biological activities to overcome malnutrition, Anti-diabetic, Anti- allergic, Anti-microbial, wound healing, diuretic, Anti-urolithiasis, Anti-obesity,Antiasthmatic,Cardiovascular,Neuropharmacological,Analgesic, anti-inflammatory, and Anti-pyretic activity. Almost every parts of the tree are eaten or used as components in traditional herbal medicines.

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