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A review on *Moringa oliefera* plant and Pharmacolgical activities of root.

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ABSTRACT:
Plants have always played a vital role in maintaining human health and well-being,and their medicinal properties have been recognized since ancient times. Among various medicinal plants, *Moringa oleifera* (Moringaceae), commonly known as the "miracle tree" has attracted significant scientific and traditional intrest due to its wide range of Therapeutic applications. This review highlights the plant's morphology, geographical distribution, traditional uses, phytochemistry and Pharmacological actions. Traditionally *Moringa oleifera* has been used valued for healing wounds and managing various ailments. Recent studies further support its role in antimicrobial, antidiabetic, antioxidant, antiepileptic, antiulcer, antidiarrheal, antiurolithiatic, anticancer, and antiproliferative activities. By compiling updated scientific evidence, this review aims to provide a comprehensive understanding of traditional attributes of *Moringa oleifera* with its pharmacological activity.

KEYWORDS: Moringa oliefera, root, flavonoids, ethanolic extracts, pharmacological activities, tannins .

I. INTRODUCTION:

The WHO reffered to good health as a state of physical and mental well-being not altered by any disease or ailment. The Moringa is medium-sized tree *Moringa oleifera*, also called drumstick, Sahjan, Moringa, etc., is grown commercially primarily for its many purposes. Moringa is gaining popularity as an affordable and practical source of bio-fortified nutrients[1].Its pharmacological efficacy is attributed to diverse secondary metabolites, including alkaloids, tannins, flavonoids, saponins, coumarins, quinones, and resins[2]. The fresh *M.oleifera* leaves are recommended for anaemia and are good for expectant and nursing mothers since they increase milk production. The Leaf juice helps diabetic individuals manage their blood sugar levels and stabilise their blood pressure. In several nations, traditional medicine uses of *M. oleifera's* roots, leaves, and flowers to cure hypertension and diarrhoea. In addition to being used as an aphrodisiac, the root powder can help treat rheumatism, asthma, gout, and enlarged liver or spleen when combined with milk[3].

PLANT PROFILE:

M. oleifera, popularly known as the horseradish tree, is the best-known of these species. The 14 species that comprise the Moringa genus are members of the Moringaceae family. This plant has been utilized for more than 2000 years, and Indian ayurvedic literature note its benefits to the environment and human health[4].

MORPHOLOGY:

Moringa oleifera's leaves are compound, which means they are made up of many leaflets grouped in a pinnate pattern. Each leaf is around 30-60 cm (12-24 inches) long and consists of 3-5 pairs of lanceolate or elliptical leaflets. The leaflets measure approximately 1-2 cm (0.4-0.8 inches) wide and 3-4 cm (1.2-1.6 inches) long. The leaves are dark green, with a slightly bitter taste.

Moringa oleifera blooms are tiny, white or cream-colored, and have five petals measuring around 1 cm (0.4 inches) long. They are grouped in clusters or panicles that can be as long as 25 cm (10 inches).

Moringa oleifera fruit is a long, thin pod of around 30-60 cm (12-24 inches) in length and 1-2 cm in diameter. The pod is green while young, but turns brown as it matures. It has many little spherical seeds that measure around 1 cm (0.4 inches) in diameter.

Moringa oleifera's roots are shallow and wide-spreading, allowing it to thrive in a variety of soil types and circumstances. The roots can extend

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up to double the height of the tree and reach depths of up to 10 meters (33 feet) in quest of water[5].

MORINGA OLEIFERA PLANT

FLOWER AND FRUIT OF *MORINGA OLEIFERA*

ROOTS OF *MORINGA OLEIFERA*

LEAVES OF *MORINGA OLEIFERA*

TAXONOMY[6]

Kingdom	Plantae
Super Division	Spermatophyte
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Dilleniidae
Order	Capparales
Family	Moringaceae
Genus	Moringa
Species	Oleifera

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GEOGRAPHICAL DISTRIBUTIONS: Despite being indigenous to India, the *M. oleifera* plant has been grown in tropical and subtropical regions such as Africa, the Caribbean Islands, Central America, the North and South Philippines, and Cambodia[7]. India is one of the world's largest producers of Moringa, producing 1.1 to1.3 million tons of fruit each year from a 380-square-kilometre region. In India, Andhra Pradesh has the most area and production (156.65 km^2), followed by Karnataka (102.8 km^2) and Tamil Nadu (74.08 km). Moringa is planted in household gardens in states such as Odisha and as living fences in southern India and Thailand[8].

PHYTOCHEMISTRY:

Leaves contains :Flavanoids ,quercitin, isoquercitin, kaemfericitin, isothiocyanates, and glycoside compounds. Niazirin and Niazirinin-nitrile glycosides,4-[(4′-O-acetylalpha-L-rhamnosyloxy) benzyl isothiocyanate, Niaziminin A and Niaziminin B, three mustard oil glycosides, niaziminin, a thiocarbamate,4-(alpha-1-rhamnopyranosyloxy) -benzylglucosinolate,quercetin-3-O-glucosideandquercetin-3-O-(6″-Malonylglucoside),Niazimicin. Pyrrole alkaloid (pyrrolemarumine 400-O-a-L-rhamnopyranoside) and 40-hydroxyphenylethanamide (Marumoside A and B) 4. Alpha and gamma-tocopherols.

Stems contains :4-hydroxyl mellein, octacosonoic acid, beta-sitosterone, and beta-sitosterol.

Flowers contain: D-glucose, quercetin, isoquercetin, kaemopherol, kaempferitin, ascorbic acid, protein, and D-mannose.

Root: contains Protective phytochemicals like gallic acid, tannins, catecholtannins, steroids and triterponoids, saponins, anthraquinones,alkaloids, and reducing sugars in ether, ethanoland aqueous extracts. Moringine, moringinine, spirachin, 1,3-dibenzyl urea, alpha- phellandrene, p-cymene, Deoxy-niazimicine, 4-(alpha-L-rhamnopyranosyloxy) benzylglucosinolate. aurantiamide acetate 4 , 1, 3-dibenzyl urea 5 were isolated. The aglycone of deoxy-niazimicine (N-benzyl, S-ethyl thioformate)procyanidins, quercetin glycoside, rhamnoglucoside quercetin, and chlorogenic acid is present in roots[8-13].

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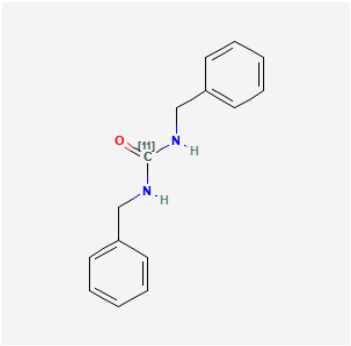
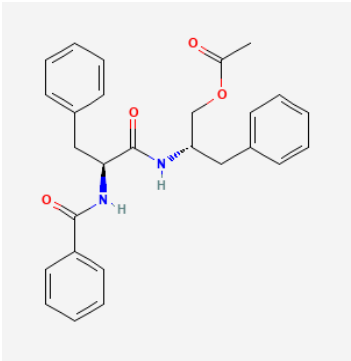
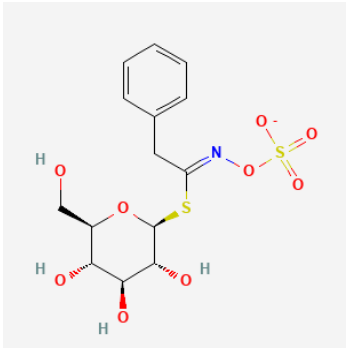


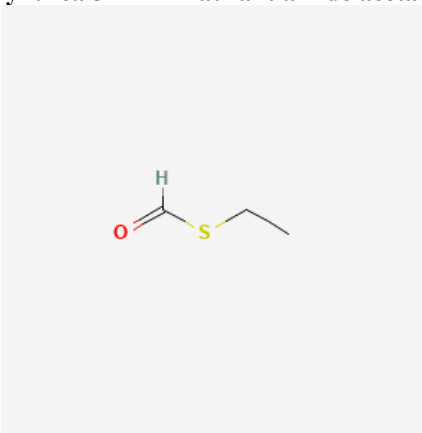
1, 3-dibenzyl urea 5



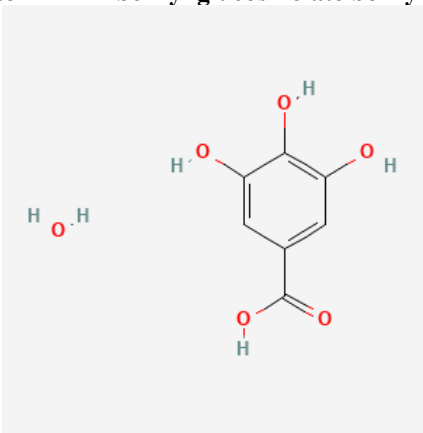
aurantiamide acetate 4



benzyl glucosinolate benzylglucosinolate



Ethyl thioformate



Gallic acid

TRADITIONAL USES:

M. oleifera has been used as food or traditional medicine in Oriental nations since antiquity. It has traditionally been utilized in India in the comprehensive system of Ayurveda because of its pharmacological qualities. It is nutritious, and nearly every part of the plant is edible. The large output of *M. oleifera* Lam and Moringa seed oil makes *M. oleifera* seeds suitable for biodiesel production. It is also utilized as animal feed because of its high nutrient content. *M. oleifera's* leaves, fruits, roots, and seeds have long been used medicinally to treat paralysis, helminthiasis, ulcers, and skin problems. In Thailand, the leaves and pods are used as antipyretics and antidotes, whereas in South Asia and India, they are utilized to prevent aging. It functions as a laxative, astringent, diuretic, cardiotonic, abortifacient, and rubefacient. Treats toothaches, colds, external sores, inflammations, stomatitis, piles, bronchitis, urinary discharges, obstinate asthma, rheumatism and epilepsy. Useful for lower back and kidney pain and constipation, and as a stimulant for nervous debility, paralytic illnesses, hysteria, and epilepsy[14].

PHARMACOLOGICAL ACTIVITIES OF *MORINGA OLEIFERA* ROOT EXTRACT.

1. **ANTIMICROBIAL, ANTIDIABETIC AND ANTIOXIDANT ACTIVITY[15]**-Tshabalala T,et.al (2020)The roots of Moringa (*Moringa oleifera*). antioxidant models including the DPPH scavenging, ferric reducing power (FRAP) as well as α-glucosidase inhibitory activity were used to evaluate and compare their bioactivity. Antimicrobial efficacy was also tested against Gram-positive (Staphylococcus aureus; Bacillus subtilis) and Gram-negative (Escherichia coli) strains and the yeast-like fungus Candida albicans using the micro dilution method. Acetone extracts of all plant parts exhibited. good antibacterial activity (MIC < 1mg/mL) against E. coli, B. subtilis and S. aureus, except for lateral root which exhibited weak activity against E. coli (MIC values N 1 mg/mL). However, all the plant part extracts exhibited low activity against C. albicans (MIC values < 1 mg/mL). Variation in the antioxidant activity was observed, with the main and lateral roots exhibiting better activity than the leaves. All

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the plant parts had better antioxidant activity than the reference compound ascorbic acid. The lateral roots had higher amounts of condensed tannins and flavonoid contents. The root extracts had significantly good antidiabetic and antimicrobial activity. This study ascertains that these different plant parts of Moringa can be suitable candidates for antimicrobial, antioxidant and antidiabetic supplementations.

2. **ANTIEPILEPTIC ACTIVITY[16]-**Rajasree PH,et.al (2012)The Extract of *Moringa oleifera* (Moringaceae) roots, a medicinal plant were used in neuro protective Ayurvedic preparations and were evaluated for its protective effect against seizures induced by Maximal Electro shock (MES) method in Male Wistar albino mice. Herbal drugs are acting at a Site. Epilepsy is a neuropsychological disorder. It is the consequence of a paroxysmal uncontrolled discharge of neuron within the central nervous system. A daily dose of 250 and 500 mg/kg of the extract was administered to the animals for 15 days, after which seizures were induced by Maximum electro shock method and the duration of various phases of epileptic attacks were recorded and compared with the control animals. A significant reduction in the time taken for recovery was noted in the experimental animals. The levels of biogenic amines such as dopamine, serotonin and nor-adrenaline in the forebrain region were also estimated and a significant level of restoration was observed in the extract treated animals. Administration of extract of *Moringa oleifera* roots for 15 days increased the seizure threshold in MES induced in mice and its possible mechanisms may be due to the inhibition of prostaglandin synthesis and monoamine oxidase enzyme.
3. **ANTIULCER ACTIVITY[17]:** Choudhary MK, et.al (2013)An ethanolic root-bark extract of *Moringa oleifera* (MO) was examined for its antiulcer potential in albino Wistar rats using two experimental models: ethanol-induced and pylorus ligation-induced gastric ulceration. The extract was orally administered at three different doses (150, 350, and 500 mg/kg) for 15 consecutive days.The antiulcer effects in rats treated with different doses of the extract and omeprazole(30 mg/kg, p.o.) were determined and compared statistically with the antiulcer effects in the control rats treated with saline (NaCl, 0.9%). The extract at doses of 350 and 500 mg/kg decreased the ulcer index significantly as compared to the control group ($p < 0.01$). The percentage protections against gastric ulcers were 82.58%, 85.13%, and 86.15% for extract doses of 150, 350, and 500 mg/kg, respectively, in the pylorus-ligated ulcer model and 55.75%, 59.33%, and 78.51%, respectively, in the ethanol-induced ulcer model. The extract significantly reduced the free acidity, total acidity, and ulcer index ($p < 0.01$) and increased the pH of gastric content compared with the control group. The mechanisms involved in the reduction of ulcers caused by administration of ethanol may be regeneration of the glandular epithelium, formation of collagen, increased capillary density, increased pH, and increased free-radical scavenging action This study suggests that Moringa oliefera root extract possesses valuable antiulcer, antisecretory, and cytoprotective activity. Thus, an ethanolic root-bark extract of *Moringa oleifera* can be used as source for an antiulcer drug.
4. **ANTIDIARRIAL ACTIVITY[18]:**GS, Paras P, et.al (2010)*Moringa oleifera* Lam. has been prescribed for a variety of ailments in traditional medicine. The study's goal is to objectively analyze the effect of a hydroalcoholic (50:50) extract of the root of *Moringa oleifera* Lam on castor oil-induced diarrhea in rats. The methanolic root extract of *Moringa oleifera* Lam at doses of 200 and 400 mg/kg significantly reduced the severity and frequency of diarrhea, intestinal fluid accumulation, intestinal content volume, and intestinal transit when compared to the normal saline control group, and was dose dependently more effective than atropine (3 mg/kg i.p).The extract's antidiarrheal action could potentially be attributed to the presence of denatured proteins, which produce protein tannates and strengthen the intestinal mucosa, reducing secretion. *Moringa oleifera* Lam root extract may be beneficial in a wide range of diarrheal states related to both transit disorders, e.g. functional diarrhoeas, radiation diarrhea, or due to aberrant secretory processes, such as in cholera or E.coli enterotoxin-induced diarrhea.
5. **ANTIUROLITHIATIC ACTIVITY[19]:** Karadi RV P <0.001) lowered the urinary excretion and kidney retention levels of oxalate, calcium and phosphate. Moreover, elevated serum levels of urea nitrogen, creatinine and uric acid were significantly (P <0.001) reduced by the extracts. The results were comparable with the standard drug,

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cystone(750 mg /kg bodyweight).The, et.al (2008)In the present study, the efficacy of the root bark of *Moringa oleifera* Lam. (Moringaceae) as an antiurolithiatic agent was investigated using an experimentally induced urolithiatic rat model. Hyperoxaluria was induced in rats using 0.75% ethylene glycol in water. Aqueous (AqE) (200 mg /kg body weight) and alcoholic extracts (AlcE) (200 mg/ kg body weight) of the root bark of *M. oleifera* were given orally in curative and preventive regimens over a period of 28 days. Both the extracts significantly (phytochemical investigation revealed the presence of saponin glycosides in Aqueous Extract of root bark of M.oleifera. The reduction of stone forming constituents in urine and their decreased kidney retentionreduces the solubility product of crystallizing salts such as calcium oxalate and calcium phosphate, which could contribute to the antiurolithiatic property of root bark of M. oleifera.

6. **CANCER APOPTOSIS ACTIVITY[20]:** Abd-Rabou AA et.al (2017)The aim of this study was to test different extracts from the *Moringa oleifera* leaves (ML), its PLGA-CS-PEG nanocomposites (MLn), as well as root core (Rc) and outer (Ro) parts for activity against hepatocarcinoma HepG2, breast MCF7, and colorectal HCT 116/ Caco-2 cells in vitro. All extracts kill the different cancer cells with different ratios, but intriguingly, the root core extract could kill the majority of cancer cells (approximately 70-80%), while sparing normal BHK-21 cells with minimal inhibitory effect (approximately 30-40%). Apoptotic cell increment came to confirm the cytotoxic effects of these extracts on HCT 116 cells (Rc: 212% and Ro: 180%, respectively) and HepG2 cells (ML: 567.5% and MLn: 608%, respectively) compared to control (100%) mechanistically wise. *Moringa oleifera* nano composites may have potential for use as a natural source of anti-cancer compounds against different cell lines. The aim of this study was to assess the potential anti-cancer effects of *Moringa oleifera* leaves (ML) as well as root core (Rc) and outer (Ro) parts, against liver, breast, and colorectal cancer cells, as well as normal kidney cells. Hence, the novelty of research is that have tested the leaves extract encapsulated PLGA-CS-PEG nanoparticles (MLn) and its free counterpart (ML) in addition to the plant root parts against these cancer types; in addition to, their impacts on sensitive and resistant colorectal cancerous cells.Moringa ML, MLn, Rc, and Ro extracts act as anti-cancer agent by decreasing cell proliferation and exhibiting apoptosis-mediated cell death in liver HepG2, colon HCT 116 and Caco-2, and breast MCF7 cancer cell lines, while Rc extract succeeded to spare healthy BHK-21 cell line with minimal cytotoxic effect. Therefore, Moringa extracts may represent a valuable therapeutic approach for aggressive breast, liver, and colorectal carcinomas.

7. **ANTIPROLIFERATIVE ACTIVITY[21]:** Abdellatef E et.al 2010.The antileukemia potency of different extract of *Moringa oleifera* roots (hot water, cold water and ethanolic extracts) were added to acute myeloid leukemia cell lines that harvested from adult patients to assess it is antiproliferative action using MTT assay. After 24 h incubation of the mononuclear AML cells with root extracts, ethanolic extract at 60 µg /ml score the highest cell death (51%) compared to cold water extract and hot water extract at the same concentration which gave 10% and 3% cell death respectively. Moringa family is rich in compounds containing anticancer activity include 4- (4'-O-acetyl--L-rhamnopyranosyloxy) benzyl isothiocy-anate and 4-(-L-rhamnopyranosyloxy) benzyl glucosinolate. Among the different used extracts, ethanolic extract killed 51% of abnormal cells among primary cells harvested from 3 patients with Acute Myeloid Leukemia. This study reveals that roots of *Moringa oleifera* contain active ingredients that were easily dissolved in ethanol and could be used as natural antitumor medicines.

8. **HYPOTENSIVE ACTIVITY[22]**: Aisha Sana AS,et.al (2015)The Hypotensive activity of M.oleifera roots was extracted with petroleum ether (PE) and dichloromethane (DC). PE extract was further divided into MRP and MRP -1. DC extract showed a thick mass during evaporation which was separated as MRDC - IN. The mother liquor left was divided into MRDC and MRDC -1. All residues were analyzed by gas chromatography mass spectroscopy (GC-MS) using ZB-5 column. Hypotensive activity was determined on urethane-anesthetized normotensive Sprague Dawly rats. Petroleum ether (MRP) and dichloromethane (MRDC) extracts of *M. oleifera* roots showed 50.06 ± 3.48 and 48.16 ± 1.79 % fall in mean arterial blood pressure

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(MABP), respectively, at a dose of 30 mg/kg ($p < 0.01$ and $p < 0.05$, respectively) compared with control. GC-MS analysis of MRP and MRDC extracts and fractions resulted in the identification of seventy four (74) compounds. Methyl hexadecanoate (**7**, 20.3 %) , stigmastan - 3, 5, diene (**24**, 19.32 %), methyl 14-hydroxy-5- tetradecenoate (**9**, 19.22 %), 1 , 11 diphenyl undecane (**47**, 18.78 %) and cyclopentanyl hexadecane (**39**, 14.44 %) were the major constituents. As far as mode of action is concerned, PE and DC extracts have opposite behavior. Stimulation of muscarinic receptors by MRP and MRP – 1 may cause the release of nitric oxide or endothelium derived relaxing factors (EDRF) that diffuse in smooth muscle cells and initiate immediate decrease in MABP (mean arterial blood pressure)The findings reveal the hypotensive potential of *M. oleifera* roots and the presence of specific hydrocarbons, fatty acid esters, thioureides, steroids and isothiocyanates in active fractions.

9. **ANTI-CHOLINESTRACE ACTIVITY[23]:** Nwidu LL, et.al (2018)The methanolic, aqueous and ethanolic extracts of *Moringa oleifera* were evaluated for inhibition of acetylcholinesterase (AChE) activity, antioxidant properties, and total phenolic and flavonoid contents using standard procedures. *M. oleifera* extracts possessed significant and concentration dependent AChE inhibitory activity for methanolic, aqueous, and ethanolic extracts. For the most potent extracts, the percentage AChE inhibition/IC50 (g/mL) values were *Moringa oleifera* root methanolic extracts (MORME): ~80%/0.00845; *Moringa oleifera* root ethanolic extract 1 (MOREE1): ~90%/0.0563; *Moringa oleifera* root ethanolic extract 2 (MOREE2): ~70%/0.00175; and *Moringa oleifera* bark ethanolic extract (MOBEE): ~70%/0.0173. The descending order of AChE inhibitory potency of plant parts were: root is greater than ,bark ,leaf, flowers, seed. All *M. oleifera* methanolic extracts at a concentration of 1000 g/mL displayed significant ($p < 0.05–0.001$) DPPH radical scavenging activity, with values of 20–50% of that of ascorbic acid. The total phenolic content and total flavonoid content (TPC/TFC) of MORME. There was an inverse correlation between plant extract AChE inhibition and total phenolic ($p<0.0001$)and total flavonoid contents ($p< 0.0012$). In summary, polyphenols inhibit lipid peroxidation by acting as chain-breaking peroxyl-radical scavengers For M. oleifera, certain terpenoids, steroids, and phenolic compounds such as tannins, coumarins and flavonoids could provide the proficient antioxidant properties. Interestingly, the AChE IC50 inhibitory concentrations for *M. oleifera* extracts were significantly inversely correlated to total phenolic and total flavonoid contents. This suggests that the agents responsible for the AChE inhibitory activity contain phenolic and flavonoid compounds. this study revealed 5 of 19 extracts of *M.oleifera* that have potent in vitro anti-cholinesterase and antioxidant activities.

10. **ANTI-FIBROTIC ACTIVITY[24]**: Park SH, et.al (2012)Fibrosis in kidney by internal and external factors causes progressive loss of renal function. Renal fibrosis is the inevitable consequence of an excessive accumulation of the extracellular matrix. TGF-β plays an important role in the process of renal fibrosis and stimulates the synthesis of profibrotic factors, including collagens, fibronectin, and plasminogen activator inhibitor (PAI-1). We examined the effect of *Moringa oleifera* Lam (moringa) extracts in a rat kidney fibrosis model. We found that moringa root extract suppresses protein expression/mRNA levels of Type I collagen, fibronectin, and PAI-1 induced by TGF-β in renal fibroblasts. Moringa root extract selectively inhibited phosphorylation of TGF-β-induced TβRII and the downstream signaling pathway (e.g., Smad4), and phospho-ERK, but not JNK, p38, or PI3K/AKT. These results suggest that moringa root extract can act against TGF-β - induced renal fibrosis in rat kidney fibroblast cells by a mechanism related to its antifibrotic activity, which regulates expression of fibronectin, Type I collagen, and PAI-1 through TβRII–Smad2/3– Smad4 and ERK. Therefore, moringa root extract is an effective substance for fibrosis therapy and provides a new therapeutic strategy for diseases associated with elevated profibrotic factor synthesis.

11. **ANTIBACTERIAL ACTIVITY[25]:**Agboke AA, et.al (2016)Bioactive components and antibacterial activities of n-hexane extract of *Moringa oleifera* root bark on clinical isolates of methicilin resistant Staphylococcus aureus was evaluated using agar dilution method. The identification and confirmation of the S. aureus were done using selective and differential medium (Mannitol salt agar) for S. aureus and

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by coagulase/staphylase test using Oxoid reagents kits (DR0595A). Pulverised *Moringa oleifera* root bark was defatted by cold maceration over night with n-hexane solvent to yield hexane extract fraction. Qualitative phytochemical analyses of the extracts were carried out using standard procedures. The antibacterial activities of hexane extract fraction were evaluated on theMRSA, the minimum inhibitory concentrations (MICs) and minimum bactericidal concentrations (MBCs) were recorded and compared with the standard disc antimicrobial test results. The extract fraction was analyzed using gas chromatographic-mass spectrometry (GC-MS) for their bioactive compounds. The results showed characterized clinical isolates to be 58.S. aureus strains. N-hexane fraction of *Moringa oleifera* contains bioactive substances which serve as promising sources of novel antibiotic prototypes. Phytochemical analysis of the extract showed the presence of alkaloids, glycosides, steroids, terpenoids, flavonoids, saponins, tannins, resins, reducing sugars, proteins, fats and oil and carbohydrates. GC-MS analysis revealed 45 distinct compounds with the following compounds dominating the fraction 9, 12-Octadecadienoic acid (41.08%), 2-Chloroethyl linoleate (41.08%), n-Hexadecanoicacid (17.35 %), 12-Octadecadienoicacid (8.55 %), Stigmasterol (4.44 %), Ergost-22-en-3-one (4.44 %) and Campesterol (3.46 %).

12. **ANTIFERTILITY ACTIVITY**[26]: Shukla S, Mathur ,et.al (1988)An aqueous extract of *Moringa oleifera* roots was investigated for its estrogenic, anti-estrogenic, progestational and antiprogestational activities. Oral administration of extract progressively increased the uterine wet weight of bilaterally ovariectomized rats. This estrogenic activity was supported by stimulation of uterine histo-architecture. When the extract was given conjointly with estradiol dipropionate (EDP), there was a successive reduction in the uterine wet weight when compared to the gain with EDP alone and uterine histological structures were also inhibited. In the deciduoma test, the highest dose of 600 mg/kg interfered with the formation of deciduoma in 50% of the rats, showing some antiprogestational activity. Doses up to 600 mg/kg of the extract orally failed to induce a decidual response in the traumatized uterus of ovariectomized rats. The antifertility effect of the extract appears to be due to multiple attributes.
13. **ANTI-TROMBOSIS**[27]: Kwon CS, et.al(2019) *Moringa oleifera* Lam (MOL) has been used as a traditional medicine to treat various cancers and inflammation. Whereas the bioactivities of the MOL leaf and seed are well reported, the study of the root is still rudimentary. In this study, the ethanol extract of MOL (EEMOL) and its subsequent organic solvent fractions were prepared and their anticoagulation activity in vitro and platelet aggregation inhibitory activity were evaluated. The EEMOL had negligible anticoagulation and strong platelet aggregation activities. However the hexane and ethyl acetate fractions of EEMOL showed significant inhibition against thrombin, prothrombin, coagulation factors, and platelet aggregation, without hemolytic activity up to 1.0 mg/ml. Our results suggest that the active fractions of MOL root have potential as new anti-thrombosis agents.
14. **ANTILIPEDIMIC ACTIVITY**[28]**:** Ogo AO, et.al (2018)Hyperlipidemia is characterized by elevated serum total cholesterol, low density lipoprotein and concomitant decrease in high density lipoprotein all of which are known risk factors for coronary heart diseases. The methanolic root extracts of *Moringa oleifera* on poloxamer 407- induced hyperlipidemia in experimental animals. Forty rats weighing 135 - 200 g were divided into 8 designated groups (n=5). Hyperlipidemia was induced in groups 2-8 animals with 1000 mg/Kg body weight of poloxamer-407. Animals in group 4 received methanol extract, while groups 5, 6, 7 and 8 received column-fractions of the extract (200 mg/kg body weight). Groups 2 and 3 received normal saline and atorvastatin (10 mg/kg), respectively, serving as hyperlipidemic and positive controls. Uninduced group 1 animals were used as negative control. Blood samples were collected after the treatment period for biochemical analysis. The methanol root extract and fractions significantly ($p < 0.05$) decreased total cholesterol, low density lipoprotein (LDL), triacylglyceride, 3-hydroxyl-3- methyl glutaryl Coenzyme A (HMG-CoA) reductase activity, and increased high density lipoprotein relative to hyperlipidemic control rats. The atherogenic indices in animals treated with methanol extract (0.35±0.33; 1.26±0.05) and fraction (0.31±0.007; 1.31±0.14) were not significantly different ($p>0.05$) compared to atorvastatin

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(0.33±0.004; 1.12±0.03), respectively. The saponins are majorly responsible for anti-lipidemic activity, which forms insoluble complexes with cholesterol or their bile salt precursor. *Moringa oleifera* extract and fractions that demonstrated positive effects on lipid profile comparable to atorvastatin possess anti hyperlipidemic potential. This finding validates its use in the management of dyslipidemia in ethnomedicine.

15. **ANTIFUNGAL ACTIVITY[29]:** El-Mohamedy RS, et.al Aqueous extracts of *Moringa oleifera* plant parts, including roots, leaves, and pods, have antifungal action against seven plant pathogenic fungi. Examples include Fusarium oxysporum, Fusarium solani, Alternaria solani, Alternaria alternata, Rhizoctonia solani, Sclerotium rolfsii, and Macrophomina phaseolina. Raj et al. (2011) found that an aqueous extract of *Moringa oleifera* (Lam.) Root inhibited the most harmful fungus and bacteria in vitro. The phytochemical screening also revealed the presence of alkaloids, flavonoids, saponins, erpenoids, steroids, tannins, cardioglycosides, aminoacids, and proteins with antifungal and antibacterial properties. *M. oleifera* extracts shown varying degrees of antifungal efficacy against the pathogens examined. The reduction effect on test pathogens was enhanced by increasing the concentration of *M. oleifera* extracts. *Moringa oleifera* root and leaf extracts may be recommended as an effective biofungicide. This is a preliminary investigation into the use of *M. oleifera* extracts as a natural fungicide against plant diseases in Egypt. Future research should focus on the root and leaf extracts of *Moringa oleifera* as potent antifungal agents against fungal plant diseases.

II. CONCLUSION

The focus of this study was reviewing the medicinal plant *Moringa oleifera* which has been traditionally used. The plant *Moringa oleifera* root belonging to the family Moringaceae, possess broad spectrum of pharmacological activities such as antimicrobial, antidiabetic, antioxidant, antiepileptic, antiulcer, antidiarrheal, antiurolithiatic, cancer apoptosis, antiproliferative, Hypotensive, anti-cholinesterase, anti-fibrotic, antibacterial, antifertility, anti-thrombosis, antilipidemic and anti-fungal activities. The further studies are needed to fully understand its medicinal properties and potential applications however the available scientific evidence suggests that this plant has significant therapeutic potential and could be valuable source of natural remedies for various health conditions. *Moringa oleifera* is promising plant species that merits further scientific investigation to fully exploit its potential health benefits and therapeutic applications.

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