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The incredible queen of green: Nutritive value and therapeutic potential of *Moringa oleifera* Lam.

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ABSTRACT

Moringa oleifera, rightly called as the miracle tree, is the extensively grown and highly valuable species of Moringaceae family. The tree has a pantropical distribution with nativity to Indian subcontinent. Nutritionally and therapeutically, it is a highly valued plant. Vitamins, proteins, β-carotene, aminoacids and various phenolics such as β-sitosterol, caffeoylquinic acid, kaempferol, quercetin and zeatin with potential for nutritional and therapeutic applications are enriched in different plant parts. Different plant parts of this plant such as roots, leaves, bark, flowers, fruit of immature pods and seeds possess a number of therapeutic properties such as diuretic, antipyretic, antioxidant, anti-inflammatory, antihypertensive, antitumor, antiulcer, antispasmodic, antidiabetic, cholesterol lowering, hepatoprotective and antimicrobial activities, and are being operational in various traditional medicine system for curing different health problems. *Moringa* is higly beneficial in depression, malnutrition, general weakness and osteoporosis. The present review is intended to emphasize the phytochemical constitution, traditional medicinal uses along pharmacological properties with the purpose to create public awareness regarding therapeutic and nutritive potential of this multipurpose tree as well as to facilitate the pharmacists and the researchers to fill the gap by exploring novel therapeutic compounds that will, of course, be in favor of humanity.

1. Introduction

Moringa oleifera Lam. (synonym: *Moringa pterygosperma* Gaertn.) (*M. oleifera*) known in 82 countries by 210 different names is well known by the name of the miracle tree. It is one of the extensively cultivated and highly valued members of Moringaceae, a monogeneric family, comprising of thirteen perennial angiosperm shrubs and trees[1-3]. *Moringa* tree is endemic to the Himalayan foothills of Pakistan, Afghanistan, Bangladesh and India, and is cultivated throughout tropics. It is recognized by a mixture of vernacular names, among of them, drumstick tree, horseradish tree, ben oil tree and malunggay are the most commonly reported in the history of this plant[4]. In Pakistan, Sohanjna is the vernacular name of *M. oleifera*[5,6]. It yields low quality timber, as it is a softwood tree, but it is belived for centuries that this plant possesses a number of industrial, traditional and medicinal benefits[7]. Fertilizer (seed cake), green manure (leaves), blue dye (wood), fencing (living trees), domestic cleaning agent (crushed leaves), alley cropping, animal feed (leaves and seed cake), medicine (all plant parts), foliar nutrient (juice expressed from the leaves), gum (tree trunks), biogas (leaves), biopesticide, ornamental plantings, water purifier (powdered seeds), honey (flower nectar) are different uses of this plant reported in literature[2,6,8-20].

M. oleifera is a good source of aminoacids and contains a number of important minerals, β-carotene, various phenolics and vitamins[21,22]. *M. oleifera* is also an important vegetable food article of trade, particularly in Pakistan, Hawaii, Philippines, Africa and India which has a huge deliberation as the natural nutrition[1,23]. In South Asia, various plant parts, including leaves, bark, root, gum, flowers, pods, seeds and seed oil are used for the variety of infectious and inflammatory disorders along with hepatorenal, gastrointestinal, hematological and cardiovascular diseases[22,24-26]. Various therapeutic potentials are also credited to different parts of

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the highly incredible tree. The plant is reported to have antitumor, hepatoprotective, analgesic, antispasmodic, antipyretic, antiulcer, diuretic, hypotensive, hypolipidemic and antimicrobial activities.

2. Morphological characters

M. oleifera is a perennial tree (maximum height: 7–12 m; diameter: 20–40 cm). The alternate, compound, pinnae and grayish-downy leaves (20–70 cm long) grow mostly at the tips of branches (Figure 1). Long petiole with 8–10 pairs of pinnae alternatively, each has two pairs of elliptic or obovate leaflets and one leaflet is present at apex which is 1–2 cm long; glands are present at the base of pinnae and petioles[10]. The flowers (2.5 cm wide), cream or white colored and yellow-dotted at the base are fragrant, produced in highly profuse form in axillary and arranged in drooping panicles (Figure 1)[10]. The fruits are hanging down from the branches represented by three lobed pods (20–60 cm long). When the pods become dry, they break into three parts. The round seeds (12–35 cm long) with a brownish semi-permeable seed hull are present in each pod (Figure 1)[27].

3. Phytochemistry

The leaves contain niazirinin and niazirin-nitrile glycosides, 4-[(4'-O-acetyl α-L-rhamnosyl oxy) benzyl isothiocyanate, and niaziminin B, niaziminin A-three mustard oil glycosides, athiocarbamate, niaziminin, quercetin-3-O-glucoside, 4-(α-l-rhamnopyranosyloxy) benzylglucosinolate and quercetin-3-O-(6''-malonyl-glucoside), 3-caffeoyl quinic acid, kaempferol-3-O-glucoside and kaempferol-3-O-(6''-malonyl-glucoside) and 5-caffeoylquinicacid, kaempferide3-O-(2'' Ogalloyl rhamnoside), kaempferide3-O-(2'',3''diacetylglucoside), kaempferol 3-O-[β-glucosyl-(1→2)-[α-rhamnosyl-(1→6)-β-glucoside-7-O-α rhamnoside, kaempferide 3-O-(2''-O-galloylrutinoside)-7-O-α-rhamnoside and kaempferol 3-O-[α-rhamnosyl-(1→2)-[α-rhamnosyl-(1→4)-β-glucoside-7-O-α-rhamnoside together with benzoic acid 4-O-α-rhamnosyl-(1→2)-β-glucoside, benzoic acid 4-O-β glucoside and benzaldehyde 4-O-β glucoside, ethyl-palmitate, hexadecanoic acid, hi-oleic safflower oil, palmitic acid ethyl ester and 4-hexadecen-6-yne, 2,6-dimethyl-1, 7-octadiene-3-ol, 3-cyclohexyliden-4-ethyl-E2-dodecenylacetate, 2-hexanone[7]. The leaves contain aspartic acid, alanine, threonine, glutamic acid, valine, glycine, isoleucine, leucine, lysine, histidine, tryptophan, phenylalanine, methionine and cysteine[28,29].

The stem contains octacosonoic acid, 4-hydroxymellein, vanillin, β-sitosterone and β-sitosterol while the flowers have kaempferol-3-rutinoside[29].

The roots contain benzyl glucosinolate and 4-(α-l-rhamnopyranosyloxy)-benzylglucosinolate, aurantiamide acetate and 1, 3-dibenzyl urea, α-phellandrene, deoxy-niazimicine, *p*-cymene[29]. Phytochemical studies on *M. oleifera* revealed major polyphenols such as rutin, quercetin, kaempferol glycosides and chlorogenic acids[30]. The researchers reported gallic acid, chlorogenic acid, ferulic acid, ellagic acid, vanillin quercetin, kaempferol[31].

The seeds contain 4(α-L-rhamnosyloxy) benzyl isothiocyanate, 4(-L-rhamnosyloxy) phenylacetonitrile 4-hydroxyphenylacetonitrile,4-(α-l-rhamnopyranosyl oxy)-benzyl glucosinolate, 4-hydroxyphenyl-acetamide, roridin E, veridiflorol, 9-octadecenoic acid, O-ethyl-4-(α-l-rhamnosyloxy) benzyl carbamate, 3-O-(6'-O oleoyl-β-D-glucopyranosyl)-β-sitosterol and β-sitosterol-3-O-β-D-glucopyranoside, niazirin, niazimicin, β-sitosterol, glycerol-1-(9-octadecanoate)[7].

The gum contains aldotriouronic acid which characterized as O-(-D-β-glucopyranosyluronic acid) (1→6)-O-β-D-galactopyranosyl(1→6)-D-galactose. A few of representative constituents were represented in Figure 2.

4. Traditional health benefits of *M. oleifera*

The traditional knowledge of *Moringa* is present in over 200 languages known in more than 80 countries, including Pakistan. *Moringa* plant has been used by Greek, Egyptian, Roman and Indian societies with writings dating back as far as 150 AD. This plant showed that ancient queens and kings used fruits as well as leaves of this miracle tree in their diet to maintain mental alertness[2]. Traditionally, *Moringa* is used as expectorant, stimulant, diuretic and antispasmodic. Root is used as vesicant and is acrid. Internally, it is used as stimulant, antilithic and diuretic (Table 1). Seeds are used as stimulant. Bark is used as antifungal, emmenagogue, antibacterial. Flowers are used as tonic, diuretic and stimulant. The plant is also antiseptic and a cardiac tonic[32]. Pods are used as anthelmintic, antipyretic and anti-diabetes. Root juice is employed as a antiepileptic, cardiac tonic, brain tonic, diuretic, anti-inflammatory, and also used for asthma, enlarged spleen and liver[33]. Decoction is used in sore throat as a gargle. Fruits and roots are used as antiparalytic. The juice of leaf is effective in hiccough and cooked leaves are used for curing catarrhal affections and influenza. The bark of root is used as analgesic, antiviral, anti-inflammatory[34]. Stem bark and flower are hypoglycemic. Seed-infusion is diuretic, anti-inflammatory and antispasmodic. Dried root bark is used in glycosuria, goitre and lipid disorders. Root, stem bark, leaf and seeds are used in piles[29] (Table 1).

Figure 1. *M. oleifera* morphology.
a: Leaves; b: Flowers; c: Pods; d: Seeds.

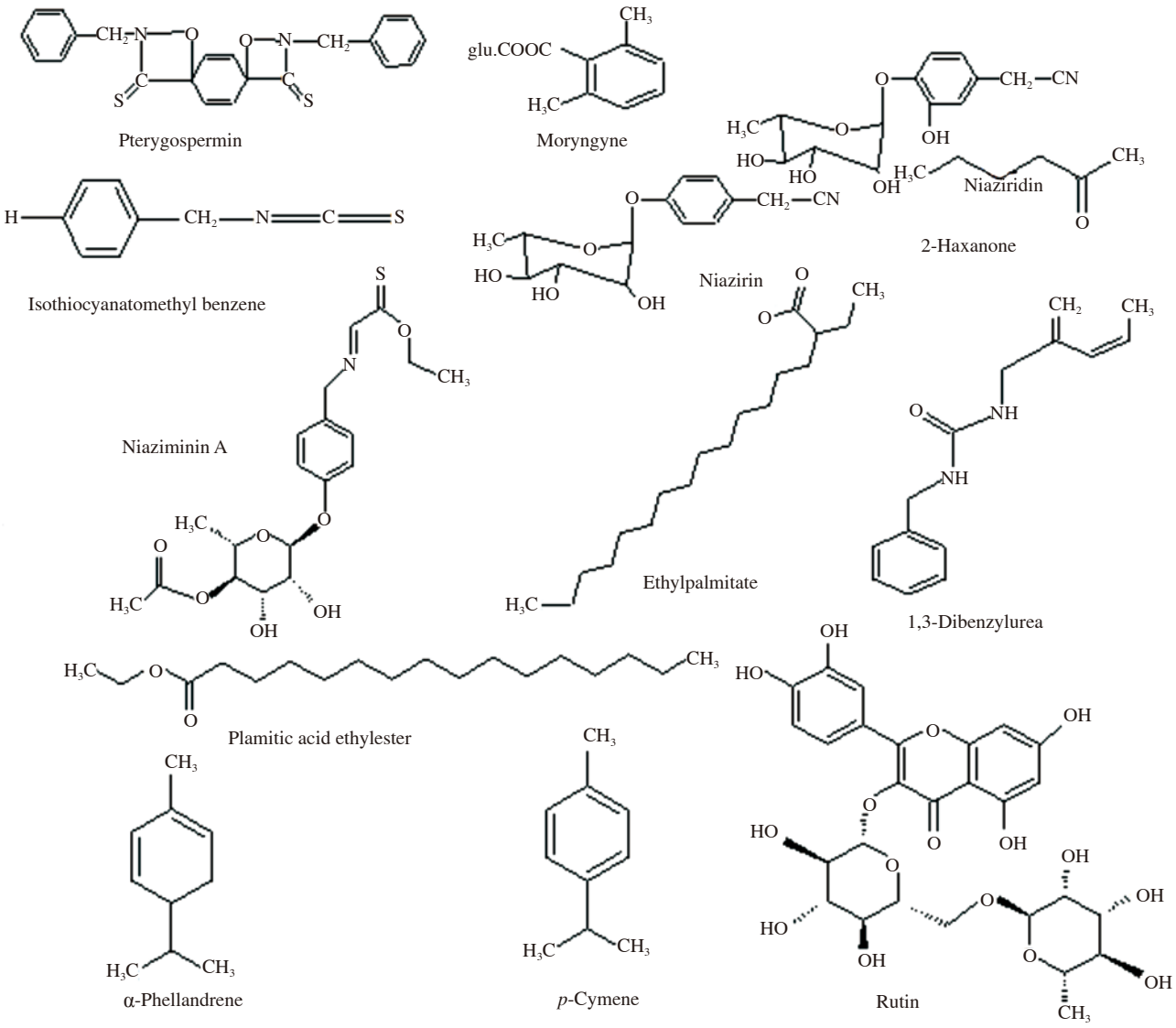

Figure 2. Chemical constituents from *M. oleifera*.

Table 1
Traditional health benefits of *M. oleifera.*

Plant parts	Health benefits	References
Leaves	Leaves relieve headache by rubbing the temple	[6,7,29,35,36]
	Poultice of leaves stop bleeding from cuts	
	Leaves produce anti-inflammatory and antibacterial effect to insect bites	
	Leaf extracts were used for skin problems caused by bacteria and fungi	
	Tea prepared from leaf treats gastric ulcers and diarrhea	
	The leaves are prescribed for anemia	
	Dried leaves treat diarrhea	
	Food products prepared from *Moringa* are good for people suffering from malnutrition	
Flowers	Flower juice is useful for urinary problems	[37]
	Boiled *Moringa* flowers taken as a tea is effective for cold and influenza	
Pods	If pods are eaten in raw form then they act as de-wormer and treat pains of the joints, spleen and liver problems	[38]
	Treat malnutrition	
Seeds	Roasted seeds treat rheumatism, arthritis, gout, cramp and boils. Pounded seeds mixed with coconut oil are applied to the problem area	[7,39]
	Roasted seeds are used as diuretic	
	A relaxant for epilepsy	
	Effective against skin-infections	
	The seed powder treats scurvy, skin diseases	
Roots, bark and gum	Bark and root are used as tonic and for curing inflammation and cardiac problems	[7,29,40,41]
	Bark is also used as appetizer	
	Roots powder are mixed with salt to make a poultice for treating rheumatism, articular pains back pain and kidney problems	
	The gum is used for treatment of asthma and also act as diuretic, abortifacient and astringent	
Oil	Seed oil is used for scurvy, hysteria and bladder problems	[42]
	Oil is used to treat stomach disorders. It is also used in hair oil perfume	

5. Nutritional facts and pharmacological properties of *M. oleifera*

Moringa is a tree that grows in almost ramshackle areas of the earth. It seems that God packed this tree with almost all the essential nutrient and made it to be pharmacy full of natural medicines in bio-available form to feed the poor of rural and barren areas. With more than 90 recognized nutrients, 36 anti-inflammatories, 46 antioxidants, *Moringa* is the most enzymatically active and nutrient-dense plant known to mankind[43]. It is analyzed scientifically that *Moringa* contains more than 539 bio-chemical activities that are absolutely beneficial to man[44]. A huge array of nutritional and medicinal qualities have been accredited to bark, roots, leaves, fruits, flowers and seeds.

5.1. Nutritional benefits

A bulk of reports exist in literature on the nutritional values of *Moringa*. The nutritional contents include vitamin A, which provides protection against skin diseases, eye disease, gastrointestinal ailments, heart ailments and many other health problems; vitamin C, which enhances immunity during different complaints including flu and colds; Ca, which makes the teeth and bones strong and prevents osteoporosis and K, which is essential for proper brain functioning and proteins, the building blocks of cells of our body[2,45]. *Moringa* leaves contained the variety of essential aminoacids which are proteins sub-units. The leaves could be fortunate to those peoples who are poor and unable to get the protein component of their diet from meat. *Moringa* contains histidine and argenine. Aminoacids are important, especially for infants who unable to make enough protein for their growth requirements.

Moringa fresh leaves were compared with other food products placed the *Moringa* on the top. It contains four times the Ca of milk, four times the vitamin A of carrots and three times the K of bananas. But the dried leaves contain even more micro-nutrient content (17 times Ca of the milk, ten times vitamin A of the carrots, 15 times K of the bananas and 25 times the iron of spinach). However, vitamin C drops to about half that of oranges[45] (Table 2). The mineral contents of *M. oleifera* leaves are 0.11 mg/kg of Mg, 1.36 mg/kg of P, 2.73 mg/kg of Na, 21.7 mg/kg of K, 26.4 mg/kg of Ca, 175 mg/kg of Fe, 51.8 mg/kg of Mn, 13.7 mg/kg of Zn and 7.1 mg/kg of Cu. Keeping in view the nutritional facts, there is a great opportunity of its utilization in fortifying milk, juices, sauces, bread, spices and instant noodles. Many commercial products like tea, Zija soft drink and neutraceuticals are a few examples.

Table 2
Nutritional value of *Moringa* compared with other food contents.

Nutrient	*Moringa*	Other food
Vitamin A	6.78 mg	Carrot: 1.89 mg
Vitamin C	220.00 mg	Orange: 30.00 mg
Ca	440.00 mg	Cow milk: 120.00 mg
K	259.00 mg	Banana: 88.00 mg
Protein	6.60 g	Cow milk: 32.00 g

5.2. Health benefits

There is a saying: *Moringa* leaves can prevent 300 diseases. Now the recent research of modern science proved that the *Moringa* tree is packed with implausible constituents that can prevent many diseases.

5.2.1. Antimicrobial activity

Inhibitory effect of *Moringa* against various microbes in several laboratory bioassay has confirmed the presence of antimicrobial components. *Moringa* extract exhibited anti-microbial activity against pathogenic bacterial strain including *Bacillus subtilis* (*B. subtilis*) and *Mycobacterium phlei*[46]. The growth of fungi *Basidiobolus ranarums* and *Basidiobolus haptosporus* is strongly inhibited by leaf extract[47]. Another research on fixed oil and extract of *Moringa* against bacterial strains [*Escherichia coli* (*E. coli*), *Staphylococcus aureus* (*S. aureus*), *Pseudomonas aeruginosa* (*P. aeruginosa*), *Bacillus stearothermophilus*], green algae (*Scenedesmus obliquus*) and Sabin vaccine (poliovirus type 1 and herpes simplex virus type 1 were performed). The antimicrobial activity was confirmed with varying degree ranging from resistant for *P. aeruginosa* to sensitive for *Bacillus stearothermophilus*[48,49]. The oil of *Moringa* possesses both antifungal and antibacterial activities[50,51]. Comparative study of seed extract for antimicrobial activity against bacteria (*B. subtilis, E. coli, Pasturella multocida* and *S. aureus*) and fungi (*Rhizopus solani* and *Fusarium solani*) validated that *B. subtilis* and *Pasturella multocida* are the most sensitive strains and cations such as K, Na, Mg and Ca^{++} affect their activity[52]. In the latest study, *Moringa* extracts were validated to be inhibitory in dose dependent manner against *B. subtilis*, *E. coli*, *S. aureus* and *P. aeruginosa*[53]. Another comparative study on the efficacy of *Moringa* steam distillate against bacteria and fungi observed that it has more inhibitory effect against *E. coli*. It was followed by the inhibitory effect for *S. aureus*, *P. aeruginosa*, *Klebsiella pneumonia* and *B. subtilis*. Among fungi, it shows strong inhibition for *Aspergillus niger* and then followed by *Aspergillus oryzae*, *Aspergillus nidulans* and *Aspergillus terreus*[54]. Compared to the previous studies on the inhibitory effect of *Moringa* on the *Candida albicans* and *P. aeruginosa*, another recent reseach using ethanol extract of flower, seeds and leaves validates antimicrobial potential against *E. coli*, *Enterobacter* spp., *Klebsiella pneumonia*, *P. aeruginosa*, *Proteus mirabilis*, *Salmonella typhi*, *Streptococcus* spp. *S. aureus* and *Candida albicans*[55]. *Moringa* contains many other specific phytoconstituents that have antibacterial activity such as 4-(a-L-rhamnopyranosyloxy)benzyl isothiocyanate, 4-(4'-O-acetyl-a-L-rhamnopyranosyloxy) benzyl isothiocyanate, 4-(a-L-rhamnopyranosyloxy) benzyl glucosinolate and niazimicin, benzyl isothiocyanate[7,56]. Other phytochemicals especially anthonine and spirochin are reported from the root of *Moringa* that have antibacterial activity. Anthonine possesses a strong inhibitory effect for *Vibrio cholerae*[47].

5.2.2. Anti-inflammatory activity

Various plant parts of *Moringa* have significant anti-inflammatory activity. The root has strong anti-inflammatory effects on rat paw edema induced by carrageenan[57]. The root methanol extract inhibited carrageenan which induced rat paw edema in a dose dependent manner, when administered orally. Another study validated that *n*-butanol extract of *Moringa* seed inhibited the inflammation in ovalbumin-induced airway in guinea pigs[58]. The betterment of inflammation produced during different chronic disease is possible with the significant anti-inflammatory activity of *Moringa* bioactives[59,60].

5.2.3. Anthelmintic activity

Moringa leaves and flowers are able to control parasitic worms[61]. The ethanol extract of leaves is reported to inhibit *Pheretima posthuma* (Indian earthworm)[62].

5.2.4. Analgesic activity

The analgesic activity is reported for several *Moringa* species. Considerable analgesic activity was reported for *Moringa* fruit in experimental animals[63]. Furthermore, marked analgesic activity is reported for alcoholic extract of *Moringa* seeds and leaves[64].

5.2.5. Antipyretic and cholesterol lowering activity

The leaves of *Moringa* put forth direct effect for stabilizing blood pressure. *Moringa* mustard oil glycosides, thiocarbamate glycosides and nitrile are compounds leading to blood pressure lowering effect in leaves[6]. In addition, β-sitosterol was reported effective in lowering cholesterol level from the rats serum when fed with high fat diet[65].

5.2.6. Antipyretic activity

Several studies reported that *Moringa* has significant antipyretic activity. The antipyretic effect of *Moringa* seeds extracts was assessed in different solvents (ethanol, petroleum ether, ether and ethyl acetate) using yeast induced hyperpyrexia method in rats taking paracetamol as a control. Ethanol and ethyl acetate extracts are reported to have significant antipyretic activity[66,67].

5.2.7. Antidiabetic activity

The leave extract of *Moringa* has potent antidiabetic activity as it can lower blood sugar levels within 3 h after ingestion[68,69]. In modeled type-II diabetes, *Moringa* leaves decrease the level of blood glucose in Goto-Kakizaki and Wister rats[31]. Dark chocolate polyphenols and other polyphenols were used for developing the mechanistic model for studing the antidiabetic effect of *Moringa* as they are considered to be responsible for hypoglycemic activity[70,71]. The leaves of *Moringa* contain a significant amount of polyphenols including quercitin-3-glycoside, kaempferol glycosides, rutin and other polyphenols which confirmed its antidiabetic activity[30]. The potential antidiabetic activity of *Moringa* can be commercialized by transferring into conventional drugs through the development of suitable technology[72].

5.2.8. Antioxidant activity

A considerable number of plants have been evaluated for their antioxidant potential. *Moringa* is an important module in this category as it is a rich source of antioxidants[73,74]. Extract obtained from fruits, seeds and leaves of *Moringa* have antioxidant potential[31,75]. One of the comprehensive studies on antioxidant property of *Moringa* leaves reported that ethanol and methanol extracts of *Moringa* have the highest antioxidant activity with 66.8% and 65.1% respectively[76-78]. The major bioactives of phenolics such as quercitin and kaempferol are responsible for antioxidant activity[22,78]. Kaempferol and quercitin showed antioxidant activity on hepatocyte growth factor induced by phosphorylation (IC_{50} value: 12 and 6 μmol/L respectively)[79]. Radical scavenging for antioxidant potential of *Moringa* seeds is comparable to palm oil[80].

5.2.9. Antitumor activity

Moringa is a potent antitumor plant and several bioactives of anticancer potential have been identified and isolated. Among bioactives, niazimicin was found to have potent anticancer activity[81]. The inhibition of teleocidin B-4-induced Epstein-Barr virus activation was shown by niazimicin[82]. Cytotoxicity through sea urchin eggs assay, brine shrimp lethality assay, hemolysis assay and MTT assay using tumor cell lines is also reported for this plant. A study on human multiple myeloma cell lines reported the cytotoxic effects of leaves[83-85]. *Moringa* seeds have anticancer activity as they affect hepatic carcinogen metabolizing enzymes[86,87].

5.2.10. Hepatoprotective activity

Moringa leaves ethanol extract showed potent effect against liver damage in rats induced by rifampicin, pyrazinamide and isoniazid (antitubercular drugs). The effect of *Moringa* on glutamic oxaloacetic transaminase (aspartate aminotransferase), glutamic pyruvic transaminase (alanine aminotransferase), alkaline phosphatase and bilirubin levels in serum and lipid peroxidation levels in liver mediates its hepatoprotective activity[36,88]. Moreover, the chloroform and methanol extract of *Moringa* flowers showed potent hepatoprotective activity against liver damage induced by CCl_4 in Albino rats. Quercitin in *Moringa* flowers also provides significant protection against liver damage[89]. *Moringa* seed extract was found to recede liver fibrosis. *Moringa* seed extract controls CCl_4 induced by serum globulin and aminotransferase elevation. Immunohistochemical studies revealed that liver fibrosis was retracted by *Moringa* plant[90].

5.2.11. Anti-ulcer effects

Different parts of *Moringa* plant, especially root and leave, contain several compounds with spasmolytic activity. 4-(α-L-rhamnosyloxybenzyl)-o-methyl thiocarbamate is affected possibly through Ca channel blockade, niazinin B, niazinin A, niazimicin, *etc*. with bradycardia and hypotensive effect. The spasmolytic activity supports traditional use of this plant in gastrointestinal disorder[91]. *Moringa* methanol extract provides significant protection against indomethacin acetylsalicylic acid and serotonin induced gastric in experimental rat[92]. Anti-ulcer effect of *Moringa* leaves aqueous extract is also reported on adult Holtzman Albino rats[93].

5.2.12. Cardiac stimulant activity

Several studies reported that all parts of *Moringa* are somewhat cardiac stimulant. Moringinine, an alkaloid, in the root bark of *Moringa* tree is considered as cardiac stimulant[93]. A comparison of *Moringa* leaves extract with atenolol on serum cholesterol, triglyceride level and blood glucose level on body weight and heart weight of rats induced with adrenaline indicated that cardiovascular parameters are significantly changed. Ara *et al.* reported *Moringa* leaf extract as hypolipidemic, lowering heart weight, body weight, serum cholesterol level and serum triglyceride level on experimental animals[94]. Anti-atherosclerotic and hyolipidemic effect of *Moringa* leaves was analyzed using simvastatin as control[3,74]. *Moringa* caused cardioprotective effects in male Wistar albino rats in isoproterenol-induced myocardial infarction. The treatment of *Moringa* played a favorable inflection on biochemical enzymetic parameters (creatine kinase-MB, glutathione

peroxidase, superoxide dismutase, lactate dehydrogenase, catalase). Moreover, it prevented ultra-structure perturbation and histopathological damage caused by isoproterenol due to induced myocardial infarction.

5.2.13. Anti-asthmatic activity

Moringine, a *Moringa* plant alkaloid, resembling in action with ephedrine is used for asthma[95]. The effectiveness of seed kernels of *Moringa* against bronchial asthma was reported. The study validated a significant decrease in the sternness of asthma and coexisting respiratory function improvement[96].

5.2.14. Ocular diseases

Moringa leaves and pods consumption is effective against eye problems and helpful in preventing night blindness.Vitamin A nutrition was improved and cataract development was delayed by ingestion of leaves[97]. As a supplementary food, *Moringa* for its potential as vitamin A source was accepted by integrated child development scheme supplementary food[98].

6. Conclusions

M. oleifera, a multipurpose tree, is cheaply and easily cultivated and grown in various regions of the world. *M. oleifera* plant is the most credible but cheap alternative for not only curing a large number of choronic diseases but also for providing worthy nutrition. Pharmacologically, this study reported the effects of this plant including antimicrobial, antioxidant, anti-inflammatory and analgesic, hypotensive, anti-ulcer, antiurolithiatic, cardioprotective and wound healing activity. This review emphasizes the further exploration regarding pharmacological activities of *M. oleifera* to isolate the active compounds for novel herbal medicine. Utilization of this plant can help poor countries to fight against poverty, hunger, malnutrition and diseases. In addition, by exporting its various products foreign exchange could be earned.

Conflict of interest statement

We declare that we have no conflict of interest.

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