

The Wonder Plant: Moringa Oleifera

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Abstract: Herbal remedies in management of numerous ailments are as old as man. The application of herb from wound healing to protracted disease has brought succor especially in the poor developing countries. In recent decades, cardiovascular diseases have emerged as major cause of morbidity and mortality in many countries. Hyperlipidemia, a condition characterized by elevation of any or all lipid profile in the blood, notably dyslipidemia has been a growing concern. Its remedies are very expensive, associated with side effects and not readily accessible unlike herbal remedies. Moringa oleifera has become a popular herb in the community in their management of numerous diseases yet there is insufficient scientific evidence to explain the mechanism of action and validate its apparent uses and efficacy. In this study, we compiled numerous uses of this wonder plant for scientific recording and appropriate application to avoid side effects.

Keywords: Moringa Oleifera, herbal remedies, hyperlipidemia, cancer and cardiovascular diseases

I. Introduction

Herbal medicine is the oldest form of healthcare known to mankind and most cultures have long folk medicine histories that include the use of plants. The WHO recognizes herbal medicines as a valuable and readily available resource for Primary Health Care and she has endorsed their safe and effective use (Tilburt and Kaptchuk, 2008). She however recommends that many herbal remedies still need to be studied scientifically while recognizing the experience obtained from their prolonged safe use over the years in the treatment of various conditions in both humans and animals, such as cardiovascular diseases (CVDs) like hyperlipidemia, diabetes mellitus, hypertension, obstetric conditions etc (Tilburt and Kaptchuk, 2008). The use of medicinal plants in West Africa is probably as old as the duration of human settlement in the region (Abdulrahman et al., 2010; Sodipo et al., 2011; Ugwu *et al.*, 2013a, Ugwu *et al.*, 2013b).

In recent decades, cardiovascular diseases have emerged as major causes of morbidity and mortality in many countries with hypertension being the commonest (Akinkugbe, 1990). The management of various health derangements often involves the use of non-pharmaceutical approaches like exercise and nutrition but also to a large extent allopathic medicine. Despite their proven efficacy, allopathic medicines are more expensive and are also presumed to be associated with a lot of side effects and they are moreover not readily accessible to the majority of the people who need them. Example of such drug is statin (Jula *et al.*, 2002).

On the other hand, herbal remedies are seen as less expensive and less toxic (Hughes and Bradly, 2004). People are thus increasingly willing to manage their medical needs by using complementary and alternative medicines like herbs (Hughes and Bradly, 2004). Among the medicinal plants that are commonly used in management of various conditions is Moringa oleifera. This herb has been reported in the management of cardiovascular disease such as hypertension and in inducing abortion by women in India and some African countries (Nath *et al.*, 1992; Faizi *et al.*, 1995; Ugwu *et al.*, 2013c).

Substances in Moringa oleifera which are similar to those derived from other herbs (for

example glycosides) have become a basis for some of the commercial medications used today for the treatment of heart disease, high blood pressure, pain, obstetric and other medical problems such as diabetes, cancer, and AIDS (Peltzer et al., 2010). Traditionally women use herbal preparations for labour. Herbs are also prescribed by traditional birth attendants and healers for various reasons including increasing chances of having twins, correcting a mal-positioned fetus, anaemia in pregnancy among others (Azriani et al., 2007). *Moringa oleifera* has been reported to be used by women for contraception and as an abortifacient (Faizi et al., 1995). *Moringa oleifera* is reportedly used for treatment of painful uterus, inducing uterine contractions, management of retained placenta and post partum bleeding among other conditions and have thus been found useful in obstetric practice (Kamatenesi-Mugisha, 2002; Ugwu et al., 2013d).

Moringa oleifera appears to have multi-system effects in the human body as shown by its numerous reported uses (Ghasi et al., 2000). Despite their reported beneficial uses, *Moringa oleifera* has been reported to cause abortion in rats (Faizi et al., 1995). It has also been reported that compounds similar to those present in *Moringa oleifera* (cardiac glycosides) is toxic and can lead to death (McVann et al., 1992). However, different parts of *Moringa oleifera* have been employed in treating so many diseases such as cancer, ulcer, diabetes asthma, hyperlipidemia to mention but a few. Hence this study attempts to review relevant literatures to update researcher of the importance of this wonder plant *moringa oleifera*. We will first of all give a full description of *moringa oleifera* before discussing the different application in different human needs.

The plant - *Moringa oleifera*

Moringa oleifera, originates from western and sub-Himalayan tracts, India, Pakistan, Asia, Africa and Arabia (Somali et al., 1984; Mughal et al., 1999), is now distributed in the Philippines, Cambodia, Central America, North and South America and the Caribbean Islands (Morton, 1991). In some parts of the world *M. oleifera* is referred to as the 'drumstick tree' or the 'horse radish tree', whereas in others it is known as the kelor tree (Anwar and Bhangar, 2003). While in the Nile valley, the name of the tree is 'Shagara al Rauwaq', which means 'tree for purifying' (Von Maydell, 1986). In Pakistan, *M. oleifera* is locally known as 'Sohanjna' and is grown and cultivated all over the country (Qaiser, 1973; Anwar et al., 2005). *Moringa oleifera* Lam is one of the best known and most widely distributed and naturalized species of a monogeneric family Moringaceae (Nadkarni, 1976; Ramachandran et al., 1980). The tree ranges in height from 5 to 10 m (Morton, 1991). It is found wild and cultivated throughout the plains, especially in hedges and in house yards, thrives best under the tropical insular climate, and is plentiful near the sandy beds of rivers and streams (Qaiser, 1973).

It can grow well in the humid tropics or hot dry lands, can survive destitute soils, and is little affected by drought (Morton, 1991). It tolerates a wide range of rainfall with minimum annual rainfall requirements estimated at 250 mm and maximum at over 3000 mm and a pH of 5.0-9.0 (Palada and Changl, 2003). *Moringa oleifera* is an important food commodity which has had enormous attention as the 'natural nutrition of the tropics'. The leaves, fruit, flowers and immature pods of this tree are used as a highly nutritive vegetable in many countries, particularly in India, Pakistan, Philippines, Hawaii and many parts of Africa (D'souza and Kulkarni, 1993; Anwar and Bhangar, 2003; Anwar et al., 2005).

Moringa leaves have been reported to be a rich source of β -carotene, protein, vitamin C, calcium and potassium and act as a good source of natural antioxidants; and thus enhance the shelf-life of fat containing foods due to the presence of various types of antioxidant compounds such as ascorbic acid, flavonoids, phenolics and carotinoids (Dillard and German, 2000; Siddhuraju and Becker, 2003). In the Philippines, it is known as 'mother's best friend' because of its utilization to increase woman's milk production and is sometimes prescribed for anemia (Estrella et al., 2000; Siddhuraju and Becker, 2003). A number of medicinal properties have been ascribed to various parts of this highly esteemed tree. Almost all the parts of this plant: leaf, root, bark, gum, fruit (pods), flowers, seed and seed oil have been used for various ailments in the indigenous medicine of South Asia, including the treatment of inflammation and infectious diseases along with cardiovascular, gastrointestinal, hematological and hepatorenal disorders (Singh and Kumar, 1999; Morimitsu et al., 2000; Siddhuraju and Becker, 2003). The seeds of *Moringa* are considered to be antipyretic, acrid, bitter (Oliveira et al., 1999) and reported to show antimicrobial activity. The seed can be consumed fresh as peas; or pounded, roasted, or pressed into sweet, non-desiccating oil, commercially known as 'Ben oil' of high quality. The unique property is the ability of its dry,

crushed seed and seed press cake, which contain polypeptides, to serve as natural coagulants for water treatment (Ndabigengesere and Narasiah, 1998).

Bark is emmenagogue and abortifacient (abortion of fetus). Flowers are stimulant, tonic and diuretic and increase the flow of bile. The leaves are tasty, cooling; removes all kinds of excessive pain & inflammation. Used in Fattening, anthelmintic, cures hallucinations, dry tumors, hicough, asthma (Oliveira et al., 1999). The root is bitter; tonic to the body and the lungs; emmenagogue, laxative, expectorant, diuretic; enriches the blood, cures stomatitis, gleans, urinary discharges, obstinate asthma. The roots and seeds are prescribed for treatment of snake bite (Charaka, Sushruta) and scorpion-sting (Sushruta) (Oliveira et al., 1999). The root is used for soreness of mouth and throat; and gum for dental carries. Seeds are used in venereal infections in Sind.

Qaiser (1973), Stanley (1982), Verdcourt (1985), ICRAF (2001) and Lu and Olson (2001), described *Moringa oleifera* as a deciduous tree occasionally growing up to 15 m in height, but is usually less than 10 m tall. It has a large underground rootstock and normally a single main trunk with a wide, open and typically umbrella-shaped crown. The trunk is generally 10-45 cm wide and covered in a pale- grey bark, but may occasionally reach up to 60 cm in diameter (Qaiser, 1973). The wood is relatively soft and the tough bark varies from smooth to rough in texture, but is usually not fissured. It exudes a whitish to reddish gum when damaged. The younger stems are finely pubescent and the younger shoots are greenish or purplish in colour (Lu and Olson 2001).

The large alternately arranged leaves are borne on petioles 4-15 cm long. These leaves are tri-pinnate and usually 25-60 cm long, but they may occasionally be as small as 6.5 cm long and as large as 90 cm long. They bear tiny stalked glands at the base of the petiole and leaflets, which exude a clear or amber-coloured liquid (Stanley, 1982). The leaves have 5-11 main branches (i.e. pinnae) that are pulvinate. Each of these branches is borne on a stalk 1-3 cm long and has 5-11 smaller branches (i.e. pinnules). The smaller branches have stalks (i.e. petiolules) 4-8 mm long and bear 3-13 leaflets. Individual leaflets are ovate, elliptic or oblong in shape (10-24 mm long and 5-18 mm wide). However, the terminal leaflet on each petiolule is usually obovate and slightly larger. These leaflets are sparsely tomentose to puberulous when young, but become glabrous at maturity (Stanley, 1982). They have

rounded to cuneate bases, entire margins, rounded to emarginate apices and are borne on stalks 1-4 mm long. The inflorescence is a widely spreading axillary panicle 8-30 cm long. Flowers are white to cream, fragrant and about 2.5 cm across. They are borne on pedicels 12-21 mm long and the flower buds are ovoid in shape. Each flower has 5 petal-like sepals (3 of which are reflexed at anthesis) and 5 petals (4 of which are reflexed at anthesis) (Verdcourt, 1985). The 2 dorsal sepals and 1 dorsal petal that usually remain un-reflexed form a projecting keel, while the rest of the perianth reflexes downwards to form a 'banner' at right angles to the keel. Sepals are elongated in shape (i.e. lanceolate to linear-lanceolate), 7-15 mm long by 5-6 mm wide, and have obtuse apices. They are white or cream, sometimes with yellow streaks in the centre, and are usually puberulent. The white or cream petals are slightly spoon-shaped (i.e. spatulate), 1-2 cm long by 5-6 mm wide, with prominent veins. They have acute apices and are glabrous or puberulent at the base (Verdcourt, 1985).

The 5 fully formed stamens (about 10 mm long) have waxy yellow or orange anthers and alternate with a row of 5 staminodes (about 7 mm long). These stamens and staminodes have filaments that are hairy at the base. The hairy ovary is oblong (about 5 mm long) with a single locule containing numerous ovules. It is topped with a single slightly hairy style and a minute stigma. Flowering can occur throughout the year (Verdcourt, 1985). The large

elongated capsules (usually 18-50 cm long and 1-3 cm wide, or occasionally 10- 90 cm long) have 9 indistinct lengthwise ribs. These fruit are green and somewhat tomentose when young, but turn pale brown as they mature. They are dehiscent and split open via three valves when fully mature. The numerous seeds, about 20 in each fruit, are sub-globose or slightly three-angled (7-15 mm across) with three papery wings (5-25 mm long and 4-7 wide). They are dark brown or blackish in colour and embedded in the pits of the valves of the fruit (Verdcourt, 1985).

There is little information in the literature as to the dispersal mechanisms of *M. oleifera*; however, much can be determined from its seed morphology and the locations in which it tends to become naturalized (DuPuy, 1993). While the seeds are relatively large, they are strongly winged. This may allow them to be spread short distances from the parent tree by wind. It may also aid their dispersal downstream in water during floods (the mature pods may also float in water), as populations are sometimes found growing along waterways. Many naturalised populations occur around old dump sites. This suggests that these plants have

grown from seed, or even pieces of stem, that have been dumped in garden waste. DuPuy (1993) notes that discarded branches remain viable for a relatively long period, and often form roots. Larger scale spread of *M. oleifera* is usually as a result of its deliberate introduction for cultivation.

HDRA (2002) states that 'seeds can be planted as soon as they are mature but should only be kept for up to 3 months in natural conditions'. Hence, they probably do not have any significant innate dormancy and begin to lose their viability after a relatively short period of time. Germination rates for fresh seeds are around 80%, going down to about 50% after 12 months storage, with no seeds usually being viable after 2 years of storage (Bosch, 2004).

II. Phytochemistry

Moringa oleifera is rich in compounds containing the simple sugar, rhamnose called glucosinolates and isothiocyanates (Fahey et al., 2001; Bennett et al., 2003). The stem bark contains two alkaloids, namely Moringine and moringinine (Fahey et al., 2001). Vanillin,

sitosterol, β -sitostenone, 4-hydroxymellin and octacosanoic acid have also been isolated from the stem of *M. oleifera* (Faizi et al., 1994a). Purified, gum exudate from *M. oleifera* has been found to contain L- arabinose, galactose, -glucuronic acid, and L rhamnose, mannose, xylose and degraded-gum polysaccharide consisting of L-galactose, -glucuronic acid, L-mannose has been obtained on mild hydrolysis of the whole gum with acid (Bhattacharya et al., 1982). Its Flowers contain nine amino acids, sucrose, D- glucose, traces of alkaloids, wax, quercetin and kaempferat; the ash is rich in potassium and calcium (Ruckmani et al., 1998). It has also been reported to contain some flavonoid pigments such as alkaloids, kaempferol, rhamnetin, isoquercitrin and kaempferitrin (Faizi et al., 1994a; Siddhuraju and Becker, 2003). Thiocarbamate and isothiocyanate glycosides have been isolated from the acetate phase of the ethanol extract of *Moringa* pods (Faizi et al., 1998). The cytokinins have been shown to be present in the fruit (Nagar et al., 1982). Lately, interest has been generated in isolating hormones/growth promoters from the leaves of *M. oleifera*. Nodulation of *Vigna munga* L. has been shown to increase vigorously with the application of an aqueous-ethanol extract (Bose, 1980) of *M. oleifera* leaves, although the nature of the active ingredient is still unknown. *Moringa* leaves act as a good source of natural antioxidant due to the presence of various types of antioxidant compounds such as ascorbic acid, flavonoids, phenolics and carotenoids (Anwar et al., 2005; Makkar and Becker, 1996). The high concentrations of ascorbic acid, oestrogenic substances and β -sitosterol, iron, calcium, phosphorus, copper, vitamins A, B and C, α -tocopherol, riboflavin, nicotinic acid, folic acid, pyridoxine, β -carotene, protein, and in particular essential amino acids such as methionine, cystine, tryptophan and lysine present in *Moringa* leaves and pods make it a virtually ideal dietary supplement (Makkar and Becker, 1996). The composition of the sterols of *Moringa* seed oil mainly consists of campesterol, stigmasterol, β -sitosterol, Δ^5 -avenasterol and clerosterol accompanied by minute amounts of 24-methylenecholesterol, Δ^7 - campestanol, stigmasterol and 28- isoavenasterol (Tsaknis et al., 1999; Anwar and Bhangar, 2003; Anwar et al., 2005). The sterol composition of the major fractions of *Moringa* seed oil differs greatly from those of most of the conventional edible oils (Rossell, 1991). The fatty acid composition of *M. oleifera* seed oil reveals that it falls in the category of high-oleic oils (C18:1, 67.90%-76.00%). Among the other component fatty acids C16:0 (6.04%- 7.80%), C18:0 (4.14%-7.60%), C20:0 (2.76%-4.00%), and C22:0 (5.00%-6.73%) are important (Tsaknis et al., 1999; Anwar and Bhangar, 2003; Anwar et al., 2005). *Moringa oleifera* is also a good source of different tocopherols (α -, γ - and δ -); the concentration of those is reported to be 98.82-134.42, 27.90-93.70, and 48.00- 71.16 mg/kg, respectively (Anwar and Bhangar, 2003; Tsaknis et al., 1999). Medicinal Importance of *Moringa oleifera* | Diuretic activity

Moringa roots, leaves, flowers, gum and the aqueous infusion of seeds have been found to possess diuretic activity (Morton, 1991; Caceres et al., 1992) and such diuretic components are likely to play a complementary role in the overall blood pressure lowering effect of this plant.

III. Cholesterol lowering activity

The crude extract of *Moringa* leaves has a significant cholesterol lowering action in the serum of high fat diet fed rats which might be attributed to the presence of a bioactive Phytoconstituents, notably β -sitosterol (Ghasi et al., 2000). *Moringa* fruit has been found to lower the serum cholesterol, phospholipids, triglycerides, low density lipoprotein (LDL), very low density lipoprotein (VLDL) cholesterol to phospholipid ratio, atherogenic index lipid and reduced the lipid profile of liver, heart and aorta in hypercholesteremic rabbits and

increased the excretion of fecal cholesterol (Mehta et al., 2003).

IV. Antihypertensive activity

The widespread combination of diuretic along with lipid and blood pressure lowering activities make this plant highly useful in cardiovascular disorders. Moringa leaf juice is known to have a stabilizing effect on blood pressure (Dahot, 1988). Nitrile, mustard oil glycosides and thiocarbamate glycosides have been isolated from Moringa leaves, which were found to be responsible for the blood pressure lowering effect (Faizi et al., 1994a; 1994b; 1995). Most of these compounds, bearing thiocarbamate, carbamate or nitrile groups, are fully acetylated glycosides, which are very rare in nature (Faizi et al., 1995). Bioassay guided fractionation of the active ethanol extract of Moringa leaves led to the isolation of four pure compounds, niazinin A, niazinin B, niazimicin and niazinin A + B which showed a blood pressure lowering effect in rats mediated possibly through a calcium antagonist effect (Gilani et al., 1994a).

V. Antispasmodic, antiulcer and hepatoprotective activities

M. oleifera roots have been reported to possess antispasmodic activity (Caceres et al., 1992). Moringa leaves have been extensively studied pharmacologically and it has been found that the ethanol extract and its constituents exhibit antispasmodic effects possibly through calcium channel blockade (Gilani et al., 1992; 1994a; Dangi et al., 2002). The antispasmodic activity of the ethanol extract of *M. oleifera* leaves has been attributed to the presence of 4-[α -(L-rhamnosyloxy) benzyl]- o-methyl thiocarbamate (trans), which forms the basis for its traditional use in diarrhea (Gilani et al., 1992). Moreover, spasmolytic activity exhibited by different constituents provides pharmacological basis for the traditional uses of this plant in gastrointestinal motility disorder (Gilani et al., 1994a). The methanol fraction of *M. oleifera* leaf extract showed antiulcerogenic and hepatoprotective effects in rats (Pal et al., 1995a). Aqueous leaf extracts also showed antiulcer effect (Pal et al., 1995a) indicating that the antiulcer component is widely distributed in this plant. Moringa roots have also been reported to possess hepatoprotective activity (Ruckmani et al., 1998). The aqueous and alcohol extracts from Moringa flowers were also found to have a significant hepatoprotective effect (Ruckmani et al., 1998), which may be due to the presence of quercetin, a well known flavonoid with hepatoprotective activity (Gilani et al., 1997).

VI. Antitumor and anticancer activities

Makonnen et al., (1997) found Moringa leaves to be a potential source for antitumor activity. O-Ethyl-4-(α -L-rhamnosyloxy)benzyl carbamate together with 4(α -L-rhamnosyloxy)-benzyl isothiocyanate, niazimicin and 3-O-(6'-O-oleoyl- β -D-glucopyranosyl)- β -sitosterol have been tested for their potential antitumor promoting activity using an in vitro assay which showed significant inhibitory effects on Epstein-Barr virus- early antigen. Niazimicin has been proposed to be a potent chemopreventive agent in chemical carcinogenesis (Guevara et al., 1999). The seed extracts have also been found to be effective on hepatic carcinogen metabolizing enzymes, antioxidant parameters and skin papillomagenesis in mice (Bharali et al., 2003). A seed ointment had a similar effect to neomycin against *Staphylococcus aureus* pyoderma in mice (Caceres and Lopez, 1991). It has been found that niaziminin, a thiocarbamate from the leaves of *M. oleifera*, exhibits inhibition of tumor-promoter-induced Epstein-Barr virus activation. On the other hand, among the isothiocyanates, naturally occurring 4- [(4'-O-acetyl- α -i-rhamnosyloxy) benzyl], significantly inhibited tumor-promoter induced Epstein-Barr virus activation, suggesting that the isothiocyano group is a critical structural factor for activity (Murakami et al., 1998).

VII. Antibacterial and antifungal activities

Moringa roots have antibacterial activity (Rao et al., 1996) and are reported to be rich in antimicrobial agents. Ruckmani et al (1998) reported that moringa root contain an active antibiotic principle, pterygospermin, which has powerful antibacterial and fungicidal effects (Ruckmani et al., 1998). A similar compound is found to be responsible for the antibacterial and fungicidal effects of its flowers (Fahey et al., 2001). The root extract also possesses antimicrobial activity attributed to the presence of 4- α -L-rhamnosyloxy benzyl isothiocyanate (Eilert et al., 1981). The aglycone of deoxy-niazimicine (N-benzyl, S-ethyl thioformate) isolated from the chloroform fraction of an ethanol extract of the root bark was found to be responsible for the antibacterial and antifungal activities (Nikken et al., 2003). Purisoft consists of peptides of the Moringa seed. It protects the human

skin from environmental influences and combats premature skin aging. With dual activity, antipollution and conditioning/strengthening of hair, the *M. oleifera* seed extract is a globally acceptable innovative solution for hair care (Stussi et al., 2002).

VIII. Antidiabetic activity

An extract from the moringa leaf has been shown to be effective in lowering blood sugar levels within 3hrs ingestion, though less effectively than the standard hypoglycemic drug, glibenclamide (Oliveira et al., 1999) In one of our work, we proved that *Moringa Oleifera* not only have antidiabetic and noncytotoxic properties but it is also associated with significant anion gap acidosis in alloxan induced type -2 diabetic rats (Omabe et.al. 2014).

IX. Wound healing properties

Three wound models viz excision wound, incision wound and dead space wound were selected for assessing wound healing activity of ethanolic and ethyl acetate extracts of leaves. Ethyl acetate extracts (10% extract in the form of ointment) showed significant wound healing activity that is comparable with the standard vicco turmeric cream. Phytosterols and phenolic compounds present in these extracts promote the wound healing activity (Stussi et al., 2002).

X. Antipyretic activity and analgesic activity

The antipyretic activity of ethanolic, petroleum ether, solvent ether and ethyl acetate extracts of seeds was screened using yeast induced hyperpyrexia method. Paracetamol I.P (200mg/kg) was used as standard for comparison. The ethanolic and ethyl acetate extracts of seeds showed significant antipyretic activity in rats (Stussi et al., 2002). The experimental studies using hot plate and tail immersion method have shown that alcoholic extract of leaves and seeds of *Moringa oleifera* possess marked analgesic activity (Stussi et al., 2002). According to the authors it is equipotent to standard drug (Aspirin 25mg/ kg.).

XI. Anti-Inflammatory activity and anti asthmatic activity

Poultice of leaves is beneficial in glandular swellings .The root extract exhibited significant anti-inflammatory activity in Carrageenan induced rat paw edema. Also, a study was carried out to investigate the efficacy and safety of seed kernels of *Moringa oleifera* in the treatment of bronchial asthma. The results showed an appreciable decrease in severity of symptoms of asthma and also simultaneous improvement in respiratory functions (Stussi et al., 2002).

XII. In blindness and eye infections

Though there are many causes of blindness Vitamin A deficiency causes impaired dark adaptation and night blindness. Eating *Moringa* leaves, pods and leaf powder which contain high proportion of Vitamin A can help to prevent night blindness and eye problems in children. Ingesting drumstick leaves (Beta- carotene and leutin) with oil helps in improving Vitamin A nutrition and perhaps delays the onset of cataract. Also the juice can be instilled into eyes in cases of conjunctivitis (Rao et al., 1996).

XIII. Cardiac and circulatory stimulant

All parts of the tree are reported to be used as Cardiac and circulatory stimulant. Moringinine acts on the sympathetic nervous system, and as a cardiac stimulant (Rao et al., 1996). 13 Antioxidant activity Antioxidant activity reported in oil from the dried seeds is higher than alpha Tocopheryl (Rao et al., 1996). Aqueous methanol (80%) and ethanol (70%) extracts of freeze dried leaves showed radical scavenging and antioxidant activities. The drumstick leaves are found to be a potential source of natural antioxidants (Rao et al., 1996).

XIV. Antifertility activity

The aqueous extract of root and bark at a dose of 200mg/kg and 400mg/kg, respectively showed post-coital antifertility effect in rat and also induced foetal resorption at late pregnancy (Gilani et al., 1994). An aqueous extract of *Moringa oleifera* roots was investigated for its estrogenic, anti- estrogenic, progestational and antiprogestational activities. 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 (Gilani et al., 1994).

XV. Antiurolithiatic activity

The effect of oral administration of aqueous and alcoholic extract of *M. oleifera* root-wood on calcium oxalate urolithiasis has been studied in male Wistar albino rats (Gilani et al., 1994). Ethylene glycol feeding resulted in hyperoxaluria as well as increased renal excretion of calcium and phosphate (Gilani et al., 1994). Supplementation with aqueous and alcoholic extract of *M. oleifera* root-wood significantly reduced the elevated urinary oxalate, showing a regulatory action on endogenous oxalate synthesis. The increased deposition of stone forming constituents in the kidneys of calculogenic rats was also significantly lowered by curative and preventive treatment using aqueous and alcoholic extracts. Thus the results indicate that the root-wood of *M. oleifera* is endowed with antiurolithiatic activity (Gilani et al., 1994).

XVI. Cosmetic use

Various parts of *Moringa oleifera* have cosmetic value. Cognis Laboratoires Serobiologiques team developed Puricare TM and Purisoft TM, two active ingredients based on botanical peptides from the seeds of *Moringa oleifera* tree that purify hair and skin and offer protection against the effects of pollution. *Moringa* seed oil, known as Behen oil is widely used as a carrier oil in cosmetic preparations (Caceres and Lopez, 1991). The healing properties of moringa oil were documented by ancient cultures. *Moringa* oil possesses exceptional oxidative stability which may explain why the Egyptians placed vases of *Moringa* oil in their tombs. It is high in oleic acid and similar in composition to olive oil (Caceres and Lopez, 1991). *Moringa* oil is light and spreads easily on the skin. It is good oil for use in massage and aromatherapy applications. It can be used in body and hair care as a moisturizer and skin conditioner. Other uses include soap making and for use in cosmetic preparations such as lip balm and creams. *Moringa oleifera* butter, a semisolid fraction of *Moringa* oil, is used in baby products to contribute a free radical resistant emollient with exceptionally long lasting skin softening and soothing effects (Caceres and Lopez, 1991).

The list is becoming endless but for the scope of this study, we summarize by saying that *Moringa oleifera* plant is a great gift to mankind when carefully harnessed.

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