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NUTRITIONAL VALUE OF ''MORINGA OLEIFERA'' A REVIEW

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ABSTRACT

Moringa oleoifera Lam (syn. Ptreygosprma Gaerther) is one of the best know most widely distributed neutralized spacies of moringaceae. It is commonly referred as to as ‘‘the miracle tree’’ (pandala, 1996), drumstick tree or horseradish tree. Its several medicinal. Indistrial and neutraceutical use make it a significantly valueable plant in the world wide. Is is distributed in many countries of the tropics and subtropics and cultivated all over the world due to its multiple utilities. It known as different names in different region: Assamese: Sojana; Bengali: sojne; Chinese: la mu; English: Moringa; Hindi: sahajan.

KEYWORD: *Moringa oleoifera*, neutraceutical, vitamins, minerals, proteins and probiotic supplement.

INTRODUCTION

Neutraceutical was defined by Stephen De Fellece in1979, founder and chairman of the foundation of innovation medicine (FIM), new jersey, and USA. A neutraceutical is considered as a non-toxic food or its part of which having basic nutritional value provides health benefits including the prevention of disease or promotion of the health. The neutraceutical values of the food should be standardized in the the nutraceutical product and production must be follows the standard guideline. As per dietary supplement health and education act of 1994, the definition of nutraceuticals has been extended to include herbs, other botanicals,vitamins, minerals, amino acid and any diatery substance for use by humans to supplement the diet (srividya et a;. 2010).

Types of diatery supplement

- **Vitamins supplement**

Dietary supplements add large amounts of micronutrients to the diet. For example, vitamins include vitamin A, vitamin D, vitamin E, and vitamin K, the family of , the family of B vitamins, Which

includes thiamine (B**1**), riboflavin (B**2**), niacin (B**3**), pantothenic acid (B**5**), pyridoxine(B**6**), biotin (H), folic acid (B**9**), cyanocobalamin (B**12**) etc. Supplement lable as a percentage of the daily value, which is the term used for the amount recommended by the regulatory body.

- **Mineral supplement**

Mineral supplement are also often chelated, or bound, with bioavailability compounds that may improve absorption. There afr twenty two well know minerals essential to human health. They are divided into major mineral and trace minerals present in the body. Minerals include calcium, chromium, copper, iodine, iron, magnesium, magaenese, molybdenum, phosphorous, potassium, selenium, sodium, and zinc.

- **Protein and amino acids**

Protein and amino acids are fundamental substances present in the human diet. Main source of the proteins are mineral or vegetable origin. Animal sources provide all essential amino acids, whereas vegetable sources generally lack one or more of the essential amino acids, animal source of diletary protein not only contain abundant vitamins and minerals, but is also may contains some amount of saturated fat compared to vegetable sources.

- **Herbal supplement**

The use of herbal supplement has expanded rapidly during the first decade. Herbal supplement contain botanicals/herbs. It may contain single herbs or mixtures of herbs, an herbs is a plant or plant parts. These product are believed to useful for a range of ailments including skin disease, sexual problems, and mental problems.

- **Fibre supplement**

Dietary fibre preparation from defatted rice bran has laxative and cholesterol ability with attendant benefits towards prevention or alleviation of cardiovascular disease, diabetes, obesity, and colon cancer it has been suggested that rice bran is a good fibre source that can be added to various food products (Hamid and Luan, 2000). Psyllium is a diatary fibre is valuable in the management of irriatable bowel syndrome, inflammatory boweldisease.

- **Probiotic Supplement**

Usage of probiotics (live viable microbial organisms) in the treatment of specific diseases hasevolved into an extremely valuable option. A supplementary use of oral ldigestive enzymes and probiotic are decreasing the incidence of breast, colon-rectal , prostate and bronchogenic cancer.

DRUG PROFILE

Synonym: Sojana, Sojne, Sahajan.

Biolocal source: *Moringa oleifera* Lam (syn. M. ptreygospermaGaertner.) is one of the best known and mostwidely distributed naturalized species of Moringaceae family.

Geographical source: India, Pakistan, phillippines, hawali many parts of afraica.

Cultivation *Moringa oleifera* plant

Growth, cultivation and distribution

M. oleifera plant is a perennial, evergreem tree tja grpws up to 20 ft (6.10) tall, with a straight trunk with corky, whitish bark. It grows well in hot, semi-arid and humid regions and in well- drined sandy or loamy soils. The tree is grown mainly in semiarid, tropical, and subtropical areas.

Toxonomy

Binomial name	***Moringa oleifera.***
Kingdom	Plantae-Plants
Subkingdom	Tracheobionta-Vascular plants
Superdivision	Spermatophyta-Seed plants

Division	Magnoliophyta-Flowering plants
Class	Magnoliopsida-Dicotyledons
Subclass	Dilleniidae
Order	Capparales
Family	Moringaceae Horse-radish tree family
Genus	Moringa Adans. – Moringa
Species	Moringa oleifera Lam. – horseradishtree

Pharmacognosy and morphology

It is small tree (7 to 12m high) with thick grey bark, fragrant white flowers and long green pods which give the tree its name. the tree has tuberous taproot and brittle stem is with corky bark.

Stem: Moringa has a short normally straight stem, the stem is poorly formed. The stem has a height of 1.5 to 2 m before it begins branching but can reach up to 3.0m

Branch: The external branches grow in a disorganized manner and umbrella shaped.

Leaves: The leaves are pale green to deep green in colour, compound, and 30 to 60 cm iln length. The leaves are bipinnate or more commonly trippinnate, up to 45 cm long, and are alternate ande sprirally arranged on the twins.

***Moringa oleifera* plant leaf.**

Flowers: The flowers are yellowish white or cream coloured, bisexual and 10 to 25 cm long and 2.5 cm wide. It has pleasant fragrance and produced profusely in axillary, drooping panicles 10 to25 cm long.

The five reflexed sepals are linear lanceolate. The five petals are slender spatulate. They surround the five stamens and five staminodes and are reflexed except for the lowest.

Flower of *Moringa oleifera* plant.

Fruit: The pods/fruits are 1 to 4 ft (30 to 120) long and 1.8cm (0.7)in wide an tapering at both ends. It is green to brown in colour. The pods contains about 10 to 20 seeds embedded in the fleshy pith. The seeds are dark brown and the kernel is surrounded by a lightly wooded shell with three papery wings, the fruits are pendulous, linear three sided pods with nine longitudinal ridges, usually 20 to 50 cm long.

Fruit of *Moringa oleifera* plant.

Phytocontituents

Different parts of Moringa containing the simple sugar, rhamnose, vitamins, minerals and carotenoid (P- carotene). Moringa species are rich sources of various phyto-chemicals including rare sugar derivative called glucosinolates and isothiocyanates. The predominant glucosinolate is 4-O- (a-L-rhamnopyranosyloxy)-benzylglucosinolate (glucomoringin) and its three mono-acetyl- rhamnose isomers of this glucosinolate (Fahey et al., 2001; Bennett et al., 2003; Kjaer et al., 1979). The root

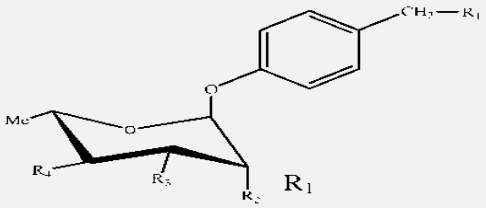
of this plant contains high concentration of 4-(α-L-rhamnopyranosyloxy)- benzylglucosinolate and benzylglucosinolate (Foidl et al., 2001). Leaves and the flowers of Moringa also contain 4-hydroxybenzyl-glucosinolate. The leaves of plant also have low amount of various nitriles, thiocarbamates and carbamates that having strong hypotensive and spasmolytic effects (Leuck and Kunz, 1998). Naturally occurring iso-thiocyanates, 4-[(4'-O- acetyl-a-i-rhamnosyloxy) benzyl], significantly inhibition on Epstein-Barr virus that may cause tumor (Murakami et al., 1998). Niazirin and niazirinin are the nitrile glycoside and three mustard oil glycoside found in the ethanolic extract of leaves.(Bennett et al., 2003). Presence of high concentrations of oestrogenic substances, iron, calcium, phosphorus, copper, vitamins A and C, a-tocopherol, riboflavin, nicotinic acid, folic acid, pyridoxine, P-carotene, protein, and essential amino acids such as methionine, cystine,tryptophan and lysine in Moringa leaves and pods make it a virtually ideal dietary supplement (Makkar and Becker, 1996). The plant is also a good source of a, y and 5 tocopherols (Anwar and Bhanger, 2003; Tsaknis et al., 1999).Leaves of this plant act as a natural antioxidant due to the presence of various compounds such as ascorbic acid, flavonoids, phenolics and carotenoids (Anwar et al., 2005; Makkar and Becker, 1996). Leaves, roots, pods and seeds of the plant vcontain 3-β-caffeoylquinic acid and4-α-caffeoylquinic acid and flavonols have been reported in different tissues of *M. oleifera*. The plant flavonoid are flavonol glycosides and it present in the form of glucosides, rutinosides and malonylglucosides of quercetin > kaempferol > isorhamnetin. Some of them quercetin-3-o-glucoside, quercetin-3-o- (6- malonyl glucoside) and lower amounts of kaempferol- 3-o glucoside and kaempferol- 3-o-(6- malonyl glucoside) (Bennett et al., 2003; Manguro & Lemmen, 2007) (Fig.3.1.f).

Vanillin, P-sitosterol, P-sitostenone, 4-hydroxymellin and octacosanoic acid, 4- α-L-rhamnopyranosyloxy)-benzylglucosinolate have been isolated from the stem of Moringa (Faizi et al., 1994a). Purified gum exudate obtained from the stem of *Moringa oleifera* reported to contain L-arabinose, D-galactose, D-glucuronic acid, L-rhamnose, D- mannose and D-xylose while a homogeneous, degraded-gum polysaccharide consisting of L- galactose, β-glucuronic acid and L-mannose has been obtained on mild hydrolysis of the whole gum with acid (Bhattacharya et al., 1982).

Flowers of Moringa plant is full of various amino acids; sugar such as sucrose & D- glucose, and potassium and calcium. It also contains flavonoids, alkaloids, kaempherol, rhamnetin, isoquercitrin and kaempferitrin (Ruckmani et al., 1998; Faizi et al., 1994a; Siddhuraju and Becker, 2003). It has been reported that Moringa roots have the antibacterial activity and the active antibiotic principle,

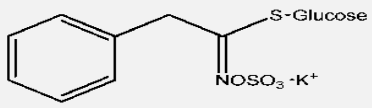
pterygospermin is responsible for antibacterial and fungicidal effects (Ruckmani et al., 1998). The cytokinins have been shown to be present in the fruit (Nagar et al., 1982). A new O-ethyl-4-(a-L-rhamnosyloxy)benzyl carbamate together with seven known bioactive compounds, 4(a-L-rhamnosyloxy)-benzyl isothiocyanate, niazimicin, P-sitosterol-3-O-P-D glucopyranoside, niazirin ,p-sitosterol and glycerol-1-(9-octadecanoate have been isolated from the ethanol extract of the Moringa seed (Guevara et al., 1999).

Fig. 3.1. Phyto-constituents of *Moringa oleifera*



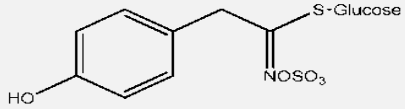
	R_1	R_2	R_3	R_4
4-(α- L-Rhamnopyranosyloxy)-benzylglucosinolate	-CH(=$NOSO_3K^+$)-S-Glc	OH	OH	OH
4'-Acetyl-4-(α-L-Rhamnopyranosyloxy)-benzylglucosinolate	-CH(=$NOSO_3K^+$)-S-Glc	OH	OH	O-AC
4-(α-L-Rhamnopyranosyloxy)-benzylisothiocyanate	-NCS	OH	OH	OH
4-(α-L-Rhamnopyranosyloxy)-benzylcyanide	-CN	OH	OH	OH

(a)



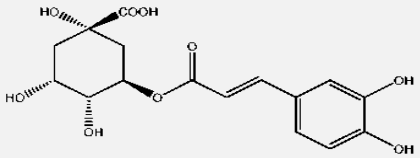
Benzylglucosinolate (Glucotropaeolin)

(b)



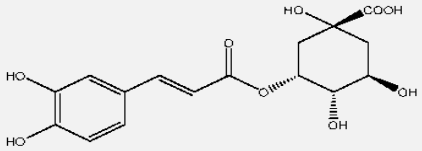
4-hydroxybenzylglucosinolate

(c)



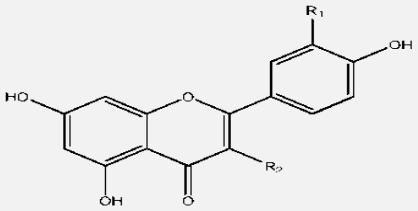
Neochlorogenic Acid (3- caffeoylquinic acid)

(d)



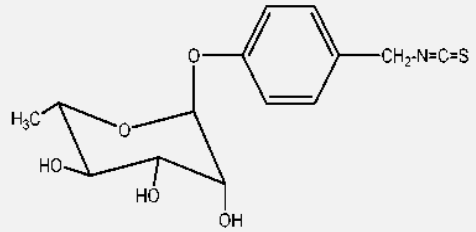
Chlorogenic Acid (5- caffeoylquinic acid)

(e)

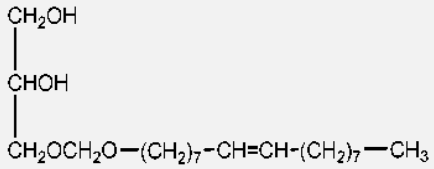


	R_1	R_2
Kaemferole 3-O-Glucoside	H	Glc
Quercetin 3-O-Glucoside	OH	Glc
Rutin	OH	Glc-Rham

(f)

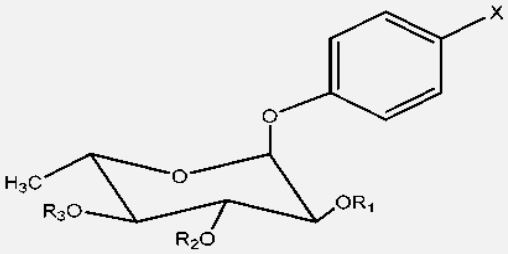


4-(α-L-rhamnosyloxy) benzyl isothiocyanate



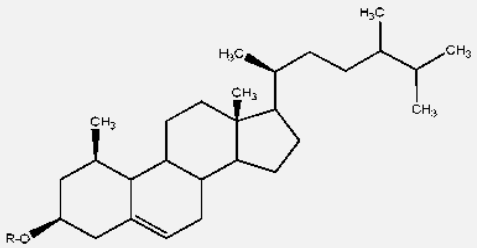
Glycerol-1-(9-octadecanoate)

(g) (h)



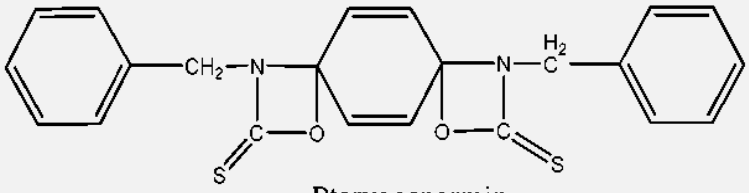
NiaZirin	($R_1 = R_2 = R_3 = H$, X = CN)
Niazirinin	($R_1 = R_2 = H$, R_3 = Ac, X = CN
Niazimin A/B	($R_1 = R_2 = H$, R_3 = Ac, X = CH_2-NH-CO-OEt)
Niazinin A/B	($R_1 = R_2$ =R3 = H, X = CH_2-NH-(C=S)-OMe)
Niazicin A/B	($R_1 = R_2 = H$, R_3 = Ac, X = CH_2-NH-(C=S)-OMe)
Niazimicin	($R_1 = R_2 = R_3 = H$, X = CH_2-NH-(C=S)-OEt)
Niaziminin A/B	($R_1 = R_2 = H$, R_3 = Ac, X = CH_2-NH-(C=S)-OEt)

(i)



R = H β-sitosterol
R = 6' -O-oleoyl-β-D-glucopyranosyl
R = β-D-glucopyranosyl

(j)



Pterygospermin

(k)

Traditional Uses

- Treatment of circulatory system.
- Anti-inflammatory

- Anti-spasmodic
- Diuretics
- Hypoglycemic
- Anti-Fertility
- Anti-hepatotoxic

Pharmacological activity

- **Antihypertensive, diuretic, and cholesterol lowering agent**

Ethanolic and aqueous extract of whole pods and its parts, i.e coats, pulp and seeds have also pressure lowering effect,among them seed shows more prominent activity.

- **Antispasmodic, antiulcer and hepatotoprotective activities**

Moringa roots have been reported to posses to antispasmodic activity. The leaves have beenextensively studied pharmacologically and it has been found that the ethanol exract and its costiltuents exhibit antisposmdic effects possibly through calcium channel blocked.

- **Antibacterial and Antifungal activities**

Moringa roots have antibacterial activity and are reported to be reach in antimicrobial agents. The active antibiotic principles is pterygospermin, which has powerful antibacterial and fungicidal effects.

- **Antitumor and anticancer activities**

Moringa leaves are potential source of antitumor compound. O-Ethyl-4-(α-L- rhamnosyloxy) benzyl carbamate and 4(α-L-rhamnosyloxy)-benzyl isothiocyanate, niazimicin, niazirin,3-O-(6'-O-oleoyl-P-D-glucopyranosyl)-P-sitosterolhave been tested on *in-vitro* assay Epstein-Barr virus- early antigen (EBV-EA) activation in Raji cells for their potential antitumor activity.

- **Others diverse activities**

Aqueous leaf extract regulate thyroid hormone and can be used to treat hyperthyroidism and exhibit antioxidant effect.

Anti HSV effect

Nutritional profile of *Moringa oleifera* leaf, pod, flower and its formulation (% w/w):

Nutritional profile	Leaf	Pod	Flower	Formulation
Energy (kcal)	71.01	66.03	51.07	103.99
Protein	9.643+0.28	6.315+0.35	2.420+0.37	12.26+0.45
Crude Fat	1.17	0.71	1.51	2.11
Carbohydrate	5.527+0.28	8.617+0.34	6.953+0.18	8.997+0.19
Total Dietary fibre	32	69.24	25.68	48.44
Sodium	0.054	0.063	0.0490	0.0836
Potassium	2.08	1.57	1.23	2.24
Calcium	0.993	0.347	0.541	2.187
Magnesium	0.63+0.03	0.197+0.015	0.13+0.018	0.744+0.019
Phosphorus	0.527+0.02	0.72+0.01	0.627+0.02	0.744+0.02
Zinc	0.0064+0.0004	0.0034+0.00045	0.0012+0.00025	0.0081+0.0002
Copper	0.119+0.41	0.30+0.39	0.10+0.61	0.341+0.52

CONCLUSION

About 2000 years ago, Hippocrates correctly emphasized "Let food be your medicine and medicine be your food". Currently there is an increased global interest due to the recognition that "nutraceuticals" play a major role in health enhancement. Hence a "nutraceutical" is any substance that may be considered as a food or part of a food that provides medical or health benefits, encompassing, prevention and treatment of diseases. Dietary supplement is a preparation intended to supplement the diet. However, supplements should not replace variety of foods that are important to a healthy diet, so it is necessary to take variety of foods as well. We are currently eating foods that are out of balance even though the requirements for these nutrients for optimal health have remained constant.

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2. *M. oleifera* is considered as one of the most beneficial tree in the world, it has several traditional medicines, industrial and nutritional uses (Fuglie, 1999; Anwar et al., 2007; Wadhwa, 2013).
3. Various parts of *M. oleifera* are highly nutritious and contain important minerals, proteins, vitamins, antioxidant, β-carotene amino acids and various phenolic (Anwar et al., 2007).
4. The Moringa trees are naturally found in tropical climates around the different zones in the world, the extent of their adaptability to cooler climates, adaptation to all these stresses is related

with metabolic modifications that lead to the increase the several organic solutes such as sugars, proline polyols, and amino acids (Tesfay et al., 2011).

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