JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

MINI REVIEW ON SOME MEDICINAL AND INDUSTRIAL BENEFITS OF DRUMSTICK (*MORINGA OLEIFERA*)

NISHA VERMA* AND RAJEEV KUMAR YADAV**
* Department of Botany, V.R.A.L. Rajkiya Mahila Mahavidyalaya, Bareilly.
** Department of Botany, Bareilly College, Bareilly.

Abstract

Moringa oleifera, Drumstick tree, also known as horseradish tree, is a small to medium-sized, evergreen tree. The tree usually grows to 10 or 12 m in height, with spreading, open crown of drooping, branches, feathery foliage of tripinnate leaves, and thick, corky, deeply fissured whitish bark. It is valued mainly for its edible fruits, leaves, flowers, roots and seed oil. It is used extensively in traditional medicines. Various parts of this plant such as the leaves, roots, seed, bark, fruit, flowers and immature pods act as antimicrobial, antifungal, antioxidant, anti-inflammatory, neurological, antias thematic, diuretic, analgesic, hepatoprotective, antiulcer, gastroprotective and anti-cancer activities and are being employed for the treatment of different ailments. The plant is also utilized in several industries of the world including; pharmaceutical, water treatment, food and biodiesel This study provides a mini review about benefits of *Moringa oleifera* including medicinal as well as industrial.

Introduction

Moringa oleifera, the "miracle tree", thrives globally in almost all tropical and subtropical regions. Moringa is also known as in Arabic- rawag ;Assamese- saijna, sohjna; Bengali- sajina; Burmese- daintha, dandalonbin ;Chinese- la ken; English- drumstick tree,horseradish tree, ben tree; French- moringe à graine ailée, morungue; Gujarati- midhosaragavo, saragavo; Hindi- mungna, saijna, shajna; Kannada- nugge; Konkani- maissang, moring, Moxing ; Malayalam- murinna, sigru; Marathi- achajhada, shevgi; Nepali- shobhanjan, sohijan; Oriya- sajina; Portuguese- moringa, moringueiro; Punjabi- sainjna, soanjna;Sanskrit- shobhanjana, sigru;Sinhalese- murunga;Spanish- ángela, ben, moringa;Swahili- mrongo, mzunze;Tamil- moringa, murungai;Telegu- mulaga, munaga,tellamunaga;Urdu-sahajna (Parrotta; 2014). Moringa family Moringaceae, comprises 13 species (*M. oleifera*, *M. arborea*, *M. rivae*, *M. ruspoliana*, *M. drouhardii*, *M. hildebrandtii*, *M. concanensis*, *M. borziana*, *M. longituba*, *M. pygmaea*, *M. ovalifolia*, *M. peregrina*, *M. stenopetala*), of which *M. oleifera* has become well known for its use in nutrition, biogas production, fertilizer and medicine etc. *M. oleifera* is among the cheapest and most reliable alternatives for good nutrition. Nearly all parts of the tree are used for their essential nutrients. *M. oleifera* leaves have a high content of beta-carotene, minerals, calcium, and potassium (Kasolo *et.al.* 2010). Dried leaves have an 70% of oleic acid content. The bark of the tree is very useful in the treatment of different disorders such as ulcers, toothache and hypertension. The flowers are used to treat ulcers, enlarged spleen, and to produce aphrodisiac substances. The tree is believed to have incredible properties in treating malnutrition in infants and lactating mothers.

Botanical Classification

Kingdom : Plantae; Division : Magnoliphyta; Class : Magnoliopsida; Order : Brassicales; Family : Moringaceae; Genus : *Moringa;* Species : *Moringa oleifera* (Fahey *et.al.* 2005).

Morphology

Moringa oleifera is a small, fast-growing evergreen or deciduous tree that usually grows up to 10 or 12 m in height. It has a spreading, open crown of drooping, fragile branches, feathery foliage of tripinnate leaves and thick, corky, whitish bark. The leaves are bipinnate or more commonly tripinnate and are alternate and spirally arranged on the twigs. Pinnae and pinnules are opposite leaflets are 1.2 to 2.0 cm long and 0.6 to 1.0 cm wide, the lateral leaflets elliptic, the terminal ones obovate, petioles of lateral leaflets are 1.5 to 2.5 mm long, those of terminal ones 3 to 6 mm long. The leaflets are green and almost hairless on the upper surface, paler and hairless beneath, with red-tinged midveins, with entire margins and are rounded or blunt-pointed at the apex and short-pointed at the base. The twigs are finely hairy and green, becoming brown. The fragrant, bisexual, yellowish white flowers are borne on slender, hairy stalks in spreading or drooping axillary clusters (panicles) 10–25 cm long. Individual flowers 3 mm long, are approximately 0.7 to 1 cm long and 2 cm broad, with five unequal yellowish-white, thinly veined, spathulate petals, five stamens with five smaller staminodes and a pistil composed of a 1-celled ovary and slender style (Kirtikar and Basu 1935; Little and Wadsworth 1964). The fruits are pendulous, linear, three-sided pods with nine longitudinal ridges, usually 20 to 50 cm long, but occasionally up to 1 m or longer, and 2.0 to
2.5 cm broad. The pods, each usually containing up to 26 seeds, are dark green during their development, and take approximately 3 months to mature after flowering (Palanisamy and Kumaresan 1985). They turn brown on maturity, and split open longitudinally along the three angles, releasing the dark brown, trigonous seeds. Seeds measure about 1 cm in diameter, with three whitish papery wings on the angles.

Ethno medicinal/Traditional Properties

People worldwide have included *M. oleifera* in their diet since ancient times because of its vital therapeutic values. Various medicines made from the plant are said to have ethnomedicinal properties for curing diseases. All part of this plant has been used to treat diseases. Uses of *M. oleifera* are observed in pathological alterations such as antihypertensive, anti-anxiety, anti- diarrheal and as a diuretic. A poultice made from Moringa leaves is a quick remedy for inflammatory conditions such as glandular inflammation, headache, and bronchitis. The pods treat hepatitis and relieve joint pain (Gopalakrishnan *et.al.* 2016). The roots are conventionally used to treat kidney stones, liver diseases, inflammation, ulcers and pain associated with the ear and tooth (Ghasi *et.al*. 2000; Mahajan *et. al.* 2007). The bark of the stem is used to treat wounds and skin infections. The seeds of the plant act as a laxative and are used in the treatment of tumors, prostate, and bladder problems. Preparations from the plant leaves benefit nursing mothers and malnourished infants. The leaves have been useful for patients suffering from insomnia and treating wounds.

Medicinal Properties

M. oleifera is often referred as a panacea and can be used to cure more than 300 diseases. Moringa has long been used in herbal medicine by Indians. The presence of phytochemicals makes it a good medicinal agent. In this section, the effect of moringa on diseases are reviewed.

Antimicrobial and Antifungal Properties

M. oleifera ethanolic root extract contains a compound N-benzylethyl thioformate responsible for the antimicrobial and antifungal effect toward an extensive array of microbes and fungi (Upadhyay *et. al*. 2015). *M. oleifera* methanolic leaf extract may exert inhibition of urinary tract infections caused by Gram-negative and Gram-positive bacteria such as *Klebsiella pneumoniae*, *Staphylococcus aureus*, *Escherichia coli, and Staphylococcus saprophyticus*.The inhibitory effect of extracts from leaves, seeds, and stems of *M. oleifera* has been specified in various fungal strains such as *Aspergillus flavus, Aspergillus terreus, Aspergillus nidulans, Rhizoctonia solani, Aspergillus niger, Aspergillus oryzae, Fusarium solani, Penicillium sclerotigenum, Cladosporium cladosporioides, Trichophyton mentagrophytes, Penicillium species, Pullarium species* (Upadhyay *et.al.* 2015). *M. oleifera* seeds have active components 4-(alpha-L-rhamanosyloxy) benzyl

isothiocyanates, which are believed to be responsible for their antimicrobial activity. The juice of Moringa leaves also showed potential against human pathogenic bacteria (Mishra et.al. 2001). The methanolic leaf extract has nearly 99% inhibition against *Botrytis cinerea*. The fruit of
M. oleifera contains alkaloids, flavonoids, and steroids, which have an inhibitory effect against the culture of *Candida albicans* by either denaturing the protein or inhibiting the germination of spores through the steroid ring they contain.

Antioxidant properties
The extract of *Moringa* possesses high phenolic content and potent antioxidant properties, (Ali; 2014) *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, (Siddhuraju and Becker 2015) *Moringa* leaves are a good source of natural antioxidant due to the presence of various types of antioxidant compounds such as ascorbic acid, flavonoids, phenolics and carotenoids. Aqueous extracts of leaf, fruit and seed of *Moringa* have antioxidant potential.

Anti-inflammatory properties
A significant anti-inflammatory effect was observed in different parts of *M. oleifera* (leaf, pods, flowers, and roots). Active compounds such as tannins, phenols, alkaloids, flavanoids, carotenoids β-sitosterol, vanillin, and moringin have anti-inflammatory properties.

Neurological properties
Moringa supports brain health and cognitive function because of its antioxidant and neuro- enhancer activities. It's also been tested as a treatment for Alzheimer‟s disease with favorable preliminary results. Its high content of vitamins E and C fight oxidation that leads to neuron degeneration, improving brain function. It is also able to normalize the neurotransmitters serotonin, dopamine, and nor-adrenaline in the brain, which play a key role in memory, mood, organ function, responses to stimulus such as stress and pleasure, and mental health, for example in depression and psychosis (Duke; 2001).

Benefits to the breast-feeding mother
Moringa flowers contain sucrose, D-glocuse nine amino acids, alkaloid, wax, and are rich in calcium, potassium and a few flavonoids and consumption of flower juice improves the quality and flow of milk in feeding mothers (Koul and Chase, 2015) In another research it is found that the leaf increases woman‟s milk production (Siddhuraju and Becker, 2015). The leaves being rich in nutrients, pregnant women and lactating mothers use the powdered leaves to enhance their child‟s or children‟s nourishment suffering from malnutrition In the Philippine *Moringa* is known as mother‟s best friend, because of its utilization to increase woman‟s milk production and is

sometimes prescribed for anemia (Fuglie; 2001). In Africa and other developing nations used Moring to overcome malnutrition especially in infants and nursing mothers (Isitua *et.al.* 2015, Shivani *et. al*. 2014; Daba *et.al.* 2016).

Antiasthmatic properties

Moringine is an alkaloid of *Moringa* resembling in action with ephedrine is used for asthma. The seed kernel of *Moringa* is effective against bronchial asthma. The study validated a significant decrease in the sternness of asthma and coexisting respiratory function improvement (Mahmood *et.al*. 2010).

Diuretic Properties
The alcoholic and aqueous root extract of *M. oleifera* significantly affects calcium oxalate urolithiasis in male rats. This reduction was observed due to the decrease in the retention level of oxalates, calcium and phosphates as well as serum urea nitrogen, creatinine, and uric acid.

Analgesic properties
The seed oil is used externally for relieving pain of the joints in gout and acute rheumatism. Root bark removes all kinds of pain (Dhakar *et.al.* 2011) As it contains sulfur, it is recommended for rheumatism and seed oil is used as an application to relieve the pain of gout and acute rheumatism (Pankaj *et.al.* 2010).

Beneficial for eye vision

Leaves and pods consumption is effective against eye problems and helpful in preventing night blindness (Amjad *et. al.* 2015). Vitamin A deficiency was improved and cataract development was delayed by ingestion of leaves. 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, (Okorocha *et.al.* 2015) 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 (Sharif *et.al.* 2016)

Hepato protective properties

Moringa play very crucial role to protect liver against damage, oxidation, toxicity due to high concentrations of polyphenols in its leaves and flowers. *Moringa* oil can also restore liver enzymes to normal levels, reducing oxidative stress, and increasing protein content in the liver. The liver is responsible for blood detoxification, bile production, fructose metabolism, fat metabolism, and nutrient processing, and it can only fulfill these functions with the aid of liver enzymes, so it's vital they stay at normal levels (Kurma et. al 1998)

Anti-Ulcer/Gastroprotective Properties

Bisphenols and flavonoids found in moringa leaves showed a reduced level of ulcer index, duodenal ulcer, and stress ulcer in the ibuprofen-induced gastric ulcer model. Moringa extract was shown to significantly reduce free radicals and neutralize the acidic behavior of gastric juice and have a protective effect on the development of gastric ulcer. The presence of flavonoids in the plant has been shown to have a protective effect on ulcer formation by increasing capillary resistance and improving microcirculation, resulting in less cell injury.

Anti-Cancer Properties

Several parts of moringa (fruits, leaves, flowers, stems) have been shown to be beneficial against cancer, a deadly disease. The isolated compounds thiocarbamate and isothiocyanate from moringa act as inhibitors of tumor cells (Guevara et.al. 1999). The dichloromethane fraction was found to be cytotoxic for MCF7 breast cancer cells. (Khalafalla *et. al.* 2010)

Industrial uses of moringa Moringa oil

The oil content of seed is approximately 42%. The oil is brilliant yellow. It is used as a lubricant for fine machinery such as timepieces because it has little tendency to deteriorate and become rancid and sticky (Ferrao and Ferrao, 1970; Ramachandran *et al.,* 1980). It is also useful as a vegetable cooking oil. The oil is known for its capacity to absorb and retain volatile substances and is therefore valuable in the perfume industry for stabilizing scents. The free fatty acid content varies from 0.5 to 3 %. The seed oil of Moringa contains approximately 13 % saturated fatty acids and 82 % unsaturated fatty acids. It has a particularly high level of oleic acid (70 %) Other vegetable oils normally contain only about 40 % oleic acid (Anwar and Bhanger, 2003 ; Dahot and Memon. 1987; Faizi *et.al.* 1998;).

Moringa as a source of biogas

Moringa plants were milled together with water. The fiber was separated by filtration through a mesh with 5 mm pores and the liquid fraction produced was then added. With an average feed of
5.7 g of volatile solids the gas production was 580 liters of gas per 1 kg of volatile solids. The average methane content of the gas was 81 %. (Atawodi *et. al.* 2010 ; Kumar, 2004)

Moringa for biodiesel

Moringa oleifera oil is evaluated for the first time as potential feedstock for biodiesel. After acid pre- treatment to reduce the acid value of the *M. oleifera* oil, biodiesel was obtained by a standard transesterification procedure with methanol and an alkali catalyst at 60ºC and alcohol/oil ratio of 6:1. *M. oleifera* oil has a high content of oleic acid (>70%) with saturated fatty acids comprising most of the remaining fatty acid profile. As a result, the methyl esters (biodiesel) obtained from this oil exhibit a high acetane number of approximately 67, one of the highest found for a biodiesel fuel. (Umer Rashid *et al.*,2008)

Water purification

Powdered seed act as a natural flocculent, able to clarify even the most turbid water Seed powder can be used as a quick and simple method for cleaning dirty water. The powder joins with the solids in the water and sinks to the bottom. This treatment also removes 90-99% of bacteria contained in water, water purification by

flocculation, sedimentation, antibiosis and even reduction of Schistosome cercariae titer. Using *Moringa* to purify water replaces chemicals such as aluminum sulphate, which are dangerous to people and the environment, and are expensive (Jahn, 1986; Sutherland, 1989; Gassenschmidt *et.al.* 1995 ; Kumar and Gopal 1999 and Yongbai ,2005).

References

- A Miracle Tree: A Review on Multipurposes of *Moringa oleifera* and its Implication for Climate Change Mitigation. J Ear Sci Clim Cha, 2016; 7: 366.
2001; 3(2): 141-164.
- Ali, E.N. *Moringa oleifera* Leaves Possible uses as environmentally Friendly Material: A review by Int J of Che, En & Bio Sc (IJCEBS), 2014; 2(2). ISSN 2320-4087 (Online)
- Amjad, M. S., Qureshi, H., Arshad, M., Chaudhari, S., K., & Masood, M. (The incredible queen of green: Nutritive value and therapeutic potential of *Moringa oleifera* Lam.) J of Coas Li Medi, 2015; 3(9): 744-751.
- Anwar F, and MI Bhanger {2003} Analytical characterization of Moringa oleifera seed oil grown in temperate regions of Pakistan. Journal of Agricultural and Food Chemistry 51: 6558-6563.
- Atawodi, S. E.; Atawodi, J. C.; Idakwo, G. A.; Pfundstein, B; Haubner, R; Wurtele, G; Bartsch, H; Owen, R. W. (2010). "Evaluation of the polyphenol content and antioxidant properties of methanol extracts of the leaves, stem, and root barks of Moringa oleifera Lam". Journal of Medicinal Food. 13 (3): 710– 6. doi:10.1089/jmf.2009.0057. PMID
20521992.
- CSIR, 1962 *The* Wealth of India, A Dictionary of Indian Raw Materials and Industrial Products. Raw Materials, Vol. VI. Publications and Information Directorate, Council of Scientific & Industrial Res., New Delhi.
- Dahot MU, and AR Memon {1987} Properties of Moringa oleifera seed lipase. Pakistan Journal of Scientific and Industrial Research 30{11}: 832-835.
- Dhakar, R.C., Maurya, S.D., Pooniya, B.K, Bairwa N, Gupta M. & Sanwarmal, M. *Moringa*: The herbal gold to combat malnutrition. Chronicles of Young Scientists, 2011; 2: 119-25.
- Duke, J.A. (Ed.). *Moringa oleifera* Lam. (Moringaceae). Handbook of nuts. Boca Raton: CRC Press, 2001; 214-7.
- Fahey, JW (2005). *Moringa oleifera*: A review of the medicinal evidence for its nutritional, therapeutic, and prophylactic properties. Part 1. *Trees Life J*, 1, 5.
- Faizi S, BS Siddiqui, R Saleem, K Aftab, F Shaheen, AH Gilani {1998} Hypotensive constituents from the pods of Moringa oleifera. Planta Medica 64: 225-228.
- Ferrao, A.M.B.C. and Mendez Ferrao, J.E. (1970). Acidos gordos em oleo de Moringueiro (*Moringa oleifera* Lam.). Agronomia Angolana, 8: 3-16.
- Fuglie, L.J. The Miracle Tree: *Moringa oleifera*: Natural Nutrition for the Tropics. Church World Service, Dakar. 68 pp.; revised in 2001 and published as The Miracle Tree: The Multiple Attributes of *Moringa*, 1999; 172.
- Gassenschmidt U, KD Jany, B Tauscher, and H Niebergall {1995} Isolation and characterization of a flocculating protein from Moringa oleifera Lam. Biochimica Biophysica Acta 1243: 477-481.
- Ghasi S, E Nwobodo, and JO Ofili {2000} Hypocholesterolemic effects of crude extract of leaf of Moringa oleifera Lam in high-fat diet fed Wistar rats. Journal of Ethnopharmacology 69{1}: 21-25.
- Gopalakrishnan, L., Doriya, K., & Kumar, D. S. *Moringa oleifera*: A review on nutritive importance and its medicinal application. Food Science and Human Wellness, 2016; 5(2): 49-56.
- Guevara AP, Vargas C, Sakurai H., 1999. An antitumor promoter from Moringa oleifera Lam. Mutat Res 440: 181- 188
- http://www.sciencedirect.com/science/article/pii/S22 13453016300362
- https://dx.doi.org/10.3389%2Ffphar.2012.00024

https://www.ncbi.nlm.nih.gov/pubmed/10675284
- https://pubmed.ncbi.nlm.nih.gov

- https://www.healthline.com › nutrition ›
- https://organicindia.com › herbal-supplement › products
- https://agritech.tnau.ac.in › pht_othervegetables
- https://link.springer.com › Phytochemistry Reviews
- https://www.mdpi.com
- https://www.webmd.com › vitamins-and-supplements › h...
- https://www.frontiersin.org › fnut.2022.799127 › full
-
- https://www.moringapartnership.com
- https://www.livemint.com › web-stories › 5-ways-morin...
- https://www.feedipedia.org › node
- https://m.economictimes.com › web-stories › slideshow
- https://www.verywellhealth.com › the-uses-and-benefits...
- https://www.frontiersin.org › fphar.2018.00108 › full
- https://www.oziva.in › acv-moringa-for-weight-loss https://agriexchange.apeda.gov.in › Moringa_Rep...
- https://treesforlife.org › our-work › our-initiatives › mori...
- Isitua, C.C., Lozano, M.S.J.M., Jaramillo, C. & Dutan F. Phytochemical and nutritional properties of dried leaf powder of *Moringa oleifera* Lam. A J of Pl Sci and Re, 2015; 5(2): 8-16.
- Jahn SA, HA Musnad and H Burgstaller {1986} Tree that purifies water: Cultivating multipurpose Moringaceae in the Sudan. Unasylva 38{152}: 23-28.
- Kasolo, J.N., Bimenya, G.S., Ojok, L., Ochieng, J. & Ogwal-okeng, J.W. (Phytochemicals and uses of *Moringa oleifera* leaves in Ugandan rural communities). J of Med pla Re, 2010; 4(9): 753-757.
- Khalafalla, M.M., Abdellatef, E., Dafalla, H.M., Nassrallah, A.A., Aboul-Enein, K.M., Lightfoot, D.A., El-Deeb, F.E. & El-Shemy, H.A. Active principle from *Moringa oleifera* Lam leaves effective against two leukemias and a hepatocarcinoma. Af J of Bio, 2010; 9(49): 8467-8471, DOI: 10.5897/AJB10.996 ISSN: 1684-5315.
- KIRTIKAR, K. R., BASU, B. D. and ANONYMOUS, 1935: Indian Medicinal Plants, reprint of 1933 2nd ed. Bishen Singh Mahendra Pal Singh, Dehra Dun, India.
- Koul, B., & Chase, N. (Moringa oleifera Lam.: Panacea to several maladies). J of Che and Phar Re, 2015; 7(6): 687-707.
- Kumar S, and K Gopal {1999}. Screening of plant species for inhibition of bacterial population of raw water. Journal of Environmental Science and Health Part A Toxic Hazardous Substances and Environmental Engineering. 34{4}: 975-987.
- Kumar, H. D. (2004-01-01). Cooper, Edwin L.; Yamaguchi, Nobuo, eds.Management of Nutritional and Health Needs of Malnourished and Vegetarian People in India. Advances in Experimental Medicine and Biology. Springer US. pp. 311–321. doi:10.1007/978-1- 4757-4820-8_23. ISBN 978-1-4419-3441-3.
- Kurma-SR; Mishra-SH; Rao-Kurma-S. 1998. Anti-inflammatory and hepatoprotective activities of fruits of Moringa pterygosperma Gaertn. Indian-Journal-of-Natural- Products. 1998, 14: 1, 3-10; 14
- LITTLE, E. L., JR.; WADSWORTH, F. H., 1964: Common trees of Puerto Rico and the Virgin Islands. Agric. Handb. 249. U.S. Dep. Agric., Washington, D.C.
- MAHAJAN, S.; SHARMA, Y. K., 1984: Production of rayon grade pulp from Moringa oleifera. Indian Forester 110, 3, 303–306.
- Mahmood K.T. et al /J. Pharm. Sci. & Res. Vol.2 (11), 2010,775-781 779.
- Mishra, G., Singh, P., Verma, R., Kumar, S., Srivastav, S., Jha, K.K., & Khosa, R. L. Traditional uses, phytochemistry and pharmacological properties of *Moringa oleifera* plant: an overview. Scholars Research Library, Der Pharmacia Lettre,
- Monica G. Marcu, {2005}. Miracle Tree, KOS Health Publications
- *Moringa oleifera*: a natural gift-A review. Mahmood, K.T., Mugal, T. & Ikram Ul Haq, Int J Phar Sci & Res, 2(11): 775-781.
- Okorocha, A.E., Folawiyo, M.A., Omabe. K., Uzor, S., Uche, JE. Wadioni, A., Ugwu, JO. & Onwe, PE. The

Wonder Plant: *Moringa oleifera*. IOSR J of Env

- PALANISAMY, V.; KUMARESAN, K. et al., 1985: Studies on seed development and maturation in annual Moringa. Vegetable Sci. 12, 2, 74–78.
- Palaniswamy U {2005}. Purslane—Drumsticks Lok-Vani {e-journal} http://www.lokvani
- Pankaj, G., Jain, Savita, D., Patil, Nitin, G., Haswani, Manoj, V., Girase, Sanjay, J. & Surana. Hypolipidemic activity of *Moringa oleifera* Lam., Moringaceae, on high fat diet induced hyperlipidemia in albino rats. Rev.bras.farmacogn, 2010; 20: 6.
- Parrotta John A. 2014 Moringa oleifera Chapter · January 2014 DOI: 10.1002/9783527678518.ehg2005015 *Enzyklopädie der Holzgewächse, Handbuch und Atlas der Dendrologie,*ISBN: 978-3-527-32141-4
- Ramachandran, C,:Peter K.V:Gopalakrishnan,P.K {1980} Drumstick {Moringa oleifera}: a multipurpose Indian vegetables, Economic Botany,34{3}:276-283
- Ramachandran, C. Peter, K.V. and Gopalakrishnan, P.K. (1980). Drumstick (*Moringa oleifera*): a multipurpose Indian vegetable. Economic Botany, 34: 276-283.
- Rashid, Umer; Anwar, Farooq; Moser, Bryan R.; Knothe, Gerhard (2008). "Moringa oleifera oil: A possible source of biodiesel". Bioresource Technology.99 (17): 8175– 9. doi:10.1016/j.biortech.2008.03.066. PMID 18474424
- Sci, Toxi and Fo Tec, ISSN: 2319-2402, p-ISSN: 2319-2399.Volume 9, Issue 10 Ver. II (Oct. 2015), 2015; 39-47.
- Sharif, I.H., Hasan, M., Shakil, M., Nazmuzzaman, M., Banu, N.A., Islam, R. & Jamal,
A.H.M. A Review of Phytochemical and Pharmacological Profile of Moringa oleifera Lam. J of Li Sci and Bio, 2016. DOI: 10.1234.67/jlsb.1010 JLSB, 2016; 3: 75-87.
- Shivani, G., Varmani & Garg, M. Health benefits of *Moringa oleifera*: A miracle tree. Int J of F & Nu Sci, 2014; 3(3).
- Siddhuraju, P. & Becker, K. Antioxidant Properties of Various Solvent Extracts of Total Phenolic Constituents from Three Different Agroclimatic Origins of Drumstick Tree (*Moringa oleifera* Lam.) Leaves. J Ag Fo Che, 51: 2144-2155
- Sutherland, J.P., Folkard, G.K. & Grant, W.D.{1989} "Seeds of Moringa species as naturally occurring flocculants", Science, Technology & Development, , Vol.7, No.3, pp.1 91-197.
- Trees For Life {2005}. Moringa Book. http://www.treesforlife.org/project/moringa/ book/default.asp..
- Upadhyay, P., Yadav, M.K., Mishra, S., Sharma, P. & Purohit, S. *Moringa oleifera*: A review of the medical evidence for its nutritional and pharmacological properties. Int J Res Phar Sci,2015; 5(2): 12-16.
- Yongbai KA {2005} Studies on the potential use of medicinal plants and macrofungi
{lower plants} in water and waste water purification. www.biotech.kth.se/iobb/news
/kenneth04.doc