Archives of Food Science and Nutrition Research

Arch Food Sci Nutr Res

Article ID: AFSNR1003

Volume 1, Issue 1

Review Article

# MORINGA (Moringa Oleifera) Cultivation Awareness in Pakistan

*Muhammad Arshad Ullah*

Pakistan Agricultural Research Council

Pakistan

ContusM Publications

www.contusm.com | submission@contusmpublications.com

# MORINGA (*Moringa Oleifera*) Cultivation Awareness in Pakistan

**Muhammad Arshad Ullah***

*Pakistan Agricultural Research Council, Islamabad, Pakistan*

***Corresponding author:** Muhammad Arshad Ullah, Pakistan Agricultural Research Council, Islamabad, Pakistan. E-mail: arshadullah1965@gmail.com

Received Date: March 30, 2021; 2021; Published Date: June 15, 2021

**Citation:** Muhammad Arshad Ullah. MORINGA (Moringa oleifera) Cultivation Awareness in Pakistan. Arch Food Sci Nutr Res. 2021;1(1):1003.

## Abstract

Moringa (*Moringa oleifera*) is locally known as "Sohanjan" in Pakistan. In Pakistan only two species of family Moringaceae: *M. concanensis* and M. oleifera are reported. *M. concanensis* is very uncommon and only noticed in some far-off parts of Tharparkar (Sindh province). Moringa (*Moringa oleifera*) is a valuable tree with great nutritional, medicinal, industrial and numerous agronomic uses. The leaves, fl Moringa Leaf Extract (MLE) are rich source of zeatin, auxin, vitamin E, ascorbic acid, minerals, and phenolic compounds. Moringa is known as Miracle Tree due to its diversified uses and benefits as food, medicinal, oil, fodder, water purification and natural plant growth enhancer. Moringa leaves are rich source of protein, calcium, potassium, β-carotene, thiamine, riboflavin and other vitamins, particularly vitamins A and C. Moringa wood is soft that's why it has little used except as a fuel and some time for light construction work. Moringa is a very important food product in tropics. It is the only plant that is rich in all five of these compounds which are vital for human health. Many countries, particularly India, Pakistan, Philippines and many parts of Africa, its leaves, flowers, pods and roots are used as highly nutritious vegetable in many countries such as Pakistan, India, and Philippines. Many countries of West Asia used moringa seed powder to purify drinking water. Mostly rural area of Sudan also used moringa seed powder for water treatment. Different parts of plant used in traditional medicine for treatment of rheumatism, ascites and cardiac stimulants. Leaves, root, stem bark, flowers and seeds are used in treatment of different diseases. Leaf extract of moringa has strong antibiotic and anti-malarial properties. Seed oil mostly used externally to cure rheumatism and gout. Many medicinal important compounds have been extracted from root, root bark, stem bark and seeds.

## Introduction

Moringa (*Moringa oleifera*) is locally known as "Sohanjan" in Pakistan. In Pakistan only two species of family Moringaceae: *M. concanensis* and *M. oleifera* are reported. *M. concanensis* is very uncommon and only noticed in some far-off parts of Tharparkar (Sindh province). *M. oleifera* is very common, widely grown and cultivated in the many regions of the Punjab, Sindh, Balochistan and KPK province of Pakistan. The tree propagated through stem cutting bears fruit within one year and 1 kg moringa seed gives 0.33 kg seed oil. Nevertheless, high oleic acid (>70%), low polyunsaturated fatty acid contents (<1%), high oxidative stability and increasing use in cosmetic industry is promoting interest in its cultivation as oil seed tree crop [1].

Moringa, a multipurpose plant, belongs to family Moringaceae with 13 known species. Moringa oleifera is most extensively diversified species in Pakistan. It is native to sub-Himalayan regions of Pakistan, India, Bangladesh and Afghanistan and now it is distributed across tropics and subtropical regions in the Cambodia, African, Philippines, Central and North America. *M. oleifera* is very fast growing, drought tolerant, grows well in poor soil. It can survive under a wide range of rainfall (30 cm to 300 cm year) and $p^H$ (5.0 to 9.0). In those regions which receive annual rainfall less than 400 mm, plant attains height of 6 m to 7 m in a year. To facilitate harvesting, pruning practice is

adopted to boost horizontal growth and give the tree bush shape [2].

Moringa (*Moringa oleifera*) is a valuable tree with great nutritional, medicinal, industrial and numerous agronomic uses. The leaves, flowers, and tender pods of moringa are used as vegetable in my sub-tropical and tropical countries. Moringa is known as Miracle Tree due to its diversified uses and benefits as food, medicinal, oil, fodder, water purification and natural plant growth enhancer [3].

## Propagation of Moringa

Moringa is propagated by two methods, sexual (seed) or asexual (cutting). In semiarid and arid climate propagation through seeds is preferred over stem cutting because in deep water table area; trees propagated through seeds develop longer roots as compared to stem cuttings [4].

## Moringa Plant Parts

Seeds and leaves are most important parts of plant. For production of leaves, Moringa plants are usually planted as following: After three months of flowering, pods mature and turned brown color. Each pod contains 12 seeds to 30 seeds covered with whitish or brownish semi permeable hull. Depending upon environment and variety, seed production may vary. Some genotypes bear flowering within six months of plantation while other takes one or more than one year [5].

Moringa leaves are rich source of protein, calcium, potassium, β-carotene, thiamine, riboflavin and other vitamins, particularly vitamins A and C. In Philippines it is used to enhance mother milk production that's why well known as mother's best friend. Tender pods (fruits) of plant are eaten as vegetable or pickled. Protein content of young pods ranges between 5% to 10%. Root of plant mostly used in pickle [6].

## Uses of Moringa

Moringa wood is soft that's why it has little used except as a fuel and some time for light construction work. However, in India, it is limitedly used in textile industry. Coarse fiber obtains from corky bark which is used in making of mats and paper while leather industry also used its stem gum in tanning of leather [7].

Moringa is a very important food product in tropics. It is the only plant that is rich in all five of these compounds which are vital for human health. Many countries, particularly India, Pakistan, Philippines and many parts of Africa, its leaves, flowers, pods and roots are used as highly nutritious vegetable in many countries such as Pakistan, India, and Philippines. Leaves are cooked as raw vegetable or mixed with flowers [8,9].

## Water Purification

Many countries of West Asia used moringa seed powder to purify drinking water. Mostly rural area of Sudan also used moringa seed powder for water treatment. Polyelectrolytes are one of the active ingredients in the moringa seed. This polyelectrolyte acts as coagulant agent and bind soil particles, reducing bacterial and viral contamination from drinking water. Water purification through seed powder is very quick and easy method. First seed hull removed from seed and then kernel ground to make powder. After mixing seed powder with water, allow water to coagulate impurities. After one hour, water is filtered to obtain pure water. In other method, seed powder packed in a cloth and suspended in water for overnight to coagulate impurities. The cloth containing the seeds powder removed from water and the purified water is poured leaving coagulant material in bottom. By this method up to 99% of colloids and germs can be removed. Only two seeds required in treatment of one liter very dirty water [10,11].

## Medicinal Uses

Different parts of plant used in traditional medicine for treatment of rheumatism, ascites and cardiac stimulants. Leaves, root, stem bark, flowers and seeds are used in treatment of different diseases. Leaf extract of moringa has strong antibiotic and anti-malarial properties. Seed oil mostly used externally to cure rheumatism and gout. Many medicinal important compounds have been extracted from root, root bark, stem bark and seeds.

**Table 1:** Illustrating medicinal importance of various parts of Moringa Plant

| Plant Part | Medicinal importance | References |
|---|---|---|
| Seed | Analgesic, anti-inflammatory activity. Antioxidant, Antimicrobia | [12-15] |
| Fruit | Analgesic, anti-inflammatory activity, Antioxidant | [12,16-18] |
| Leaves | Hypolipidaemic, antiatherosclerotic Analgesic, anti-inflammatory activity. Antioxidant | [12,17,19] |
| Root | Analgesic, anti-inflammatory activity. CNS depepressant | [12,20-22] |

## Moringa as Fodder for Livestock

A number of studies reveal that, Moringa being used as livestock fodder or mix with other fodder as a supplement. Human and animals widely used all parts of moringa due to high nutritional value. With less input and management practices, moringa fodder can easily be grown and increase milk and meat production. Under abiotic stress conditions, plant roots enter deep in soil in search of water and nutrients. Apart from its root system, moringa is very fast-growing plant with least nutrient and water requirement. This character makes moringa superior over other crops (soybean and cotton seed cake) and different range grasses, which relatively high-water requirement. Depending on fertilizer, genotype, season and environment, moringa crop produce high dry matter ranging from 4 to 8 $tha^{-1}$. Moringa leaves are rich source of all important nutrients and minerals important for livestock to produce more milk and meat. Low quality fodders can be enriched by adding moringa leaves which not only increases the total dry matter and digestibility but also improve protein intake in fish. Moringa fodder produces more biomass per unit area as compared to other forage crops. More over moringa fodder ensure availability of fodder during dry season which extends from December through May [23].

## Crop Growth Enhancer

Moringa Leaf Extract (MLE) is rich source of zeatin, auxin, vitamin E, ascorbic acid, minerals, and phenolic compounds. Zeatin is the natural form of cytokine which has important role in cell elongation, cell division, root formation, leaf senescence and apical dominance. With increase in concentration of zeatin in plant, many physiological processed accelerated many times. Seed priming with MLE increase seed emergence percentage and early seed emergence. MLE foliar and priming on crops increase photosynthetic and antioxidant activity which help plants to mitigate abiotic stresses. Ultimately increase crop yield [24].

## Moringa Seeds Oil (Ben oil)

Fully mature dried seeds are round or triangular in shape while, kernel is covered with semi-permeable hull with tree wings and are brownish or whitish in color. Mature dry seeds harvested from pods approximately yield 30% to 40% of non-drying oil, commercially well known as “Ben oil” or “Behen oil”. Oil is highly edible, good taste, and resembles olive oil in its fatty acid composition. Ben oil has both nutritional and industrial applications. Seed oil contents of moringa seeds varies depending upon climate, genotype and extraction methods. Seed also contains 38.4% crude protein. Moringa oil contains almost 17% saturated and 83% unsaturated fatty acids. Monounsaturated fatty acid, oleic acid contributes major part in fatty acid composition (more than 70%) while polyunsaturated fatty acids are less than 1% which makes oil less prone to oxidative damages. The contribution of seed oil content in total seed weight is about 30% to 40%. The nutritional status of moringa seeds also tell that besides oil it is also rich in protein (31.4%), carbohydrate (18.4%), fiber (7.3%) and ash content (6.2%). Besides higher protein content, moringa seeds have ample content of cysteine and methionine. The higher protein digestibility (93%) of moringa seeds is liable to its free urease activity and trypsin inhibition. Ben oil contains up to 20% saturated fatty acid. Palmitic acid is most dominating

fatty acid follower by behenic, steric and arachidic acids. Content of behenic acid is more than other common edible oil that's why moringa oil commercially known as "Ben" or "Behen" oil [25].

Health websites identify Moringa as a miracle tree, drumstick tree, horseradish tree or ben oil tree. It lowers blood pressure, blood sugar and cholesterol, reduces inflammation, and protect against arsenic toxicity. Monounsaturated fatty acids are dominant in fatty acid composition. Oleic acid (18:1) is the predominant fatty acid with contributes up to 75% of total fatty acids. While polyunsaturated fatty acids (linoleic and linoleic acid) are less than 1% in moringa oil. Oil extraction methods have no effect on fatty acid composition. Moringa oil MUFA/SFA ratio is high due to high content of oleic acid. Due to this characteristic, oil is associated with a reduce risk of cardio vascular diseases. Sterol composition of moringa oil is different from conventional edible oil s and olive oil. It mainly comprised of four main plant sterol compounds β-sitosterol, compesterol, stigmasterol and delta-5-avenasterol. These four compounds account almost 92% of total sterols. Genotype and Agro-climatic conditions could affect sterol composition. Sterols compounds play important role in metabolism of cholesterol and reduce chances of heart diseases while β-sitosterol also possesses antidiabetic potential [26].

## Health Benefits of Moringa Oil

The application of monounsaturated oils in varying number of foods has increased due to their superior oxidative stability and health benefits; hence the production and need of monounsaturated oils is rising all over the world. Oleic acid has some cholesterol lowering characteristics. Partial hydrogenation is not necessary for monounsaturated oils for increasing their shelf life and stability. Incidence of cardiovascular diseases has been positively correlated with the consumption ratio of partially hydrogenated fats. Enzymatic transesterification and fraction resulted in high oleic acid fraction of ben oil. High oleic acid fraction contains greater than 80% oleic acid; hence considered as the power house of oleic acid. The oil extracted from its seeds is edible and is comparable to olive oil in terms of quality.

Every part of the moringa plant is edible. Its fruit is shaped like a pod and is used as a vegetable, while its roots are similar to a radish and can be pickled. They leaves are used to make syrup and ketchup, he added [27].

## Medicinal and Pharmaceutical Application

Moringa seed oil has been used in folk medicines since pre-historic time. It is highly rich in oleic acid and possesses anti -inflammatory properties and also used in the treatment of breast cancer and cardiovascular diseases. Oil is rich in vitamins A and E and possesses good antibacterial properties. It also has antifungal, antiepileptic and antihypertensive characteristics [28].

## Biodiesel

Moringa seeds yields 30% to 40% good quality oil, rich in oleic acid. The worth of moringa oil is far better than the sunflower oil and research studies have also demonstrated that the biodiesel made from moringa oil is better in quality than those of other substrates, as it contains the highest number of methyl esters i.e., 67 which is the maximum for any biodiesel fuel. As trees bears fruit after one year of plantation hence production of biodiesel can be started after 1 year of cultivation. One hectare approximately can produce 2000 L biodiesel annually. The moringa oil-based biodiesel has better stability as they contain higher iodine content as compared to conventional diesel fuels. Its ignition performance is also better in winter because of the cold filter plugging point and it also contains higher octane number. The quality and recovery of moringa oil biodiesel is far better than other crops with by-product of glycerine. Moringa plants were milled to mesh size 5 after 30 day of cultivation, and solid mass is separated from the liquid by the process of filtration. The liquid was then moved to a gas reactor. It was noted that 580 L of gas is produced from 1 kg volatile solids produced possessing 81% methane content [29].

## Cosmetic Industry

Oleic acid is the major fatty acid of moringa oil and it is extensively suggested for the preparation of pharmaceutical ointments. It is a good cleansing agent with good cosmetic value. The ability of mixing with other essential oils and its non-drying properties made moringa oil excellent massage oil. The major utilization of oil is carried out in manufacturing of different soaps and cosmetic products. It is also used oil as perfume and skin lotion. Moringa was rich in healthy antioxidants and bioactive plant compounds are very nutritious and western countries sell it as dietary supplements either in powder or capsule form [30].

Moringa juice and hand it over to their industrial partner who sprayed it on crops and registered 10 percent increase in production. The Moringa juice gives strength to plants and improves their immunity against diseases. Its spray would either reduce cost of farmers on application of other sprays to zero or significantly low [31].

Moringa, a tropical plant, has gained popularity as a new super food because of its highly nutritious profile including its anti-inflammatory, antioxidant, and other protective properties.

Laboratory tests show that the plant contains 14% more calcium than milk. Similarly, it contains 2% more protein than yogurt, 4% more vitamin A than carrots, 7% more vitamin C than oranges and 3% more potassium than bananas [32].

One spoon of powdered moringa leaves can fulfill an individual's daily nutritional needs. As for its medicinal value, the plant is recommended for treating joint pain, blood pressure, sugar, cholesterol and various other diseases.

## Moringa Products

1. Moringa Leaf Powder
2. Moringa seed powder
3. Moringa oil (Ben or Behen oil)
4. Moringa Milk Powder
5. Moringa tablets
6. Moringa tea
7. Green Wheat Flour
8. Moringa juice
9. Moringa Super food
10. Moringa biodiesel
11. Moringa Roots for Pickles
12. Moringa Plant nursery
13. Moringa Fodder

## Pakistani Institutes Working on Moringa

1. Agronomy Department, Uni. Of Agri. Faisalabad
2. Pakistan Institutes of Engineering and Applied Sciences, Islamabad
3. National Institute Health, Islamabad.
4. Buffalo Research Institute, Pattoki, Lahore.
5. Moringa pharmaceutical Pvt. Ltd.
6. Herby Zone, Lahore.
7. Moringa Pakistan for Life, Islamabad.
8. Moringa Welfare Society, Faisalabad, Pakista

## References

1. Nouman W, Anwar F, Gull T, Newton ER, Domínguez-Perles R. Profiling of polyphenolics, nutrients and antioxidant potential of germplasm leaves from seven cultivars of Moringa oleifera Lam. Ind Crops Prod. 2016;83:166-76.
2. Anwar F, Bhanger MI. Analytical characterization of Moringa oleifera seed oil grown in temperate regions of Pakistan. J. Agri. Food Chem. 2003;51(22):6558-63.
3. Jabeen R, Shahid M, Jamil M, Ashraf M. Microscopic evaluation of the antimicrobial activity of seed extracts of Moringa oleifera. Pak. J. Bot. 2008;40(4):1349-58.
4. Anwar F, Ashraf M, Bhanger MI. Interprovenance variation in the composition of Moringa oleifera oilseeds from Pakistan. Journal of the American Oil Chemists Society. 2005;82(1):45-51.
5. Iqbal S, Bhanger MI. Effect of season and production location on antioxidant activity Moringa oleifera leaves grown in Pakistan. J Food Comp Anal. 2006;19(6-7):544-51.
6. Anjorin TS, Ikokoh P, Okolo S. Mineral composition of Moringa oleifera leaves, pods and seeds from two

regions in Abuja, Nigeria. Int J Agric Biol. 2010;12(3):431-4.

7. Animashaun J. Prospects of Agriculture Enterprise for Sustainable Economic Development: Success Story of University of Ilorin Moringa Value-Addition Activities. In Proceedings of the 4th International Conference of the African Association of Agricultural Economists, Hammamet, Tunisia. 2013;22–25.
8. Animashaun JO, Toye AA. Feasibility Analysis of Leaf-Based Moringa oleifera Plantation in the Nigerian Guinea, Savannah: Case Study of University of Ilorin Moringa Plantation. Department of Agricultural Economics & Farm Management, University of Ilorin, P.M.B. 1515, Ilorin, Nigeria. 2014.
9. The Smallholder Farmers Alliance (SFA). Moringa: Export Market Potential for Smallholder Farmers in Haiti. 2015.
10. Babu R, Chaudhuri M. Home water treatment by direct filtration with natural Coagulant. J Water Health. 2005;3(1):27-30.
11. Chumark P, Khunawat P, Sanvarinda Y, Phornchirasilp S, Morales NP, Phivthong-Ngam L, et al. The in vitro and ex vivo antioxidant properties, hypolipidaemic and antiatherosclerotic activities of water extract of Moringa oleifera Lam Leaves. J. Ethnopharmacol. 2008;116(3):439-46.
12. Trapti R, Bhutda V, Moon K, Aswar PB, Khadabadi SS. Comparative Studies on Anthelmintic Activity of Moringa oleifera and Vitex Negundo. Asian J Research Chem. 2009;2(2):181-2.
13. Fakurazi S, Hairuszah I, Nanthini, U. Moringa oleifera Lam prevents acetaminophen induced liver injury through restoration of glutathione level. Food Chem Toxicol. 2008;46(8):2611-5.
14. Chuang PH, Chi-Wei L, Jia-Ying C, Murugan M, BorJinn S, Hueih-Min C. Anti-fungal activity of crude extracts and essential oil of Moringa oleifera Lam. Bioresour Technol. 2007;98(1):232-6.
15. Pezzuto JM, Park EJ. Autoxidation and antioxidants. In: Swarbrick J, Boylan JC (Eds.) Encyclopedia of Pharmaceuticals Technology, second ed. Marcel Dekker Inc. New York. 2002;1:97-113.
16. Gautum R, Saklani A, Jachak SM. Indian medicinal plants as a source of antimycobacterial agents. J Ethnopharmacol. 2007;110(2):200-34.
17. Late MK, Balaraman R, Amin AH, Bafna PA, Gulati OD. Effect of fruits of Moringa oleifera on the lipid profile of normal and hypercholesterolaemic rabbits. J. Ethnopharmacol. 2003;86(2-3):191-5.
18. Siddhuraju P, Becker K. Antioxidant properties of various solvent extracts of total phenolic constituents from three different agroclimatic origins of Drumstick tree (Moringa oleiferea Lam) leaves. J. Agric. Food Chem. 2003;51(8):2144-55.
19. Nikkon F, Zahangir AS, Habibur Rahman M, Eqramul H. Invitro antimicrobial activity of the compound isolated from chloroform extract of Moringa oleifera Lam. Pak J Biol Sci. 2003;6(22): 1888-90.
20. Sreelatha S, Padma PR. Antioxidant Activity and Total Phenolic Content of Moringa oleifera Leaves in Two Stages of Maturity. Plant Foods Hum Nutr. 2009;64(4):303-11.
21. Talreja T. Screening of crude extract of flavonoids of Moringa oleifera against bacterial and fungal pathogen. J Phytol. 2010;2(11):31-5.
22. Ajit K, Choudhary BK, Bandyopadhyay NG. Comparative evaluation of hypoglycaemic activity of some Indian medicinal plants in alloxan diabetic rats. J. Ethnopharmacol. 2003;84(1):105-8.
23. Adline J, Devi J. A study on phytochemical screening and antibacterial activity of Moringa oleifera. Int J Res Appl. 2014;2:169-76.
24. Anonymous. Moringa'shope- the miracle tree. Available
25. Doughari JH, Pukuma MS, De N. Antibacterial effects of Balanites aegyptiaca L. Drel. and Moringa oleifera Lam. on Salmonella typhi. Afr J of Biotech. 2007;6(19):2212-5.
26. Farooq A, Bhanger MI. Analytical Characterization of Moringa oleifera Seed Oil Grown in Temperate

Regions of Pakistan. J Agric Food Chem. 2003;51(22):6558-63.

27. Newton KA, Richard NB, Rosario BLC, Eduardo ASR, Vincenzo LT, Angela G, et al. Profiling selected phytochemicals and nutrients in different tissue of the multipurpose tree Moringa oleifera L. grown in Ghana. Food Chemistry. 2010;122(4):1047-54.
28. Pandey A. Moringa oleifera Lam. (Sahijan)-A plant with a plethora of diverse therapeutic benefits: An updated retrospection. Med. Aromat. Plants. 2012;101.
29. Palada MC, Changl LC. Suggested Cultural Practices for Moringa. International Cooperators' Guide. Asian Vegetable Research and Development center (AVRDC). 2003;3:1-5.
30. Lipipun V, Kurokawa M, Suttisri R, Taweechotipatr P, Pramyothin P, Hattori M, et al. Efficacy of Thai medicinal plant extracts against herpes simplex virus type 1 infection in vitro and in vivo. Antiviral Res. 2003;60(3):175-180.
31. Mendieta-Araica B, Sporndly E, Sanchez NR, Miranda FS, Halling M. Biomass production and chemical composition of Moringa oleifera under different planting densities and levels of nitrogen fertilization. Agroforestry Syst. 2012;87(1)81-92.
32. Musa D, Baba Garba Y, Jibril MY, Lukman H. Costs and Returns of Moringa (Moringa oleifera) Production in Zuru Local Government Area of Kebbi State, Nigeria. N. Y. Sci. J. 2015;8(1):36-40.