

**INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES &
MANAGEMENT****A MULTIPURPOSE TREE- MORINGA OLEIFERA: REVIEW ON
NUTRITIVE IMPORTANCE AND ITS MEDICINAL EVIDENCE****Smruti Sohani**College of Professional Studies
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smrutisohani@gmail.com**ABSTRACT**

Moringa oleifera, native to India, grows in the tropical and subtropical regions of the world. It is known by such regional names as benzolive, drumstick tree, kelor, marango, mlonge, mulangay, nébéday, saijhan, and sajna. The Moringa plant provides a rich and rare combination of zeatin, quercetin, sitosterol, caffeoylquinic acid and kaempferol. In addition to its compelling water purifying powers and high nutritional value, M. oleifera is very important for its medicinal value. Various parts of this plant such as the leaves, roots, seed, bark, fruit, flowers and immature pods act as medicine. Moringa can withstand both severe drought and mild frost conditions and hence widely cultivated across the world. With its high nutritive values, every part of the tree is suitable for either nutritional or commercial purposes. The leaves are rich in minerals, vitamins and other essential phytochemicals. Extracts from the leaves are used to treat malnutrition, augment breast milk in lactating mothers. M. oleifera seed, a natural coagulant is extensively used in water treatment. The scientific effort of this research provides insights on the use of moringa as a cure for diabetes and cancer and fortification of moringa in commercial products. This review explores the use of moringa across disciplines for its medicinal value and deals with cultivation, nutrition, commercial and prominent pharmacological properties of this “Miracle Tree”. Over the past two decades, many reports have appeared in mainstream scientific journals describing its nutritional and medicinal properties.

Keywords: Moringa oleifera; Miracle Tree; Antidiabetic; Anticancer; Coagulant

INTRODUCTION

Moringa oleifera belonging to the family of Moringaceae is an effective remedy for malnutrition. *M. oleifera* is a small or middle-sized tree, ranges in height from 5 to 10 m. 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. It can grow well in the humid tropics or hot dry lands, can survive destitute soils, and is little affected by drought. 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 5.0–9.03. Moringa is rich in nutrition owing to the presence of a variety of essential phytochemicals present in its leaves, pods and seeds. In fact, moringa is said to provide 7 times more vitamin C than oranges, 10 times more vitamin A than carrots, 17 times more calcium than milk, 9 times more protein than yoghurt, 15 times more potassium than bananas and 25 times more iron than spinach [1]. The fact that moringa is easily cultivable makes it a sustainable remedy for malnutrition. Countries like Senegal and Benin treat children with moringa [2]. Children deprived of breast milk tend to show symptoms of malnutrition. Lactogogues are generally prescribed to lactating mothers to augment milk production. The lactogogue, made of phytosterols, acts as a precursor for hormones required for reproductive growth. Moringa is rich in phytosterols like stigmasterol, sitosterol and kampesterol which are precursors for hormones. These compounds increase the estrogen production, which in turn stimulates the proliferation of the mammary gland ducts to produce milk. It is used to treat malnutrition in children younger than 3 years [3]. About 6 spoonfuls of leaf powder can meet a woman’s daily iron and calcium requirements, during pregnancy. This study provides an overview on the cultivation, nutritional values, medicinal properties for commercial use and pharmacological properties of moringa. There are no elaborate reports on treatment of diabetes and cancer using moringa.

NUTRITIVE PROPERTIES

Every part of *M. oleifera* is a storehouse of important nutrients and antinutrients. The leaves of *M. oleifera* are rich in minerals like calcium, potassium, zinc, magnesium, iron and copper [2]. Vitamins like beta-carotene of vitamin A, vitamin B such as folic acid, pyridoxine and nicotinic acid, vitamin C, D and E also present in *M. oleifera* [4]. Phytochemicals such as tannins, sterols, terpenoids, flavonoids, saponins, anthraquinones, alkaloids and reducing sugar present along with anti-cancerous agents like glucosinolates, isothiocyanates, glycoside compounds and glycerol-1-9-octadecanoate [5]. Moringa leaves also have a low calorific value and can be used in the diet of the obese. The pods are fibrous and are valuable to treat digestive problems and thwart colon cancer [6, 7]. A research shows that immature pods contain around 46.78% fiber and around 20.66% protein content. Pods have 30% of amino acid content, the leaves have 44% and flowers have 31%. The immature pods and flowers showed similar amounts of palmitic, linolenic, linoleic and oleic acids [8].

Moringa has lot of minerals that are essential for growth and development among which, calcium is considered as one of the important minerals for human growth. While 8 ounces of milk can provide 300–400 mg, moringa leaves can provide 1000 mg and moringa powder can provide more than 4000 mg. Moringa powder can be used as a substitute for iron tablets, hence as a treatment for anemia. Beef has only 2 mg of iron while moringa leaf powder has 28 mg of iron. It has been reported that moringa contains more iron than spinach [9]. A good dietary intake of zinc is essential for proper growth of sperm cells and is also necessary for the synthesis of DNA and RNA. *M. oleifera* leaves show around 25.5–31.03 mg of zinc/kg, which is the daily requirement of zinc in the diet [10]. Research show that moringa seed oil contains around 76% PUFA, making it ideal for use as a substitute for olive oil [11]. A point to note is that the nutrient composition varies depending on the location. Fuglie [12] revealed that seasons influence the nutrient content. It was shown that vitamin A was found abundantly in the hot-wet season, while vitamin C and iron were more in the cool-dry season [13]. The difference in results can be attributed to the fact that the location, climate and the environmental factors significantly influence nutrient content of the tree [14]. Moringa can be used as a potent neuroprotectant. Cerebral ischemia is caused due to obstruction of blood flow to the brain. This leads to reperfusion and lipid peroxidation, which in turn results in reactive oxygen species. Moringa with its antioxidants can reduce the reactive oxygen species, thereby protecting the brain [15, 16]. Moringa decreased acidity in gastric ulcers by a percentage of 86.15% and 85.13% at doses of 500 mg and 350 mg, respectively and therefore can be used as an antiulcer agent [17].

COMMERCIAL APPLICATIONS

Moringa seeds are used to extract oil called the Ben oil. This oil is rich in oleic acid, tocopherols and sterols. It can also withstand oxidative rancidity. The oil can be used in cooking as a substitute for olive oil, as perfumes and also for lubrication [14, 17]. The pods can absorb organic pollutants and pesticides. Moringa seeds also have great coagulant properties and can precipitate organics and mineral particulates out of a solution [1]. Chemical coagulants such as aluminum sulfate (Alum) and ferric sulfate or polymers removes suspended particles in waste water by neutralizing the electrical charges of particles in the water to form flocs making particles filterable. *M. oleifera* seed is a natural coagulant, containing a cationic protein that can clarify turbid water. This property of *M. oleifera* seeds is attracting much research as other coagulants such as alum, activated carbon and ferric chloride are expensive and rare [18]. Suhartini et al. [19] developed a two-stage clarifier for the treatment of tapioca starch waste water by placing coconut fiber followed by a layer of sand media mixed with powdered *M. oleifera*, this lead to improvement on physical and chemical characteristics, stabilizing pH value. Moringa seed extract has the ability to eliminate heavy metals (such as lead, copper, cadmium, chromium and arsenic) from water [20]. *M. oleifera* functionalized with magnetic nanoparticles such as iron oxide were found beneficial in surface water treatment by lowering settling time [21]. Seed extracts have antimicrobial properties that inhibit bacterial growth, which implies preventing waterborne diseases. These properties of *M. oleifera* seeds have wide applicability in averting diseases and can enhance the quality of life in rural communities as it is highly abundant.

Moringa seeds can be used in cosmetics and are sources of biodiesel while the seedcakes, can be used as a green manure or a fertilizer. The flowers of moringa are used to make tea with hypocholesterolemic properties. Moringa flowers are said to taste like mushrooms when fried [24]. The moringa flowers are great sources of nectar and are used by beekeepers. The root bark has medicinal values and is used for dyspepsia, eye diseases and heart complaints [22]. The tap root of Moringa is used as a spice. The gum from the tree can be used in calico printing. The gum and roots also have antibacterial, antifungal and anti-inflammatory properties [23]. *M. oleifera* leaves can be incorporated in the diet of hens and layers thereby providing excellent protein source, substituting other expensive ingredients such as soybean meal and ground nut cake [24,25]. Considering the views of several such fortifications, it is suggested that such addition can be done to other snacks as well. Addition of moringa to the snacks can add nutritive value to the snacks. Most snacks are made up of corn meal and several studies demonstrated that a little addition of moringa to maize flour can add nutritive value to the snack in terms of protein, energy and minerals. However, further studies on moringa as a fortified Indian snack is required before bringing commercialized moringa to the market.

CONCLUSION AND FUTURE PROSPECTS

The research on *M. oleifera* is yet to gain importance in India. It is essential that the nutrients of this wonder tree are exploited for a variety of purposes. *M. oleifera* has great anti-diabetic and anti-cancer properties. However, double blind researches are less prevalent to further substantiate these properties of moringa. More studies are needed to corroborate the primary mechanisms of moringa as antidiabetic and anticancer agents. Several puzzling questions are unanswered. Research on the antioxidant nature of aqueous extracts on cancer cells needs further inquiry. Studies have proven that moringa causes ROS in cancer cells that leads to apoptosis or necrosis. However, the aqueous extracts also have antioxidants present in them. The exact mechanism of this irony is yet to be explored. The effect of environmental factors affecting the nutrient levels of leaves and other parts of *M. oleifera* grown across the globe require further analysis.

Further research to isolate endophytic fungi and identify the enzymes or proteins from *M. oleifera* that are accountable for the anticancer and antidiabetic activity may lead to development of novel therapeutic compounds. Yet another focal area is to evaluate the commercial use of *M. oleifera* as a bio-coagulant. It might be a viable alternative for water purification. The demand for snacks in the market is huge. Hence Moringa fortification in snacks to eradicate malnutrition has a twin advantage. The tree as a native to India can become a great source of income for the nation if this potential for highly nutritional food is exploited by the industries and researchers by undertaking further research to corroborate earlier studies.

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