

An Overview on Moringa Oleifera

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ABSTRACT: *Moringa oleifera* is a plant native to India that thrives in tropical and subtropical climates throughout the globe. It's also known as the 'drumstick tree' or the 'horseradish tree.' Moringa is extensively grown throughout the globe because it can survive both severe drought and moderate cold. Every component of the tree is useful for nutritional or economic uses due to its high nutritious properties. Minerals, vitamins, and other phytochemicals are abundant in the leaves. The leaves' extracts are used to treat malnutrition and to supplement breast milk in nursing mothers. It's been utilized as an antioxidant, anticancer, anti-inflammatory, anti-diabetic, and antibacterial agent in the past. A natural coagulant, *M. oleifera* seed, is widely utilized in water treatment. This study's scientific endeavor sheds light on the usage of moringa as a diabetic and cancer treatment, as well as moringa fortification in commercial goods. This study looks at how moringa is used in a variety of fields for its medical qualities, including production, nutrition, commercialization, and the most important pharmacological aspects of this "miracle tree".

KEYWORDS: Antidiabetic, Anticancer, Coagulant, Miracle Tree, Moringa Oleifera.

1. INTRODUCTION

The Moringa oleifera plant, which belongs to the Moringaceae family, is an excellent treatment for malnutrition. Moringa's leaves, pods, and seeds contain a range of important compounds, making it a nutrient-dense plant. Moringa is reported to have seven times the vitamin C of oranges, ten times the vitamin A of carrots, seventeen times the calcium of milk, nine times the protein of yoghurt, fifteen times the potassium of bananas, and twenty-five times the iron of spinach. Moringa is a sustainable treatment for malnutrition because to its ease of cultivation. Moringa is used to cure children in Senegal and Benin. Children who do not get breast milk are more likely to develop malnutrition symptoms.

Lactogogues are often given to breastfeeding women to help them produce more milk. Lactogogue is a phytosterol-based lactogogue that serves as a precursor for hormones needed for reproductive development. Moringa contains phytosterols such as stigmasterol, sitosterol, and kampesterol, which are hormone precursors. These chemicals enhance estrogen production, which promotes mammary gland duct growth and milk production. It's used to treat malnutrition in kids under the age of three. During pregnancy, around 6 spoonfuls of leaf powder may satisfy a woman's daily iron and calcium needs. Moringa's cultivation, nutritional value, therapeutic qualities for commercial use, and pharmacological properties are all included in this research. There are no comprehensive studies on the use of moringa in the treatment of diabetes and cancer. The goal of this research is to close the gap[1]–[6].

Soil and Plantation Conditions:

M. oleifera may be cultivated in any tropical or subtropical area with a temperature of 25–35 degrees Celsius. It needs sandy or loamy soil with a slightly acidic to slightly alkaline pH and 250–3000 mm of net rainfall. Because of the high germination rates, the direct sowing technique is used. Moringa seeds may be sown at a depth of 2 cm in the soil and are anticipated to germinate in 5–12 days after planting. Containers may also be used to propagate Moringa. The seedlings are put in plastic bags with sandy or loamy soil in them. It may be transplanted after it reaches a height of approximately 30 cm. However, since the tap roots are delicate and susceptible to damage, extreme caution should be used while

transplanting them. Cuttings with a length of 1 m and a diameter of 4–5 cm may also be used to grow the tree, although these plants may not have a strong deep root system. Drought and wind sensitivity are common in such plants. Moringa plantations on a big scale, both intense and semi-intensive, may be used for commercial reasons. Spacing is essential in commercial agriculture because it aids in plant care and harvest. The nutritional content of *M. oleifera* varies depending on the region.

Properties Nutritive:

M. oleifera has a wealth of essential nutrients and antinutrients in every section of the plant. Minerals such as calcium, potassium, zinc, magnesium, iron, and copper are abundant in the leaves of *M. oleifera*. Vitamins such as beta-carotene (vitamin A), folic acid, pyridoxine, and nicotinic acid (vitamin B), vitamin C, D, and E are also found in *M. oleifera*. Anti-cancerous agents such as glucosinolates, isothiocyanates, glycoside compounds, and glycerol-1-9-octadecanoate are present, as are phytochemicals such as tannins, sterols, terpenoids, flavonoids, saponins, anthraquinones, alkaloids, and reducing sugar. Moringa leaves are similarly low in calories and may be included in an obese person's diet. The fibrous pods are useful for treating digestive issues and preventing colon cancer.

Moringa has a variety of nutrients that are necessary for human growth and development, including calcium, which is one of the most important elements for human growth. While 8 ounces of milk has 300–400 mg of moringa, moringa leaves have 1000 mg, and moringa powder contains around 4000 mg. Moringa powder may be used as a replacement for iron pills, and therefore as an anemia therapy. Beef has just 2 mg of iron, while moringa leaf powder contains 28 mg. Moringa is said to have higher iron content than spinach. Zinc is required for sperm cell development and DNA and RNA production, therefore it's important to have enough of it in your diet. *M. oleifera* leaves contain about 25.5–31.03 mg of zinc per kilogram, which is the daily zinc requirement [7], [8].

Moringa Processing:

When plants are treated, they lose much of their nutritional value. When the nutritive content of raw, germinated, and fermented moringa seed flour was examined, it was discovered that raw seed flour had more phytochemicals, while fermented and germinated seed flour had the highest amino acid concentration. This may be the consequence of biochemical and microbiological action during germination and fermentation. However, a research looked at the impact of boiling, simmering, and blanching on moringa leaf nutritional content retention. Surprisingly, boiling was the most efficient of all the procedures, substantially lowering the levels of cyanide, oxalate, and phytate compared to the other two. Because the presence of phytate and other anti-minerals may decrease the bioavailability of some nutrients, processing is necessary to get the most out of the seeds and leaves.

- *Methods of Preservation:*

Moringa may also be stored for an extended period of time without losing nutrients. To preserve the leaves, they may be dried or frozen. According to Yang et al., a low temperature oven used to dry the leaves preserved more nutrients than freeze-dried leaves, with the exception of vitamin C. As a result, to maintain a constant supply of nutrients in the leaves, drying may be done using a low-cost home device such as a stove. Moringa's shelf life is extended by dehydration without compromising its nutritional content. An excessive amount of moringa may lead to a lot of iron buildup. Hemochromatosis and gastrointestinal discomfort may be caused by high iron levels. As a result, a daily dosage of 70 g of moringa is recommended to avoid excessive nutrient buildup.

Properties Medicinal:

M. oleifera is known as a panacea since it can treat more than 300 illnesses. Indians and Africans have traditionally utilized moringa in herbal therapy. It's an excellent medicinal agent since it contains phytochemicals. The impact of moringa on illnesses such as diabetes and cancer is discussed in this section[9], [10].

a. Anti-diabetic activity:

Both Type 1 and Type 2 diabetes have been proven to be cured with moringa. Type 1 diabetes is characterized by the inability of individuals to produce insulin, a hormone that keeps blood glucose levels in the normal range. Insulin resistance is a feature of type 2 diabetes. Type 2 diabetes may potentially be caused by Beta cell malfunction, in which the cells fail to detect glucose levels and therefore decrease insulin signaling, resulting in excessive blood glucose levels. Diabetic problems include retinopathy, nephropathy, and atherosclerosis, among others. Moringa is a plant that may help you avoid becoming sick. Blood glucose interacts with proteins in hyperglycemia, resulting in advanced glycated end products (AGEs). RAGE, which is expressed on the surface of immune cells, binds to these AGEs. Increased transcription of cytokines like interleukin-6 and interferons results from this interaction. Cell adhesion molecules are expressed on the surface endothelium of arteries at the same time. This promotes transendothelial migration, which leads to artery irritation and atherosclerosis. Moringa is a plant that is used to treat atherosclerosis. Moringa's antioxidant capabilities account for its anti-atherogenic effects.

b. Cancer-fighting properties:

Cancer is a prevalent illness, and incorrect treatment is responsible for one out of every seven fatalities. In India, there are about 2.4 million instances, and there are no known causes for cancer. The illness may be caused by a number of causes, including smoking, lack of exercise, and radiation exposure. Treatments for cancer, such as surgery, chemotherapy, and radiation, are costly and have adverse effects. At established doses, *M. oleifera* may be utilized as an anticancer drug since it is natural, dependable, and safe. Moringa has been demonstrated in studies to be an anti-neoproliferative drug, slowing the development of cancer cells. Leaf extracts, both soluble and solvent, have been shown to be potent anticancer agents. Furthermore, study articles indicate that cancer's capacity to generate reactive oxygen species in cancer cells may be responsible for its anti-proliferative impact. Apoptosis is caused by reactive oxygen species produced in cells, according to studies.

c. Other illnesses:

Moringa has been shown to be a powerful neuroprotectant. Obstruction of blood flow to the brain causes cerebral ischemia. Reperfusion and lipid peroxidation occur as a consequence, resulting in reactive oxygen species. Moringa's antioxidants may help protect the brain by lowering reactive oxygen species. *M. oleifera* has been proven to improve spatial memory and is thus used to treat dementia. The leaf extracts have been found to reduce the activity of acetylcholine esterase, enhancing cholinergic function and memory.

Applications in Business:

Moringa seeds are used to make a kind of oil known as Ben oil. Oleic acid, tocopherols, and sterols are abundant in this oil. It also has the ability to resist oxidative rancidity. The oil may be used as a replacement for olive oil in cooking, as well as for fragrances and lubrication. Organic contaminants and pesticides may be absorbed by the pods. Moringa seeds are also excellent coagulants, allowing them to precipitate organics and mineral particles from a solution. Chemical coagulants, such as aluminum sulfate (Alum) and ferric sulfate (FeSulfate), or polymers, remove suspended particles in waste water by neutralizing the electrical charges of particles in the water, forming flocs that are filterable. *M. oleifera* seed

has a cationic protein that may clear murky water, making it a natural coagulant. Other coagulants, such as alum, activated carbon, and ferric chloride, are costly and scarce; therefore this characteristic of *M. oleifera* seeds is receiving a lot of attention. Suhartini et al. devised a two-stage clarifier for the treatment of tapioca starch waste water, which consisted of a layer of coconut fiber followed by a layer of sand medium mixed with powdered *M. oleifera*, which improved physical and chemical properties while stabilizing pH.

Heavy metals (such as lead, copper, cadmium, chromium, and arsenic) may be removed from water using moringa seed extract. Surface water treatment using *M. oleifera* functionalized with magnetic nanoparticles such as iron oxide was shown to be helpful by reducing settling time. Seed extracts contain antibacterial qualities that prevent germs from growing, which means they may help prevent waterborne illnesses. These characteristics of *M. oleifera* seeds have a broad range of applications in disease prevention and may improve the quality of life in rural areas due to their abundance.

Moringa seeds may be used in cosmetic and as a source of biodiesel, while seedcakes can be used as a fertilizer or green manure. Moringa flowers are used to make a tea that has anti-cholesterolemic properties. When fried, moringa flowers are said to taste like mushrooms. Beekeepers use moringa flowers because they have a lot of nectar. The root bark has therapeutic properties and is used to treat dyspepsia, vision problems, and cardiac problems. Moringa's tap root is used as a spice. Calicoprinting can be done with the tree's gum. Antibacterial, antifungal, and anti-inflammatory properties are also found in the gum and roots. Zeatin, a foliar growth hormone derived from the leaves, is a good foliar that may enhance crop production by 25%–30%. Moringa fortification and incorporation may help to combat nutritional deficits and malnutrition. Moringa has been used to fortify snacks in studies.

2. DISCUSSION

Moringa oleifera is a fast-growing, drought-resistant tree native to the Indian subcontinent, belonging to the Moringaceae family. Moringa, drumstick tree (due to the tall, thin, triangular seedpods), horseradish tree (because to the flavor of the roots, which is similar to horseradish), and ben oil tree or benzolive tree are all common names. Moringa may also be used orally to decrease edema, act as an antioxidant, prevent spasms, enhance sex desire (aphrodisiac), prevent pregnancy, strengthen the immune system, and increase breast milk supply. Some individuals use it as a tonic or nutritional supplement. It's also called a "water pill" (diuretic). Even at larger doses, moringa powder has been shown to be safe. The daily dose should be restricted to 70 grams of moringa leaves or 11 tablespoons of moringa powder per day.

Moringa oleifera is a valued medicinal plant in traditional folk medicine. Many pharmacological studies have shown the ability of this plant to exhibit analgesic, anti-inflammatory, antipyretic, anticancer, antioxidant, nootropic, hepatoprotective, gastroprotective, anti-ulcer, cardiovascular, anti-obesity, antiepileptic, antiasthmatic, antidiabetic, anti-urolithiatic, diuretic, local anesthetic, anti-allergic, anthelmintic, wound healing, antimicrobial, immunomodulatory, and antidiarrheal properties. This review is a comprehensive summary of the phytochemical and pharmacological activities as well as the traditional and therapeutic uses of this plant. *M. oleifera* has wide traditional and pharmacological uses in various pathophysiological conditions. We will review the various properties of *M. oleifera* (drumstick tree) and focus on its various medicinal properties. We think that it is an attractive subject for further experimental and clinical investigations.

Moringa oleifera is an important tropical food plant that seems to have great nutritional, therapeutic, industrial, agricultural, and socioeconomic value. Dietary consumption of its parts and preparations is encouraged by several organizations, health food enthusiasts, and other specialists as a strategy of personal health preservation and self-medication in the treatment of various diseases. Studies extolling its ability to mitigate various degenerative ailments now exist in both the scientific and the popular literature. At face value, and considering the volume of reports available, much of this enthusiasm seems to be indeed justified. However, it is imperative to distinguish rigorous scientific evidence from anecdote. To achieve this, relevant experimental and review articles were sought and read critically to identify recent patterns and trends on this subject matter. Studies on the medicinal and functional properties of *M. oleifera* are available from various parts of the world, especially developing regions. Attempts have been made to parse the contemporary scientific data available supporting the claims regarding the phytochemical, nutritive, medicinal, environmental, agricultural, and socioeconomic capabilities of this plant. Studies reviewed provide compelling, albeit preliminary experimental evidence of therapeutic potential of the plant. It is important that *M. oleifera* products and preparations be properly chemically characterized and standardized before being administered.

It tolerates a wide range of rainfall, with minimum annual rainfall requirements estimated at 250 mm and maximum at over 3000 mm.³ It is an important food plant highly nutritious and generally esteemed as a functional food with all parts established to be edible.⁴⁻⁶ A wide variety of nutritional, prophylactic, and therapeutic virtues have been attributed to its roots, bark, leaves, flowers, sap, fruits, and seeds. There is some documented evidence that *M. oleifera* possesses medicinal attributes, including hypotensive, hypoglycemic, anticancer, radioprotective, thyroid hormone regulatory, antiobesity, antipyretic, antiepileptic, and diuretic attributes among others.⁷⁻¹¹ Numerous traditional and scientific studies have been conducted on the attributes of *M. oleifera*, the output of which have been the subject of many extensive reviews.^{1,2,4,6-8} Many experts have proposed the use of *M. oleifera* as a complementary medical option or for use in relief and prevention of disease symptoms. However, in spite of these studies, reviews, recommendations, and widespread claims, Western (conventional) medicine has been spectacularly hesitant in exploring its nutritional and medicinal potential. This lukewarm attitude is curious, as other “superfoods” such as garlic and green tea have enjoyed better reception. However, the recent “healthy eating” trend where many consumers are inclined to consume wholesome foods, are skeptical of synthetic medications, as well as the advancement of “green” medicine and so on, has placed a spotlight on *M. oleifera* among other “healthy” options.

3. CONCLUSION

M. oleifera research has failed to find traction in India. It's critical that the wonder tree's nutrients be used for a variety of reasons. *M. oleifera* is a powerful anti-diabetic and anti-cancer herb. Double-blind studies, on the other hand, are less common in order to further establish moringa's characteristics. More research is required to confirm moringa's main mechanisms as an anti-diabetic and anti-cancer drug. A number of perplexing questions remain unsolved. More research on the antioxidant properties of aqueous extracts on cancer cells is needed. Moringa generates ROS in cancer cells, which leads to apoptosis or necrosis, according to studies. The aqueous extracts, on the other hand, include antioxidants. This irony's precise mechanism has yet to be discovered. Environmental variables influencing the nutritional levels of *M. oleifera* leaves and other components cultivated throughout the world need to be investigated further.

Further study to extract endophytic fungus and discover *M. oleifera* enzymes or proteins responsible for anticancer and antidiabetic action may lead to the creation of new medicinal molecules. Another focus is on evaluating *M. oleifera*'s economic potential as a bio-coagulant. It may be a feasible water filtration option. Snacks are in high demand on the market. As a result, adding Moringa to snacks to combat malnutrition has a double benefit. The tree, which is native to India, has the potential to become a major source of revenue for the country if its high nutritional value is realized by businesses and academics who do further study to back up previous findings.

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