MORINGA OLEIFERA: A REVIEW ON MEDICINAL AND NUTRITIONAL PROPERTIES

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ABSTRACT

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. The fact that moringa is easily cultivable makes it a sustainable remedy for malnutrition. Moringa can also be preserved for a long time without loss of nutrients. Drying or freezing can be done to store the leaves. 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. M. oleifera has great anti-diabetic and anti-cancer properties.

KEYWORDS: Moringa, herbal medicine, anti-diabetic, anticancer properties.

INTRODUCTION

Moringa oleifera (M. oleifera) or drumstick is a member of Moringaceae, and it is grown extensively in many Southeast Asian countries particularly in Thailand, India, Philippines and Pakistan (Fuglie, 2001). It has long been known as a food plant in Thai cuisine and as an ingredient of Indian traditional medicine (Wutythamawech, 1997; Mishra et al., 2011).

Moringa oleifera is one of the important plants to be mentioned with priority in medicinal herbs. A folk remedy for catarrh, cancer, gastric ulcer, skin disease, lower blood sugar, nervous condition and diabetes. It is also used to strengthen lever, eye, brain, gall, and immune system and most important. It is also used to expel intestinal worm. The leaves,
flower and pod are used as significant source of vitamins A, riboflavin, nicotinic acid, folic acid, pyridoxine, ascorbic acid, beta carotene, calcium, iron and \( \alpha \)-tocopherol (Prasad and Ganguly 2012). There is need for immunomodulator that can safely and selectively enhance a specific class or antiinflammatory, antioxidant, CNS depressant, anti-hyper lipidaemic, anticancer, antihepatotoxic and anti-ulcer property. It can be presumed that the plant working through immune system (Ganguly and Prasad 2010).

The leaves contain nutrients especially essential amino acids, vitamins, minerals and \( \beta \)-carotene (Sabale et al., 2008; Sharma et al., 2012). For this reason, it is used as an alternative source for nutritional supplements and growth promoters in some countries (Anwar et al., 2007). Apart from nutritional benefits, M. oleifera is reported to be used for the treatment of rheumatism, ascites, infection, hiccough influenza and internal abscess (Anwar et al., 2007; Mishra et al., 2011). Many recent reports on disease prevention by M. oleifera have been reported. The leaf extract is capable of reducing hyperglycemia and dyslipidemia (Mbkikay, 2012). (Budda et al., 2011). Moreover, it has been reported that the leaf extract had potent anti-proliferative activity and apoptosis inducing capacity on tumor (KB) cell line (Sreelatha et al., 2011), and it also increased the cytotoxicity of chemotherapy on pancreatic cancer cells (Berkovich et al., 2013)

**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. 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. 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.

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.\textsuperscript{10,62} 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 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. 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.

**Medicinal properties of Moringa oleifera**

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 and Africans. The presence of phytochemicals makes it a good medicinal agent. In this section, the effect of moringa on diseases like diabetes and cancer are reviewed.

- **Anti-diabetic properties**

  Moringa has been shown to cure both Type 1 and Type 2 diabetes. Type 1 diabetes is one where the patients suffer from non-production of insulin, which is a hormone that maintains the blood glucose level at the required normal value. Type 2 diabetes is one associated with insulin resistance. Type 2 diabetes might also be due to Beta cell dysfunction, which fails to sense glucose levels, hence reduces the signaling to insulin, resulting in high blood glucose levels.\(^{[22]}\) Several studies have shown that, moringa can act as an anti-diabetic agent. A study has shown that the aqueous extracts of M. oleifera can cure streptozotocin-induced Type 1 diabetes and also insulin resistant Type 2 diabetes in rats.\(^{[23]}\) In another study, the researchers fed the STZ-induced diabetes rats with Moringa seed powder and noticed that the fasting blood glucose dropped.\(^{[50]}\) Also, when the rats were treated with about 500 mg of moringa seed powder/kg body weight, the antioxidant enzymes increased in the serum. This shows that the antioxidants present in moringa can bring down the ROS caused in the Beta-cells due to the STZ induction.\(^{[8]}\) STZ causes ATP dephosphorylation reactions and helps xanthine oxidase in the formation of superoxides and reactive oxygen species (ROS) in Beta cells. This reduces insulin secretion leading to hyperglycemia and in turn diabetes mellitus Type-2. The flavonoids like quercitin and phenolics have been attributed as antioxidants that bring about a scavenging effect on ROS. It can be hypothesized that the flavonoids in Moringa scavenge the ROS released from mitochondria, thereby protecting the beta cells and in turn keeping hyperglycemia under control.
• **Anticancer properties**

Cancer is a common disease and one in seven deaths is attributed due to improper medication. Around 2.4 million cases are prevalent in India, while there are no specific reasons for cancer to develop. Several factors like smoking, lack of exercise and radiation exposure can lead to the disease. Cancer treatments like surgery, chemotherapy and radiation are expensive and have side effects. *M. oleifera* can be used as an anticancer agent as it is natural, reliable and safe, at established concentrations. Studies have shown that moringa can be used as an anti-neoproliferative agent, thereby inhibiting the growth of cancer cells. Soluble and solvent extracts of leaves have been proven effective as anticancer agents. Furthermore, research papers suggest that the anti-proliferative effect of cancer may be due to its ability to induce reactive oxygen species in the cancer cells. Researchs show that the reactive oxygen species induced in the cells leads to apoptosis. This is further proved by the up regulation of caspase 3 and caspase 9, which are part of the apoptotic pathway. Moreover, the ROS production by moringa is specific and targets only cancer cells, making it an ideal anticancer agent. Also, it showed that the extracts increased the expression of glutathione-S-transferase, which inhibits the express of antioxidants. Anticancer agents targeting cancer using ROS induction are common, but these substances should also be able to attack the antioxidant enzymes. However, Moringa leaf extracts have been shown to be antioxidants and anticancer agents which induce ROS. The exact behavior of the two contrary attributes of the leaves is yet to be explored. The compounds of the leaves that are held responsible for the anticancer activities are glucosinolates, niazimicin and benzyl isothiocyanate. Benzyl isothiocyanate has been shown to be linked with cancer. Research shows that BITC causes intracellular ROS, which leads to cell death. This could be one of the reasons for moringa to be a good anticancer agent.

• **Other diseases**

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. *M. oleifera* is used to treat dementia, as it has been shown to be a promoter of spatial memory. The leaf extracts have shown to decrease the acetylcholine esterase activity, thereby improving cholinergic function and memory. showed that moringa in diet of rats, can increase protein content and decrease levels of urea and creatinine in blood, preventing renal dysfunction. 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. Moringa is prescribed by herbal practitioners for patients with AIDS. Moringa is suggested to be included in the diet, with the view of boosting the immune system of HIV positive individuals. However, more research is essential to validate the effect of moringa on anti-retroviral drugs. The hydro-alcoholic extract of moringa flowers reduced the levels of rheumatoid factor, TNF-alpha and IL-1 in arthritic rats. This proves that moringa can be a potent therapy for arthritis. Microbial diseases are widespread and there is a need for antimicrobial agents, M. oleifera has been proven as a good antimicrobial agent. A study by Viera et al. has shown that the extracts of M. oleifera can act against bacteria like Bacillus subtilis, Staphylococcus aureus and Vibrio cholera. The antibacterial effects of the seeds were accounted for by the presence of pterygospermin, moringine and benzyl isothiocyanate.

- Benefits of moringa oleifera

  - Protecting and nourishing skin and hair:- Moringa seed oil is beneficial for protecting hair against free radicals and keeps it clean and healthy. Moringa also contains protein, which means it is helpful in protecting skin cells from damage. It also contains hydrating and detoxifying elements, which also boost the skin and hair. It can be successful in curing skin infections and sores.

  - Treating edema:- Edema is a painful condition where fluid builds up in specific tissues in the body. The anti-inflammatory properties of moringa may be effective in preventing edema from developing.

  - Protecting the liver:- Moringa appears to protect the liver against damage caused by anti-tubercular drugs and can quicken its repair process.

  - Preparing and treating cancer:- Moringa extracts contain properties that might help prevent cancer developing. It also contains niazimicin, which is a compound that suppresses the development of cancer cells.

  - Treating stomach complaints:- Moringa extracts might help treat some stomach disorders, such as constipation, gastritis, and ulcerative colitis. The antibiotic and antibacterial properties of moringa may help inhibit the growth of various pathogens, and its high vitamin B content helps with digestion.
- **Fighting against bacterial diseases:** Due to its antibacterial, antifungal, and antimicrobial properties, moringa extracts might combat infections caused by Salmonella, Rhizopus, and E. coli.

- **Making bones healthier:** Moringa also contains calcium and phosphorus, which help keep bones healthy and strong. Along with its anti-inflammatory properties, moringa extract might help to treat conditions such as arthritis and may also heal damaged bones.

- **Treating mood disorders:** Moringa is thought to be helpful in treating depression, anxiety, and fatigue.

- **Protecting the cardiovascular system:** The powerful antioxidants found in Moringa extract might help prevent cardiac damage and have also been shown to maintain a healthy heart.

- **Helping wounds to heal:** Extract of moringa has been shown to help wounds close as well as reduce the appearance of scars.

- **Treating diabetes:** Moringa helps to reduce the amount of glucose in the blood, as well as sugar and protein in the urine. This improved the haemoglobin levels and overall protein content in those tested.

- **Treating asthma:** Moringa may help reduce the severity of some asthma attacks and protect against bronchial constrictions. It has also been shown to assist with better lung function and breathing overall.

- **Protecting against kidney disorders:** People may be less likely to develop stones in the kidneys, bladder, or uterus if they ingest moringa extract. Moringa contains high levels of antioxidants that might aid toxicity levels in the kidneys.

- **Reducing high blood pressure:** Moringa contains isothiocyanate and niaziminin, compounds that help to stop arteries from thickening, which can cause blood pressure to rise.
• **Improving eye health:** Moringa contains eyesight-improving properties thanks to its high antioxidant levels. Moringa may stop the dilation of retinal vessels, prevent the thickening of capillary membranes, and inhibit retinal dysfunction.

**REFERENCES**


