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## *Moringa Oleifera*: The Miracle Tree

### Introduction:

*Moringa oleifera*, also called the Miracle Tree, is a native fruit-bearing shrub of Northern India. It is drought resistant, grows quickly and can survive sandy soils and humid conditions, making it a versatile and useful plant. It has many names including the horseradish tree, the drumstick tree, mother's best friend, the clarifier tree, Jacinto, Arbol de Perlas, Maluungay and Mlonge (Anwar, 2007). *Moringa* is an invasive species and is now found in India, Southeast Asia, the Philippines, Africa, Central and South America, Florida and Hawaii where it is used for live fencing, making dyes, and fertilizer (Mesfin, 2010). However, it is most often used for its many medicinal uses. In fact, virtually every part of the plant can be used either as supplemental nutrition or as medicine, which is why some call it "the Miracle Tree".

### History and Description of Alternative Therapy:

In India, *Moringa oleifera* has been recognized and utilized in Ayurvedic medicine since 2000 B.C. It is believed to treat and prevent over three hundred diseases including anemia, anxiety, asthma, respiratory infections, cholera, eye infections, diarrhea, hypertension, hyperglycemia, fever, glandular swelling, headaches, stiff joints, scurvy, tuberculosis, intestinal worms, sore throats, psoriasis, and increases lactation for mothers. In sub-Saharan Africa, it has proven to be a fantastic source of essential nutrients and medicine (Coppin, 2008).

## Food and Nutrition Facts:

Each part of the plant contains ascorbic acid, carotenoids, and flavonoids such as quercetin, kaempferol, B-sitosterol, caffeoylquinic acid and zeatin (Anwar, 2007). The plant also contains all nine essential amino acids (“Moringa Oleifera”, 2006-2008).

The seeds can be roasted and eaten like nuts or raw like peas. In Ghana and Sudan, they have traditionally been used to treat abdominal tumors (Coppin, 2008) and remove harmful bacteria from wounds and water. The seeds of the Moringa plant contain Ben oil, which is used in cosmetic products and contains omega-9 fatty acids. In lab tests, Ben oil acts similarly to neomycin against *Staphylococcus Aureus* (Anwar, 2007). These seeds also contain a compound called pterogospermin, which has anti-microbial and anti-fungal properties and is also found in the flowers and bark extract. In fact, much of the plant can be used to stop or inhibit infection.

The juice from the stem bark is effective against *S. aureus* and the fresh leaf juice inhibits microorganism growth (Anwar, 2007). Ancient Egyptians used it to protect their skin from the elements and three quarts of Ben oil, dating back to 1427 BC was found in Prince Maiherperi's tomb in the Valley of the Kings (“Moringa in Ancient Egypt”).

The leaves are perhaps the most widely used part of the plant. They can be eaten raw or sun-dried and crushed into powder and contain vitamins A, B, C, and E, B-sitosterol (a known hypotensive substance), Iron, Calcium, Phosphorous, Copper, Potassium. They also contain folic acid, pyroxidine, and protein. The leaves are eaten raw or in powder form in salads, vegetables and curries. (Coppin, pp 21-22).

The flowers and stems contain nine amino acids, sucrose, wax and antioxidants Beta-Sitosterol and octacosanoic acid as well as vanillin and isothiocyanates. Beta-sitosterol is a plant

ester known to lower total cholesterol levels (“Beta Sitosterol”, 2009). Quercetin, reduces inflammation, acts as an antihistamine (“Quercetin”, 2011).

The fruit grow as long skinny pods and contain phytochemicals, which have hypotensive effects. The roots may be ground and used like horseradish and exhibit anti-spasmodic properties (Anwar, 2007).

#### Modern Uses and Dosage:

Moringa is relatively unknown by most Americans, but the same cannot be said about its knowledge in the developing world, especially where there is widespread malnutrition. There is plenty of folklore surrounding Moringa and its uses. There is equal attention by the scientific and medical community, as well as international botanists and researchers who believe Moringa holds promise in preventing and treating malnutrition (Birman, 2010). Moringa is rich in both macro and micronutrients that are lacking in the diet of many people in the developing world (Fahey, 2005).

Moringa has helped to curb blindness in very poor rural areas of India, Africa and Southeast Asia due to its high levels of vitamin A (Birman, 2010). When the leaves of the tree are dried and ground into powder, the concentration of all of its nutrients increase, making them more available to the body. In the case of vitamin A, a child, who has two tablespoons added to their food, can get more than one hundred percent of their day’s nutrient needs. Just one rounded tablespoon, or about 8 grams of Moringa powder, provides about 15% protein, 40% daily calcium and 23% daily iron for a child ages one to three. Senegal, in West Africa, is but one example where the evidence of Moringa is clearly visible. Pregnant and nursing mothers are advised to sprinkle a rounded tablespoon of Moringa three times a day over their food to supplement their nutrient intake. It costs them about three cents for a two-day supply. The

results, according to humanitarian agencies like Educational Concerns for Hunger Organization, state that birth rates are higher, children have fewer developmental problems and that the mothers are more energetic and produce more breast milk (Birman, 2010).

In addition to combating malnutrition, Moringa is making a difference in the lives of many without fresh drinking water. After the seeds of the Moringa tree are pressed for their oils, the remaining parts or “cake” is then used to purify contaminated ground water or well water. This is accomplished through a complex reaction between the pathogens in the water and the chemical composition in the seeds that attract and hold onto microbes, leaving behind clear, safe water. Moringa is likely to prove its ability to save millions of lives that might otherwise have been lost to malnutrition and unsafe drinking water. That is why it deserves to be called a “Miracle Tree.”

#### Scientific Research:

In recent years scientific study has sought to prove Moringa’s therapeutic value through western research standards. Although it seems that the needs of developing countries might drive Moringa research and explain why it is yet hardly known in the west (Mahmood & Mugal, 2010).

In 2012, researchers in Nigeria investigated *in-vitro* antisickling activities of Moringa seeds and flower extract using red blood cells from a volunteer with sickle cell disease (SCD). A dried Moringa sample was diluted in solution. A 5 ml SCD blood sample was centrifuged to remove serum, leaving packed erythrocytes. Two controls were used in the bioassay and one was a positive control. The Moringa dose of 20 mg/ml showed a significant reversal of red blood cell sickling at 72% compared to the positive control at 82%. Innate phytochemical and antioxidant properties present in the seeds and flowers likely provide the antioxidative benefits to reverse SCD.

These findings are significant as Nigeria has about 24 million carriers of sickle cell disease and these findings suggest that Moringa may be a valuable resource as treatment for the disease (Adejumo & Folarin, 2012).

Research from India in 2011, evaluated the antidiarrheal properties of Moringa leaves. Castor oil and Magnesium sulfate were used to induce diarrhea in five groups of healthy rodents and dose extracts of Moringa were administered. When compared to the percent protection by the control, loperamide (Imodium), the Moringa extract dose of 500 mg/k provided 90% magnesium sulfate induced protection vs. 91% protection from loperamide. The results suggest that Moringa provides significant antidiarrheal properties. It is hypothesized that tannic acid, present in Moringa, may coat intestinal lumen and reduce secretions during intestinal emptying.

According to the World Health Organization (WHO), diarrhea is one of the most common causes of death and acute disease in many developing countries, with children being most impacted. Safe, potable water remains a major concern for India's low-income communities and Moringa may a viable filter (Lakshminarayana & Shivkumar, 2011).

Research again from India in 2003 used extract of Moringa drumsticks, the fruit, to treat skin cancer in lab mice. Doses of 125 mg/k and 250 mg/k were used. The experiment has two phases, testing the effect of Moringa on the rodents' livers, followed by exposure to papillomagenesis and monitoring the tumor inhibition that occurred. The results were significant for average number of papillomas per mouse.

Possible reasons for Moringa's chemopreventative agents, high consumption of vegetables and fruits may reduce cancer incidence and beneficial effects may be due to individual or synergistic effects of the vitamins and minerals present. The phytochemicals

present in Moringa extract may scavenge free radicals increased by the exposure to the cancer cells. The authors conclude that Moringa represents a promising chemopreventative treatment by enhancing antioxidant protection (Bharali & Tabassum, 2003).

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When considering the possible reasons for Moringa *oleifera* chemopreventative agents, high consumption of vegetables and fruits may positively reduce cancer incidence. The beneficial effects may be due to individual or synergistic effects of the vitamins and minerals present. The phytochemicals present in Moringa extract may have scavenged free radicals increased by the exposure to the cancer cells. The authors conclude that Moringa *oleifera* represents a promising chemopreventative treatment by enhancing antioxidant protection.

Further research from India in 2011, positively demonstrates that Moringa reduces dental plaque bacteria. Two *in vitro* agar plate tests using five positive antibiotic controls against Moringa, measuring the zone of inhibition around cultures of nine oral bacteria and organisms. The zone of inhibition by Moringa ranged between 10-20 mm vs. 10-23 mm for the positive antibiotic controls. The discussion attributed antibacterial activity by flavonoids for significant inhibition against pathogen growth of dental plaque by Moringa extracts (Rao & Rao, 2010).

Drug Nutrient Interactions:

A recent study conducted in India researched the effects of Moringa leaf extract preventing early liver disease in mice fed with a high-fat diet (HFD). Two groups of mice on a HFD were observed, one with Moringa leaf extract supplementation and one without. Results suggested that the leaf extract protected against HFD induced liver damage indicated by histopathology and liver enzyme activity in comparison to the group only fed a HFD (Das, 2012). There was a significant increase in endogenous antioxidant parameters and lower lipid peroxidation, indicating that the leaf extract has preventative and curative properties.

Doses:

Further research is still needed on safe dosage amounts, however a study in Ghana tested toxicity potentials of Moringa leaf extract in order to tighten the parameters. In this study, Moringa leaf extract was given to mice at supra-supplementation levels. The first group of mice was given a low dose (3,000mg/kg body weight) of leaf extract powder and the other group was given a high dose (1,000mg/kg body weight). The groups were observed for 14 days, with blood sampling after the first 48 hours and 14 days. The blood was examined for toxicity. Results indicated that Moringa leaf extract is genotoxic at levels of 3,000mg/kg body weight, however safe at levels of <1,000mg/kg body weight (Asare, 2012).

Side Effects:

Although Moringa is known for its abundance of nutritional and medicinal uses, there are also some negative side effects that are of importance. Beta-sitosterol found in the leaves can cause symptoms such as nausea, diarrhea, indigestion, and constipation (Beta-Sitosterol, 2009). The flowers contain an antioxidant, Quercetin, which has been shown to be safe in doses of <500mg, twice/day, for twelve weeks (Quercetin, 2009). There have been some reports of liver damage when taking high doses, however further research is needed to determine the exact

parameters of dosage and duration. The bark and stems are to be used with the most caution. These specific parts contain toxic chemicals that can cause violent uterine contractions (Bose, 2007). It is advised that pregnant woman do not use these parts of the plant.

#### Discussion:

The history of Moringa's use is as diverse as it is historic. Evidence of Moringa's broad health benefits justify the name "Miracle Tree." The biggest question might be, why is it not better known in the western world and used for nutritional benefit and medical practices? A possible answer is that parts of a tree cannot be patented and extensive profits cannot be made from something widely available. Commercial pharmaceutical interest might be tempered by Bayer's historic battle to hold patents for aspirin at the turn of the 20<sup>th</sup> century.

If access to Moringa extracts and powders is only available in supplement form, then monitoring of authentic and safe products cannot be guaranteed as consumers will be forced to source Moringa from international vendors whose products have not been tested for safety and whose dosage has not been determined.

#### Conclusion:

Moringa Oleifera shows enormous potential as a functional food and medicine. It has proven to contain anti-fungal properties and the ability to make water potable. The implications are truly awesome. Moringa could be an answer in staving off hunger in countries famous for malnutrition and shortened life spans. It is gaining attention and popularity and the research that has been performed, though difficult to find, seems only to further this excitement. Moringa Oleifera clearly deserves more research as food insecurity and lack of access to clean water continue to be widespread global health issues.



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