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MEDICINAL VALUE, HERBAL GOLD TO COMBAT MALNUTRITION AND HEALTH BENEFIT OF MORINGA LEAF AND MULTIPURPOSE USES OF ALL PARTS- A REVIEW

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ABSTRACT

Moringa tree is broadly cultivated in the tropical and subtropical region, but mostly fast growth in equatorial region. *Moringa* is called a miracle tree having a lot of potential in its therapeutic and medicinal value which is yet to be explored completely. *Moringa* is a common traditional and medicinal plant having rich amount of essential nutrients in its bark, leaves, roots and seeds. Various parts of *Moringa* tree, due to its nutritional and medicinal values, have treasures that can help civilization. Various parts of *Moringa* tree including its gum, seeds, flower bark and pods are being used in a number of countries to fight vitamin and mineral deficiency. They are also being used to keep a healthy cardiovascular system, to maintain optimal blood sugar level, to improve anaemic blood and to boost human immune system. It is also known to improve eyesight, mental alertness and bone strength. It has shown positive results in malnutrition, osteoporosis, menopause, depression and for lactating mother. Malnutrition is the foremost problem of global population during the last few decades. The increasing number of infant mortality related under caloric protein diet was reported in the developing countries. Thus, the exploration of a reliable nutritional therapy derived from local biodiversity is required. We have to do more research on the medicinal properties and health benefit of this gift of mother earth which is considered as the most useful tree of the world. The review is focused on the economic significance of this multipurpose tremendous food which is serving humankind incredibly and fighting malnutrition. It is possible to propose this local *Moringa* as an additional future nutrigenomic therapy combating malnutrition.

Keywords: *Moringa*, Medicinal value, Malnutrition, Health benefits.

INTRODUCTION

Dr Martin Price elaborates, in his book “The *Moringa* Tree”, the effect of use of *Moringa* in various developing countries for treating Protein energy malnutrition. Since ancient times in India, thousands of plant species are identified for their medicinal value and they have been used to cure specific ailments (Parekh *et al.*, 2005). *Moringa oleifera* is one of them and it's also known as horseradish tree, ben oil tree, *Moringa*, benzoil tree and also Drumstick tree. Almost all part of *Moringa* tree are consumable and have long been consumed (Prabhu *et al.*, 2011). South Asia is natural habitat of *Moringa oleifera* where it grows in the foothill of Himalaya from Bengal, India to north-eastern Pakistan. It was introduced and grown in other parts of India, Sri Lanka, West Asia, Bangladesh, Southeast Asia, Afghanistan and Pakistan, west and east Africa, Arabic countries, Brazil, Paraguay and from and from Peru to Mexico (Mahmood *et al.*, 2010). It is known to have rich amount of protein content and micronutrients in its leaves and hence it's used to prevent/fight malnutrition (Anjorin *et al.*, 2010). Mother Nature has gifted us a number of medicinal plants containing precious bioactive compound and these plants are used in traditional medicines (Gampa *et al.*, 2012). Medicinal plants are generally used for the treatment of disease all over the world. The use of medicinal plant to cure various diseases has been in vogue since ages. As per a report by World Health

Organization more than 80% of the world population

intent to use local medicinal plants for remedies (Sahito *et al.*, 2003). *Moringa* is one of these medicinal plants having a lot of potential not only for its medicinal properties but also for its tremendous nutritional treasures.

MEDICINAL USES OF ALL PARTS OF MORINGA OLEIFERA

Traditional medicines like Chinese medicine or Indian medicines are extensively in use since ages which uses variety of medicinal plants. In modern age, the ability of these plants for treatment of various disease and symptoms is recognised. This healing potential is due to presence of bioactive metabolites found in medicinal plants (Sen and Samanta, 2014). These plants are source of a number of natural antioxidants which are used for treating diseases all over world. Some of the properties of medicinal plants are anti-diabetic, anti-cancer, immunomodulatory, antimicrobial, atherosclerosis and even hepato-protective or reno-protection effect (Kopaei, 2012). It is one of the globally used traditional medicinal plant and it is used for many health conditions like asthma, anaemia, anxiety, tuberculosis, blood impurities, cholera, chest congestion, bronchitis, fever, infection, swelling, glandular, abnormal blood pressure, headache, diabetes, joint pain, respiratory disorders, sore throat, for intestinal worms, some skin infections, sprain, pregnancy and lactation (Fuglie, 2001; Mahmood *et al.*, 2010). Phytochemical analyses of *Moringa oleifera* have revealed that it is a good source of minerals (calcium, phosphorous, iron and potassium) vitamins

(vitamin-A and D), essential amino acids, and known antioxidants, such as flavonoids, β -carotene and vitamin C (Bennett *et al.*, 2003; Mbikay, 2012). A wide variety of phenolic acids and polyphenols as well as flavonoids, possibly alkaloids and glucosinolates are believed to be responsible for the effects of the plant (Stoys and Hartman, 2015). The leaves can be consumed after cooking or eaten as vegetable such as spinach. Further, powder are made by grinding dried leaves and used in sauces and soups. They are particularly effective in treating many diseases because of their rich iron content and variety of medicinal properties (Olushola, 2006).

ANTIOXIDANT PROPERTY

Antioxidants are chemical compound that prevent oxidation and removes free radical from human body. Drumstick is found to be very good natural source of antioxidants. These free radicals are considered to be the root cause of many diseases like cancer, cirrhosis and liver atherosclerosis etc. *Moringa oleifera* is a natural resource which is rich in antioxidant activity. According to a study the alcoholic and water extract of *Moringa* leaves is a very good antioxidant agent (Siddhuraj *et al.*, 2003). Other study established the protective effect of *Moringa* and also the enhanced antioxidant level during Antitubercular drug induced toxicity in rats (Kumar *et al.*, 2004).

ANTI-ASTHMATIC ACTIVITY

Alkaloids found in *Moringa* plant have similarity with ephedrine in activity. Hence it has anti-asthmatic property and can be used to treat asthma. The uses of kernel of *Moringa* seed have shown beneficial effect on bronchial asthma. The patients with asthmatic symptoms have shown relief in severity and their respiratory system also shown improvement (Agarwal, 2008).

ANTI-CANCER ACTIVITY

Several bioactive compounds found in *Moringa oleifera* have shown antitumor activity. Niazimicin is a bioactive compound, it is found in *Moringa* tree leaves and it has anti-cancer property (Guevaraa *et al.*, 1999). The extracts from *Moringa* tree leaves have potential cytotoxic effects on myeloma cell lines of human (Parvathy *et al.*, 2007). Also, extracts from *Moringa* seed have positive effect on hepatic carcinogen metabolizing enzymes (Bharali *et al.*, 2003).

WOUND HEALING ACTIVITY

Moringa is also having wound healing property and this have been backed by a number of studies. The extracts of leaves, bark and seed of *Moringa oleifera* have shown wound healing properties. The *Moringa* leaf extract was tested for three wound models incision wound, dead space and excision wound. The extracts in the form of ointment (10% extract in Ethyl acetate) showed significant positive activity which was comparable to standard vicco turmeric cream. Wound healing activity is promoted by phenolic and phytosterols present in *Moringa oleifera* extracts (Hukkeri *et al.*, 2006). The root and leaf aqueous extracts have been studied for fibrinolytic, proteolytic and fibrinogenolytic

actions on blood coagulation mechanism by protease activity (Satish, Sairam, Ahmed, and Urooj, 2012).

ANTI-DIABETIC ACTIVITY

Diabetes is a lifestyle related very common disease. A number of researches have been conducted to investigate use of *Moringa oleifera* as potential therapeutic agent diabetes. *Moringa* tree leaves have shown potential to lower blood glucose level of type 2 diabetic rats. The *Moringa* leaves are good source of polyphenols which is responsible for hypoglycaemic activity (Ndong *et al.*, 2007). The extracts from *Moringa* leaves are so powerful that it reduces blood sugar level in 3 hours after ingestion intake (Mittal *et al.*, 2007).

ANTI-INFLAMMATORY ACTIVITY

Many parts of *Moringa* tree is known to show anti-inflammatory property. A study established that *Moringa* leaves extract is helpful in the treatment of inflammation and pain (Sulaiman *et al.*, 2008). Bandage of *Moringa* leaves helps in relieving glandular swelling (Dubey *et al.*, 2013). Alcohol extract of the seeds of *Moringa oleifera* showed anti-inflammatory activity in guinea pigs (Mahajan *et al.*, 2009). *Moringa oleifera* poultice, due to occurrence of bioactive compound, can induce anti-inflammatory activity for improving the pathogenesis of inflammatory-associated chronic diseases (Muangnoi *et al.*, 2012). Another study on methanol extract of *Moringa* roots indicates that it is beneficial in treating both chronic and acute inflammatory disease (Ezeamuzie *et al.*, 2008).

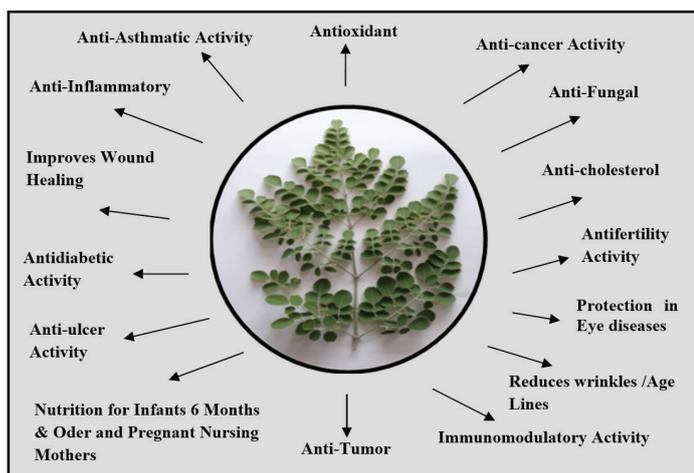
IMMUNOMODULATORY ACTIVITY

It has been established by experimental studies regarding immunity boosting activity of *Moringa oleifera* (MEMO) extract. Neutrophil adhesion test was conducted to study cellular immunity in which carbon clearance assay and cyclophosphamide induced neutropenia were used. The effect on Humoral immunity was tested in mice by immunoglobulin levels estimation in serum, lethality test in mice and indirect haemagglutination assay in animals. The result of the study suggested that lower doses of methanolic extract of *Moringa oleifera* MEMO stimulate both humoral and cellular immune response (Sudha *et al.*, 2010).

PROTECTION IN EYE DISEASES

It is a well known fact that Vitamin A is good for eyesight and its deficiency in human can cause blindness. *Moringa* is a very good source of Vitamin A and its consumption may fulfil its deficiency and can prevent night blindness and some eye problems in children. Vitamin A nutrition can be improved by consuming *Moringa* leaves with oil and it can delay the development of cataract (Pullakhandam, 2007). *Moringa* was highly accepted as supplementary food for integrated child development scheme supplementary food (ICDS-SFP) due to its high content of Vitamin A (Nambiar *et al.*, 2007). A study had established the retinoprotective properties of *Moringa* by anti-inflammatory, anti-angiogenic and antioxidant mechanism streptozotocin-induced diabetic rats. *Moringa oleifera* can be used to

Traditional medicinal uses of *Moringa*



prevent retinal dysfunction induced by diabetes (Kumar *et al.*, 2013).

CHOLESTEROL LOWERING

Moringa leaves have been found to have cholesterol lowering property. Study conducted on high fat fed rats showed that crude extract of *Moringa* leaves has significant cholesterol lowering action in rat’s serum which may be due to the presence of β -sitosterol, a bioactive Phytoconstituents (Ghasi *et al.*, 2000). *Moringa* fruit or Drumstick has been found to lower serum cholesterol, triglycerides, phospholipids, very low density lipoprotein (VLDL), reduced the lipid profile of liver, low density lipoprotein (LDL), cholesterol to phospholipid ratio, atherogenic index lipid and increased the excretion of fecal cholesterol in aorta and heart of hypercholesteremic rabbits (Mehta *et al.*, 2003).

CARDIO PROTECTIVE PROPERTY

Moringa also has protective effect on cardiac system. It has been proved by a study that *Moringa* leaves extract have protective effect on cardiac system which may be due to its myocardial preservative, antioxidant and antiperoxidative effect (Nandave *et al.*, 2009). In another study proved that the N, α -L-rhamnopyranosyl vicosamide (VR) extracted from *Moringa* leaves have cardio protective capability (Panda *et al.*, 2013).

MORINGA OLEIFERA: PRESERVING LIVER FUNCTION

Moringa has been widely accepted as a very useful therapeutic plant which has a wide variety of health benefit. Research has suggested that the harm to liver caused by instruction and non prescription medicine can be lowered by *Moringa* supplements and in a few cases it can even cure the damage and shield the liver from further damage. Though the remedial effect of *Moringa* is still a subject of investigation but the studies have established a number of positive effects of this versatile herbal plant in protecting and treating liver dysfunction in vulnerable patients. Food supplement based on *Moringa* may help to reduce and reverse the ill effects of liver infection and restore the liver function by permitting it to efficiently filter toxins from the body (Das *et al.*, 2012).

NUTRITION FOR INFANTS 6 MONTHS & ODER AND PREGNANT NURSING MOTHERS

The *Moringa oleifera*, due to rich amount of nutrients like proteins, vitamins and minerals, is considered as a food supplement to fight malnutrition. A study was conducted at Church World Service where relatively cheaper and nutritious *Moringa* was used to fight and cure malnutrition in infants, lactating and pregnant women in place of conventional expensive alternatives like milk powder, vegetable oil, sugar and peanut butter. The result was encouraging as the *Moringa* leaves supplement showed improvement in malnourished children in 10 days while conventional foods takes months for same level of improvement. Dr. Lowell Fuglie was representative of West Africa in Church World Service and he asserts that if freshly cooked 100g of *Moringa* leaves is given to a child between 1 to 3 year old then it will provide him about 75% of his iron, 100% calcium and 50% of his protein requirement along with good amount of Vitamins, copper, potassium and essential amino acids. Even a 20g of *Moringa* leaves will fulfil a child’s all Vitamin C and A requirement (Fuglie *et al.*, 2000 and Fuglie *et al.*, 2001). The leaves and bark of *Moringa* have beneficial effect on breast feeding and pregnant women. It protects health of the mother and gives strength to nursing child and fetus. Breastfeeding mothers in the Philippines and India have been traditionally recommended to add boiled *Moringa* leaves as supplementary food by elders. The mechanisms by which it helps breastfeeding mothers are not exactly known but its lactation inducing effects are known since long. 100g *Moringa* leaves as food supplement can fulfil a woman with one third of her daily calcium need and provide her with rich amount of B-vitamins, protein, copper, iron and sulphur. It is especially beneficial for women and children suffering from anaemia due to menstrual cycles (Anwar *et al.*, 2003 and Prakash *et al.*, 1998).

MORINGA AND MALNUTRITION

Moringa oleifera is a gifted plant having rich amount of protein, Vitamin, minerals in its leaves, bark, seed and other parts. Due to this *Moringa* can be a good food supplement to fight malnutrition. Cheaper price and wide availability has made this plant a good candidate to fight malnutrition in developing countries. The presence of phytochemicals in its pods, seeds and leaves makes it rich in nutrients. It is estimated that *Moringa* provides 10 times more vitamin A than carrots, 7 times more vitamin- C than orange, 9 times more protein than yoghurt, 17 times more calcium than milk, 25 times more iron than spinach and 15 times more potassium than bananas (Rockwood *et al.*, 2013). As *Moringa* is easily cultivable it can be used as sustainable cure for malnutrition. Countries like Benin and Senegal uses *Moringa* to treat children (Kasolo *et al.*, 2010). Children who do not get breast milk are likely to be malnourished. The milk production can be augmented in lactating mother by lactogogue. The lactogogue made of phytosterols, acts as a precursor for hormones required for reproductive growth. *Moringa* is rich in phytosterols

Uses of all parts of *Moringa*

Leaf		Although almost all parts of <i>Moringa oleifera</i> is edible but leaves are the most used part. Its leaves malaria, headaches, treat asthma, Dyslipidemia, syphilis, heart burn, diarrhea, pneumonia, flu, scurvy, bronchitis, hyperglycemia, ear and eye infections. Also reduces cholesterol and acts as an anticancer and blood pressure, anti-atherosclerotic, neuro protectant, antimicrobial, Antioxidant and ant diabetic agents.
Seed		A number of researchers have found that <i>Moringa</i> seed powder can clean dirty water in a fast and easy way. The seed of <i>Moringa</i> is helpful in treating rheumatism, hyperthyroidism, Chronn's disease, epilepsy gout and antiherpes-simplex virus arthritis, cramp. It can also as anti-inflammatory agents and antimicrobial.
Root		The roots of <i>Moringa</i> has anti-inflammatory, antifertility, carminative, vesicant, rubefacient and Antilithic property and it is used to treat inflammation, constipation, kidney pain, rheumatism and articular pains. It acts as a tonic for heart/circulatory system. It is used also used as abortifacient and laxative.
Stem bark		The bark is vesicant and rubefacient and it is used as a cure for eye disease and to prevent tuberculous gland formation in neck, to treat ulcer and to tumour. The root bark juice is used to relieve earache and toothache and it has anti-tubercular activity.
Gum		The gum of <i>Moringa</i> is rubefacient and astringent and is used for dental caries. It is used to relieve fevers, asthma, dysentery, intestinal complaints and headaches by mixing it with sesame oil. It is sometimes used as abortifacient and to treat rheumatism and syphilis
Flower		<i>Moringa</i> flowers have high medicinal values as cholagogue, abortifacient, aphrodisiac and stimulant. It is used to cure enlargement of spleen, hysteria, tumours, muscle disease and inflammations. It lowers triglyceride, phospholipid, serum cholesterol, atherogenic index and cholesterol to phospholipid ratio.

Source: Anwar *et al.*, 2006 and Daba *et al.*, 2016

like stigma sterol, sitosterol and kampesterol which are precursors for hormones. The lactagogue is made of phytosterols and it act as a catalyst for hormones responsible for reproductive growth. These phytosterols augments production of estrogens which in turn stimulate mammary gland ducts to produce milk. *Moringa* is used to treat malnutrition in children younger than 3 years (Mutiarra *et al.*, 2013).

HEALTH BENEFITS OF MORINGA LEAF

All parts of *Moringa* tree is edible and is rich source of vitamins, protein and minerals. *Moringa* leaves are a rich source of vitamin A, vitamin C, calcium, iron, potassium. The protein content and quality of *Moringa* leaves is comparable to that of eggs and milk (Fahey, 2005). *Moringa oleifera* is one of the most nutrient rich plants found on earth. Though it is being used by lesser developed societies for hundreds of year but significant formal research are being conducted since 1970. *Moringa oleifera* provides us unmatched rich combination of antioxidants, nutrients, amino acids, anti-aging and anti-inflammatory properties for healing and nutrition. Due to

these health's enhancing capabilities it is sometimes called "Mother's Best Friend" and "Miracle Tree." Since 1998, the World Health Organization has promoted *Moringa* as an alternative to imported food supplies to treat malnutrition (Mahmood *et al.*, 2010). World Health Organization (WHO) has been promoting it as food supplement to fight malnutrition especially in developing countries with poor socio economic condition (Sreelatha *et al.*, 2009). *Moringa oleifera* has great potential for prevention of different diseases like nutrient deficiency, anaemia, cancer as well as for dirty water purification (Gedefaw, 2015). *Moringa oleifera* leaves contain rich amount of nutrients, vitamins and vital minerals. Cheaper cost and abundance makes it important food supplement to treat malnutrition. *Moringa* has capability to promote rural development, improve nutrient, support sustainable milestone and boost food security in developing countries. Some of the benefits of *Moringa* include the following: (Nwakalor *et al.*, 2014)

- Takes care of the immune system of the body.
- Optimise sugar level of the body.
- It enhances the immunity of the body.

- Promotes energy and proper digestion.
- Gives nourishment to the brain and the eye.
- Enhance metabolism and the cell structure of the body.
- Promotes health circulatory system.
- Supports normal functioning of the liver and kidney.
- Enhance natural serum cholesterol.
- Acts as antioxidants.
- It promotes common wellness.

CONCLUSION

Moringa oleifera is a miracle tree gifted by the god to humans. Widespread availability and treasures of nutrients found in it makes it super food. Due to its cheap price it can be promoted to fight malnutrition in developing countries of the world. Almost all parts of *Moringa* tree are rich in nutrients and have therapeutic properties. This study throws light on its antioxidant, anti-inflammatory, anti-tumour, anti-ulcer, cardio protective and wound healing activity. This plant can help poor countries to fight against disease, poverty and malnutrition. Further research needs to be done on its medicinal and therapeutic properties. Its anti-cancer and anti-diabetic properties are well known but the exact mechanism is not known and needs extensive research.

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