



Enthralling Drum Stick Tree for fascinating Human reassurance and Socio-Economic Protract

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Received: 14 February 2014, Accepted: 18 May 2014, Published Online: 21 June 2014

Contents

1. Introduction	103
2. Conclusion	112
3. Abbreviations.....	112
4. References	112

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Manuscript ID: JPBR2178



PAPER QR-CODE

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Abstract

From time immemorial and historical perspective, it's evident that affluent stockroom of traditional therapeutic lashing medication is well documented and enthralling in ancient literature. This review paper focuses on the detailed phytochemical composition, therapeutic applicability, along with pharmacological assets of Drum stick, multipurpose tree. Different parts of this plant contain a profile of important minerals, and are a good source of protein, vitamins, -carotene, amino acids and various phenolics. 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. Various parts of this plant such as the leaves, roots, seed, bark, fruit, flowers and immature pods act as cardiac and circulatory stimulants, possess antitumor, antipyretic, antiepileptic, antiinflammatory, antiulcer, antispasmodic, diuretic, antihypertensive, cholesterol lowering, antioxidant, antidiabetic, hepatoprotective, antibacterial and antifungal activities, and are being employed for the treatment of different ailments in the indigenous system of medicine, particularly in South Asia. Global industrialization and the increasing demand for environmental friendly products make moringa have great potential as a source of pharmaceuticals, dyes, biofuel, human food, animal and fish feed, and water purification products.

Dietary consumption of its part is therein promoted as a strategy of personal health preservation and self-medication in various diseases. The enthusiasm for the health benefits of *M. oleifera* is in dire contrast with the scarcity of strong experimental and clinical evidence supporting them. Fortunately, the chasm is slowly being filled. Reported studies in experimental animals and humans, although limited in number and variable in design, seem rigorously concordant in their support of therapeutic potential. Phytochemical analyses have shown that its leaves are particularly rich in K, Ca, P, Fe, vitamins A and D, essential amino acids, as well as such known antioxidants such as β -carotene, vitamin C, and flavonoids. By using Moringa seeds people will no longer be depending on expensive means originating from the West. Using Moringa to purify water replaces chemicals such as $Al_2(SO_4)_3$, which are dangerous to people and the environment, and are expensive. Further research considering relevance to explore the potential of *M. oleifera*'s various parts has to be emphasized.

Keywords: ROS, Antioxidants, Free radicals, SOD, GTH, Oxidative stress, Pathogenesis, CVD, Diabetes, Water purification, Biodiesel, Quercetin-3-O- β -D-glucoside, Chlorogenic acid, Phenolic acids

1. Introduction

Moringa oleifera, the Tree of Life or a Miracle Tree, but rather than this being in reference to its potential medicinal usage this is actually referring to how It's a very valuable food crop (It's drought resistant, grows very fast, and is highly nutritive) and even beyond food it serves many benefits in third world countries such as having an ability to be used for some crafts (due to being a tree) and cleaning water. For usage as a supplement, *moringa oleifera* is recommended mostly as being a highly nutritious antioxidant. All parts of the Moringa tree (Figure 1a,b,c,d,e,f,g), are edible and have long been consumed by humans. According to Fuglie.1 the many uses for Moringa include: alley cropping (biomass production), animal forage (leaves and treated seed-cake), biogas, domestic cleaning agent, blue dye (wood), fencing (living trees), fertilizer (seed-cake), foliar nutrient (juice expressed from the leaves), green manure (from leaves), gum (from tree trunks), honey- and sugar cane juice-clarifier (powdered seeds), honey (flower nectar), medicine (all plant parts), ornamental plantings, biopesticide (soil incorporation of leaves to prevent seedling damping off), pulp (wood), rope (bark), tannin for tanning hides (bark and gum), water purification..

It has been used in salads, for fine machine lubrication, and in the manufacture of perfume and hair care and health products[2]. In the West, one of the best known uses for Moringa is the use of powdered seeds to flocculate contaminants and purify drinking water but the seeds are also eaten green, roasted, powdered and steeped for tea or used in curries [4]. This tree has in recent times been advocated as an outstanding indigenous source of highly digestible protein, Ca, Fe, Vitamin C, and carotenoids suitable for utilization in many of the so-called "developing" regions of the world where undernourishment is a major concern. The Moringa tree gained popularity because of its high uses in traditional medicine originally by the Indians. Preparations (e.g. extracts, decoctions, poultices, creams, oils, emollients, salves, powders, porridges) are not quite so well known[12]. Presently, numerous scientific investigations have confirmed the effectiveness of these traditional remedies. Also based on research the plant is very nutritious, earning it the WHO candidate in the fight against malnutrition.

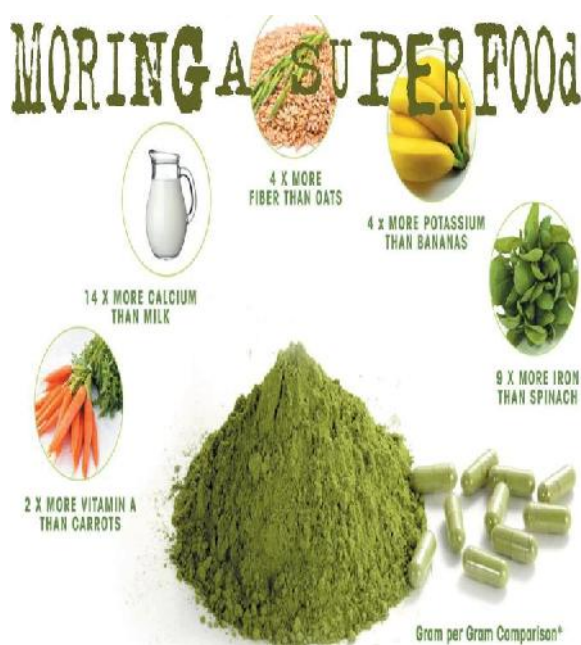




Figure 1. a, b (domestic) & c, d, e, f, g (exotic) Moringa Tree

Moringa seed oil (yield 30-40% by weight), also known as Ben oil, is a sweet non-sticking, non-drying oil that resists rancidity (Fig. 15).



Figure 2. Moringa's Dried Leaves

Moringa's Nutritive Applicability

Moringa is traditionally part of the staple food diet of many countries like India, Thailand, Cambodia, Sri Lanka, etc. and even the Hausas in northern Nigeria. It's estimated to have more than 92 verifiable cell-ready nutrients, 46 types of antioxidants⁷⁰⁻⁷⁷ and 36 anti-inflammatories all readily available to the body.

Nutritional assessment of the raw Moringa leaf/100g

Energy 64kCal (270kJ); Carbohydrates 8.28 g; Dietary Fiber 2.0 g; Fat 1.40 g; Protein 9.40 g; Water 78.66 g; Vitamin A equiv 378 ug (47%); Thiamine (Vit B1) 0.257 mg (22%); Riboflavin; Vit B2) 0.660 mg (55%); Niacin (Vit B3) 2.220 (15%); Panthothenic acid (Vit B5) 0.125 mg (3%); Vitamin B6 1.200 mg (92%); Folate (Vit B9) 40 mg (10%); Vit c 51.7 mg (62%); Ca 185 mg (19%); Fe 4.00 mg (31%); Mg147 mg (41%); Mn 0.36 mg (17%); P112 mg (16%); P 337 mg (7%); Na 9 mg (1%); Zn 0.6 mg (6%) [Source: USDA Nutrient Database]. Most of these foods are even more expensive and mostly seasonal while Moringa leaves are available year round. Since dried Moringa leaves retain their nutrient content, It's possible and convenient to convert them into leaf powder which is easy to make, store and use. Moringa has the unique advantage of being somewhat tastelss so it makes excellent nutritional supplement that can be added to any dish or taken on its own.

This is why Moringa is being advocated as “natural nutrition for the tropics.” The great majority of multivitamins available today are synthesized and chemically formulated so most of them are not easily absorbed by the body while Moringa is a natural whole food source for vitamins, minerals, proteins, antioxidants and other important components that the body relies upon to stay healthy. Regular intake of Moringa will give benefits of increased energy, greater alertness, better endurance, increased focus, mental clarity, strong immune system, etc. also rare for a plant source, Moringa leaves contain all the essential Amino Acids (usually found only in animal products like eggs) in good proportion including argemine and histidine which are especially important for infants. Hence, Moringa leaf is a food source for infants, children, pregnant women and everybody. The reason for the increased potency in living models is not known (although It's possible that it can induce genetic transcription similar to SFN (Figure 4) since the bioactives are similar in structure), but the antioxidant properties seem to underlie the vast majority of benefits associated with this supplement. There are also antiinflammatory effects that, while less studies, seem to be quite effective; one of the bioactives, RBITC (*rhodamine B isothiocyanate*), is effective in suppressing macrophage activation in the nanomolar range which is worth some future research into. Beyond that, there does appear to be a nice anti-diabetic effect that has gone some very preliminary human testing which suggests that this plant may benefit pancreatic function and reduce blood glucose secondary to that.



Figure 3. Moringa's Tablets

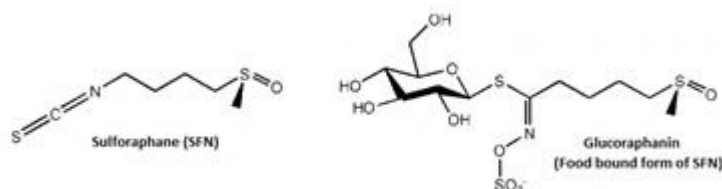


Figure 4. SFN (Sulforaphane) & Glucoraphanin - food bound form of SFN

Now, despite the plant being referred to as 'nontoxic' this does not appear to be the case. While supplemental dosages listed below appear to be safe from all tested toxicity a relatively small increase (3-4x the recommended dose) is known to cause genotoxic damage and may promote cancer formation whereas doses higher than that cause overt organ damage (mostly liver and kidneys).



Figure 5a. Moringa's Healthcare capsules



Figure 5b. Moringa's Tea Bags



Figure 6a&b. Moringa pods (FRESH & DRY)

Comparison (g/g) of Moringa leaves' (fresh & dry) nutrients with oranges, carrots, milk, bananas, spinach & Yoghurt [64-66].

Contents in Moringa's fresh leaves - 7x the Vit C of Oranges; 4x the Vit A of carrots
4x the Ca of Milk; 3x the K of Bananas; 4x the Fe of Spinach
2x the Protein of Yoghurt

Contents in Moringa's dried leaves - 4x the Vit C of Oranges; 10x the Vit A of carrots; 17x the Ca of Milk; 15x the K of Bananas; 25x the Fe of Spinach; 9x the Protein of Yoghurt Moringa

While It's indeed nutritious, supplemental dosages are too low to acquire adequate nutrition from and this claim is not relevant; It's a relatively potent antioxidant, and while it seems to be less potent than other herbs when tested outside of a living system it does appear to be quite potent when tested in living models. Of importance is that all parts of Moringa are edible and also effective when used for treating various diseases. As earlier said, Moringa is traditionally used in the treatment of several diseases of chronic conditions. This has prompted scientific research by the WHO, universities and organizations who have verified and concluded on most of its diverse medicinal properties on an on-going basis. Of utmost importance is its ability to aid in the cure of those diseases without any side effects or allergic reactions commonly experienced with western medicines. Also, since dietary treatment is one of the core programs in treating systemic conditions like Hypertension, Diabetes, Anaemia, kidney conditions, etc, Moringa combined the rare dual role as the ideal meal supplement and ideal medicine. Moringa has demonstrated its effectiveness in the management and/or treatments of Hypertension & Blood Pressure, Cancer & Tumor, Diabetes, HIV AIDS, Arthritis, Rheumatism, Asthma, Ulcer, Prostrate problems, Erectile dysfunction, Sexual virility, Cholesterol Control, Syphilis and many others. Due to its multidimensional benefits, Moringa oleifera is called the miracle tree, the tree of life, mother's best friend, etc.

Phytochemistry Realm

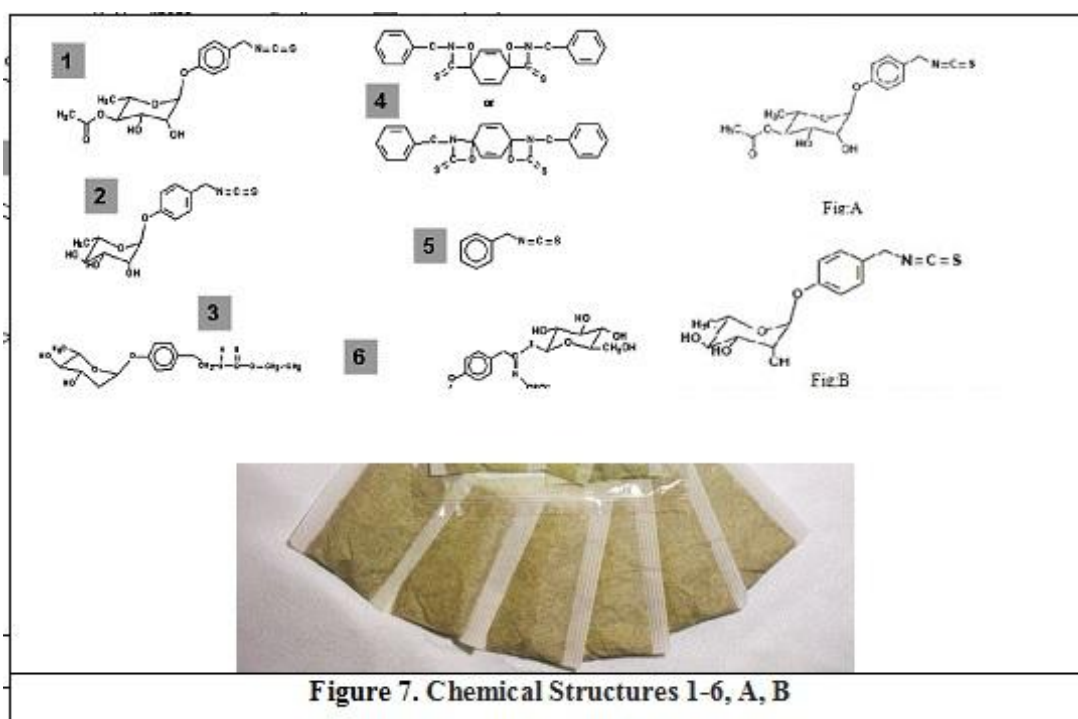
Because of the chemical complexity of the *M. oleifera*, apparent therapeutic effects could be due to the combined actions of various bioactive components found in the plant, including trace metal ions, vitamins, alkaloids, carotenoids, polyphenols, fats, carbohydrates, and proteins. Some compounds may collectively affect broad aspects of physiology, such as nutriment absorption and processing, redox state, or immunity. *Moringa oleifera* leaves

contain phytosterols such as β -sitosterol. These compounds can reduce intestinal uptake of dietary cholesterol. They could partly account for the decrease of plasma cholesterol and the increase of fecal cholesterol observed in rodents treated with *M. oleifera* leaves [17-18]. *M. oleifera* leaf powder also contain about 12% (w/w) fibers. Dietary fibers reduce gastric emptying. They may partly explain the greater stomach content, the improved OGTT response in treated GK diabetic rats [21], as well as the progressive improvement of PPBG levels in treated T2DM patients[22].

The viability and functionality of a cell partly depends on a favorable redox state, i.e., on its ability to prevent excessive oxidation of its macromolecules, including DNA (deoxyribose nucleic acid), proteins, and lipids. ROS (reactive oxygen species) and free radicals are the major mediators of the oxidative process. Cellular inability to reduce ROS leads to oxidative stress. All cells are variably capable of endogenous self-protection against this stress through the actions of enzymes such as catalase, superoxide dismutase, and glutathione peroxidase, as well as through reducing molecules such as glutathione. Nutritional antioxidants such as vitamins A, C, and E provide additional protection from the stress. Oxidative stress is widely accepted as a major contributing factor in the pathogenesis of CVD (cardiovascular disease) and diabetes. A recurring explanation for the therapeutic actions of *M. oleifera* medication is the relatively high antioxidant activity of its leaves, flowers, and seeds [27-36].

Glucosinolates are characterized by β -thioglucoside *N*-hydroxysulfate motif. In *M. oleifera* leaves, most phytochemicals of this class carry a benzyl-glycoside group linked to the single carbon of the motif. The most abundant of them is 4-*O*-(β -D-rhamnopyranosyl-oxy)-benzylglucosinolate, otherwise known as glucomoringin. Enzymatic hydrolysis of the glucosinolate motif of members of this class leads to the formation of corresponding isothiocyanates, thiocyanates, or nitriles. Several of these by-products have been shown to possess antihypertensive properties. Flavonoids and phenolic acids are collectively referred to phenolic compounds.

The structural skeleton of flavonoids is made of two aromatic rings joined by a 3-C link; that of the sub-class of flavonols is 3-hydroxy-2-phenylchromen-4-one, Quercetin and kaempferol, in their β -D-glucoside forms, are the predominant flavonols in *M. oleifera* leaves. The sugar moieties include, among others, rhamnoglucosyl (rutinosides), glucosyl (glucosides), 6-malonylglucosyl, and 2-galloylrutinoside groups. Biologically, flavonoids are best known for their antioxidant properties, but their metabolic pathways of activity remain to be fully elucidated. Phenolic acids have benzoic acid and cinnamic acid as backbones, with one or several (-OH)hydroxyl groups. Chlorogenic acid, which is an ester of dihydrocinnamic acid (caffeic acid) and quinic acid, is a major phenolic acid in *M. oleifera* leaves. The flavonol quercetin is found at concentrations as high as 100 mg/100 g of dried *M. oleifera* leaves predominantly as quercetin-3-*O*- β -D-glucoside also known as isoquercitrin or isotrifolin (Figure 7. 1-6, A, B).



Quercetin is a potent antioxidant with multiple therapeutic properties. It can reduce hyperlipidemia and atherosclerosis in HCD (high-cholesterol diet) or HFD rabbits. It has shown anti-dyslipidemic, hypotensive, and anti-diabetic effects in the obese Zucker rat model of metabolic syndrome. It can protect insulin-producing pancreatic cells from STZ-induced oxidative stress and apoptosis in rats. Its hypotensive effect has been confirmed in a randomized, double-blind placebo-controlled, human study. Chlorogenic acid can beneficially affect glucose metabolism. It has been shown to inhibit glucose-6-phosphate translocase in rat liver, reducing hepatic gluconeogenesis and glycogenolysis [52-53]. It was found to lower PPBG in obese Zucker rats. In OGTT experiments performed on rats or humans, it reduced the glycemic response in both species, in rodents, it also reduced the glucose AUC [55]. Its anti-dyslipidemic properties are more evident as its dietary supplementation has been shown to significantly reduce plasma TC and TG in obese Zucker rats or HFD mice [58] and to reverse STZ-induced dyslipidemia in diabetic rats [59].

The alkaloid moringinine was initially purified from *M. oleifera* bark and later chemically identified as benzylamine. It's also present in leaves. This substance was suspected to mediate the hypoglycemic effect of the plant. An early study showed that Wistar rats provided with drinking water containing 2.9 g/L of benzylamine for 7 weeks exhibited a reduced hyperglycemic response in IPGTT (glucose tolerance test), suggesting improved glucose tolerance. More recently, the effect was further explored using HFD-fed, insulin-resistant C57BL/6 mice taking an estimated daily dose 386 mg/kg-body weight in drinking water for 17 weeks. Compared to untreated controls, these mice gained less weight, had reduced FPG and PTG and were more glucose tolerant. Niaziminin is a mustard oil glycoside initially isolated (along with other glycosides such as niazinin and niazimicin) from ethanolic extracts of *M. oleifera* leaves, based on their hypotensive properties on Wistar rats. At 1 mg and 3 mg/kg-body weight, these compounds caused a 16–22 and a 40–65% fall of MABP [63].

Other active isothiocyanate glycosides and thiocarbamates were isolated from the plant using the same bioassay. This compound was isolated from *M. oleifera* roots and structurally identified as *N*-benzoylphenylalanyl phenylalanyl acetate. At 25 μ M, this unusual dipeptide derivative inhibited by nearly 90% the secretion TNF and IL-2 from lipopolysaccharide-stimulated peripheral blood lymphocytes in culture. It had no effect on IL-6 secretion. This inhibitory activity may contribute to the anti-inflammatory properties of the plant. An examination of the phytochemicals of Moringa species affords the opportunity to examine a range of fairly unique compounds. In particular, this plant family is rich in compounds containing the simple sugar, rhamnose, and it's rich in a fairly unique group of compounds called glucosinolates and isothiocyanates. For example, specific components of Moringa preparations that have been reported to have hypotensive, anticancer, and antibacterial activity include 4-(4'-O-acetyl-a-L-rhamnopyranosyloxy)benzyl isothiocyanate, 4-(a-L-rhamnopyranosyloxy)benzyl isothiocyanate⁷, niazimicin, pterygospermin, benzyl isothiocyanate, and 4-(a-L-rhamnopyranosyloxy)benzyl glucosinolate. While these compounds are relatively unique to the Moringa family, it's also rich in a number of vitamins and minerals as well as other more commonly recognized phytochemicals such as the carotenoids (including β -carotene or pro-vitamin A). These attributes are all discussed extensively by Lowell Fuglie [1], and will be the subject of a future review in this series.



Figure 8. Moringa's seeds oil

Gastronomic Utility and Socioeconomic Status

The *M. oleifera* pod (munga/ saragwa/saragwe) is often referred as drumstick tree and horshredish tree in English. In south India, it's used to prepare a variety of sambars and is also fried. In other parts of India, especially West Bengal, and also in a neighbouring country like Bangladesh, it's enjoyed very much. It's made into a variety of curry dishes by mixing with coconut, poppy seeds and mustard or boiled until the drumsticks are semi-soft and consumed directly without any extra processing or cooking. It has found utility in curries, sambars, kormmas, and dals, although it's used to add flavor to cutlets, etc. In Maharashtra, the pods are used in sweets and curries called Aamatee. Tender drumstick leaves, finely chopped, are used to garnish veggie dishes, dals, sambars, salads, etc. also, it has gained popularity to be used as coriander, as these leaves have high therapeutic significance. Its flowers, in some regions, are gathered and cleansed to be cooked with basan to make pakoras. It's preserved by canning and exported worldwide [77,81].

Clean Water With Moringa Seeds

In addition to food, shelter and clothing, water is one of our basic human needs and lack of potable water is a major cause of death and disease in our world. The purpose of this document is to provide information on household water treatment using seeds of the *Moringa oleifera* tree. Using natural materials to clarify water is a technique that has been practiced for centuries and of all the materials that have been used, seeds of the *Moringa* have been found to be one of the most effective. Studies have been conducted since the early 1970's to test the effectiveness of *Moringa* seeds for treating water. These studies have confirmed that the seeds are highly effective in removing suspended particles from water with medium to high levels of turbidity (*Moringa* seeds are less effective at treating water with low levels of turbidity). *Moringa* seed powder can be used as a quick and simple method for cleaning dirty river water. Studies showed that this simple method of filtering not only diminishes water pollution, but also harmful bacteria. The *moringa* powder joins with the solids in the water and sinks to the bottom. This treatment also removes 90-99% of bacteria contained in water. Water from varying sources will need different amounts of *Moringa* seeds powder because of the impurities present will not be the same. Experiments with a jar will help in working out the correct amount needed.

Moringa oleifera seeds treat water on two levels, acting both as a coagulant and an antimicrobial agent. It is generally accepted that *Moringa* works as a coagulant due to positively charged, water-soluble proteins, which bind with negatively charged particles (silt, clay, bacteria, toxins, etc) allowing the resulting "flocs" to settle to the bottom or be removed by filtration. The antimicrobial aspects of *Moringa* continue to be researched. Findings support recombinant proteins both removing microorganisms by coagulation as well as acting directly as growth inhibitors of the microorganisms. While there is ongoing research being conducted on the nature and characteristics of these components, it is accepted that treatments with *Moringa* solutions will remove 90-99.9% of the impurities in water.

Solutions of *Moringa* seeds for water treatment may be prepared from seed kernels or from the solid residue left over after oil extraction (presscake). *Moringa* seeds, seed kernels or dried presscake can be stored for long periods but *Moringa* solutions for treating water should be prepared fresh each time. In general, 1 seed kernel will treat 1 liter (1.056 qt) of water.

Dosage Rates: Low turbidity NTU < 50 1 seed per 4 liters (4.225 qt) water Medium turbidity NTU 50-150 1 seed per 2 liters (2.112 qt) water

High turbidity NTU 150-250 1 seed per 1 liter (1.056 qt) water

Extreme turbidity NTU > 250 2 seeds per 1 liter (1.056 qt) water

From collected mature *Moringa oleifera* seed remove seeds from pods. In order to obtain clean seed kernels, shell seeds are prepared by removing seed coat. Color seeds are discarded. Quantity of kernels needed based on amount and turbidity of water is determined; in general 1 seed kernel will treat 1 liter of water. Using grinder, mortar & pestle, etc., appropriate number of seeds are crushed to obtain a fine powder and then powder through a screen or small mesh, is sifted. Paste is prepared by mixing small amount of water with seed powder. Mix the paste and 250 ml (1 cup) of clean water into a bottle and shake for 1 minute to activate the coagulant properties and form a solution. Filter this solution through a muslin cloth or fine mesh screen (to remove insoluble materials) and into the water to be treated. Stir treated water rapidly for at least 1 minute then slowly (15-20 rotations per minute) for 5-10 minutes. Let the treated water sit without disturbing for at least 1-2 hours. When the particles and contaminants have settled to the bottom, the clean water can be carefully poured off. Mix seed powder with a small amount of clean water to form a paste. Mix the paste and 250 ml (1 cup) of clean water into a bottle and shake for 1 minute to activate the coagulant properties and form a solution. Filter this solution through a muslin cloth or fine mesh screen (to remove insoluble materials) and into the water to be treated. Stir treated water rapidly for at least 1 minute then slowly (15-20 rotations per minute) for 5-10 minutes. Let the treated water sit without disturbing for at least 1-2

hours. When the particles and contaminants have settled to the bottom, the clean water can be carefully poured off. This clean water can then be filtered or sterilized to make it completely safe for drinking.

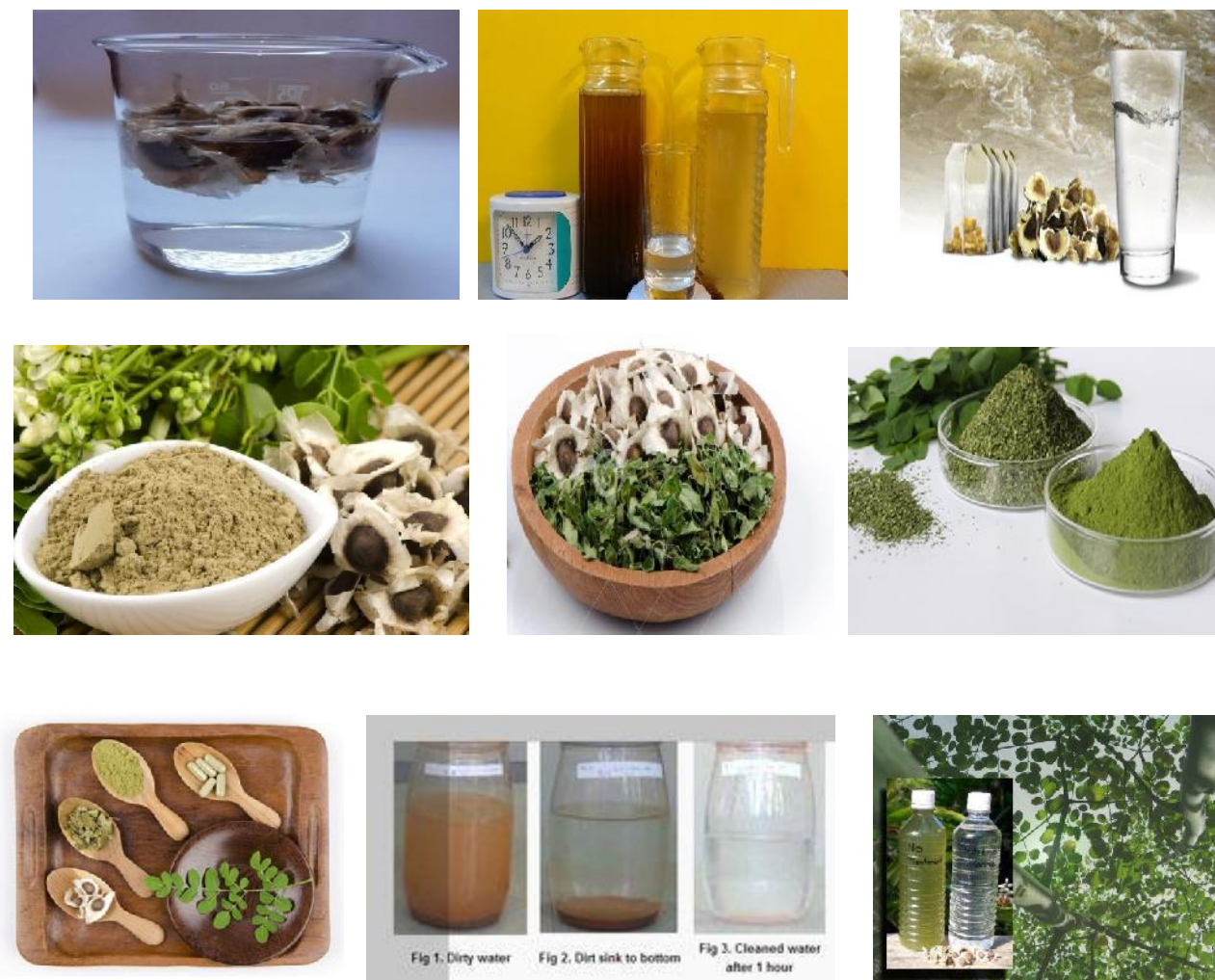


Figure 9. Moringa's seeds deturbidifies water

M. oleifera is one of the most tropical trees. The relative ease with which it propagates through both sexual and asexual means and its low demand for soil nutrients and water after being planted makes its production and management easy. Introduction of this plant into a farm, which has a biodiverse environment, can be beneficial for both the owner of the farm and the surrounding eco-system. Distinction of cultivators has not yet been formally carried out. *M. oleifera* was well known to the ancient world, but only recently has it been rediscovered as a multipurpose tree with a tremendous multiplicity of potent applicability.

Moringa oleifera Lam. is the most "underutilized" multipurpose tropical crop. The leaves, tender pods and seeds could serve as a valuable source of nutrients for all age groups. The leaves, tender pods and seeds are sources of vitamins, minerals and proteins. The leaves and branches can be used as feed for livestock and fish. Due to the high nutrient content of the leaves, moringa can be incorporated into the mulching system. The dry seed suspension is a known natural coagulant and coagulant aid with antibacterial activity. Dry moringa seeds can be used in place of alum to treat turbid water and reduce bacteria in drinking water (Figure.9). Geographically, many of developing countries are located in the tropical and sub-tropical regions of the world where *M. oleifera* grows and is cultivated. If validated by medical science, dietary consumption of this plant could be advocated in these and other countries as an inexpensive prophylactic strategy against diabetes mellitus (DM), and chronic dyslipidemia a risk factor for CVD. Chronic hyperglycemia is an indicator of DM and chronic dyslipidemia a risk factor for CVD. These metabolic disorders are global epidemics [13].

II Generation Biodiesel Invention

With years of continuing research, experiments and trials has provided an adage to find and develop 2nd generation biodiesel feedstock with low cost input technology. *Moringa oleifera* is a very fast growing tree; it commonly reaches four meters in height just 10 months after the seed is planted and can bear fruit within its first year. Its seeds are triangular in cross-section (30 to 50 cm long) and legume-like in appearance (Figure 10a,b,c).



Figure 10a. Moringa's seeds, freshly picked



Figure 10b. Moringa's legume shaped - triangular seeds

These seeds have oil rich black and winged seeds, which can be crushed to produce biodiesel.. *Moringa* could yield +3 ton oil/ ha and that it could be used for food in times of shortages. The seeds contain 30% to 40% oil that is high in oleic acid. The meal yields about 61% protein. Biodiesel made from *Moringa* has better oxidative stability than biodiesel made with most other feedstocks the crop's multiple dimensions would make it attractive to farmers worldwide. Other than biodiesel, the pods can also produce highly nutritious edible seeds. Their pods are harvested, meaning that the trees keep on growing, using water and reducing the high water table whilst sequestering carbon. The *Moringa oleifera* trees must be regarded as a sure source of 2nd Generation Biodiesel. The *Moringa oleifera* tree that has enough credentials: a higher recovery and quality of oil than other crops, no direct competition with food crops as It's a edible source of fuel, and no direct competition with existing farmland as can be grown for both purpose same time.



Figure 10c. Moringa's preserved seeds

2. Conclusion

Moringa is especially promising as a food source in the tropics because the tree is in full leaf at the end of the dry season when other foods are typically scarce. Extensive field reports and ecological studies forming part of a rich traditional medicine history, claim efficacy of leaf, seed, root, bark, and flowers against a variety of dermal and internal infections. Of importance is that all parts of Moringa are edible and also effective when used for treating various diseases. Any researches continue to be conducted on further establishment of Moringa as a potent medical solution and many are directed towards the acceptance and commercialization of Moringa bio active components. A large number of reports on the nutritional qualities of Moringa now exist in both the scientific and the popular literature. A plethora of traditional medicine references attest to its curative power, and scientific validation of these popular uses is developing to support at least some of the claims. Moringa preparations have been cited in the scientific literature as having antibiotic, antitrypanosomal, hypotensive, antispasmodic, antiulcer, anti-inflammatory, hypocholesterolemic, and hypoglycemic activities, as well as having considerable efficacy in water purification by flocculation, sedimentation, antibiosis and even reduction of Schistosoma cercariae titer. This fast growing tree now well known for its employability in human nutrition, dye, fodder, and water decontamination as it bears an imposing assortment for day to day welfare of wellbeing and socioeconomic comfort.

Moringa seed contain oil that can be used for various industrial purposes and as vegetable oil for human consumption or as biofuel. Though apparently native only to restricted areas in the southern foothills of the Himalayas, *M. oleifera* is cultivated in all the countries of the tropics. Outstanding oil is derived from the seeds, which is used for cooking and lubrication of delicate mechanisms. We can clearly affirm the superiority of Moringa over the other foods. As it was found that Moringa leaves contain more Vitamin A than carrots, more Ca than milk, more Fe than spinach, more Vitamin C than oranges, and more K than bananas,” and that the protein quality of Moringa leaves rivals that of milk and eggs. Clearly much more research is justified, but just as clearly this will be a very fruitful field of endeavor for both basic and applied researchers over the next decade. Moringa preparations (e.g. extracts, decoctions, poultices, creams, oils, emollients, salves, powders, porridges) are not quite so well known. *M. oleifera* is also of interest because of its production of compounds with antibiotic activity such as the glucosinolate 4 alpha-L-rhamnosyloxy benzyl isothiocyanate. Other research has focused on the use of *M. oleifera* seeds and fruits in water purification. Meeting all bodies nutritional requirements will naturally curb junk food cravings and supply with the energy needed to maintain a robust & active standard of living.

3. Abbreviations

RBITC (rhodamine B isothiocyanate); OGTT (oral glucose tolerance test); GK (Goto-Kakizaki) T2DM (type-2 diabetes mellitus); DNA (deoxyribose nucleic acid); HCD (high-cholesterol diet); HFD (high-fat diet); STZ (streptozotocin); AUC (area under the curve); IPGTT (intraperitoneal glucose tolerance test); FPG (fasting blood glucose); PTG (plasma triglyceride); MABP (mean arterial blood pressure respective); WHO (World Health Organization); USDA (United States Dietary Association); K (potassium), Ca (calcium); P (phosphorus); Fe (ferrum); Al₂(SO₄)₃ aluminium sulphate.

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