

Nutritional Potential of Drumstick *Moringa Oleifera* Leaves

REETA MISHRA, SATYENDRA PAL SINGH AND B.P.S. RAGHUBANSHI
RVSKVV- Krishi Vigyan Kendra, Morena-476001 (M.P.)

Abstract

Moringa Oleifera is considered as “The Miracle Tree”. It is also known as drumstick. All parts of the tree are useful, especially due to their pharmacological, nutritional properties. Drumstick leaves can be used successfully in its dried state or powdered form for the purpose of making different types of meals and porridge diets. These leaves are a rich source of potassium, calcium, phosphorous, iron, vitamin A, D and C, essential amino acids as well-known antioxidants such as beta carotene and flavonoids. The nutrient benefits in drumstick leaves provide a gentle nudge over time to improve the body’s metabolic processes because of critical nutrients. Drumstick trees have been used to combat malnutrition, especially among infants and nursing mothers. Products developed from this moringa leaves are rich sources of nutrients. Hence the consumption of drumstick leaves in different forms can enhance the nutritional security of preschool children, adolescent girls, pregnant and lactating women especially in rural areas.

Key words: *Moringa Oleifera*, drumstick leaves, nutrients, preschool children, women

Introduction

Food based strategies are preventive, cost-effective, sustainable and income generating. Food fortification is one of the food-based strategies that have the potential for wide population. One of the strategies to minimize micronutrient deficiency is supplementation. It is cheap and promotes intake a whole range of micronutrients rather than singling out and tackling just one. It also fosters community and individual involvement, and can help to stimulate local food economy. Nutritional interventions among the vulnerable groups of populations, with such compounds or foods that can improve the availability of nutrients from the diet, could be of immense value to combat the global prevalence of micronutrient malnutrition. *Moringa Oleifera* is perhaps the most nutrient dense single food source on the plant.

Moringa Oleifera is considered as “The Miracle Tree” because it is a multipurpose and exceptionally nutritious vegetable tree with variety of potential uses. All parts of the tree are useful, especially due to their pharmacological, nutritional properties. *Moringa Oleifera* is also known as drumstick. It is a nature’s gift to mankind. It 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. It is one of the vegetables of the

Brassica order and belongs to the family Moringaceae. The Moringaceae is a single genus family with 13 known species.

Drumstick leaves can be used successfully in its dried state or powdered form for the purpose of making different types of meals and porridge diets mostly aiming pregnant expectant mothers, nursing mothers, infants and young children, as well as adults of all age groups mostly due to their nutritional and medicinal properties. Usually the dried leaves can be stored for a long time and can be used regularly without refrigeration, and reportedly without loss of nutritional value.

Nutritional benefits of drumstick leaves

Drumstick leaves possess remarkable nutritional and medicinal qualities. They could serve as a valuable source of nutrient for all age groups. Drumstick leaves are extremely nutritious (Table 1) and this plant has tremendous potential for greater use in the human diet.

The micro-nutrient content is even more in dried leaves, that is;

- ten times vitamin A of carrots
- 17 times calcium of milk
- 15 times the potassium of banana
- 25 times the iron of spinach
- 9 times the protein of yogurt

Table 1: Nutrient contents of drumstick leave (mg/100g on fresh weight basis)

Nutrients	Value
Moisture	79.2 %
Total iron	0.26 mg
Calcium	431.6 mg
Phosphorus	133.57 mg
Ascorbic acid	139 mg
Oxalic acid	11.23 mg

Moringa leaves also contains α -linolenic acid (all- cis- 9, 12, 15-octadecatrienoic acid) which can be converted for eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) within human body. Drumstick leaves has a prominent role in consumption due to the presence of many nutrients. They contain all of the essential amino acids in a good proportion, which are the building blocks of proteins. These leaves could be a great boon to the people who do not get protein from meat. These leaves are a rich source of potassium, calcium, phosphorous, iron, vitamin A, D and C, essential amino acids as well-known antioxidants such as betacarotene and flavonoids. The nutrient benefits in drumstick leaves provide a gentle nudge over time to improve the body's metabolic processes because of critical nutrients.

Drumstick leaves contains 23791.91mcg total carotene and highest β -carotene content 16165.33 mcg/100gm on fresh weight basis and can be a suitable

protocol for dietary diversification/improvement strategy especially to eradicate vitamin A deficiency. Apart from β -carotene content they are also a good source of ascorbic acid, calcium, phosphorus, vitamin E and have low levels of oxalates. They are a rich source of protective nutrients essential for healthy vision, bones, blood and skin. They are also rich in various polyphenols, which act as antioxidants and are recommended for protecting against cardio vascular diseases.

Drumstick trees have been used to combat malnutrition, especially among infants and nursing mothers. The leaves of this tree contain argenine and histidine two amino acids especially important for infants, which are unable to make enough protein for their growth requirements. One rounded tablespoon (8 g) of leaf powder will satisfy about 14 percent of the protein, 40 percent of the calcium, 23 percent of the iron and nearly all the vitamin A needs for a child aged 1-3. One 100g portion of drumstick leaves could provide a woman with over a third of her daily need of calcium and give her important quantities of iron, protein, copper and sulphur and B-vitamins.

Medicinal benefits of drumstick leaves

The drumstick leaves are a good source of a natural antioxidant due to the presence of various compounds such as ascorbic acid, flavonoids, phenolic and carotenoids (Table 2 and 3). The antioxidants are capable of performing a number of functions including acting as free radical scavengers, enzyme inhibitors, reduce damage caused by free radical activity and

Table 2: Phytochemical constituents of drumstick from different part

Parts	Phytochemical constituents
Roots	4-(a-L-rhamnopyranosyloxy)-benzylglucosinolate and benzylglucosinolate
Stem	4-hydroxymellein, vanillin, β -sitosterone, octacosanic acid and β -sitosterol
Bark	4-(a-L-rhamnopyranosyloxy)-benzylglucosinolate
Whole gumexudates	L-arabinose, D-galactose, D-glucuronic acid, L-rhamnose, D-mannose, Dxylose and leucoanthocyanin
Leaves	Glycoside niazirin, niazirinin and three mustard oil glycosides, 4-[4'-Oacetyl- a -L-rhamnosyloxy) benzyl] isothiocyanate, niaziminin A and B
Mature flowers	D-mannose, D-glucose, protein, ascorbic acid, polysaccharide
Whole pods	Nitriles, isothiocyanate, thiocarbantes, 0-[2'-hydroxy-3'-(2'-heptenyloxy)]- propylundecanoate, 0-ethyl-4-[(a -1 rhamnosyloxy)-benzyl] carbamate, methyl-p-hydroxybenzoate and β -sitosterol
Mature seeds	Crude protein, Crude fat, carbohydrate, methionine, cysteine, 4-(a-Lrhamnopyranosyloxy)-benzylglucosinolate,benzylglucosinolate, moringyne, mono-palmitic and di-oleic triglyceride
Seed oil	Vitamin A, beta carotene, precursor of Vitamin A

oxidation, have significant role in preventing stress that might cause several degenerative diseases. These leaves also contain alkaloids which are nitrogen-containing naturally occurring compounds, commonly found to have antimicrobial properties due to their ability to intercalate with DNA of the microorganisms.

Table 3: Phytochemicals in leaves of *Moringa oleifera*

Phytochemical	Ether extract	Ethanol extract	Water extract
Gallic tannins	+	+	++
Catechol tennins	+	-	++
Coumarins	-	-	-
Steroids and triterpenoids	+++	++	++
Flavonoids	++	++	++
Saponins	+	+	++
Anthraquinones	+	++	+++
Alkaloids	+	-	++
Reducing sugars	-	++	++

Key: - Not detected, + present in low concentration, ++ present in moderate concentration, +++ present in high concentration

The juice of drumstick leaves is known to have a stabilizing effect on blood pressure due to the presence of nitrile, mustard oil glycosides and thiocarbamate glycosides. The presence of glucosinolates and hypotensive thiocarbamate glycosides in drumstick, contributes to the use of the plants in hypertension. On the other hand, they are also reported to modify tumorigenesis, able to inhibit carbohydrate-mediated tumor growth, induced a stress response and apoptosis in human breast cancer cells. Anthraquinones (9, 10- dioxoanthracene) which are a group of naturally occurring phenolic compounds are found in drumstick leaves and tend to have laxative effects. Terpenoids and steroids present in leaves are described as being active against bacteria such as *Staphylococcus aureus*, capable of preventing cancer having anticarcinogenic effects. They contain high amount of vitamin C, which fights a host of illnesses including colds and flu; vitamin A, which acts as a shield against eye disease, skin disease, heart ailments, diarrhoea, and many other diseases; Calcium, which builds strong bones and teeth and helps prevent osteoporosis; Potassium, which is essential for the functioning of the brain and nerves, and Proteins, the basic building blocks of all our body cells.

Drying of drumstick leaves

Drying can be considered as the most commonly used method for preservation, packaging, transportation and distribution of drumstick leaves. The principle of preservation by dehydration process is to remove the moisture content of a material to a level where microorganism may not be able to grow and spoil it. During the drying process there can be lots of losses takes place like nutritional, physical and chemical composition of leaves. Therefore, to minimize drying losses of drumstick leaves, various pretreatments like blanching can be used. Blanching is important mainly for the purpose of inactivating enzymes that can cause undesirable changes to reduce the quality of the final product; modifying texture; preserving color, flavor, and nutritional value of the product (retain certain nutrients such as vitamins) and removing trapped air. The drumstick leaves can retain 50% of their β -carotene on shade dehydration and the dehydrated leaves can be easily rehydrated and incorporated into local recipes without altering their acceptability characteristics.

Development of nutritious and organoleptically acceptable recipes with locally available foods is a challenge for the food scientist. However, the benefits of such food based strategies to prevent micronutrient malnutrition are manifold. They:

- are preventive
- are cost effective
- are sustainable
- are income generating
- are culturally acceptable and feasible to implement
- promote self reliance and community participation
- foster the development of environmentally sound food production systems

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