

## Use of *Moringa oleifera* Leaves as a Functional Food

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### INTRODUCTION

In order to address the worldwide food and health security, there is a need to expand food farming design and its nutritive worth. With rising income and urbanization in the world, people are changing their diets and are captivated by foods that have higher nutrition per bite. The functional food market is the rapidly developing section of the food market across the globe. Plant-based fortified functional foods are getting popular globally due to their disease preventive properties. They include dietary fiber which helps to maintain gastro intestine health; potassium helps to maintain a normal level of fluids inside our cells; beta carotenes for healthy eyes and skin; flavonoids have an anti-inflammatory effect; calcium reduces the chance of bone-related diseases, etc. One such food source that can be useful to different food varieties is *Moringa oleifera*, which is also known as drumstick and belongs to the family Moringaceae. The miraculous healing qualities of *Moringa oleifera* gained it the nickname "The Miracle Tree" among those suffering from a variety of life-threatening diseases. Its leaves are dried and ground to powder or used fresh as it is highly nutritious and studies have reported that leaves have high levels of calcium and vitamins like A, C, and E. To battle malnutrition among infants and children, *M. Oleifera* leaf has been utilized as an alternative food source. This article gives an outline of the *Moringa oleifera* leaves as a functional food and its potential applications.

### Availability and Growing Conditions of Moringa

In the present times, 80% of the world's moringa is produced by India. However, the production is spread worldwide to regions like South and Central America, Africa, and Asia and is known by different names i.e., "drumstick tree, Ben oil tree, horseradish tree, saijhan, sajna, mulangay, benzolive tree, moonga, marengo or mlonge".

*Moringa oleifera* grows at a temperature of around 25-35°C in sub-tropical and tropical districts of the world. The crop is effortless to grow since it requires low soil supplement and water interest. Moreover, it is spread by sexual and agamic means and requires a net rainfall of 250-3000mm, and is grown best in sandy or loamy soil with slightly alkaline to acidic pH. High germination rates were seen in direct seeding methods so it is followed. It takes 5-12 days for moringa seeds to germinate and can be embedded at a profundity of 2 cm in the soil. Moringa can also be grown in containers, plastic packs containing sandy or loamy soil are used in which saplings are set. It could be relocated once it reaches a size of roughly 30 cm. Extreme attention to detail must be taken while relocating as the taproots are delicate and will more often than not get impacted. The tree can reach a height of 5-10 meters.

### Nutritive Properties

The leaves of *M. oleifera* are eaten fresh in curry and salads or can be cooked in stews and soup. They are rich in minerals like zinc, magnesium, calcium, iron, potassium, and copper. Vitamins like beta-carotene of vitamin A, and vitamin B such as folic acid, pyridoxine, and nicotinic acid, vitamin C, D, and E are also present. It also contains phytochemicals such as tannins, sterols, terpenoids, flavonoids, saponins, etc. Moringa leaves are used in the diet of obese people since they have a low calorific value. It has a lot of minerals that are vital for development and improvement among which, calcium is viewed as one of the significant minerals for human development. Leaves can provide 1000mg calcium while 250 ml milk can only provide 300-400 mg.

**Table 1: Nutrients composition of *Moringa oleifera* fresh, dry, and powder (Gopalakrishnan, Doriya, and Kumar 2016) (All values are in 100 g per plant material)**

Nutrients	Fresh leaves	Dry leaves	Leaf powder
Calories (cal)	92	329	205
Carbohydrate (g)	12.5	41.2	38.2
Fat (g)	1.7	5.2	2.3
Protein (g)	6.7	29.4	27.1
Fiber (g)	0.9	12.5	19.2
Vitamin C (mg)	220	15.8	17.3
Vitamin E (mg)	448	10.8	113
Vitamin B1 (mg)	0.06	2.02	2.64
Vitamin B2 (mg)	0.05	21.3	20.5
Vitamin B3 (mg)	0.8	7.6	8.2
Calcium (mg)	440	2185	2003
Phosphorus (mg)	70	252	204
Magnesium (mg)	42	448	368
Potassium (mg)	259	1236	1324
Copper (mg)	0.07	0.49	0.57
Iron (mg)	0.85	25.6	28.2

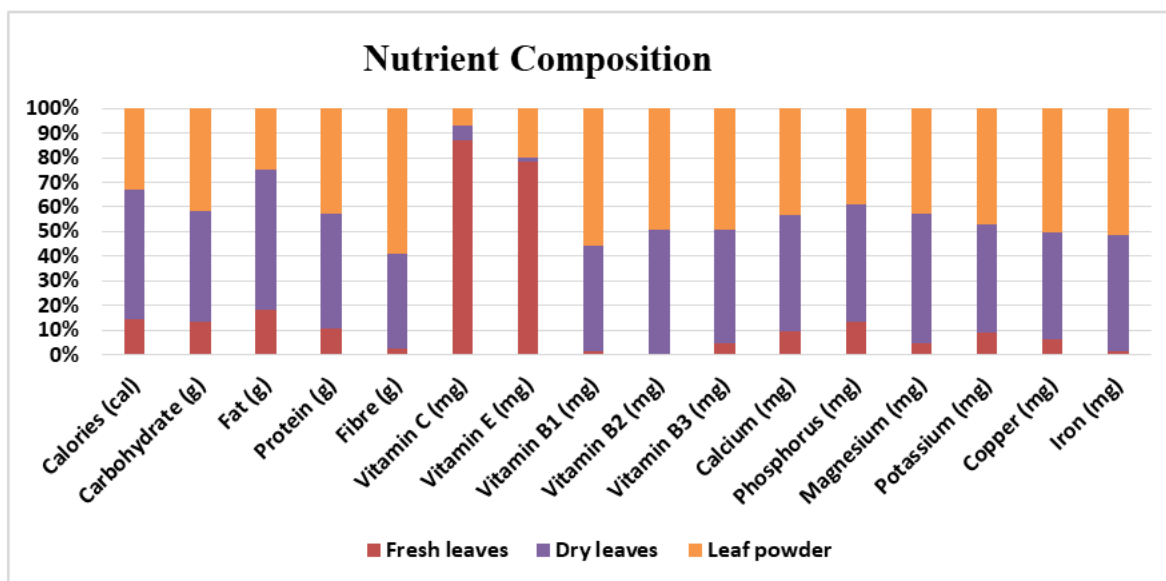


Figure 1: Nutrients composition of *Moringa oleifera* fresh, dry, and powder

### Use of *Moringa oleifera* leaves

There are a variety of uses, some studies show that the concentrate of leaves and products of *Moringa oleifera* can mend constant gastric ulcers initiated by means of acetic acid. Probioticated *Moringa* leaf extract had a more elevated level of haemoglobin in rats treated with it thus can be used as a nutraceutical to treat anaemia. It can be used to cure more than 300 diseases. *Moringa* has been used by Indians and Africans in herbal medicines. It is a good medicinal agent due to the presence of phytochemicals. In addition, nutrients and phenolic acids present in *Moringa oleifera* likewise help to battle against numerous sicknesses, for example, coronary illness and blood clumps which can prompt strokes and tumours. Moreover, the leaves are known to have anti-obese and anti-diabetic properties as well. It is likewise viable against scorpion and snake bites and works as a detoxifying specialist. Certain nervous system problems including cerebral pains, epilepsy, headaches, and delirium can likewise be healed somewhat with *Moringa oleifera*. Other uses of the plant include that the juice from fresh moringa leaves can be used as effective growth hormones and the yield can be expanded by 25-30% for almost any plant group (soya,

maize, tomato, bell pepper, tea, melon, coffee, etc.). Abscisic acid, auxins, cytokinins, ethylene, and gibberellins are five different groups of growth regulators which increase food production.

### Potential food application of *Moringa oleifera* leaves

*Moringa oleifera* is recommended for cultivation, assimilation, and consumption in the diet by food scientists and nutritionists. It might be used to make easy, palatable, and nutritionally dense foods, which would aid in the fight against nutritional deficiency in countries around the world. Furthermore, the formulation of such foods will provide dietary variety. Identification of inexpensive, easily accessible food items with a rich source of nutrients will be a significant boon to the food sector, particularly in developing countries, where the number of individuals living in poverty is high. *Moringa* leaves are easy to handle and store because of their long shelf life. Furthermore, the nutrients are more concentrated after drying, making them more beneficial. Many researchers have demonstrated that various *Moringa oleifera* leaves can be used in food applications such as:

- Paneer, Moringa Paneer made from moringa leaf extract at various concentrations was tested, and it was discovered to have a higher nutrient content than regular paneer.
- Soups, moringa leaves with a combination of spinach is used as soup ingredients.
- Herbal biscuits, Biscuits containing 5% *Moringa oleifera* leaf powder were shown to have a 14% increase in protein content.
- Bread enriched with 5% Moringa oleifera had an 88% increase in protein and dietary fiber content, respectively.
- Khakhra, Dried drumstick leaves with high antioxidant activity were mixed into khakhras in different quantities, and physicochemical and sensory analyses were performed. The moisture, fat, ash, protein, carbohydrate, and antioxidant activity of the khakhras were all raised when these treated leaves (sun-dried, shadow-dried, and manually dried) were added.
- Moringa muffins, dried leaf powder was incorporated in the preparation of muffins. 12% dried powder per 55grams of flour was used to achieve a successful result. Protein, fat, beta carotene, vitamin C levels and minerals in Moringa muffin were found to be much higher. The potassium, calcium, and iron content of the Moringa muffin was found to be considerably higher than that of the control muffin.
- Dry leaf powder is used in supplements and infant diets to increase its nutritional value. It incorporated in Halwa and chocolate better the protein, fibre, and ash content noticeably.

### CONCLUSION

*Moringa oleifera* is an outstanding source of micro and macronutrients including antioxidants. The leaves are not as popular as other vegetables like fenugreek and spinach worldwide but are used as substitutes in foods

in Southern and Eastern parts of India. Moringa is very less explored but has enormous uses. It very well may be used to make food sources that could be a step towards curing malnutrition. A number of studies showed that the use of moringa leaves is used for the treatment of various illnesses including chronic non-infectious and infectious diseases. Consuming moringa powder is safe, even at higher levels. The daily dosage of leaves should be limited to approximately 70 grams per day. With regular consumption of moringa, we can step by step work on the condition of our general well-being.

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