



Original Article



## Processing of *Moringa oleifera* Leaves for Human Consumption

Satya Prakash Mishra\*, Pankaj Singh and Sanjay Singh

\**Moringa* Biotech, Ranchi Gumla NH-23, Ranchi-835303, Jharkhand. India

Institute of Forest Productivity, Ranchi Gumla NH-23, Ranchi-835303, Jharkhand. India

### ABSTRACT

*Moringa Oleifera* is one of the most useful tropical trees. Its leaves are extremely valuable source of nutrition for people of all ages. Nutritional analysis indicates that *Moringa* leaves contain affluence of essential, disease preventing nutrients. They even contain all of the essential amino acids, which is unusual for a plant source. The young leaves are edible and are commonly cooked and eaten like spinach or used to make soups and salads. They are an exceptionally good source of provitamin A, vitamins B, and C, minerals (in particularly iron), and the sulphur-containing amino acids methionine and cystine. The composition of the amino acids in the leaf protein is well balanced since the dried leaves are concentrated; they contain higher amounts of many of these nutrients. In this paper processing of fresh *Moringa* leaves into dry form for consumption purpose has been described.

### INTRODUCTION

*Moringa oleifera* Lam. is a multipurpose and exceptionally nutritious vegetable tree with a variety of potential uses. It is a sub-tropical species that is known by different regional names as benzolive, drumstick tree, kelor, marango, mulangay, nébéday, saihan, mooringai and sajna. It has very high nutritional properties that would be useful as a food supplement, especially in those relegated communities. Besides its nutritional and medicinal applications, *M. oleifera* is very useful as an alley crop in the agro-forestry industry. It is useful not only for human beings but also for animals and also in various industrial applications. Besides *Moringa oleifera* being processed into a medicine, it contains acetone which can be prepared into herbal formulation which is an effective anti-malaria bio agent [1]. Such trees have the potential to be a source of new drugs [2]. It is also an effective water clarifier using the seed, thus providing millions of people with clean drinking water [3]. The leaves, fruit, flowers and immature pods of this tree are used as a highly nutritive vegetable in many countries, particularly in India, Pakistan, Philippines, Hawaii and many parts of Africa. It is originated initially in the Northern part of India some 5000 years back and soon moved into the Southern parts as well, where it was known as 'Murungaikerai' (*Moringa* leaves) and 'Murungaikaai' (*Moringa* vegetable). The *Moringa* tree had spread to most part of Asia, nearly the whole of Africa, South America, southern part of North America and some pockets in Europe [4,5]. *Moringa* has been used as a traditional medicine around the world, for anemia, skin infections, blackheads, anxiety, bronchitis, catarrh, chest congestion, asthma, blood impurities, cholera, glandular, swelling, headaches, conjunctivitis, cough, diarrhea, eye and ear infections, fever, abnormal blood pressure, hysteria, pain in joints, pimples, psoriasis, respiratory disorders, scurvy, semen deficiency, sore throat, sprain, tuberculosis, for intestinal worms, lactation, diabetes and pregnancy. The healing properties of *Moringa* oil have been documented by ancient cultures. *Moringa* oil has tremendous cosmetic value and is used in body and hair care as a moisturizer and skin conditioner. *Moringa* oil has been used in skin preparations and ointments since Egyptian times [6-9].

The leaves possess remarkable nutritional and medicinal qualities [10,11]. 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, diarrhea, 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. Another important point is that *Moringa* leaves 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 people who do not get protein from meat. *Moringa* even contains arginine and histidine

two amino acids especially important for infants, who are unable to make enough protein for their growth requirements [12-18]. The micro-nutrient content is even more in dried leaves; (ten times the vitamin A of carrots), (17 times the calcium of milk), (15 times the potassium of bananas), (25 times the iron of spinach) and (nine times the protein of yogurt)[18, 19].

Therefore it is necessary to increase the utilization of *Moringa* leaves consumption by the different communities. It should be consumed either fresh or dry. Dried leaves can be stored for a long time and can be used regularly. Many companies across the world manufacturing various products of *Moringa* leaves such as *Moringa* Tea, *Moringa* Tablets, *Moringa* Capsules, *Moringa* leaf Powder, *Moringa* Soaps and *Moringa* Face wash. Some beverages are also available in market prepared by *Moringa* leaves. So it is necessary to hygienically drying and processing of *Moringa* leaves for further uses. In this paper we have described processing of fresh *Moringa* leaves into dry form for consumption purpose.

## MATERIAL AND METHODS

### Leaf Harvesting

Young and old leaves both are suited to making dried leaf powder. Morphology of leaf can be identified as they are 20-70 cm long, grayish-downy when young, long petiole with 8-10 pairs of pinnae each bearing two pairs of opposite, elliptic or obovate leaflets and one at the apex, all 1-2 cm long; with glands at the bases of the petioles and pinnae [20]. *Moringa* leaves can easily lose moisture after harvesting, therefore, harvest early in the morning and complete the initial phase of processing in the same day, if possible.



Figure: A



Figure: B

Figure: A- Young and tender leaf of *Moringa oleifera*  
 Figure: B- Pure and Fresh *Moringa* Leaf Powder (ready to eat)

### Selection of healthy leaves

Fungi like *Cercosporasp* and *Septoria lycopersic* causing brown spot in the leaves and further turning the leaves yellow and killing them. Apart from fungi the most common pests on the leaves are grasshoppers, crickets and caterpillars [21,11]. Therefore diseased and damaged leaves are discarded manually just after the collection of fresh leaves.

### Washing

Collected leaves are washed in running tap water till the removal of dirt. After this leaves are soaked in 1% saline solution (NaCl) for 5 minutes to remove microbes. Leaves are further washed with 70 % ethanol followed by twice washing with distilled water. This step plays a substantial role in removal of dust, pathogens as well as microbes present on the leaf surface.

### Draining

The excess water can be removed by spreading the leaves in sunlight for a brief period till the removal of water present on the leaf surface.

**Drying**

It is estimated that only 20-40% of vitamin A will be retained if leaves are dried under direct sunlight, but that 50-70% will be retained if leaves are dried in the shade. High temperature may lead down to the breakage of protein present in the leaves [22]. Therefore shade dry is recommended for the drying process. Spread the leaflets on the sterile clean green net in a well-ventilated room. Mosquito net may be used for this purpose because these materials give a space between the floor and the leaves. This room should be insect, rodent and dust proof. Air circulation can be improved by using ceiling and floor level vents protected with a clean filter to keep the sun and dust out. It is possible to use a fan, but the air must not be directly oriented towards the leaves, as it can increase contamination with germs in the air. It is advisable to turn the leaves over at least once, with sterile gloves, to improve uniform drying. Leaves should be completely dry within a maximum of 4 days. The loading density should not exceed 1 kg/m<sup>2</sup>. All persons involved in this step must ensure that, while on duty, personal cleanliness and hygiene are maintained. Personal protective equipment (PPE) such as head caps, nose masks, disposable gloves, etc. must be used at all times.

**Grinding**

In small scale dried leafs can be grinded by mortar and pestles or pulverizer machine can be used for fine grinding. Commonly 0.5 mm – 1.0 mm pore size screen is used for the separation of the fine grinded leaf powder.

**Drying of the leaf powder**

*Moringa* leaf powder immediately absorbs moisture and the product can reabsorb humidity during or after grinding. For this reason, *Moringa* leaf powder should be dried at 50°C for 30 minutes to reduce moisture content. If stored powder is exposed to heat or light it will degrade and the nutrient content will be reduced. *Moringa* Leaf Powder can be stored for up to 6 months under the following conditions: clean, dried powder stored in air-tight containers, protected from light and humidity, and kept below 24°C (75.2 °F).

**DISCUSSION**

*Moringa* trees have been used to combat malnutrition, especially among infants and nursing mothers. One rounded tablespoon (8 g) of leaf powder will satisfy about 14% of the protein, 40% of the calcium, 23% of the iron and nearly all the vitamin A needs for a child aged 1-3. Six rounded spoonful of leaf powder will satisfy nearly all of a woman's daily iron and calcium needs during pregnancy and breast-feeding. Three non-governmental organizations in particular—Trees for Life, Church World Service and Educational Concerns for Hunger Organization—have advocated *Moringa* as “natural nutrition for the tropics.” Leaves can be eaten fresh, cooked, or stored as dried powder for many months without refrigeration, and reportedly without loss of nutritional value. *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. Leaves were also used for food fortification [8]. Spoonful of the powder can then be added to baby food, soups, and vegetables, adding nutrition but not changing the taste. This powder can be used in place of fresh leaves to make lead sauces, or few spoonful of the powder can be added to other sauces just before serving. Addition of small amounts of leaf powder will have no discernible effect on the taste of a sauce. In this way, *Moringa* leaves will be ready available to improve nutritional intake on a daily basis. 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. The present study recommends the prospect of more aggressive introduction and utilization of drumstick leaves by the food sector. It also implies that it may be worthwhile for industry to take up the production of drumstick leaf powder. Such promotion of drumstick leaf incorporation into the diet in India and other countries could go a long way towards not only alleviating micronutrient deficiencies, but also towards the development of functional foods for several chronic degenerative disorders. These efforts could also be an additional source of income generation, employment and exports providing a viable alternative to imported food supplies to treat malnutrition in poor countries.

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