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Moringa Leaf Powder: A Natural Superfood with Nutritional Potential

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Abstract

Malnutrition can be described by excesses, imbalances, or shortages in an individual's energy and nutritional intake, according to the World Health Organization (WHO). The plant Moringa oleifera, which is indigenous to India, thrives in tropical and subtropical regions all over the world. The nutritional properties of Moringa are high and it is rich in calcium. The nutritional value of fresh moringa leaf is ranged as protein 6.9 g, ash 1.5–2.5%, crude fiber 1.75 g, carbohydrate 2.93 g, fat 1.5–2%, energy (kcal) 110–140l/100 g and calcium 390–420 mg, iron 6–8 mg, magnesium 38–42 mg, potassium 350–400 mg and zinc 0.60–0.80 mg and vitamin E – 113 mg, vitamin B1 – 2.64 mg, vitamin B2 – 20.5 mg, vitamin B3 – 8.2 mg, and vitamin C – 17.3 mg. After drying moringa leaves at 60°C in a hot air oven for 5.25 hours, the nutritional properties of moringa leaves were increased. The nutritional value of moringa leaf powder ranged as protein 23.12 g, ash 7.8 g, crude fiber 11.43 g, carbohydrate 46.4 g, fat 5.25 g, moisture content of 6% per 100 g, and calcium 2300 mg, Therefore, the people who are suffering from malnutrition can consume this jaggery cubes including lactating women.

Keywords: Malnutrition, Moringa Leaf, WHO, Protein, carbohydrate

INTRODUCTION

Malnutrition is the cause of almost half of child fatalities in India. Malnutrition is characterized by excesses, imbalances, or shortages in an individual's energy and nutrient intake, according to the World Health Organization (WHO). It is commonly understood that maternal, baby, and child nutrition all play important roles in the child's normal growth and development, as well as his or her future socioeconomic status [1–10]. Malnutrition rates among children, pregnant and lactating women, and girls are remarkably high in India, according to reports from the WHO, the United Nations International Children's Emergency Fund, and the National Health and Family Survey [8].

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Since its native India, *Moringa oleifera* has thrived in tropical and subtropical regions worldwide. Moringa is a tropical plant that grows throughout the tropics and is a member of the *Moringaceae* family. It is frequently referred to as the "drumstick tree". Moringa can endure both severe drought and mild frost, and it is widely cultivated around the world. India is the world's biggest moringa grower, producing 2.2 million tons of tender fruits per year from 43, 600 ha of land, resulting in a yield of approximately 51 tonnes per ha. Tamil Nadu (13, 042 ha), Karnataka (10, 280 ha), and Andhra Pradesh (15, 665 ha) are the three largest states in terms of area. In other states, it covers 4, 613 ha [3]. The nutritional tree Moringa is a rapidly growing tree found across the

tropics and subtropics. Moringa grows best in temperatures ranging from 25 to 35°C, and while it is drought-hardy, it thrives with an annual rainfall of 250 to 1500 mm. Moringa is a flexible plant that can be cultivated as a tree or as a "perennial-vegetable". Moringa trees can grow up to 4 meters (15 feet) per year, reaching a height of 15 meters (50 feet) and living for about 20 years. Regular trimming is indicated to promote branching and leaf formation [5].

The nutritional value of moringa leaf is ranged as protein 6.9 g, ash 1.5–2.5%, crude fiber 1.75 g, carbohydrate 2.93g, fat 1.5–2%, energy (kcal) 110–140l/100 g and calcium 390–420 mg, iron 6–8 mg, magnesium 38–42 mg, potassium 350–400 mg and zinc 0.60–0.80 mg and vitamin E – 113 mg, vitamin B1 2.64 mg, vitamin B2 – 20.5 mg, vitamin B3 – 8.2 mg, and vitamin C – 17.3 mg (Ray Yu Yang et al., 2006).

Once the plants are established, moringa leaves can be harvested whenever desired. Plants are cut to a height of 15–50 cm (6–20 in) above ground for leaf harvest. The trees can be trimmed up to nine times a year. To harvest leaves from trees, chop the entire tree back to a height of 1–2 m (3–6 ft). This is best done during the wet season so that the tree has time to recover before the winter season. Other leaf harvesting methods for trees include cutting chosen branches (saving some for the future harvest or seed production), halving each branch, and collecting a few leaves from each branch. After harvesting the leaves, remove the stems. Any leaves that get damaged or discolored during this process can be set aside for compost or animal feed [1]. Using proximate analysis, the nutritional research of dried moringa leaves revealed the following moisture content 6.53%, crude protein 27.51%, carbohydrate 43.88%, crude fat 2.23%, crude fiber 19.25%, ash 7.13% and the calorific value was 1296 kJ/100g. They suggested that the moringa leaves can be consumed in our daily diets or used as a nutritional supplement for people who are malnourished [2].

Moringa trees have been utilized to help people who are malnourished, especially newborns and nursing moms. As "natural 4 nutrition for the tropics," moringa has been acknowledged by three non-governmental organizations: Trees for Life, Church World Service, and Educational Concerns for Hunger Organization. According to the mentioned sources, leaves can be eaten raw, roasted, or kept as a dry powder for months without losing their nutritional value. In tropical regions, moringa holds particular potential as a food source since it is in full leaf near the end of the dry season when other foods are in short supply [3].

Green vegetables are traditionally preserved with the help of drying, which turns them into a lightweight, transportable, and storable product. This technique has the advantage of rehydrating the vegetables, which enables them to be used all year. Furthermore, green vegetables that have been dehydrated are more convenient and have a longer shelf life than fresh vegetables, which increases nutritional value while decreasing waste, labor, and storage space. Product rehydration ratio, color, and flavor retention are influenced by pretreatments, drying methods, and dehydration quality.

MATERIALS AND METHOD

Materials

Moringa oleifera's mature, fresh, healthy, and dark green leaves were bought from the nursery of the College of Agriculture and Research Station's Department of Vegetable Science at Indira Gandhi Krishi Vishwavidyalaya in Raipur (C.G.). Leaves were selected based on a visual assessment of their uniform color and size. Leaves were always picked up in the morning and dried. The leaves' stalks were trimmed from the main branches, later each leaf was detached manually and then they were properly washed three to four times with tap water to eliminate any foreign substances, such as chaff, dust, and dirt. After being washed, the leaves were spread out on tissue paper to absorb any excess moisture. The moisture in the leaves was evaporated at room temperature and they were employed for further research. Moringa leaves were kept in zip lock bags before reaching the laboratory to avoid any bias in analysis.

Hot Air Oven Drying of Fresh Moringa Leaves

The drying experiments were carried out in a hot air oven dryer at 60°C. In order to stabilize the dryer was turned on 30 minutes before to attain the drying temperature. Fresh moringa leaves were loaded upon aluminum trays and placed inside the drying chamber, which was set to 60°C for drying. After every 60 minutes, the weight difference was measured again. When the weight difference of Moringa leaf became constant, the drying was stopped and the leaves were ground in a mixer grinder. After that, the powder was sieved in 282 µm (Figures 1 and 2).

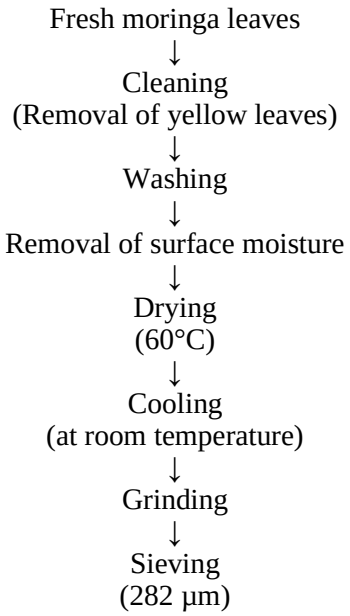

Figure 1. Development of moringa leaf powder.

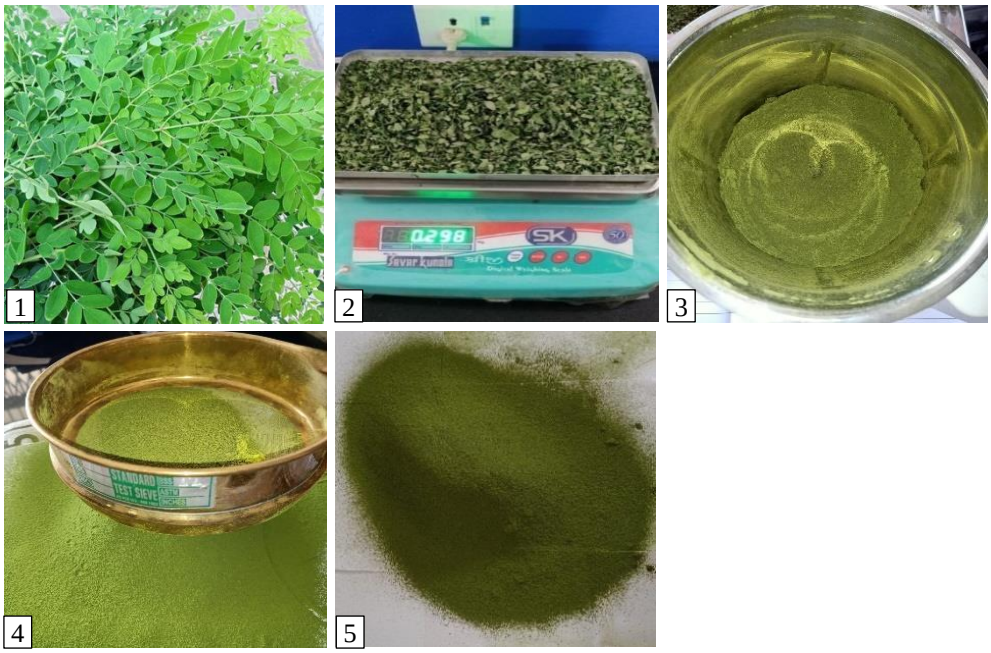

Figure 2. Pictorial flow chart for development of moringa leaf powder.

PROXIMATE COMPOSITION

A standard approach cited by multiple researchers was used to determine the proximate compositions of moringa leaves. The methods and standard procedure are as follows:

Moisture Content

The moisture content of moringa powder was determined using the standard hot air oven method [4] which has been mentioned by various researchers. To assess the moisture content of moringa powder, a known amount of moringa powder was put in moisture dishes that had been carefully cleaned, dried, and pre-weighed, and placed in a hot air oven for 24 hours at a temperature of 103 ± 2°C. After 24 hours moisture plates were then removed and cooled in desiccators. The moisture content of moringa powder was then estimated using the equation below.

$$\text{Moisture content, \% (wb)} = \frac{W_1 - W_2}{W_1} \times 100$$

where,
W1 = Initial weight of sample.
W2 = final weight of sample.

Fat Content

The AOAC (2005) approach was used to assess the fat content of moringa powder using a soxTRON extraction unit. First, 2g of moringa powder was weighted individually on a weighing balance before being transferred to a thimble. Further, 80 ml of n-hexane was poured into previously dried and weighed extraction beakers. The thimble-containing the sample was fixed in the beaker in such a way that the thimbles were immersed. After that, beakers were placed on the heating plate on the heating zone by pressing down the hand lever and left to boil for 2–3 hours at a temperature of 75–150°C. After cooling down, the thimble was gently removed from the container and the n-hexane on top was collected and emptied into another container for reuse. Then, the beakers were removed and placed in an oven set to 60°C to evaporate any remaining moisture in the beakers. After that, the beakers were taken out and put in desiccators to get to room temperature [5]. The following equation was used to calculate the percentage of fat content.

$$\text{Fat content (\%)} = \frac{W_1 - W_2}{W_2} \times 100$$

where,
w_1 = Weight of beaker containing fat, (g),
w_2 = Weight of empty beaker, (g),
w_3 = Weight of sample taken, (g).

Protein Content

The Micro-Kjeldahl technique was used to assess the protein content of moringa powder. 0.5 g moringa powder was transferred to a 500 ml kjeldhal digestion tube. After that, 10 ml of sulphuric acid (H_2SO_4) was added to the tube, followed by the catalyst digestion mixture (potassium sulfate and cupric sulfate in proportions of 1:1). The tubes were placed in the digestion chamber and covered with fume suction panels. The digestion main power was turned on and left on for 3–4 hours at a temperature of 420 ± °C. The digested material in the tube was distilled with 40% NaOH in a distillation apparatus and the liberated ammonia was collected in a flask containing 4% boric acid and 4 to 5 drops of mixed indicator. The boric acid was then titrated with 0.05 N hydrochloric acid and a gentle shake until the flask resulted in a mild pink color. By multiplying with the correction factor 6.25, the sample's liberated free nitrogen percent and protein percentage were calculated. The nitrogen percentage and protein content were determined using the following procedure [5].

$$\text{Nitrogen} = \frac{14.01 \times (\text{Titrated} - \text{Blank})\ \text{value} \times \text{Normality of acid}}{\text{Sample weight (g)} \times 1000} \times 100$$

Amount of protein (%) = Nitrogen (%) x 6.25

Ash Content

Ash content was determined by [5] method. The amount of ash in the moringa powder was measured using a muffle furnace. Initially, 2 g of moringa powder was weighed and placed in previously weighted silica crucibles. Then, they were placed in a silica crucible and heated before being placed in the furnace on a low flame until thoroughly charred and cooled. After that, crucibles

with churning samples were then put in a muffle furnace and ashed at 550°C for four hours. After 4 hours, all of the crucibles were removed using crucible tongs and placed in a desiccator to bring the temperature up to ambient temperature before being weighed individually. The ash content was calculated using the difference between the samples' initial and final weights.

$$\text{Ash content (\%)} = \frac{W_2 - W_1}{W_3} \times 100$$

where,
W_1 = weight of the empty crucible, (g),
W_2 = final weight of the crucible with the ash, (g),
W_3 = weight of the sample.

Crude Fiber Content

The Fibra plus extraction unit was used to evaluate the fiber content of moringa powder. The fiber estimation procedure was primarily divided into two stages: acid and alkali wash. In a crucible, one gram of defatted material was placed and 150 ml of 1.25% H_2SO_4 solution was added to the beaker. Crucibles were placed on a heating plate and allowed to boil for 45 minutes at 500°C, after which it was filtered. The filtrate was neutralized by washing the residues in the beaker with distilled water. Then the residues were washed with 150 ml of 1.25% NaOH in the second step which is an alkali wash. Again wash the residues three times with distilled water.

After that, the crucible with the sample was dried in an oven at 100°C for 1–2 hours to remove any remaining moisture and then cooled in a desiccator. The weight was recorded along with the sample after cooling. The samples were then placed in an ashing crucible and heated to 550°C in a muffle furnace for 4 hours. The crucibles were then weighed after cooling in a desiccator. The fiber content was determined using the formula below [5].

$$\text{Crude fiber (\%)} = \frac{W_1 - W_2}{W_3} \times 100$$

where,
W_3 = Weight of sample, (g),
W_1 = Crucible weight before ashing, (g),
W_2 = Crucible weight after ashing, (g).

Total Carbohydrate Content

The carbohydrate content was calculated by deducting the sum of the percentage of moisture content, crude fiber content, protein content, fat content, and total ash content from the hundred [4].

Carbohydrate content = [100 – (moisture content + crude fiber content + protein content + fat content + ash content)].

Determination of Calcium Content

A flame photometer was used to determine the calcium present in moringa leaf powder after preparing a set of standard solutions [5].

RESULT AND DISCUSSION

This chapter describes the findings and outcomes of different experiments planned as per the set objectives of the study. The major goal of the present research work was to investigate the nutritional properties of moringa leaf powder and influence the quality of the product (Table 1).

The drying experiment was carried out using a hot air oven dryer at 60°C for 5.25 hours. Then the powder was sieved using a BSS 80 sieve (282 µm). During the experiment, the proximate composition of moringa leaf powder was determined. The proximate composition of moringa leaf powder was determined as moisture content of 6%, protein as 23.12 g, fat as 5.25 g, fiber as 11.43 g,

ash content as 7.8 g, carbohydrates as 46.4 g and calcium as 2300 mg (Table 1). This result was similarly reported by [6] as calcium 2600 mg of dried moringa leaves. Similar results were also found in Joshi and Mehta (2010) as moisture content of 6%, protein of 23.78 g, fat of 7.06 g, fiber of 11.8 g, and carbohydrates of 38.08 g of dried moringa leaves. According to the experimental findings (Table 1), the fat contents of hot air oven-dried moringa leaf powder at 60°C were found to be 5.25 g/100 g. The ash content was also discovered to be 7.8 g/100 g. Crude fiber and crude protein were found to be (11.43 g/100 g) and (23.12 g/100 g). A carbohydrate was found to be (46.4 g/100 g). At 60°C hot air oven drying temperature moringa leaves the moisture content of moringa powder was decreased from 11% to 6% as compared to fresh moringa leaves which would likely extend the shelf life of the powder because spoiling agents including microorganisms develop under high moisture levels [7]. Compared to other green vegetables, Moringa leaves are high in minerals including potassium, calcium, magnesium, iron, zinc, and copper, as well as vitamins like β-carotene, vitamin B, folic acid, and vitamins C, D, and E. Moringa leaves also include anti-diabetic, anti-oxidant, anti-cancer, and neuroprotective chemicals. Additionally, Moringa leaves are a strong source of natural antioxidants and other components including carotenoids, flavonoids, phenolics, and ascorbic acid that can extend the shelf life of foods that contain fat. More than 90 minerals, including antioxidants, and all eight necessary amino acids can be found in moringa leaves [8, 9]. According to numerous studies, dried Moringa leaves have 17 times the calcium of milk, 9 times the proteins of yogurt, 10 times the vitamin A of carrots, 25 times the iron of spinach, 15 times the potassium of bananas, and 7 times the vitamin C of oranges [10]. Moreover, moringa leaves powder can be stored for several months without any special storage facility or refrigeration system with quality retention like fresh leaves. The increasing demand for nutritious, fortified and variety of food products could enable the incorporation of moringa leaf powder for the development of such nutritious food products.

Table 1. Proximate composition of moringa powder.

Moringa Leaf Powder	**Proximate Analysis (per 100 g)**
Moisture content (%)	6%
Protein (g)	23.12 g
Fat (g)	5.25 g
Fiber (g)	11.43 g
Ash content (g)	7.8 g
Carbohydrates (g)	46.4 g
Calcium (mg)	2300 mg

CONCLUSIONS

For thousands of years, plants have been identified as significant sources of nutritional and medicinal properties. The various plant parts including leaves, bark, roots, flowers, and fruits of moringa trees have been utilized to address the problem of malnourishing. The nutritional value of moringa powder was determined and reported. Since the moringa leaf powder are source of several nutritional and medicinal properties therefore the moringa leaf powder could be used as a supplement of nutrition due to the high amount of protein and calcium. The nutritional value of moringa powder is high so it can be utilized for the development of different fortified value-added products.

REFERENCES

1. Oduro I, Ellis WO, Owusu D. Nutritional potential of two leafy vegetables: Moringa oleifera and Ipomoea batatas leaves. Sci Res Essay. 2008;3(2):57–60.
2. Bashir KA, Waziri AF, Musa DD. Moringa oleifera, a potential miracle tree; a review. IOSR J Pharmacy Biol Sci. 2016;11(6):25–30.
3. Gandji K, Chadare FJ, Idohou R, Salako VK, Assogbadjo AE, Kakai RLG. Status and utilisation of Moringa oleifera Lam: a review. Afr Crop Sci J. 2018;26(1):137–156.
4. AOAC. Association of Official Analytical Chemists, Official Methods of Analysis. 17th ed. Washington, DC: USA; 2000.

5. AOAC. Association of Official Analytical Chemists, Official Methods of Analysis. 18th ed. Washington, DC: USA; 2005.
6. Fahey JW. Moringa oleifera: a review of the medical evidence for its nutritional, therapeutic, and prophylactic properties. Part 1. Trees Life J. 2005;1(5):1–15.
7. Olabode ZA, Akanbi CT, Olunlade B, Adeola AA. Effects of drying temperature on the nutrients of Moringa oleifera leaves and sensory attributes of dried leaves infusion. Direct Res J Agric Food Sci. 2015;3(5):177–182.
8. Narayan J, John D, Ramadas N. Malnutrition in India: status and government initiatives. J Public Health Policy. 2019;40:126–141.
9. Foidl N, Makkar HPS, Becker K. The potential of Moringa oleifera for agricultural and industrial uses. 2001.
10. Ashfaq M, Basra SM, Ashfaq U. Moringa: a miracle plant for agro-forestry. J Agric Soc Sci. 2012;8(3):115–122.

