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**Nidhi**
School of Studies in Botany and Research Centre, Maharaja Chhatrasal Bundelkhand University, Chhatarpur, Madhya Pradesh, India

**PK Khare**
School of Studies in Botany and Research Centre, Maharaja Chhatrasal Bundelkhand University, Chhatarpur, Madhya Pradesh, India

**Corresponding Author:**
**Nidhi**
School of Studies in Botany and Research Centre, Maharaja Chhatrasal Bundelkhand University, Chhatarpur, Madhya Pradesh, India

# Estimation of vitamins content in different parts of *Moringa oleifera* Lam. in Chhatarpur district (MP)

**Nidhi and PK Khare**

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**Abstract**
The "miracle tree" or "tree of life," *Moringa oleifera*, is prized for its many medicinal uses and amazing nutritional composition. Traditionally uses have been found for almost every part of the plant, including the leaves, pods, seeds, flowers, roots, and bark. In this research work also critically analysed *Moringa oleifera* plant parts for medicinal and nutritional properties to cure the woman's diseases at different age of life. The malnutrition was managed by used of *Moringa oleifera*; because of availability of high amount of nutrients like proteins, calcium, iron, and vitamins A, B, C, E. Apart from $B_1$ and $B_6$, every vitamin that was assessed shown a notable reaction to admission. The seeds have a higher concentration of all the vitamins exhibiting notable variation than the leaves. The well-known saying that "ounce-for-ounce, *Moringa oleifera* leaves contain more Vitamin A than carrots and more Vitamin C than oranges. The maximum Vitamin A, $B_1$, $B_2$, $B_3$, C and E contents was high in leaves i.e. 6951, 2.64, 20.5, 8.2, 329.7, 480 mg per 100 g.d.w. respectively as compared to flowers and pods.

**Keywords:** *Moringa oleifera*, vitamin A, B, C and E, medicinal uses, human health

## Introduction
*Moringa oleifera* are annual and perennial tree, still considered as among underutilized plant and falls under *Moringa oleifera* ceae family (Singh Y. *et al.*, 2012) [26]. The sub-Himalayan regions of northern India are home to the fast-growing, drought-resistant *Moringa oleifera* plant. It is the most extensively grown species in the *Moringa oleifera* genus, which includes 13 species found in tropical and subtropical parts of Asia and Africa. It belongs to the family Moringaceae. Known as the "tree of life" or "miracle tree" because of its many uses and remarkable nutritional composition, *Moringa oleifera* has been used for millennia as a food and in traditional medicine (Rajangam *et al.*, 2001) [23]. The leaves, pods (often referred to as "drumsticks"), seeds, flowers, bark, roots, and almost every other part of the tree are important and have multiple uses. Because of its versatility, quick growth, and many advantages, *Moringa oleifera* is now grown all over the world in tropical and subtropical regions. As a nutrient-dense food that can aid in the fight against malnutrition, it is especially prized in underdeveloped nations. Its components are utilized in traditional medicine, eaten as vegetables, and even used in industry for things like oil production and water purification. The usage of this plant has been encouraged by the World Health Organization (WHO) to aid nations that are experiencing malnutrition, one of the leading causes of death globally. One in twelve people globally, including 160 million children under the age of five, suffer from malnutrition, according to a United Nations Food and Agriculture study (United Nations Food and Agriculture Statistics, 2008). Interest in its cultivation and use has grown worldwide because of the rediscovery of its potential in modern times (Singh Y. *et al.*, 2012) [26].

Rich in vital minerals, *Moringa oleifera* contains: Vitamins; B vitamins ($B_1$, $B_2$, $B_3$, and B6), vitamin K, vitamin A, vitamin C, and vitamin E. Minerals include copper, zinc, phosphorous, iron, magnesium, calcium, and potassium. Amino Acids is a complete protein source since it contains all nine necessary amino acids. Antioxidants: Packed with ascorbic acid, flavonoids, phenolic acids, and carotenoids, among other antioxidants. Additional bioactive substances include tannins, saponins, isothiocyanates, and glucosinolates (Nidhi and Khare P.K. 2023) [20]. *Moringa oleifera* is unquestionably a remarkable plant because of its many qualities.

Many tropical and subtropical nations eat the leaves, flowers, seeds, and pods (Anhwange *et al.* 2004) [3]. According to Ajantha *et al.* (2018), Nidhi and Khare P.K. (2023) [20] the leaves are thought to be a great source of protein, vitamins, and minerals. It is also known that the seeds have excellent nutritional qualities. Lack of minerals and vitamins has been connected to an increase in dietary illnesses and malnutrition that plagues most developing nations ([AVRDC] Asian Vegetable Research and Development Centre 1998). Numerous noncommunicable diseases are exacerbated by obesity, which is on the rise. Fruits and vegetables high in phytochemicals and micronutrients may help treat obesity and undernutrition (Yang *et al.* 2006) [30]. According to Tesfaye *et al.* (2011), *Moringa oleifera* may be able to help with the world's undernourishment issues, especially those that the developing world faces. *Moringa oleifera* is currently widely grown in many tropical nations due to the benefits of its morphological parts and products (Nouman *et al.* 2012) [22].

It has been demonstrated that even the frequently discarded seed hull contains significant levels of nutrients, with Na and K being the most prevalent minerals (Saheed *et al.* 2019) [25]. The well-known saying that "ounce-for-ounce, *Moringa oleifera* leaves contain more Vitamin A than carrots, more calcium than milk, more iron than spinach, more Vitamin C than oranges, and more potassium than bananas" demonstrates the relative superiority of *Moringa oleifera* 's nutritional content, and that the protein content of *Moringa oleifera* leaves is comparable to that of milk and eggs. Fahey (2005) [6]. For example, *Moringa oleifera* leaves and pods contain all the amino acids, which is uncommon for a plant source (Mathur 2006) [14]. According to Nouman *et al.* (2012) [22], one tablespoon of powdered *Moringa oleifera* leaves provides 9.9-13.6% of the daily crude protein requirements of breastfeeding women and children. The concentration of essential amino acids of *Moringa oleifera* leaves is higher than the recommended amino acid pattern of the FAO reference protein for children between 2 and 5 years (Makkar and Becker 1997) [13].

Because to its high protein, mineral, and vitamin content, *Moringa oleifera* is now most useful in the fight against hunger, malnutrition, and sickness, despite its many other uses. The body requires trace amounts of minerals and vitamins, which oversee a few chemical processes that support good health. As a result, they help the body avoid illnesses and operate at its best (ENCARTA 2010). Minerals basically play several functions, including being components of different compounds, structures, enzymes, and colours. In addition, they aid in impulse transmission, osmotic balance maintenance, and metabolic activation (Robert 1976) [24], Nidhi and Khare P.K. (2025) [19]. Animal performance and health suffer when certain elements are deficient (Merck 2005) [16]. Vitamins are chemical substances grouped together because of their useful qualities. They are needed in trace amounts for certain metabolic functions that are essential to good health. They specifically can generate coenzymes, which are essential for several metabolic processes (Roberts 1976) [24].

In the battle against illness and hunger is unquestionably one of the most promising options. The plant is found in most tropical nations (Anhwange *et al.* 2004) [3] and grows in a variety of habitats, including marginal or water-stressed places where, despite producing food of adequate nutritional quality, it is susceptible to soggy circumstances suggested by Nouman *et al.* (2013) [21]. Furthermore, it grows at a faster rate than regularly grown agroforestry species like Leucaena (Nduwayezu *et al.* 2007) [18], yielding large amounts of biomass in a short period of time (Nouman *et al.* 2012) [22]. It is implied that *Moringa oleifera* is readily available to many impoverished individuals who might not have access to pricey dietary sources. They can really cultivate it themselves and reap its benefits for little to no money if the right circumstances are there.

Although all parts of the plant are said to be useful (Haldar and Kosankar 2017) [8], greater attention seemed to be focused on the leaves and the seeds for consumption, at least in Nigeria. However, relative distribution of minerals and vitamins between these two plant parts has not been thoroughly explored. One such report from Nigeria (Igwilo *et al.* 2017) [10] involved sample collection only from one location which does not afford the opportunity of assessing variation over a wider geographical range. Relative distribution of proximate and anti-nutritional qualities of *Moringa oleifera* between leaves and seeds in Nigeria has already been documented (Stevens *et al.* 2015) [27]. This report focuses on the distribution of vitamins in different parts of *Moringa oleifera*.

## Materials and Methods

### Collection of *Moringa oleifera* plant parts as sample and lab work

The sample collection and lab work has been done between 2023-2025. The Healthy and disease-free plant parts as leaves, stems, barks, roots, flowers, and seeds of *Moringa oleifera* were collected from the “Botanical Garden” in front of Department of Botany, Maharaja Chhatrasal Bundelkhand University, Chhatarpur, Madhya Pradesh, India. The chemical analysis was done in Lab of “Centre of Excellence on Soybean Processing and Utilisation (CESPU)” of ICAR-Central Institute of Agricultural Engineering, Bhopal (MP).

### Cleaning and sanitizing of sample

The collected plant parts were three time washed out with tap water and

after that sterilized with 70% alcohol. The sterilized plant sample were dried in shade

at room temperature and avoid the fungal infection on plant materials. When the sample was completely dried, then it is made into powder form by the used of mortar and pestle. To collected the fine powder for further studies based on Jongrungruangchok, S. *et al.* (2010) [12].

### Preparation of sample for further processes

One hundred grams of powdered of *Moringa oleifera* leaves, stems, barks, roots, flowers, and seeds were stored in a thick filter paper thimble that was put into the Soxhlet extractor's main chamber. A 700 ml flask of methanol, the extraction solvent, was placed inside the Soxhlet extractor. A heating mantle then housed the Soxhlet setup. As the solvent began to boil, vapours were released, which were then reduced by the condenser and dropped into the thimble containing the plant material. One could see a change in the solvent's colour as it accumulated in the round-bottom flask as the amount of solvent in the jar increased and the soluble bioactive components dissolved in it based on Bello, O. S. *et al.* (2017) [5].

**Vitamin's analysis**

The B-complex and additional water-soluble vitamin's such as $B_1$, $B_2$, $B_3$, and C were identified. The vitamin E that was examined was fat soluble (McMurray *et al*., 1980 and Thompson and Duval, 1989) [15, 29]. The Harris L.J. (1935) [9] method was used to determine the ascorbic acid content of *Moringa oleifera* (leaves, flowers, and pods). stated as milligrams (mg) per hundred grams. Weighing 2.0 g of the sample into a series of conical flasks allowed us to calculate the amount of vitamin A present. After being saponified, the sample was extracted using 10 milliliters of xylene-kerosene combination, agitated for half an hour, and centrifuged for twenty-five minutes. The spectrometer was used to run the supernatant at 328 and 460 nm, respectively. Weighing 2.5 g of the samples into a set of conical flasks, adding 0.5 N HCL solution, and heating at 150°C for 1 hour and 30 minutes allowed us to determine the B vitamins ($B_1$, $B_2$, $B_6$, and $B_{12}$). A pH of 4.5 was achieved. Following a shake and centrifugation, the samples were moved to a series of vials. The spectrometer measured the wavelengths of vitamins $B_1$, $B_2$, $B_6$, and $B_{12}$ at 450, 476, 500, and 586 nm, respectively. The spectrometer measured a prepared sample of vitamin C at a wavelength of 560 nm, and Waters 616/626 HPLC was used to analyse vitamin E at a wavelength of 650 nm.

**Results**

**Vitamins content estimation in different parts of *Moringa oleifera***

The vitamin content of the nutrient-rich plant *Moringa oleifera* varies depending on the plant parts; like flower, pods, and seeds also have the overall nutritional profile but leaves were especially high in vitamins A, B, and C. The vitamins A, B and C were estimated in leaves, flowers, and pods (Table 1 and Fig. 1,2,3,4,5 & 6).

**Vitamins - A content estimation in different parts of *Moringa oleifera***

The Vitamin A content estimated and result shown that the maximum Vitamin A contents was in leaves i.e. 6841 mg per 100 g.d.w. The minimum Vitamin A content was observed in flowers i.e. 55 mg per 100 g.d.w. The Vitamin A contents in pods also estimated which was observed as 68 mg per 100 g.d.w. (Table 1 and Fig.1).

**Vitamins - B content estimation in different parts of *Moringa oleifera***

The Vitamin $B_1$ content estimated and result shown that the maximum Vitamin $B_1$ contents was in leaves i.e. 2.64 mg per 100 g.d.w. The minimum Vitamin $B_1$ content was observed in Flower i.e. 0.05 mg per 100 g.d.w. The Vitamin $B_1$ contents in pods also estimated which was observed as 0.06 mg per 100 g.d.w. (Table 1 and Fig. 2).

**Table 1:** Vitamin composition of *Moringa oleifera* leaves, flowers and pods(mg per 100g)

| Sr. No. | Plant parts | Vitamin A | Vitamin C | Vitamin E | Vitamin $B_1$ | Vitamin $B_2$ | Vitamin $B_3$ |
|---|---|---|---|---|---|---|---|
| 1 | Leaves | 6951 | 329.7 | 480 | 2.64 | 20.5 | 8.2 |
| 2 | Flowers | 51 | 398 | 98 | 0.05 | 0.06 | 0.2 |
| 3 | Pods | 67 | 793 | 140 | 0.05 | 0.07 | 0.2 |
| | S.E. ± | 1.01 | 0.38 | 0.38 | 0.023 | 0.023 | 0.023 |
| | C.D.(P=0.05) | 3.06 | 1.15 | 1.15 | 0.51 | 0.51 | 0.51 |

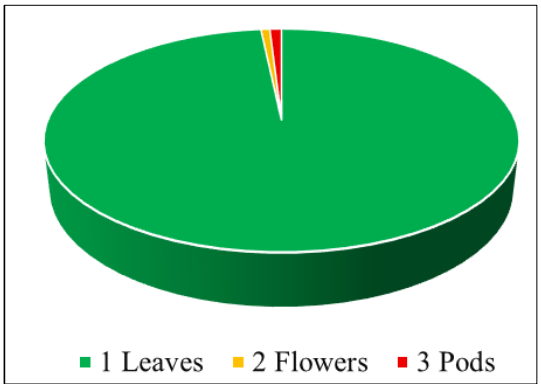


**Fig 1:** Vitamin A

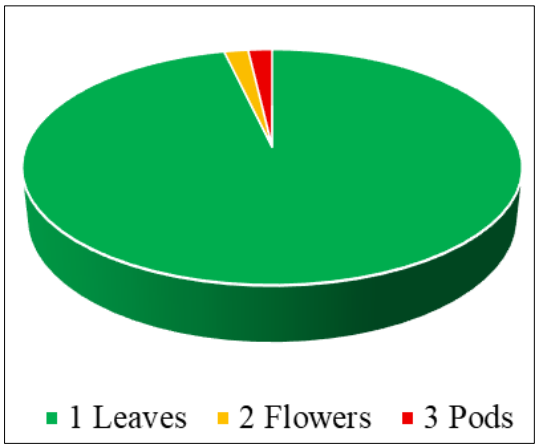


**Fig 2:** Vitamin $B_1$

The Vitamin $B_2$ content estimated and result shown that the maximum Vitamin $B_2$ contents was in leaves i.e. 2.05 mg per 100 g.d.w. The minimum Vitamin $B_2$ content was observed in Flower i.e. 0.06 mg per 100 g.d.w. The Vitamin $B_2$ contents in pods also estimated which was observed as 0.07 mg per 100 g.d.w. (Table 1 and Fig. 3).

The Vitamin $B_3$ content estimated and result shown that the maximum Vitamin $B_3$ contents was in leaves i.e. 8.20 mg per 100 g.d.w. The minimum Vitamin $B_3$ content was observed in Flower i.e. 0.02 mg per 100 g.d.w. The Vitamin $B_3$ contents in pods also estimated which was observed as 0.03 mg per 100 g.d.w. (Table 1 and Fig. 4).

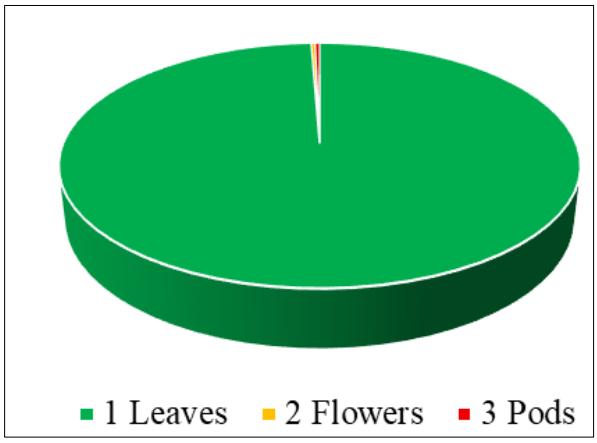


**Fig 3:** vitamin $B_2$

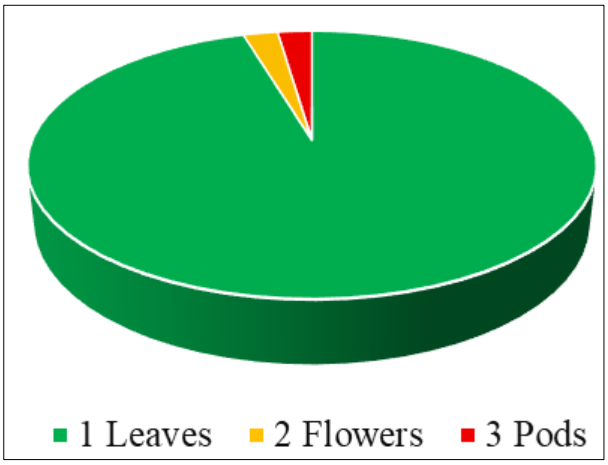


**Fig 4:** Vitamin $B_3$

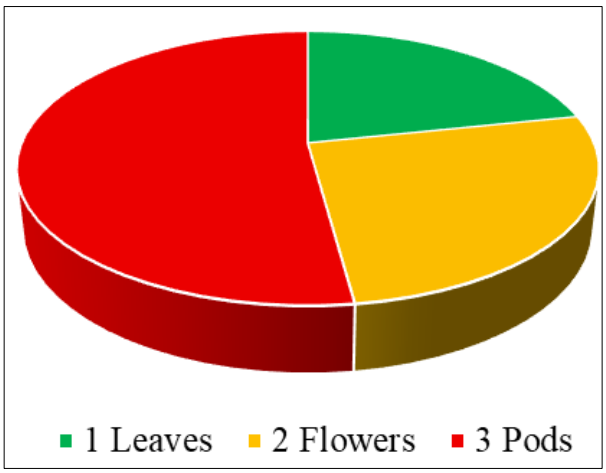


**Fig 5:** Vitamin C

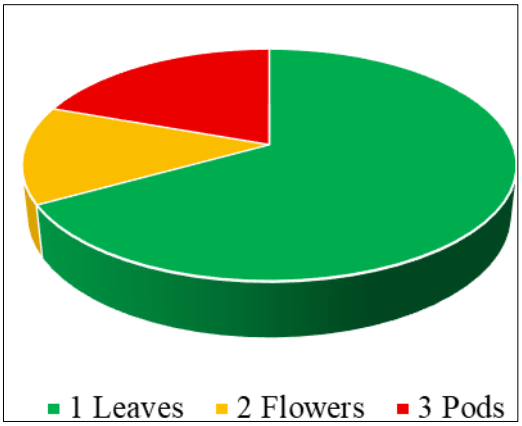


**Fig 6:** vitamin E

**Vitamins - C content estimation in different parts of *Moringa oleifera***

The Vitamin C content estimated and result shown that the maximum Vitamin C contents was in pods i.e. 781 mg per 100 g.d.w. The minimum Vitamin C content was observed in leaves i.e. 327.9 mg per 100 g.d.w. The Vitamin C contents in flowers also estimated which was observed as 388 mg per 100 g.d.w. (Table 1 and Fig. 5).

**Vitamins - E content estimation in different parts of *Moringa oleifera***

The Vitamin E content estimated and result shown that the maximum Vitamin E contents was in leaves i.e. 489 mg per 100 g.d.w. The minimum Vitamin E content was observed in flowers i.e. 99 mg per 100 g.d.w. The Vitamin E contents in pods also estimated which was observed as 150 mg per 100 g.d.w. (Table 1 and Fig. 6).

**Discussion**

The vitamin content of the nutrient-rich plant *Moringa oleifera* varies depending on the plant parts; like flower, pods, and seeds also have the overall nutritional profile but leaves were especially high in vitamins A, B, and C. The vitamins A, B and C were estimated in leaves, flowers, and pods. Some studies suggested that dried leaves/powder: Because of concentration, much higher. Beta-carotene levels vary greatly, ranging from 18.5 mg/100g (18500 µg/100g) to 6.8 mg/100g (6800 µg/100g). According to some sources, beta-carotene is 61.05 mg/100g by Metwally, F. M. *et al.* (2018) [17]. Fresh Leaf: Extremely elevated. 8.6 mg to 220 mg per 100g is the range. "Seven times the vitamin C of oranges," as it is commonly said by Islam Z. *et al.* (2021) [11]. Dried Leaves/Powder: Since vitamin C is heat-sensitive, its concentration may be diminished by drying. But there are still huge volumes left. 7.3 mg to 660 mg per 100g have been reported, depending on the source and drying technique Giannakourou, M. C. and Taoukis, P. S. (2021) [7]. Medical news today suggested that Vitamins B: Several B vitamins that are essential for metabolism can be found in *Moringa oleifera* leaves. Fresh leaves: 0.103 mg/100g of thiamine ($B_1$). Approximately 0.26 mg/100g of dried leaves. Fresh leaves: 0.112-0.66 mg/100g of riboflavin ($B_2$). Leaf dryness: 0.06-1.0 mg/100g. Fresh leaves: 1.5-2.2 mg/100g of niacin ($B_3$). Leaf dryness: 2.7 mg/100g. Fresh leaves: 0.48-0.13 mg/100g of pantothenic acid ($B_5$). Fresh leaves: 0.129-1.20 mg/100g of vitamin $B_6$ (pyridoxine). Leaf dryness: 0.5-1.2 mg/100g. Folate ($B_9$): 40-41 µg/100g of fresh leaves. 27 µg to 150 µg per 100g of dried leaves.

Vitamin E (Tocopherols): Powdered or dried leaves: A reliable source. reported to be between 2.8 and 5.6 mg/100g, with alpha-tocopherol levels reaching as high as 77 mg/100g. Phylloquinone, or vitamin K, is found in leaves. Vitamin K content in *Moringa oleifera* leaves is well known, while precise figures are less common; Abd Rani N. Z. *et al.* (2018) [1], Fahey J. W. (2005) [6] and Anhwange B. A. *et al.* (2004) [3].

**Summary**

The malnutrition was managed by used of *Moringa oleifera*; because of availability of high amount of nutrients like proteins, calcium, iron, and vitamins A, B, C, E. The Vitamin A content estimated and result shown that the maximum Vitamin A contents was in leaves i.e. 6841 mg per 100 g.d.w. The Vitamin $B_1$ content estimated and result shown that the maximum Vitamin $B_1$ contents was in leaves i.e. 2.64 mg per 100 g.d.w. The Vitamin $B_2$ content estimated and result shown that the maximum Vitamin $B_2$ contents was in leaves i.e. 2.05 mg per 100 g.d.w. The Vitamin $B_3$ content estimated and result shown that the maximum Vitamin $B_3$ contents was in leaves i.e. 8.20 mg per 100 g.d.w. The Vitamin C content estimated and result shown that the maximum Vitamin C contents was in pods i.e. 781 mg per 100 g.d.w. The Vitamin E content estimated and result shown that the maximum Vitamin E contents was in leaves i.e. 489 mg per 100 g.d.w.

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