

# Studies on nutritional profile of different parts of *Moringa oleifera* (Leaf, flower and pod)

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The leaves, fruit, flowers and immature pods of *Moringa oleifera* are used as a highly nutritive vegetable. The mandate of current study was to explore the nutritional worth of *Moringa oleifera* because of its easily availability and mostly use. The raw materials were analyzed for the proximate like moisture, fat, protein, fibre, ash and carbohydrate and mineral profile. The composition profiling of *Moringa oleifera* indicated that leaves, flowers and pods are good source of protein, fat, crude fibre and ash content. *Moringa oleifera* leaves powder had highest protein content (24.14 %) followed by flower (16.1 %) and pods (13.8 %). *Moringa oleifera* leaves contain high calcium, magnesium, phosphorous and iron content than flowers and pods. *Moringa oleifera* pod powder was found to be higher in potassium content (2847 mg) followed by leaves and flowers. *Moringa oleifera* leaves noted 6951 IU of vitamin A, 329 mg of vitamin C and 480 mg of vitamin E. *Moringa oleifera* leaves are having significant amount of vitamin A, C and E. However flowers and pods of *Moringa oleifera* are also reported considerable amount of vitamin C. Among the parts of *Moringa oleifera* total flavonoids and tannin content in the pods was found to be highest than flowers and leaves. *Moringa oleifera* leaves powder had highest alkaloid content (5.68 %) followed by flower (3.87 %) and pods (3.28 %).

**Key Words :** *Moringa oleifera*, Proximate composition, Phytochemicals, Vitamins

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## INTRODUCTION

*Moringa oleifera* belongs to a family *Moringaceae* commonly referred to as “The Miracle Tree” (Palada, 1996), ‘drumstick tree’ or ‘horseradish tree’. The leaves, fruit, flowers and immature pods of this tree are used as a highly nutritive vegetable in many countries. World Health Organization has promoted *Moringa* as an alternative to imported food supplies to treat malnutrition (Khawaja *et al.*, 2011). In Maharashtra, the area under drumstick production was 7000 hectare with the annual

production of 2,10,000 MT. and the productivity was 30 T/ha. fruits are ready for harvest 60 days after flowering; the period extends 2-3 months. 200-250 fruits/tree/year in annual types, in perennial types, the yield will be generally low (80-90 fruits/tree/year) in the first two years. Then it increases to about 500-600 fruits/tree/year. Each tree gives 35 kg of drumstick in 1 season (Pandey, 2011). The leaves, seeds and flowers all have good nutritional and therapeutic values used to prevent or treat protein-energy malnutrition and other nutritional related diseases (Tete-Benissan *et al.*, 2012). *Moringa oleifera* leaves are low in fat and carbohydrate but are excellent sources of amino acids (Rajangam *et al.*, 2001).

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## METHODOLOGY

### Collection of *Moringa oleifera* varieties:

The prominent variety of *Moringa oleifera*

Koimtoor-1 (*Odisi*) majorly grown in Marathwada region was selected with concern of horticulturist. Leaves, flowers and pods of desirable maturity were selected for research project.

### Proximate analysis of *Moringa oleifera* plant fractions (leaf, flower and pod) :

Analysis of ground *Moringa oleifera* (leaf, flower and pod) for moisture, ash content, crude protein, crude fat, crude fibre and carbohydrate were carried out according to their respective methods (AOAC, 2005). All the tests were executed in triplicates.

### Mineral estimation :

The determination of calcium, magnesium, potassium, phosphorus and iron were done as per the method described by Ranganna (1986).

### Vitamin estimation :

*Determination of vitamin A (β-carotene) content:*

The vitamin A content was determined using a standard method (AOAC, 1984) by using the formula:

$$\beta\text{-carotenoid (g)/100g N} = \frac{\text{Conc. of carotene in solution } \mu\text{g/cm}^3 \times \text{dilution} \times 100}{\text{Weight of sample (g)}}$$

### Vit. E (l-tocopherol) :

Vitamin E was measured according to the methods of McMurray *et al.* (1980).

### Ascorbic acid (vitamin C) :

Ascorbic acid content was determined by titration of a known weight of sample with 2, 6-dichlorophenol indophenol dye using oxalic acid (AOAC, 2000). The 2, 6-dichlorophenol dye which is blue in alkaline solution and red in acid solution reduces ascorbic acid to a colorless form. Ascorbic acid was expressed as mg/100g by using given formula  $\text{Dye Factor} = 0.5 / \text{Titre}$

$$\text{Ascorbic acid (mg/100g) N} = \frac{\text{Titre} \times \text{Dye factor} \times \text{Volume made up} \times 100}{\text{Aliquot of extract taken for estimation} \times \text{Wt. or volume of sample taken for estimation}}$$

### Phytochemical analysis of *Moringa oleifera* plant fractions (leaf, flower and pod) :

The determination of alkaloid, flavanoid and saponin were done as per the method described by Krishnaiah *et al.* (2009) and Mir *et al.* (2013) and Total Tannins (TT) content by Tamilselvi *et al.* (2012).

## OBSERVATIONS AND ASSESSMENT

The results of proximate composition revealed that leaves, flowers and pods of *Moringa oleifera* are good source of protein, fat, crude fibre and ash content. The moisture content was in the range of 5.2 to 5.7 in the pods of *Moringa oleifera*, *Moringa oleifera* flowers powder had higher moisture content (5.7 %) followed by leaves powder (5.4 %) and pod powder (5.2 %). Moreover there was statistical difference in the moisture content of *Moringa oleifera* flowers over leaves and pod powder while leaves and pods are statistically at par with each other.

*Moringa oleifera* leaves powder had highest protein content (24.14 %) followed by flower (16.1 %) and pods (13.8 %) (Table 1). Fat content was also recorded highest in the leaves followed by flower and lowest was recorded in pods (0.5 %) in *Moringa oleifera*. The crude fibre and ash content was also found to be more in leaves and pods than flowers. The total carbohydrate content were higher in pods of *Moringa oleifera* followed by its flower and minimum carbohydrate were reported in leaves. The protein content was found significantly higher in leaves of *Moringa oleifera* than its flowers and pods. The similar data on the proximate composition of *Moringa oleifera* leaves, flowers and pods are also reported by Arise *et al.* (2014); Moyo *et al.* (2013); Okereke and Akaninwor (2013) and Charles *et al.* (2011).

Minerals are inorganic elements needed by the body

**Table 1 : Proximate composition of *Moringa Oleifera* leaves, flowers and pods (variety – Koimtoor-1)**

Sr. No.	Parts of <i>Moringa oleifera</i>	Per cent composition					
		Moisture	Protein	Fat	Crude fibre	Ash	Carbohydrate
1.	Leaves	5.4	24.14	8.0	9.2	10.2	43.13
2.	Flowers	5.7	16.1	5.6	5.2	5.2	62.04
3.	Pods	5.2	13.8	0.5	7.5	6.9	66.1
	S.E. ±	0.06	0.23	0.15	0.03	0.12	0.23
	C.D. (P=0.05)	0.20	0.72	0.46	0.11	0.37	0.70

as structural component and regulators of body processes. The data regarding calcium, magnesium, phosphorus, iron and potassium of *Moringa oleifera* leaves, flowers and pods are presented in Table 2. Calcium content of all the parts of *Moringa oleifera* was found to be higher, whereas *Moringa oleifera* leaves reported highest calcium content (2080 mg) followed by flower (444 mg) and pods (188 mg). *Moringa oleifera* leaves also contain high calcium, magnesium, phosphorus potassium and iron content than flowers and pods. *Moringa oleifera* pod powder was found to be higher in potassium content (2847 mg) followed by leaves and flowers. Similar results are also reported by Okereke and Akaninwor (2013) and Massry *et al.* (2013).

The results of vitamin A, C and E of *Moringa oleifera* plant parts are depicted in Table 3. It is clearly shown from the table that *Moringa oleifera* leaves retained significant amount of vitamin A, C and E. However flowers and pods of *Moringa oleifera* are also reported considerable amount of vitamin C. *Moringa oleifera* leaves noted 6951 IU of vitamin A, 329 mg of vitamin C and 480 mg of vitamin E. *Moringa oleifera* flowers reported 51 IU, 398 mg and 480 mg of vitamin A, C and E, respectively. *Moringa oleifera* pods contain 793 mg of vitamin C and 140mg of vitamin E. The results

of vitamins of *Moringa oleifera* leaves are in good agreement with the results of Khawaja Tahir Mohmood *et al.* (2011) and Arise *et al.* (2014).

The data pertaining to the phytochemical constituents of *Moringa oleifera* leaves, flowers and pods are reported in Table 4. Phytochemicals are non-nutritive plant chemicals that have protective or disease preventive properties. *Moringa oleifera* leaves have higher total alkaloids (5.68 g) and saponin (6.9 g) and lower in total flavonoids than flowers and pods. Among the parts of *Moringa oleifera* total flavonoids and tannin content in the pods was found to be highest than flowers and leaves. The contents of tannin and saponin in moringa plant are not antinutritional and protein inhibitors and hence safe as a food. These results are corresponds with the report by Kasolo *et al.* (2010) and Onyekwere and Felix (2014).

### Conclusion :

*Moringa oleifera* plant found rich source of nutrients. *Moringa oleifera* leaves powder had highest protein content (24.14 %) followed by flower (16.1 %) and pods (13.8 %). *Moringa oleifera* pod powder was found to be higher in potassium content (2847 mg) followed by leaves and flowers. *Moringa oleifera* leaves noted 6951 IU of vitamin A, 329 mg of vitamin C and 480 mg

**Table 2 : Minerals composition of *Moringa Oleifera* leaves, flowers and pods (variety – Koimtoor;1) (mg per 100g)**

Sr. No.	Parts of <i>Moringa oleifera</i>	Calcium	Magnesium	Phosphorus	Iron	Potassium
1.	Leaves	2080	502	325	132	2411
2.	Flowers	444	270	203	8.3	1393
3.	Pods	188	317	288	8.0	2847
	S.E. ±	0.38	0.58	0.58	0.80	1.35
	C.D. (P=0.05)	1.15	1.76	1.76	2.41	4.09

**Table 3 : Vitamin composition of *Moringa oleifera* leaves, flowers and pods (variety – Koimtoor;1)(mg per 100g)**

Sr. No.	Parts of <i>Moringa oleifera</i>	Vitamin A	Vitamin C	Vitamin E
1.	Leaves	6951	329.7	480
2.	Flowers	51	398	98
3.	Pods	67	793	140
	S.E. ±	1.01	0.38	0.38
	C.D. (P=0.05)	3.06	1.15	1.15

**Table 4 : Phytochemical constituents of *Moringa oleifera* leaves, flowers and pods (variety – Koimtoor;1)( g per 100g extract)**

Sr. No.	Parts of <i>Moringa oleifera</i>	Total alkaloids	Total flavonoids	Tannin	Saponin
1.	Leaves	5.68	14.03	1.98	6.9
2.	Flowers	3.87	18.29	1.19	2.5
3.	Pods	3.28	31.83	6.47	3.4
	S.E. ±	0.03	0.16	0.02	0.02
	C.D. (P=0.05)	0.11	0.50	0.06	0.06

of vitamin E. *Moringa oleifera* leaves are having significant amount of vitamin A, C and E. However flowers and pods of *Moringa oleifera* are also reported considerable amount of vitamin C. Among the parts of *Moringa oleifera* total flavonoids and tannin content in the pods was found to be highest than flowers and leaves. *Moringa oleifera* leaves powder had highest alkaloid content (5.68 %) followed by flower (3.87 %) and pods (3.28 %).

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