

RESEARCH PAPER

DOI: 10.15740/HAS/IJPPHT/7.2/237-242

Studies on morphological and nutritional characteristics of different parts (Leaf, flower and pods) of *Moringa oleifera* (Variety : Koimtoor-1)

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■ Research chronicle : Received : 14.09.2016; Revised : 22.10.2016; Accepted : 23.11.2016

SUMMARY :

Moringa oleifera L. belongs to a family *Moringaceae* commonly referred to as “The Miracle Tree”, ‘drumstick tree’ or ‘horseradish tree’. This research study was aimed at investigating the morphological and nutritional characteristics of different parts of *Moringa oleifera*. Fresh sample of *Moringa* leaves, flowers and pods were collected, sorted, blanched and dried. Colour, length, width measurement of *Moringa* leaves and flowers while average weight and number of seeds per pod were analysed to determine morphological characteristics of *Moringa oleifera*. The per cent yield from different parts were also investigated. The per cent yield of blanched powders are comparatively lower than blanched samples. The blanched and dried plant samples were analysed separately for proximate composition using appropriate methods. The chemical composition of different parts of *Moringa* such as leaves, flower and pod for their moisture content, crude fat, crude protein, carbohydrates, crude fibre and ash were 5.4, 3.4, 28, 43, 10.2, 8.5 per cent (for leaves); 5.7, 1.6, 24.1, 53.6, 7.5, 5.9 per cent (for flowers); 5.2, 0.5, 17, 26, 34. 1 per cent (for pods) observed, respectively.

KEY WORDS : *Moringa oleifera* L., Morphological, Nutritional, Yield

How to cite this paper : Kshirsagar, R.B., Sawate, A.R., Patil, B.M. and Zaker, M.A. (2016). Studies on morphological and nutritional characteristics of different parts (Leaf, flower and pods) of *Moringa oleifera* (Variety : Koimtoor-1). *Internat. J. Proc. & Post Harvest Technol.*, 7 (2) : 237-242. DOI: 10.15740/HAS/IJPPHT/7.2/237-242.

The *Moringa* plant has been consumed by humans throughout the century in diverse culinary ways (Iqbal and Bhangar, 2006). Almost all parts of the plant are used culturally for its nutritional value, purported medicinal properties and for taste and flavour as a vegetable and seed. The leaves of *M. oleifera* can be eaten fresh, cooked, or stored as a dried powder for many

months reportedly without any major loss of its nutritional value (Arabshahi *et al.*, 2007 and Fahey, 2005). The leaves, seeds, flowers, pods (fruit), bark and roots are all seen as a vegetable and each part is uniquely harvested and utilized. 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). The leaves, flowers and fruits of this plant are used in the preparation of several delicacies in Indian sub-continent. Associated with high nutritional value of its edible portions pave a way in making this plant more popular as an important food source in order to combat protein energy malnutrition problem prevailed in most of the under developed and developing countries of the world. Presence of various types of antioxidant compounds make this plant leaves a valuable source of natural antioxidants (Anwar *et al.*, 2007) and a good source of nutraceuticals and functional components as well (Makkar and Becker, 1996).

Flowers of *Moringa* plant is full of various amino acids; sugar such as sucrose and D-glucose, and potassium and calcium. It also contains flavonoids, alkaloids, kaempferol, rhamnetin, isoquercitrin and kaempferitrin (Siddhuraju and Becker, 2003). The flowers are rich in Ca^{2+} and K^{+} and leaves are widely used as food complement, with appreciable amounts of vitamins [(A, 7-fold higher than in oranges), B and C], Fe^{2+} and proteins. *Moringa* flowers contain a well-recognized flavonoid (Quercetin), which may be responsible for its potent hepato protective activity (Ruckmani *et al.*, 1998; Selvakumar and Natarajan, 2008). Pods have negligible amounts of tannin, but saponins and alkaloids are found in significant quantities in leaves and stem, respectively, though they should be considered non-toxic to ruminants. Seed pods of this tree are eaten as vegetables, which are reported to taste like asparagus. The fruit (pod) is used to treat diseases of the liver and spleen, particular pains, tetanus, paralysis and tonic (Mohammed *et al.*, 2012).

This study was carried out to evaluate the morphological and chemical composition of *Moringa* plant parts.

EXPERIMENTAL METHODS

Collection of drumstick varieties:

The prominent variety of drumstick (Koimtoor-1) majorly grown in Marathwada region was selected with concern of horticulturist.

Morphological and physical characteristics of leaf, flower and pods were determined with the help of Vernier Calliper and Electronic Digital Weighing Balance.

Pre-treatments:

Blanching:

Three blanching treatments were selected namely

immersed hot water, steam blanching, and hot water with Na_2CO_3 . The *Moringa oleifera* leaves, flowers and pods were sorted, washed with distilled water and sprayed on muslin cloth then placed in above blanching medias for 3 minutes. Further these blanched parts *viz.*, leaves, flowers and pods of *Moringa oleifera* are dried in a cabinet drier at a temperature of 60° C for 4 hours, 6 hours and 9 hours, respectively in a single layer.

Drumstick powder (Leaf, flower and pod):

After drying, the dried leaves, flowers and pods were further grinded mixer cum grinder, sieved through a 0.4 mm wire mesh and stored in airtight container at room temperature prior to formulations and chemical analysis (Ukey *et al.*, 2014).

Proximate composition :

Moisture, fat, protein, carbohydrates, crude fibre and ash content were determined by using AOAC methods (AOAC, 2005).

EXPERIMENTAL FINDINGS AND ANALYSIS

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Morphological characteristics of moringa oleifera leaves and flowers (Variety: Koimtoor-1) :

The morphological characteristics of *Moringa oleifera* leaves and flowers were observed and pertained as in Table 1.

The leaves are pale green to deep green in colour, compound, and 30-60 cm in length. The leaves are bipinnate or more commonly tripinnate, upto 45 cm long, and are alternate and spirally arranged on the twigs. Pinnae and pinnules are opposite. It has many small leaflets which are 1.0 to 2.0 cm long and 0.6 to 1.0 cm wide. The leaflets are finely hairy, green and almost hairless on the upper surface, paler and hairless beneath, with red-tinged mid veins, with entire (not toothed) margins, and are rounded or blunt-pointed at the apex and short-pointed at the base.

The flowers are white or cream coloured, bisexual and 10- 20 cm long and 2 to 2.5 cm wide. It has pleasant fragrance and produced profusely in axillary, drooping panicles 10-25 cm long (Sachan *et al.*, 2010). The five-

reflexed sepals are linear lanceolate. The five petals are slender-spatulate. They surround the five stamens and five staminodes and are reflexed except for the lowest.

Morphological characteristics of *Moringa oleifera* Pods (Variety: Koimtoor-1) :

The morphological characteristics of *Moringa oleifera* pods were observed and pertained as in Table 2.

It could be clearly observed from Table 2 that *Moringa oleifera* pods varied morphological characteristics such as average weight of pod (71.5 g), average weight of 100 pod (7150 g), average length of pod (47.6 cm), average width of pod (5.2 cm), average number of seeds/pod 15 and average weight (42.3 g)/100 seed. It is also noticed through that table that the

number of seeds in every pod of *Moringa oleifera* is perhaps higher than that any other famous vegetable such as peas or green bean indicating that *Moringa oleifera* pods are full seeds and not empty.

Per cent yield of different parts (leaves, flower and pod) of *Moringa oleifera* (Variety: Koimtoor-1) :

The per cent yield of different parts (leaves, flower and pod) of *Moringa oleifera* (variety: odisi or koimtoor-1) were observed and pertained as in Table 3.

The per cent yield of different parts such as leaves, flower and pod powder prepared depends upon pre-treatments viz., blanching and drying methods and the moisture content. The highest value obtained in unblanched leaves was (22 %), unblanched flower (14 %) and steam blanched pod (18 %) while lowest yield of

Table 1 : Morphological characteristics of *Moringa oleifera* leaves and flowers (Variety: Koimtoor-1)

Sr. No.	Parameter	Observation
Leaves		
1.	Colour	Pale green to deep green in colour
2.	Length (cm)	30-60
3.	Leaflets length (cm)	1-2
4.	Width of leaflets (cm)	0.6-1.0
Flower		
1.	Colour	White and cream coloured
2.	Length (cm)	10-20
3.	Leaflets length (cm)	2-2.5
4.	Length of drooping panicles (cm)	10-25

*Each value is average of three determinations

Table 2 : Morphological characteristics of *Moringa oleifera* pods (Variety: Koimtoor-1)

Sr. No.	Parameter	Observation
1.	Average weight of pod (g)	71.5
2.	Average weight of 100 pod (g)	7150
3.	Average length of pod (cm)	47.6
4.	Average width of pod (cm)	5.2
5.	Average number of seeds/pod	15
6.	Average weight (g)/100 seed	42.3

*Each value is average of three determinations

Table 3 : Per cent yield of different parts (leaves, flower and pod) of *Moringa oleifera* (Variety: Koimtoor-1)

Sr. No.	Treatments	<i>Moringa oleifera</i> parts (%)		
		Leaves	Flower	Pod
1.	Unblanched (control)	22	14	15
2.	Boil blanched	15	10	15
3.	Steam blanched	17	14	18
4.	Boil blanched + Sodium bicarbonate treatment	14	12	17

*Each value is average of three determinations

Table 4 : Chemical composition of different parts (leaves, flower and pod) of *Moringa oleifera* powder dried in cabinet dryer at 60°C

Different parts of <i>Moringa oleifera</i>	Moisture content (%)	Crude fat (%)	Crude protein (%)	Carbohydrates (%)	Crude fibre (%)	Ash (%)
Leaves	5.4	3.4	28.0	43.0	10.2	8.5
Flower	5.7	1.6	24.1	53.6	7.5	5.9
Pod	5.2	0.5	17.0	26.0	34.1	12.0

*Each value is average of three determinations

leaves was obtained in case of boil blanched + sodium bicarbonate treatment (14 %), boil blanched flower was (10 %) and unblanched and boil blanched pod observed lowest yield (15 %). Moreover, unblanched leaves and flower sample having more yield than other treatments but incase of steam blanched pods more yield was observed (18 %) than other sample.

The reduction of per cent yield in treatment of blanching may be due to split upto tissues in the leaves during blanching which had rapid evaporation of water as compare to unblanched sample in both drying.

Chemical composition of different parts (leaves, flower and pod) of *Moringa oleifera* powder dried in cabinet dryer at 60°C :

The proximate composition of the different parts of *Moringa oleifera* were studied and given in Table 4.

The chemical composition of different parts of *Moringa* such as leaves, flower and pod for their moisture content, crude fat, crude protein, carbohydrates, crude fibre and ash shown in Table 4.

The results of the proximate composition (Table 4) revealed that leaves, flower and pod of *Moringa oleifera* are good source of crude protein, crude fibre and ash content. The highest moisture contained in the flower was recorded (5.7 %) followed by leaves (5.4 %) and the lowest was recorded in pod (5.2 %).

The fat contained was recorded highest (3.4 %) in the leaves followed by flower (1.6 %) and lowest was recorded in pod (0.5 %) and also, dried leaves contained high amounts of protein (28 %) followed by flower (24.1 %) and low amount of protein contained in pod (17 %) and the leaves, flower and pod contained crude fibres which were recorded 8.5, 5.9 and 12.0 per cent, respectively.

The total carbohydrates contents were higher in flower and leaves of *Moringa oleifera*, which were 53.6 and 43.0 per cent, respectively lowest was recorded in the pod (26 %). In addition the ash content was highest in pod (12.0 %) followed by leaves (8.5 %) and lowest

was recorded in the flower (5.9 %).

Conclusively, it could be observed that the leaves of *Moringa oleifera* are good source of fat and protein as compared with flower and pod. Crude fibre and ash was recorded highest in pod as compared with leaves and flower. Charles *et al.* (2011), stated that the percentages (%) of proteins, moisture, fat, carbohydrates of fresh and dried leaves were 11.9, 73.9, 1.1 and 10.6 and 27.2, 5.9, 17.1 and 38.6 per cent, respectively.

Finally, through data tabulated in Table 4, it could be clearly concluded that different *Moringa* parts are rich to great extent in many significant components such as protein, crude fibre and carbohydrates.

Conclusion :

In this study, morphological and nutritional characteristics of *Moringa oleifera* were analysed. The leaves are pale green to deep green in colour, compound, and 30-60 cm in length while the flowers are white or cream coloured, bisexual and 10- 20 cm long and 2 to 2.5 cm wide. It could be clearly observed that *Moringa oleifera* has very morphological characteristics such as average weight of pod (71.5 g), average length of pod (47.6 cm), average width of pod (5.2 cm), average number of seeds/pod 15 and average weight (42.3 g)/100 seed. The maximum per cent yield was observed in steam blanched leaves while lowest for boiled blanched flowers. The highest value for crude fat and crude protein were observed for leaves while crude fibre and ash content highest recorded in pod and flowers.

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