

Nutritional Composition of Drumstick (*Moringa Oleifera*)

Dr Shalini Kushwaha

Deptt. of Food Science & Technology, School for Home Sciences, Babasaheb Bhimrao Ambedkar University, Lucknow, India

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. (Kushwaha *et al* 2015). Seshadri and Jain (1997) analyzed drumstick leaves and reported 27.1mg of total carotene, 17.4mg of β -carotene and 143.6mg of ascorbic acid per 100 gm of fresh leaves. The shade dried drumstick leaves when rehydrated and incorporated into recipes suffered further losses of β -carotene, which were smaller in recipes that involved steaming and shallow frying (27% and 31%) but greater in recipes that involved repeated boiling and stirring (65%). There are many varieties of green leafy vegetables, which are rich in antioxidants and other essential micronutrients, but they are discarded and are not used for human consumption. Drumstick (*Moringa oleifera*) leaves are one of them, which are available at no cost and are very rich in all the micronutrients (Kushwaha and Chawla, 2015).

Seshadri *et al* (1997) analysed fresh drumstick leaves and revealed that they contain 27.1mg of total carotene, 17.4 mg of beta carotene, and 143.6 mg of ascorbic acid per 100g. Sulphiting in addition to blanching was more effective in the retention of beta-carotene immediately after dehydration (72% vs 59%) and at the end of one month of storage (64% vs 51%) but not at the end of 90 days of storage (53% vs 47%). The shade dried drumstick leaves when rehydrated and incorporated into recipes suffered further losses of beta-carotene, which were smaller

in recipes that involved steaming and shallow frying (27% vs 31%) but greater in recipes that involved repeated boiling and stirring (65%). Nambiar and Seshadri (2001) fed 4000IU/kg diet in form of Vitamin A acetate, fresh drumstick leaves and dehydrated drumstick leaves for 4 weeks to rats. Gain in weight was highest in group fed with dehydrated drumstick leaves. Results imply that β -carotene from drumstick leaves was effective in overcoming vitamin A deficiency. It was therefore concluded that in the developing countries like India, sources of vitamin A such as drumstick leaves are valuable in overcoming the problem of vitamin A deficiency. Drumstick leaves contain cytokinins in the form of zeatin as well as other beneficial phytochemicals such as vanillin, beta-sitosterol, caffeoylquinic acids, kaempferol, quercetin and carotenes (Kushwaha *et al* 2012).

Nambiar *et al* (2003) conducted a pilot study and found that integration of nutrition communication along with the introduction of unconventional dehydrated drumstick leaves, into the Integrated Child Development Scheme-supplementary food, was feasible and can be endeavored for a longer duration in the existing national programmes.

Reddy *et al* (2005) analyzed three plant foods viz. amla, drumstick leaves and raisins as source of natural antioxidants. All the three extracts exhibited a high percentage of antioxidant activity evaluated using β -



carotene-linolenic acid in vitro system, compared to synthetic antioxidants. Biscuits prepared by addition of natural extracts were subjected to sensory studies and chemical analysis. Biscuits treated with natural antioxidants, extracted from raisins and drumstick leaves received higher ($p \leq 0.05$) panel scores during storage period of six weeks than control, butylated hydroxyl anisole (BHA) and amla extract incorporated biscuits.

Drumstick has been used to combat malnutrition, especially among infants and nursing mothers. Three non-governmental organizations in particular—Trees for Life, Church World Service and Educational Concerns for Hunger Organization—have advocated drumstick 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 (Fahey 2005).

Bineesh *et al* (2005) evaluated degradation kinetics of ascorbic acid of leaves of drumstick in normal open-pan cooking, pressure-cooking and a newly developed and patented fuel efficient eco cooker (non-isothermal heating process). The ascorbic acid degradation followed first-order reaction kinetics where the rate constant increased with an increase in the temperature. Results obtained indicated the ascorbic acid degradation is of similar order of magnitude in all the methods of cooking.

Lakshmi and Kohila (2007) conducted study on five commonly consumed vegetables namely agathi, coriander leaves, drumstick leaves and carrot. Vegetable powders were prepared by sun drying, shade drying, cabinet drying and found that shade dried powders had better acceptability and nutrient retention.

Elkhalifa *et al* (2007) analysed drumstick leaves and found that they contain high amount of water (74.40%) and a reasonable amount of protein (16.70%). The oil content of the leaves was found to be 1.7%, ash content was 8% which indicate a high content of minerals. The in vitro protein digestibility (IVPD) of leaves was found to be high (89.15%) The calcium content was found to be 0.20 mg/100g while the phosphorous content was found to be (0.031mg/100g). Magnesium, sodium and potassium content were 0.13, 0.01 and 0.075 mg/100g respectively. Drumstick found to be a good source for calcium and phosphorous. Extract was found to have a high in vitro protein digestibility (89.15%).

Nambaiar and Seshadri (2007) examined drumstick leaves and found moisture 79.2%, total iron 0.26 ± 0.005 mg, calcium 431.6 ± 51.73 mg, phosphorous 133.57 ± 6.51 mg, ascorbic acid 139 ± 8.37 mg, oxalic acid 218 ± 11.3 mg, calcium: phosphorous (Ca:P) ratio 3.2:1 and calcium : oxalic acid ratio 1.9:1 Drumstick ranked second and fourth in ranking of highest content of ascorbic acid and Ca :oxalic acid respectively in comparison with colocasia, chana, radish, fenugreek.

Oduro *et al* (2008) reported that drumstick leaves contain crude protein as 27.51%, crude fibre as 19.25%, crude fat as 2.23%, ash content as 7.13%, moisture content as 76.53%, carbohydrate content as 43.88%, and the calorific value as 1296.00 kJ/g (305.62 cal/g). Quarcoo (2008) developed beverage from leaves of drumstick and final validated product contains 50-52% drumstick, 38-40% pineapple and 10-12% carrots. The optimized beverage recorded 2.9 g/100ml of protein, 1.02 mg/100ml of iron and 159.14 mg/100ml of vitamin C. After 8 weeks of storage 78% of vitamin C was still retained even under the most severe storage conditions (sunlight).



There were no microbial growths under all the conditions of storage, and the product was still acceptable.

Drumstick had higher levels of crude protein, crude fibre, crude fat, iron, calcium and beta-carotene. Cream cracker were developed from cassava and sweetpotato flour incorporated with these leaves using wheat flour as the control. Sensory evaluation of the cream crackers developed showed that they have good sensory properties and since the cassava and sweetpotato flour crackers do not contain gluten, they can be consumed by those who are gluten intolerant (Owusu 2008).

Nambiar and Parnami (2008) standardized and organoleptically evaluated freshly blanched leaves of the drumstick incorporated into three recipes commonly consumed in India: mung (*Phaseolus aureus*), kabuli chana (*Cicer arietinum*) and desi chana (*Cicer arietinum*). One serving of each of these recipes (30 g raw weight of pulses) could incorporate a maximum of 20 g of fresh drumstick leaves. All three recipes were found to be acceptable with an overall composite score ranging from 3.06-3.53. The drumstick leaf recipes were micronutrient rich, and each serving could provide 3955 µg β-carotene, 46 mg ascorbic acid and 1.6 mg iron. Meal planners typically use a benchmark of 1/3 of the RDA, and these recipes could achieve 24%, 341%, 15% and 496% of that level for adult women in energy, vitamin C, iron and β-carotene respectively. Even if only 1/6 of the β-carotene is considered as bioavailable for vitamin A, these recipes still meet 82.5% to 83.3% of the RDA for adult women. This analysis also suggested that industrial production of ready-to-eat foods incorporating drumstick leaves might also be a useful endeavor. Fresh drumstick leaves

contained 120 mg/100g vitamin C, whole plant contained 107 mg/100g. Treatment by blanching resulted in a decrease in the level of vitamin C by 21-50%. After blanching smaller losses were recorded in whole plants, more so than in leaves. Freezing induced a decrease in the levels of the vitamin. Approximately 21–50% of the ascorbic acid contents were lost in leaves by water (Begum *et al* 2009).

In view of its multiple uses, the *M. oleifera* plant needs to be widely cultivated in most of the areas where climatic conditions favor its optimum growth. In this way, a maximum yield of its different useable parts could be achieved to derive the maximal amount of commodities of a multifarious nature for the welfare of mankind.

REFERENCES

- [1.] Seshadri S and Jain M (1997) Retention and storage stability of β-carotene in dehydrated drumstick leaves (*Moringa oleifera*). *Int J Food Sci Nutr* **48(6)**:373-79.
- [2.] Seshadri S, Jain M and Dhabhai D (1997) Retention and storage stability of beta-carotene in dehydrated drumstick leaves (*Moringa oleifera*). *Int J of Food Sci Nutr* **48(6)**:373-79.
- [3.] Nambiar V S and Seshadri S (2001) Bioavailability trials of β-carotene from fresh and dehydrated drumstick leaves (*Moringa oleifera*) in a rat model. *Plant Foods for Human Nutr* **56(1)**:83-95.
- [4.] Nambiar V, M Daxini and K Bhadalkar (2003) Nutritional and sensory evaluation of shade dried beta rich drumstick leaf (*Moringa oleifera*) recipes. *Indian Food Packer* **57(6)**: 156-61.



- [5.] Reddy V, Urooj A and Kumar A (2005) Evaluation of antioxidant activity of some plant extracts and their application in biscuits. *Food Chem* **90**:317-21.
- [6.] Nambiar V S and Seshadri S (2007) Selected nutrients and non nutrients in seventeen common and uncommon green leafy vegetables of western India. *J Ind Dietet Asso* **32(1)**:22-30.
- [7.] Nambiar V S and Parnami S (2008) Standardization and organoleptic evaluation of drumstick (*Moringa oleifera*) leaves incorporated into traditional Indian recipes. *Trees Life J* **3(2)**: 1-7.
- [8.] Oduro I, Ellis W O and Owusu D (2008) Nutritional potential of two leafy vegetables : *Moringa oleifera* and Ipomoea batatas leaves. *Scientific Res Essay* **3(2)**:57-60.
- [9.] Owusu D (2008) *Phytochemical composition of ipomoea batatas and Moringa oleifera leaves and crackers from underutilised flours*. M.Sc. thesis, Kwame Nkrumah University of Science and Technology, Kumasi.
- [10.] Quarcoo P (2008) *Development of Moringa oleifera leaf beverage*. M.Sc. thesis, Kwame Nkrumah University of Science and Technology, Kumasi
- [11.] Bineesh N P, Singhal R S and Pandit A B (2005) A study on degradation kinetics of ascorbic acid in drumstick (*Moringa oleifera*) leaves during cooking. *J Sci Food Ag* **85**:1953-58.
- [12.] Begum S A, Ahmed M F and Rahman M M (2009) Effect of cooking temperature and storage period on preservation of water soluble vitamin C content in Citrus macroptera and *Moringa oleifera* lunk. *As J Food Ag Ind* **2(3)**:255-61.
- [13.] Elkhalfifa A E O, Ahmed S A A and Adam S (2007) Nutritional evaluation of *Moringa oleifera* leaves and extract. *Ahfad J* **12(1)**:143-47.
- [14.] Fahey J W (2005) *Moringa oleifera*: A review of the medical evidence for its nutritional, therapeutic, and prophylactic properties. Part 1. *Trees for Life J* **1(5)**:246-52.
- [15.] Lakshmi U K and Kohila B (2007) Development and evaluation of vegetable based antioxidant mixes. *The Indian J Nutr Dietet* **44**:471-75.
- [16.] Kushwaha S and Chawala P (2015) Impact of supplementation of drumstick (*Moringa oleifera*) and amaranth (*Amaranthus tricolor*) leaves powder on menopausal symptoms of postmenopausal women. *Int J Sci Res Pub* **5(1)**:1-11.
- [17.] Kushwaha S, Chawla P and Kochhar A(2012) Effect of supplementation of drumstick (*Moringa oleifera*) and amaranth (*Amaranthus tricolor*) leaves powder on antioxidant profile and oxidative status among postmenopausal women. *J Food Sci Technol* DOI 10.1007/s13197-012-0859-9
- [18.] Kushwaha S, Daniel M and Shakti (2015) Potential of Underutilized Drumstick (*Moringa Oleifera*).*Int J Res* **2(4)**:478-83.