

## STUDIES ON THE EFFECT OF MATURITY AND HANDLING METHODS ON THE ASCORBIC ACID CONTENT OF AMARANTH (*AMARANTHUS GANGETICUS*) LEAVES AND STEM

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A large amount of work has been carried out by some workers in U. S. A. and in Europe on the effect of maturity and handling on the nutritive value of vegetables grown in these countries.<sup>1</sup> Very little work, however, has been carried out so far in India on this problem.<sup>2</sup> Green leafy vegetables are the most inexpensive among the protective foods.<sup>3</sup> They are in general good sources of carotene, calcium, ascorbic acid and iron. Among the green leafy vegetables consumed in different parts of India, amaranth leaves (*amaranthus gangeticus*) are the most popular. The present paper deals with studies on the effect of maturity and handling methods on the ascorbic acid content of amaranth leaves and stems.

### Experimental

**Cultivation of amaranth under controlled conditions:** The strain H. 123 was selected as it was the most commonly cultivated species in and around Coimbatore city. The seeds were obtained from the Government Agricultural College and Research Institute, Coimbatore. The seeds were sown in the kitchen garden attached to the college and irrigated with water according to the directions given by Singh and Joshi.<sup>4</sup> The plant was harvested on the 20th, 29th, 38th, 47th and 56th days of its growth.

**Handling:** The handling process included (a) storage (under different conditions) for short periods as in the market or household and (b) cutting and washing before cooking.

**(a) Storage:** The following storage procedures commonly followed in the local market and homes for storing and handling

amaranth before cooking were followed. (1) washing the freshly harvested whole plants in bunches in tap water to remove adhering mud (2) keeping the bundles of amaranth on bamboo trays in the shade in open air (partly exposed to sun) from 8 a.m. to 4 p.m. as in the local market (3) household storage such as storing in polyethylene baskets, wrapping in moist cloth, storing in a mud pot cooler<sup>5</sup> (Saurashtra type), and storing in a refrigerator.

**(b) Cutting and washing:** In the first procedure the leaves were cut with cast iron or stainless steel knife and then washed with water. In the second procedure, the leaves were washed and then cut into pieces, using cast iron or stainless steel knife.

**Estimation of ascorbic acid:** The ascorbic acid content of amaranth leaf and stem was determined according to the 2:4 dinitrophenyl-hydrazine method of the Association of Vitamin Chemists.<sup>6</sup>

### Result

The results are presented in Tables I to IV and are briefly discussed under the following heads:

**Effect of maturity on ascorbic acid content:** The ascorbic acid content of amaranth leaves and stem determined in the samples harvested during the different stages of growth is given in Table I. The results show that the ascorbic acid content of leaves and the stem reached a maximum value of 155 mg/100 g and 32 mg/100 g respectively when the plant is 29 days old and is almost stationary between 29 and 38 days of growth and slowly decrease afterwards.

**Methods of storage:** The ascorbic acid

Table I. Ascorbic acid content of amaranth during different stages of maturity

Parts of the plant	20	29	38 (days)	47	56
(Ascorbic acid mg/100g)					
Leaves	85	155	153	122	111
Stem	29	32	32	31	14
Whole plant (without roots)	65	87	87	71	45

Table II. Ascorbic acid content of amaranth stored at room temperature 26–40°C in open air partly exposed to sun and partly in the shade

Sl.No.	Treatment	Ascorbic acid in whole plant (mg / 100g)	Loss of ascorbic acid (%)
1.	Initial	61.3	—
2.	Stored for 4 hours	47.3	22.8
3.	Stored for 8 hours	38.9	37.4

Table III. Ascorbic acid content of amaranth stored under different conditions for 8 hours

Sl.No.	Storage condition	Ascorbic acid in whole plant (mg/100g)	Loss of ascorbic acid (%)
1.	Initial	67.0	—
2.	Refrigerator (0–4°C)	61.3	8.0
3.	Mud pot cooler (Janata cooler–15°C– 20° C)	56.1	16.1
4.	Moist cloth (temp. 21– 25°C)	51.6	22.9
5.	Polyethylene basket temp. 25–34°C	41.3	40.0

Table IV. Effect of cutting with cast iron or stainless steel knife and washing with water on the ascorbic acid content of amaranth

Sl.No.	Treatment	Loss of ascorbic acid (%)
1.	Washed with water and cut with stainless steel knife	24.5
2.	Cut with stainless steel knife and washed with water	53.7
3.	Washed with water and cut with cast iron knife	42.5
4.	Cut with cast iron knife and washed with water.	59.3

content of the whole plant (without roots) stored in the shade for 8 hours is given in Table II. It is evident that the average losses of ascorbic acid after storage for 4

hours and 8 hours were 22.8% and 37.4% respectively. The results on the extent of loss of ascorbic acid in amaranth stored for 8 hours in refrigerator, mud pot cooler, moist cloth and polyethylene basket are given in Table III. The data indicate that the losses of ascorbic acid were as follows: stored in refrigerator, 8%; mud pot cooler, 16.1%; moist cloth 22.9% and polyethylene basket, 40%.

**Effect of cutting with knife and washing :** The results of losses of ascorbic acid in amaranth as a result of cutting with stainless steel or cast iron knife and washing are presented in Table IV. The results indicate that the losses of ascorbic acid were high (53.7 and 59.3% respectively) when amaranth was cut with stainless steel or cast iron knife and then washed. The losses were low (24.5 and 42.5%) if the amaranth was washed first and then cut with stainless steel or cast iron knife. The losses when cut with stainless steel knife was lower than when cut with cast iron knife.

#### Discussion

The results obtained in this study have shown that considerable losses of ascorbic acid present in amaranth leaves can occur if it is stored for 8 hours partly exposed to sun and partly in the shade for eight hours. Under home conditions, the losses can be minimised by storing amaranth in a refrigerator in the absence of which in moist cloth or mud pot cooler. Since amaranth leaves are rich sources of ascorbic acid, further studies on the effects of different methods of cooking on the loss of ascorbic acid will be undertaken shortly.

#### Summary

(1) The ascorbic acid content of amaranth leaves (*amaranthus gangeticus*) as influenced by different stages of growth and different methods of handling under market and home conditions has been studied.

(2) The ascorbic acid content (mg/100g) of the leaves and stem in plants of different ages was as follows: 85mg and 29mg (20 days old); 155mg and 32mg (29 days old); 153 mg and 32 mg (38 days old); 122 mg and 31 mg (47 days); 111 mg and 14 mg (56 days old).

(3) The average losses of ascorbic acid in the whole plant stored under market conditions in open air (partly in the sun and partly in the shade) for 4 and 8 hours were 22.8% and 37.4% respectively. The average losses of ascorbic acid in the whole plant stored under different home conditions were as follows : refrigerator, 8.0%; mud pot cooler (Janatha cooler) 16.1%; moist cloth, 22.9% and polyethylene basket 40%.

(4) The losses of ascorbic acid were high (53.7 and 59.3%) when amaranth was cut first with stainless steel or cast iron knife and then washed while the losses were low (24.5% and 42.5%) when amaranth was washed first and then cut. The losses of ascorbic acid when cut with stainless steel knife was less than that cut with cast iron knife in both the instances.

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