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## **Vitamin C content of vegetables and fruits available in Saudi Arabia**

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With 2 tables

(Received February 28, 1979)

The edible and some of the non-edible parts of 27 samples of various vegetables and fruits which are commonly used for human consumption in the Western zone (Jeddah) were analysed for their vitamin C contents. It was found that vitamin C is present in good amounts in pepper (sweet, green hot, and red hot), spinach, cabbage, peas, parsley, sweet potato, radish and cauliflower. It was concluded that the vitamin C level of vegetables and fruits is affected by the long hours of sunshine and the hot climate and several other factors. The studies showed that some of the non-edible parts can also be utilized as a source of vitamin C.

Numerous reports have been published abroad on the ascorbic-acid content of various foodstuffs (1, 2, 3). Ascorbic acid is widely distributed throughout the foods of the world, but is found chiefly in plant products, especially rapidly growing vegetables and fruits, whereas grains and cereals contain almost none. *Oliver* (1936) has shown that storage, even for a day or so, results in the loss of ascorbic acid from vegetables such as new potatoes, spinach, carrots, and asparagus tips. Storage in a clamp as potatoes are stored lowers the ascorbic acid progressively. In September a main-crop of potato may start with 30 mg per 100 g and could be sunk to the following March to the low figure of 7 mg. Vitamin C occurs in animals and vegetables (5) extensively but haphazardly. Fresh raw fruits and vegetables contain it, yet few animals need it. Peoples, monkeys, and guinea pigs get it from sources outside their bodies, other species make their own (4).

Because people must depend on outside supplies of vitamin C, we aimed in the present work at knowing which local foods furnish it.

### **Material and method**

The edible and non-edible parts of a total of 27 samples of various vegetables and fruits which are in commonly available in the market (Jeddah) for human consumption were obtained in the morning during the months of March, April, May, and June. The vitamin C content was determined by the N-bromo succinamide method (6).

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### Results and discussion

The data obtained (table 1) revealed that in general the vitamin C content of commonly used vegetables and fruits is relatively lower than the values previously reported in many countries.

Fresh spinach (*Spinacea oleracea*) showed vitamin C ranged from 38.8 to 45.4 (mean 40.8) mg per 100 g. The present values are similar to the values (28.5 to 49.6 mg%) previously reported (6). However, the obtained values are slightly lower than the reported values (50.0 and 51.0 mg) (7, 8).

Peas (*Pisum sativum*) have vitamin C levels ranging from 37.1 to 43.5 (mean 41.3) mg%, which is slightly lower than the range of 39.2 to 47.1 previously reported (6). In contrast, the present range is higher than the reported (8) range of 21.0 to 27.0 mg per 100 g.

Okra (*Hibiscus esculentus*) contains vitamin C ranging from 8.48 to 17.4 (mean 11.1) mg%, which is considerably lower in respects to the range of 22.2 to 33.2 mg% previously reported (6). The decrease in the vitamin level may be due to the variations of the size, which may be a factor, or to the difference in the growth cycle. Also the hot climate accelerates the destruction of vitamin C after cutting the plants.

Table 1. Vitamin C content of edible parts.

Name	Range		Mean
	from	to mg per 100 g	
<i>Spinacea oleracea</i>	38.80	45.40	40.80
<i>Pisum sativum</i>	37.10	43.50	41.30
<i>Hibiscus esculentus</i>	8.48	17.40	11.10
<i>Phaseolus vulgaris</i>	6.14	15.40	12.40
<i>Capsicum frutescens</i> (sweet)	108.00	116.00	114.00
<i>Capsicum frutescens</i> (hot red)	212.00	218.00	216.00
<i>Capsicum frutescens</i> (hot green)	198.30	204.50	202.00
<i>Solanum tuberosum</i>	5.40	11.30	8.80
<i>Petroselinum sativum</i>	70.20	90.30	80.00
<i>Allium cepa</i> (dry)	7.10	10.60	8.12
<i>Allium cepa</i> (green)	9.50	10.70	10.00
<i>Beta vulgaris</i>	4.20	8.70	6.52
<i>Portulaca oleracea</i>	14.84	16.96	15.80
<i>Raphanus sativus</i>	23.20	26.00	25.15
<i>Allium porrum</i>	13.40	18.00	15.40
<i>Brassica oleracea</i> (cabbage)	44.20	66.70	61.68
<i>Solanum melongena</i>	6.30	9.00	7.89
<i>Cucurbita pepo</i>	14.90	20.30	15.30
<i>Brassica oleraceae</i> (cauliflower)	56.80	124.60	77.30
<i>Cucumis sativus</i>	5.80	7.20	6.50
<i>Allium sativum</i>	14.30	17.00	16.00
<i>Daucus carota</i>	6.50	7.46	7.16
Sweet potato	43.50	58.20	47.20
Tomato ( <i>Lycopersicon esculentum</i> )	15.20	27.10	23.10
Bananas	6.64	12.60	9.20
Orange	9.30	26.20	19.30
<i>Apium graveolens</i>	27.40	40.10	30.73

Bean (*Phaseolus vulgaris*) shows vitamin C content varying from 6.14 to 15.4 (Mean 12.4) mg%, which is lower than the values of 20 mg% reported (6, 7).

The vitamin C content for three varieties of pepper (*Capsicum frutescens*), sweet, hot red, and hot green, are 116.0, 216, and 202.0 mg% respectively, which are in accordance with the reported values (9) of 116.0, 216.0, and 203.0 mg% for the same varieties.

The vitamin C content of potatoes (*Solanum tuberosum*) ranged from 5.4 to 11.3 (mean 8.8) mg%; being much lower than the value of 20.0 mg% previously reported (10).

Parsley (*Petroselinum sativum*) vitamin C level was 80.0 mg%, which is considerably lower than the value of 180.0 mg% reported (10). Also dry onion (*Allium cepa*) gave a value of 8.12 mg%. The chard (*Beta vulgaris*) contains 6.52 mg%; being much lower with respect to the value of 34.0 mg% previously reported (10). In addition, the purslane (*Portulaca oleracea*) showed a range of 14.84 to 16.96 mg%, which is again lower than the previous data of 30.0 mg% reported (10).

The lower values obtained for vitamin C content may be influenced by the hot climate of Saudi Arabia, causing an excessive release of the great quantity of the ascorbic oxidase enzyme, and accordingly more vitamin C is destroyed.

The present study showed that the following vegetables have slightly lower or higher values in regard to the values previously reported (10). The vitamin C content for those vegetables are shown in mg% as follows: Radish (*Raphanus sativus*) has a range of 23.2 to 26.0 (mean 25.15) mg%. Leek (*Allium porrum*) showed vitamin C content ranged from 13.4 to 18.0 (mean 15.4) mg%. Cabbage (*Brassica oleracea*) vitamin C level varied from 44.2 to 66.7 (mean 61.68) mg%. Egg plant (*Solanum melongena*) has a vitamin C range from 6.3 to 9.0 (mean 7.89) mg%. Squash (*Cucurbita pepo*) vitamin C level varied from 14.9 to 20.3 (mean 15.3) mg%. Cauliflower (*Brassica oleracea*) has a vitamin C range between 56.8 and 124.6 (mean 77.3) mg%. Cucumber (*Cucumis sativus*) vitamin C content varied from 5.8 to 7.2 (mean 6.5) mg%. Garlic (*Allium sativum*) showed a vitamin C range from 14.3 to 17.0 (mean 16.0) mg%. Green onions (*Allium cepa*) have a vitamin C level varying from 9.5 to 10.7 (mean 10.0) mg%. Carot (*Daucus carota*) showed a vitamin C range from 6.5 to 7.46 (mean 7.16) mg%.

Sweet potato vitamin C content ranged from 43.5 to 58.2 (mean 47.2) mg%, which is higher than the value of 22.0 mg% previously reported (10).

Tomato (*Lycopersicon esculentum*) gave a vitamin C content varying from 15.2 to 27.1 (mean 23.1) mg%, which is similar to the previous ranges of 13.8 to 23.3 and from 10.0 to 26.0 mg% reported (6, 8).

Bananas showed vitamin C values ranging from 6.64 to 12.6 (mean 9.2) mg%, which is lower than the value of 15.0 mg per 100 g previously reported (10).

Orange showed vitamin C content varying from 9.3 to 26.2 (mean 19.3), which is much lower than the value of 49.0 mg% previously reported (4).

The data so obtained confirmed the statements that the vitamin C content during the growth cycle may vary from high to low or low to high. Growing conditions are vital in the synthesis of ascorbic acid by plants. Size, soil, and growing conditions play an important role (8). It was

Table 2. Vitamin C content of non-edible parts.

Name	mg%
Cabbage	78.28
Peas	28.13
Potatoes	14.83
Radish	22.24
Egg plant	2.90
Squash	5.13

postulated that the season with long hours of sunshine in Saudi Arabia may accelerate the vitamin C synthesis as well as destroy it after cutting.

### *The non-edible parts*

The present work (table 2) showed that some of the non-edible parts have higher values than those obtained with the edible parts, such as potatoes and cauliflower. On the other hand, the vitamin C content of some non-edible parts was much lower than the content of edible parts of eggplant and green pea.

The present data explain the importance of the non-edible parts, which can be utilized for many purposes such as animal diets, and as a source for vitamin C to be used in medicine and as antioxidant for the food preservation.

### *Acknowledgement*

Our great thanks to Dr. *Fathy Ashmawy* for his help throughout the studies.

Also our thanks to Dr. *Nazar Tawfiq*, Dean of the Faculty of Science, Dr. *Ahmed Achi*, Vice-Dean, and Dr. *A. M. Khalil*, Head of the Chemistry Department, for their help and for the facilities they afforded.

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