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Short communication:

QUANTIFYING VITAMIN C IN EDIBLE ITEMS: TEMPERATURE-INDUCED CHANGES AND IMPLICATIONS FOR DIETARY RECOMMENDATIONS

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Leafy vegetables are a diverse group of edible plants known for their tender, leafy green parts that are typically consumed as part of a balanced diet. These vegetables are appreciated for their rich nutritional value, appealing taste, and versatility in various culinary applications (Mohammed, and Sharif 2011). Leafy greens are a vital component of a healthy diet and offer a wide range of health benefits (Seung and Adel, 2000).Top of form leafy vegetables are among the most affordable vegetables on the market and are aptly referred to as "poor man's vegetables" due to their low production costs and great yield (Arya *et al.*, 1998, Biswas and Mannan, 1996).

Antioxidants found in vegetables are thought to be responsible for their primary protective effects. Reactive oxygen species, which are produced by a variety of sources, including free radicals, can cause chemical damage that antioxidants can stop (Roberts and Caserio, 1977). Ascorbic acid is an example of an antioxidant vitamin that is crucial for human nutrition since it has anticancer properties (Sarkar *et al*., 2009).Vitamin C, commonly referred to as ascorbic acid, is a water-soluble antioxidant that can be found in varying amounts in fruits and vegetables (Marti *et al*., 2009, Okwu , 2005). It makes them more mobile and has been used to stop tissue damage. Numerous medical professionals frequently recommend vitamin C to help patients recover from a variety of illnesses and conditions. The need for precise and targeted approaches for vitamin C measurement has arisen from our growing understanding of the vitamin's function (Rekha *et al*., 2012).

Sample collection and preparation

Leafy vegetables, including *Coriandrum sativum* (Coriander leaves), *Sauropus* (Velicheera), *Spinacia oleracea* (Naadancheera), *Talinum fruticosum* (Sambar Cheera), *Amaranthus dubius* (Red cheera), and *Mintha spicata* (Mint leaves), were obtained from the premises of Mala Gramapanchayat during the year 2023.The leaves were removed from the stem and damaged ones excluded. These were then washed thoroughly with water and dried. 100 g sample blended with 50 ml of distilled water. After blending, pulp was strained, washed with a few 10 ml portions of distilled water and extracted solution was made up to 250 ml in volumetric flask.

Estimation of Vitamin C in juice samples

50 ml of sample was pipetted into a 125 ml erlenmeyer flask. Following by 10 drops of 1% starch solution and titrated against standardised iodine solution until blue-black colour was observed. Titrations were repeated (Gunjan and Mangala, 2012, Vasanth *et al*., 2013).

Estimation of Vitamin C at different temperatures

50 ml of chosen samples were pipetted into 250 ml beakers with labels. They were heated to a temperature of 60 ^{0}C and kept there for two hours. The second set of samples, totaling 50 ml, were placed in several beakers and heated to a temperature of 100 ^{0}C, where they were kept for two hours. All the samples were then cooled. After that 40 ml of samples were pipetted out into a 250 ml conical flask. 4 ml of 1% starch solution added and titrated against standardised iodine solution until blue-black colour was observed. Titrations were repeated three times.

Temperature effects on the amount of vitamin C in leafy vegetables were also tested by titrating the samples with standardised iodine solution. The results of the average value of vitamin C content (mg 100 g^{-1}) in various leafy vegetables at different temperatures: 32°C, 60°C, and 100°C were tabulated in Table 1. It showed the highest concentration of vitamin C found in *Sauropus* (Velicheera), hitting 85.82 mg 100 g^{-1}, the lowest level was found in *Talinum fruticosum* (Sambar cheera), when it reached 41.8 mg 100 g^{-1} of extract as the temperature was kept at 32^{0}C.The Vitamin C content varied with the temperature, generally decreased as the temperature increased. The table shows that *Sauropus* (Velicheera) had the highest Vitamin C content at all temperatures.

Table 1. Total Vitamin C content in samples at different temperature

Leafy vegetables	Total Vitamin C (mg 100 g^{-1})		
	32^{0}C	60^{0}C	100^{0}C
Coriandrum sativum (Coriander leaves)	48.6	32.16	20.23
Sauropus(Velicheera)	85.82	73.132	62.78
Spinacia oleracea (Naadan cheera)	55.9	32.56	21.98
Talinum fruticosum (Sambar cheera),	41.8	35.25	20.76
Amaranthus dubius (Red cheera)	51.7	42.12	36.58
Mintha spicata (Mint leaves)	63.5	56.19	49.45

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Overall, the effect of temperature on vitamin C concentration in vegetables depends on various factors, including the specific vegetable, the temperature used, the duration of exposure, and the cooking or processing method. Higher temperature does not favour Vitamin C. To maximize the retention of vitamin C, it's generally advisable to store vegetables in cool conditions, use gentle cooking methods, and minimize cooking times when possible.

Iodometric analysis of the ascorbic acid concentration of leafy vegetables was performed to identify the leafy vegetable that would best meet the body's ascorbic acid requirements. This method is simple, convenient and less time consuming. It showed the highest concentration of vitamin C found in *Sauropus* (Velicheera), hitting 85.82 mg 100 g^{-1}, the lowest level was found in *Talinum fruticosum* (Sambar cheera), when it reached 41.8 mg 100 g^{-1} of extract. However, *Coriandrum sativum* (Coriander leaves) 48.6 mg 100 g^{-1}, *Spinacia oleracea* (Naden cheera) 55.9 mg 100 g^{-1}, *Amaranthus dubius* (Red cheera) 51.7 mg 100 g^{-1} and *Minthas picata* (Mint leaves) 63.5 mg 100g^{-1} were also found to be rich in vitamin C. The temperature dependence investigation also showed that vitamin C concentration in all samples reduced with rising temperature and passage of time. Optimizing the samples' storage settings to preserve their nutritional value required an understanding of the temperature dependence of vitamin C breakdown in these frequently consumed samples. In order to preserve the vitamin C content during storage and distribution, this research offers useful insights for both consumers and the food sector.

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