ISSN 2664-8059 (Print) & ISSN 2706-767X (Online)
South Asian Research Journal of Nursing and Healthcare
Abbreviated Key Title: South Asian Res J Nurs Health Care

| Volume-4 | Issue-6 | Nov-Dec- 2022 | **DOI: 10.36346/sarjnhc.2022.v04i06.001**

Original Research Article

Effect of Heated Temperature Environment on Vitamin C in Four Fruit Citrus Juice

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Article History
Received: 23.09.2022
Accepted: 04.11.2022
Published: 09.11.2022

Abstract: Vitamin C in different in citrus juice samples was investigated; Citrus Limon, Citrus reticulate, Citrus paradise, Citrus sinensis. Iodine titration was utilized for determination of vitamin C in the different samples. Highest amount of vitamin C concentration was observed in Citrus sinensis was 95 mg / 100 ml whereas Citrus reticulate showed low levels 82 mg / 100 ml. The effect of temperature was highest in fresh lemon. In packed juices the same tendency was observed, though the content of vitamin C was found to be less than in fresh juices. Results revealed that; there is a loss of vitamin C content in citrus juice samples as much as the boiled juice Table1. The rate at which vitamin C is lost and depends on the temperature and time methods employed. It has been found out that the hot environment provides the conditions for fast decay of vitamin C content and room environment provides the conditions for slow decay of vitamin C content. In present analyzed samples values are different because of the fact that the composition of content vitamin c depends upon the environmental factors.

Keywords: Vitamin C, citrus juice, room temperature, hot temperature, time, Iodine titration.

INTRODUCTION

Vitamins are organic substances that are essential for normal physiological functions such as maintenance, growth, development, and production [1]. A vitamin is an organic compound, which means that it contains carbon. It is usually needed in miniscule quantity in order for the body to have optimal functionality. A deficiency syndrome happens when your body doesn't get enough vitamins, a lack or shortage of certain vitamin [2]. For health system human have to obtain vitamins from exogenous source such as food where vitamin is one of its natural components and found in small amount [1]. This is because most vitamins are not synthesized by human [3]. Humans, unlike most animals, are unable to synthesize vitamin C endogenously, so it is an essential dietary component [4].

Vitamin C (also known as ascorbic acid) is an essential vitamin that is well known for its effects on the immune system, can be found plenty in vegetables and fruits. A water-soluble vitamin and powerful antioxidant, it helps the body in building new tissue and maintains connective tissue, including bones, blood vessels, and skin [5].

Ascorbic acid, in turn, is essential for the activity of Prolylhydroxylase which convert proline residues in collagen to hydroxyproline [6].

Vitamin C is also known to be vital for many biological processes such as in absorption of inorganic iron, inhibition of nitrosamine formation, collagen formation, reduction of plasma cholesterol level, enhancement of the immune system [7].

Ascorbic acid is an organic compound which consists of carbon, hydrogen and oxygen. Pure ascorbic acid is a white solid and is made synthetically from the sugar dextrose. It is used both in vitamin supplements and as a food preservative.

As we know Ascorbic Acid is a dietary supplement to help individuals meet their daily vitamin C requirements. It is a powerful dietary antioxidant, providing optimal nutritional support for most all physiological functions, including vascular and capillary integrity in support of the circulatory system, immune system function and cellular health. Fruit juices are liquid naturally contained in fruit or vegetables tissue. Juices are prepared by mechanically squeezing or macerating fresh fruits or vegetables without the application of heat or solvents.

Food has been linked to health since ancient times [8]. Fruits and vegetables meet the physiological needs of the human body, in addition to their medicinal benefits [9].

vegetables and fruits differ in their impact on health due to their different chemical composition, where an inverse relationship was found between the increase in the consumption of vegetables and fruits and diseases [10], which requires knowing the most effective of them so that it can be included in the system food [11], in which plant products play an important role in health care systems .It has been found that citrus fruit consumption is inversely associated with several diseases [12].

Citrus juices are a rich source of bioactive compounds with various well-known health benefits. Citrus juice has been identified as one of the most promising sources of flavonoids in the human diet, compounds well- known for their anti-angiogenic, anti-inflammatory, and anti-cancer properties, where the peel and pulp have lipid antioxidant effects [13].

Vitamin C is also a highly effective antioxidant, protecting cells from the effects of free radicals (harmful compounds produced as a byproduct of metabolism), as well as protecting against exposure to toxins and pollutants (such as smoking), and vitamin C plays a role in activating other antioxidants. Citrus fruits provide about 51% of vitamin C as well as significant amounts of some carotenoids: 68% beta-cryptoxanthin and 43% zeaxanthin [14].

Kaleem *et al.,* (2016) [15] found that the vitamin C content is more in Pineapple juice compared to Orange, Watermelon and Tomato juice, The rate at which vitamin C is loss during storage depend on the type of storage methods employed. Moorthy (2020) [16] found Highest amount of vitamin C content was observed in fresh lemon, whereas fresh apple, orange, pineapple, mango, water melon, melon and tomato showed low levels. The effect of temperature was highest in fresh lemon. In packed juices the same tendency was observed, though the content of vitamin C was found to be less than in fresh juices.

OBJECTIVES OF THE STUDY

Objectives of the research were as follows:

- To determine the level of Vitamin C in Four citrus fruits.
- To investigate the effect of different temperature environments and time on Vitamin C and relate it to the stability of Vitamin C in in four citrus fruits.

MATERIALS AND METHODS

Sample Collection and Preparation

Four citrus fruits samples were collected from local market of Tripoli. These are, Citrus Limon, Citrus reticulate, citrus paradise, Citrus sinensis. Juice of citrus fruits was extracted with the help of common kitchen juicer.

Iodometric Titration of Fruit Samples

The freshly plucked fruit is weighed (one piece) and the mass is recorded. Using a sharp knife and a cotton cloth, the juice of the whole piece of fruit is collected and few drops 0.5 % starch indicator (0.25 g soluble starch is dissolved in 50 mL nearly boiled distilled water) is added. The sample is titrated with 0.005 M iodine solution (2 g of PI and 1.3 g iodine in 1 L distilled water). The titration endpoint is detected when a dark blue- black color due to the starch-iodine complex becomes permanent.

Determination of vitamin C in Citrus Fruits

10 drops of starch indicator is added to 25 mL of sample and titrated with 0.005 M iodine solution until it turns to blue-black color. 10 mL of filtrate juice sample with 10 drops of 0.5 % starch indicator is titrated with iodine solution.

C. Temperature Environments to be provided

Five different temperatures, namely, heated, and room temperature conditions were provided for each of the four different citrus fruits juice samples. For heated condition, different temperature for 30 °C ,40°C, 50 °C, 60 °C ,70 °C at 10 min, 15 min, 20 min.

RESULTS AND DISCUSSION

The Concentration of vitamin C in each fruit tested is tabulated in Table 1, The amount of vitamin C clearly that room temperatures are much better conditions than hot temperatures for the four citrus juice samples, it is found that Citrus sinensis (95 mg / 100 ml) has more vitamin C content, followed by Citrus limon (92 mg / 100 ml), Citrus paradisi (84 mg / 100 ml) and Citrus reticulate (82 mg / 100 ml) in that order. It is evident from the results that all the samples are rich in vitamin C.

Table 1: Concentration of vitamin c (mg/100ml) of citrus juice samples

Citrus fruits	Vitamin C at 25°C (mg/100mL)	30 °C			40°C			50°C			60°C			70°C		
		10 min	15 min	20 min	10 min	15 min	20 min	10 min	15 min	20 min	10 min	15 min	20 min	10 min	15 min	20 min
Citrus limon	92	84	82	81	80	77	75	75	73	70	64	55	52	50	47	43
Citrus reticulate	82	77	72	71	71	68	68	66	61	54	51	47	45	44	41	40
Citrus paradisi	84	78	75	73	72	71	68	67	64	62	60	58	53	50	48	44
Citrus sinenss	95	87	81	78	77	76	76	75	72	71	68	60	55	51	48	42

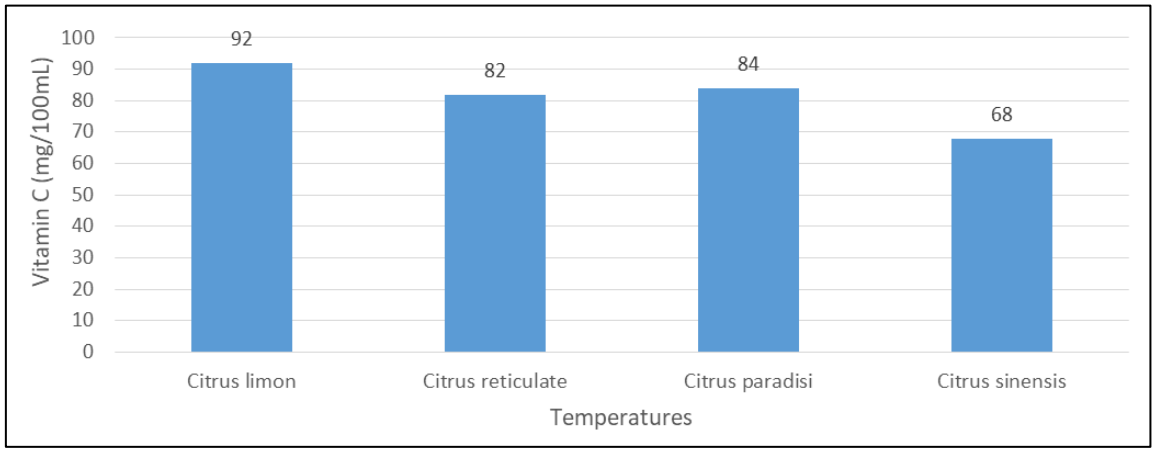

Fig. 1: Vitamin C Concentration (mg/100 ml) for citrus juice

The citrus juice samples were boiled at five different temperatures (30, 40, 50, 60, and 70) degree Celsius for (10, 15, and 20) minutes, and vitamin C content was determined.

In Figure 1, the concentration of vitamin c in Citrus Limon were 84,82, 81 mg / 100 ml at 30 °C for 10 ,15, 20min, were 80, 77,75, mg / 100 ml at 40 °C for 10 ,15,20 min, were 75,73,70 mg / 100 ml at 50 °C for 10 ,15,20 min, were 64,55,52 mg / 100 ml at 60 °C for 10 ,15 ,20 min and were 50,47,43 mg / 100 ml at 70 °C for 10 ,15,20 min.

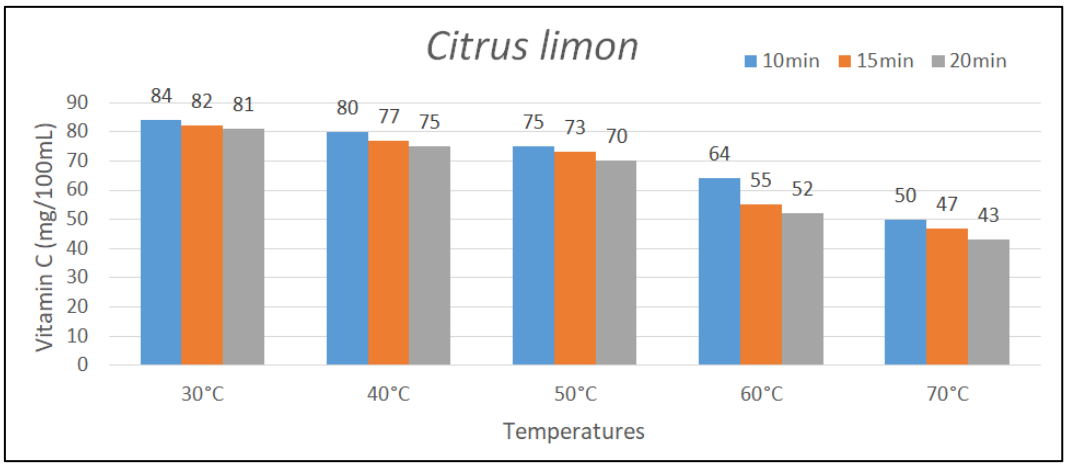

Fig. 1: Effect of time and different temperatures on Citrus Limon

Illustrates the result obtained from the Fig. 2. Citrus reticulate were 77,72, 71 mg / 100 at 30 °C for 10 ,15,20 min, were 71, 68,68 mg / 100 at 40 °C for 10 ,15,20 min, were 66,61,54 mg / 100 at 50 °C for 10 ,15,20 min, were 51,47,45 at 60 °C for10 ,15,20 min, were 44,41,40 mg / 100 ml at 70 °C for 10 ,15,20 min.

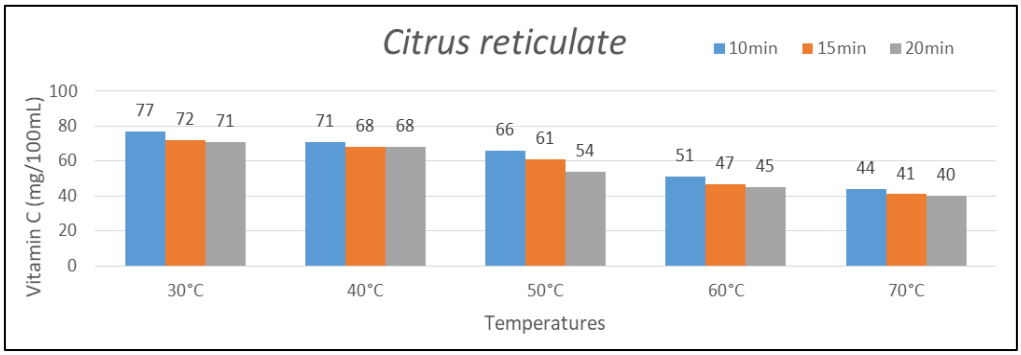

Fig. 2: Effect of time and different temperatures on Citrus reticulate

For Citrus paradise shown in Fig. 3 were 78,75, 73 mg / 100 ml at 30 °C at 10 ,15,20 min were 72, 71,68 mg / 100 ml, for 40 °C at 10 ,15,20 min were 67,64,62 mg / 100 ml, for 50 °C at 10 ,15,20 min, were 60,58,53 mg / 100 ml at 60 °C for 10 ,15,20 min, were 50,48,44 mg / 100 ml at 70 °C for 10 ,15,20.

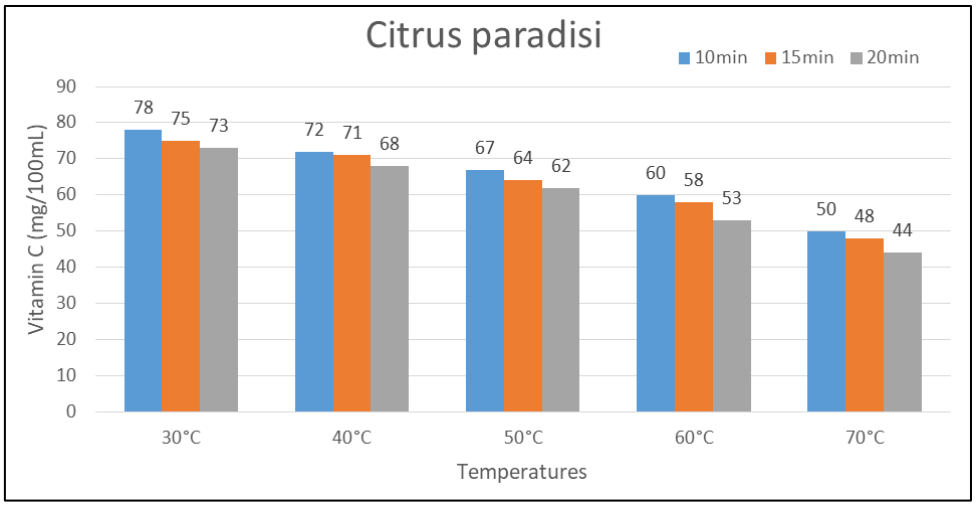

Fig. 3: Effect of time and different temperatures on Citrus paradise

It is obvious from Fig 4 Citrus sinensis were 87,81, 78 mg / 100 ml at 30 °C for 10 ,15,20 min, were 77, 76,76 mg / 100 ml, at 40 °C for 10 ,15,20 min, were 75,72,71 mg / 100 ml at 50 °C for 10 ,15,20 min, were 68,60,55 mg / 100 ml at 60 °C for 10 ,15,20 min, were 51,48,42 mg / 100 ml at 70 °C for 10 ,15,20 min.

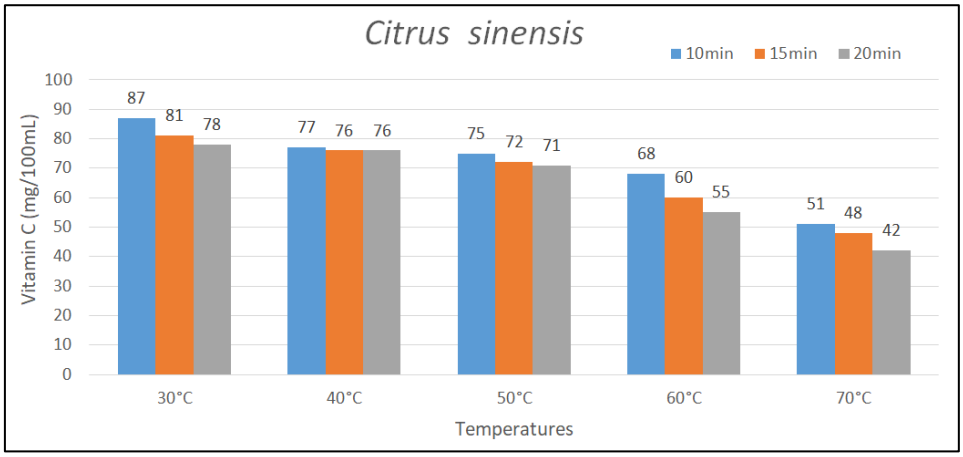

Fig. 4: Effect of time and different temperatures on Citrus sinensis

The results showed that temperature and time have an effect on the concentration of vitamin C shows that; there is decreased in Vitamin C content after boiling as shown in Table 1.and fig (2,3,4,5), as we increase the temperature the concentration of vitamin C decreases, there is loss of vitamin C content in all The citrus juice. The rate at which vitamin C is loss during the boiling depend on the temperature and time, this is because the high heat used to increase the temperature of fruit juices kills the enzyme ascorbic acid oxidize found in fruits and vegetables before much vitamin C is oxidized. It can be inferred from the results that the lower the temperature, the higher the availability of vitamin C in fruit juice. It is best to keep or store vitamin C at a place lower than room temperature.

Boiling and cooking subject the vitamin C to degradation [17]. It is obvious that with increasing temperature the amount of vitamin C decreases, which is in agreement with previous studies 18]. The citrus juice was found to follow a similar pattern of loss [19].

CONCLUSION

The results of the analysis showed that different temperatures and specific time intervals significantly affected the stability of Vitamin C under the heated condition (30°C -40°C -50°C -60°C - 70°C) for (10-15-20 min) and it was observed that there is negative relation exists between Vitamin-C and temperatures. It is verified that vitamin C is an easily oxidizable and unstable compound whose content in a fruit juice sample gets lowered at a higher temperature environment. Higher values for the vitamin C content of the citrus juice samples when compared to those of its indicative standard values as per international standards indicate that the fruit samples.

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