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Original Research Article

Effect of Cold Temperature Environment on Fruit Juice Samples during Storage

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Abstract: Vitamin C in different citrus juice samples were investigated; Citrus Limon, Citrus reticulate, Citrus paradise, and Citrus sinensis. Iodine titration was utilized for thedetermination of vitamin C in the different samples. The highest amount of vitamin C concentration observed in Citrus sinensis was 95 mg / 100 ml whereas Citrus reticulate showed low levels of82 mg / 100 ml. The same tendency was observed in packed citrus juice, with the effect of cold temperature as though the content of vitamin C was less than in fresh citrus juice. Results revealed that; there is a loss of vitamin C content in all four storage conditions (days), Vitamin C reduces differently in citrus juice samples stored in different conditions. On the Fourth day Table 1. The rate at which vitamin C is lost depends on the temperature and time methods employed. It has been found that the hot environment provides the conditions for fast decay of vitamin C content and the 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 environmental factors. Hence it is always suggested to consume fresh juice rather than packed and stored one.

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

INTRODUCTION

Vitamins are organic substances that are extremely important for normal physiological functions such as maintenance, growth, development, and production [1]. A vitamin is an organic compound, which means that are contains carbon. It is usually needed in minuscule quantities in order for the body to have optimal functionality. A deficiency syndrome happens when your body doesn't get enough vitamins [2]. For the health system, humans have to obtain vitamins from anexogenous source such as food where the vitamin is one of its natural components and is found in small amounts [1].

Vitamin C (Also referred to as L- ascorbic acid) is the Lactose -2,3,-dienol-L-gluconic acid is an odorless, white solid having the chemical formula C6 H8O6. Vitamin C is the L-enantiomic form of ascorbic acid which also encompasses the oxidation product of dehydroascorbic [3].

The function of vitamin c as a powerful antioxidant furthermore helps the body in building new tissue and maintains connective tissue, including bones, blood vessels, and skin [4], besides, inhibition of nitrosamine formation, collagen formation, reduction of plasma cholesterol level, enhancement of the immune system inhibition of nitrosamine formation, collagen formation, reduction of plasma cholesterol level, enhancement of the immune system [5].

It participates in numerous biochemical reactions, suggesting that vitamin C is important for the body's process of repair [6].

The storage conditions are essential for their amount of vitamin C. If the fruit surface is damaged, that causes significant losses of ascorbic acid. Fruits with a low pH (citrus fruits) have smaller losses of ascorbic acid and fruit with a soft consistency, such as strawberries are more sensitive to external influences [7].

Many vitamins are lost in fruits and vegetables during handling, processing, and storage. The retaining ability of vitamins under chemical, physical, and/or thermal stress is called stability. Fruits and vegetables lose many vitamins during handling and storage. The retaining ability of vitamins under chemical, physical, and/or thermal stress is called stability [8].

Scientists studied Vitamin C stability based on the percentage loss of Vitamin C [9]. consequently, a low percentage loss indicates high stability of Vitamin C, while a high percentage loss means low stability. [10].

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 cold environments on Vitamin C and relate it to the stability of Vitamin C in Four citrus fruits

MATERIALS AND METHODS

Sample collection and preparation

Four citrus fruit samples were collected the from local market of Tripoli. These are, Citrus Limon, Citrus reticulate, Citrus paraand dise, Citrus sinensis. Juice of citrus fruits was extracted with the help of a 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 the starch indicator are added to 25 mL of sample and titrated with 0.005 M iodine solution until it turns to a blue-black color. 10 mL of filtrate juice sample with 10 drops of 0.5 % starch indicator is titrated with iodine solution.

Stored the samples:

About 10 ml of extracted juice was transferred from the beaker into 50 ml Falcon tubes fully covered with aluminum foil to protect from light and was prelabeled (day 0, 1, 2, 3, and 7). Juice in the tube labeled day 0 was tested for its Vitamin C level on the same day of juice extraction. All the other tubes were covered with aluminum foil to avoid light exposure and then stored in a fridge set at 4°C until it was used for analysis at the intended time.

Statistical analysis:

All experiments were performed in duplicate. Mean values with standard deviation were calculated using standard statistical procedures. The data obtained were subjected to statistical evaluation, linear regression analysis was calculated by Microsoft Excel 2010 program.

RESULTS AND DISCUSSION

Losing in vitamin C Concentration in citrus fruits after storage at 4-5° C temperature is tabulated in Table 1, The quantity of vitamin C obviously that room temperatures are much better conditions than cold 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: Effect of Cold Temperature Environment on Fruit Juice Samples

Ctrus fruits	Storage duration/Day	Amount of vitamin C (mg/100 ml)	Vitamin C loss (%)
Citrus limon	0	92±0.30	-
	1	91 ±0.71	1.09
	2	90±0.73	1.10
	3	81±0.30	10
	4	60±0.85	25.9
Citrus reticulate	0	82±0.30	0
	1	81±0.30	1.21
	2	80±0.30	1.23
	3	79±0.30	1.25
	4	78±0.30	1.26
Citrus paradisi	0	84±0.30	0
	1	83±0.30	1.19
	2	82±0.30	1.20
	3	80±0.30	2.43
	4	78±0.30	2.50
Citrus sinensis	0	95±0.30	0
	1	94±0.30	1.05
	2	93±0.30	1.06
	3	92±0.30	1.07
	4	91±0.30	1.08

All data are expressed as mean±SD of a triplicate set of values (n=3). SD: Standard deviation

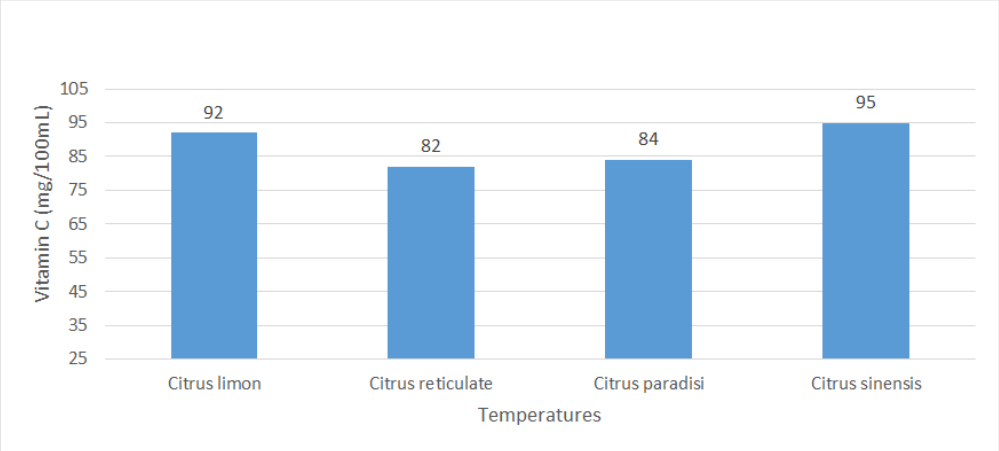

Fig 1: Comparison of Vitamin C Concentration (mg/100 ml) in citrus juice

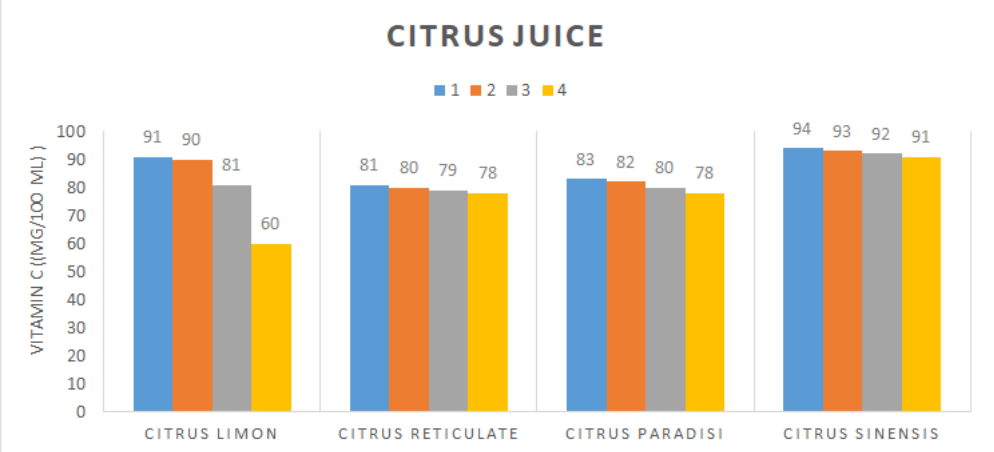

Fig 2: Effect of days under cold temperatures on vitamin C Concentration

The results illustrated that vtamin C concentration (mg/100 ml) for citrus juice was found in citrus sinensis (95 mg/100ml) followed by citrus Limon (92mg/100ml), citrus paradisi (84 mg/100ml), and citrus reticulate (82 mg/100ml) respectively. The citrus juice samples were cold at constant temperature conditions (under refrigeration at 4-5° C) on day 0,1, 1 The Vitamin C level in each fruit tested is tabulated in Table 1 & Figure 1.

A different source of Vitamin-C was maintained at constant temperature conditions (under refrigeration at 4-5° C. Table 1 depicts changes in the ascorbic acid content of different sources kept under the refrigeration condition after 4 days' intervals. From the above mention experiment, it was indicated that ascorbic acid content gradually decreased with time. It was also observed that the maximum degradation occurred within 4 days of storage. In the case of Citrus sinensis 95mg/100ml ascorbic acid degraded at the same time of day followed by 94 mg/100ml after one day, 93mg/100ml after 2 days, 92mg/100ml after 3 days, 91mg/100ml after 4 days. Respectively. It is obvious in citrus limon that 92 mg/100ml ascorbic acid was degraded at the same time followed by 91 mg/100ml after one day, 90 mg/100ml after 2 days, 81 mg/100ml after 3 days, 60 mg/100ml after 4 days respectively, the concentration of vitamin c in citrus paradise 84mg/100ml ascorbic acid was degraded in the same time, 83 mg/100ml after one day followed by 82 mg/100ml after 2 days, 80mg/100ml after 3 days, 78 mg/100ml after 4 days, Illustrates the result obtained in citrus reticulate82mg/100ml ascorbic acid was degraded in the same time, 81 mg/100ml after 1 day followed by 80 mg/100ml after 2 days, 79mg/100ml after 3 days, 78 mg/100ml after 4 days.

All the results showed that cold temperature and time have an effect on the concentration of vitamin C shows; there is a decrease in Vitamin C content after days, as we increase days the concentration of vitamin C decreases, and there is a loss of vitamin C content in all the citrus juice. The rate at which vitamin C is lost during the cooling depends on the time.

The percentage losses of vitamin C at 1,2,3,4 day observed were in citrus reticulate (1.21%, 1.23%, 1.25%, 1.26%), citrus limon (1.0%, 1.09%, 10%, 25%), citrus paradise (1.19%, 1.20%, 2.43%, 2.50%), citrus sinensis (1.05%, 1.1.06%, 1.07%, 1.08%) respectively. This is in agreement with the findings of [11-13].

This result in the study correlates with the finding of Kavousi (1997) [14] who reported that the change of vitamin C in commercially pasteurized lime juice showed a low dependence on the temperature change between 4ºC and 25ºC. However, Burdurlu *et al*., (2006) [15], expressed that loss of vitamin C increased with the increasing storage temperature.

Using computer statistical software (excel) was used to automatically generate suitable models for the rate of vitamin C degradation in all citrus fruits. This was achieved by using the experimental data obtained for each respective fruit.

The coefficients of correlation (r^2) are stronger for Citrus sinensis $r^2=1$, Citrus reticulate $r^2=1$, followed Citrus paradise $r^2=0.97$, Citrus limon $r^2=0.75$ at 95% confidence level with the vitamin C content as given by the Excel statistical software.

Figures 3, 4, 5and 6 showed the linear respectively developed from the observed mean concentrations of vitamin C in the citrus fruits investigated at constant temperature condition (under refrigeration at 4-5° C)

The vitamin C content was used as the response or dependent variable, while number of days of storage were used as the independent variables respectively. The statistical validity and strengths of the obtained models (regression equations) were provided alongside the figures using the statistical software.

The amount of vitamin C in Citrus limon (mg/100 ml) = 97.6 - 7.4, amount of vitamin C in Citrus reticulate (mg/100 ml) = 82 - t, amount of vitamin C in Citrus reticulate (mg/100 ml) = 84.4 – 1.5 t, amount of vitamin C in Citrus sinensis (mg/100 ml) = 95 - t. the amount of vitamin C is reduced by the same linear dependence.

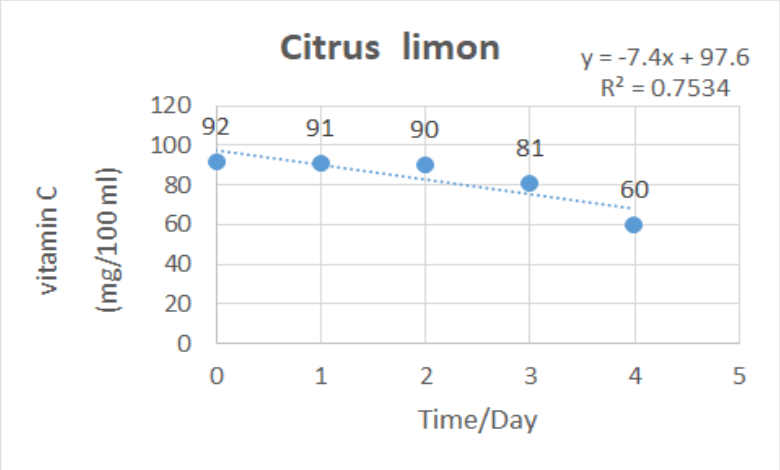

Figure 3: Linear Model of Citrus limon

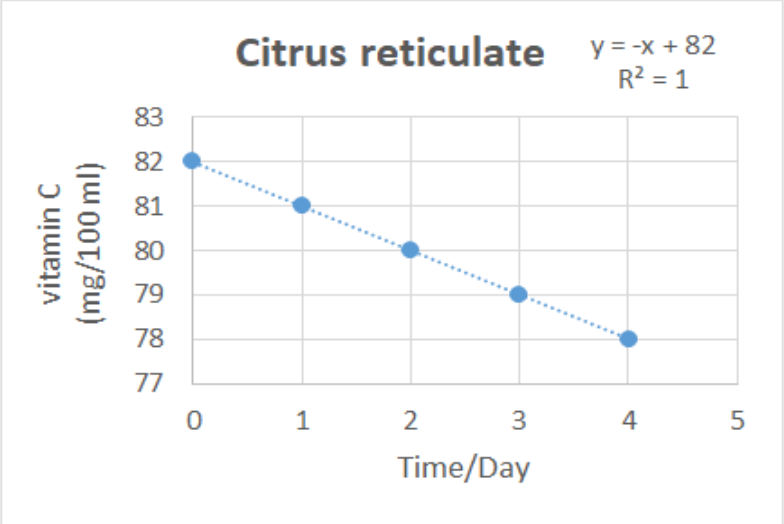

Figure 4: Linear Model of Citrus reticulate

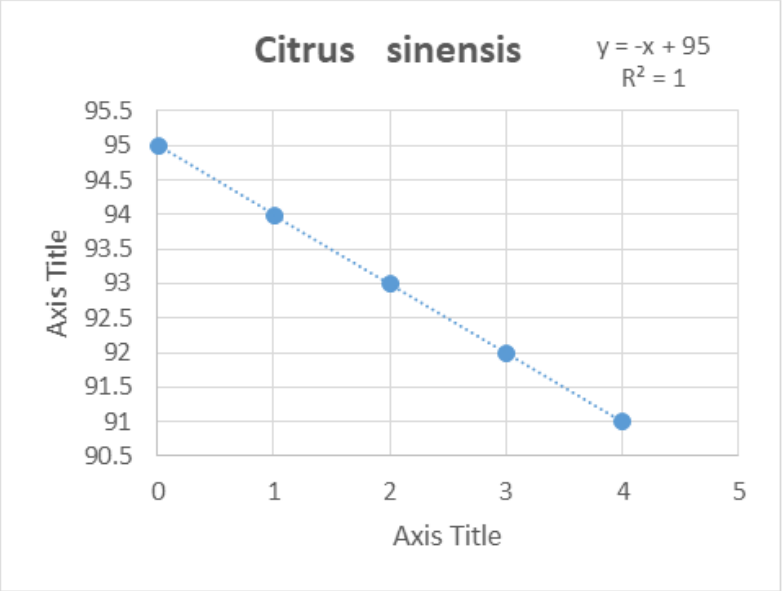

Figure 5: Linear Model of Citrus reticulate

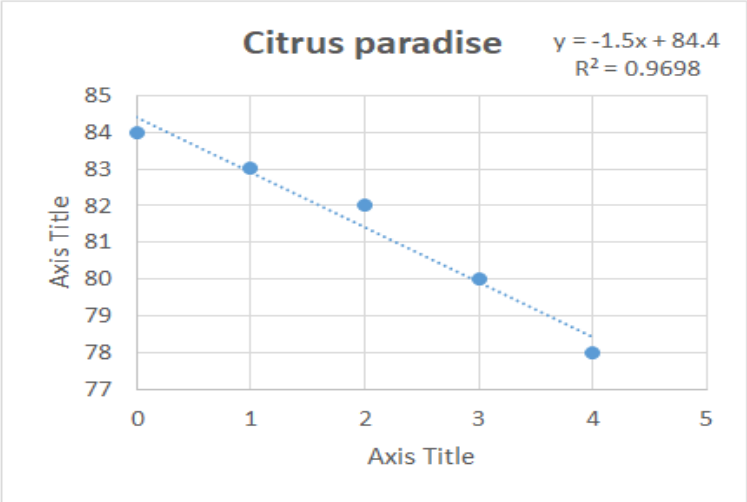

Figure 6: Linear Model of Citrus sinensis

CONCLUSION

The results of the investigation showed that specific time intervals conspicuously affected the stability of Vitamin-C even stored under the refrigeration condition (4- 5^0C) and there is a significant negative relationship exists between Vitamin C and time of storage. The conclusion of this work will be highly valuable for society because it will throw light on the Vitamin-C content of commonly used citrus fruits. Most important will be the data generated regarding the degradation of Vitamin-C of different fruits during the course of storage. Having this much data, it will be possible to educate the masses regarding proper storage technology. The results will also be employed for proper economic management of nutrients.

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