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Research Article

Estimation of Vitamin C in Selected Fruits and Vegetables Commonly Consumed in Sabratha, Northwestern Libya

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Abstract

In the present work, vitamin C (ascorbic acid) content of some fruits; guava, kiwi, orange and lemon, and vegetables; green pepper, red pepper, greenhouse-growing pepper, tomato and parsley was determined by means of a titration method. It was found that ascorbic acid content of fruits was highest in guava (217.32 mg/100g) and lowest in lemon (58.12 mg/100g); and in vegetables, it was highest in green pepper (123.94 mg/100g) and lowest in green pepper grown in greenhouse (24.12 mg/100g). These observations may serve as guidance on selection of fruits and vegetables that can be consumed to meet the daily requirements of vitamin C.

Keywords: Estimation**,** Vitamin C, Fruits, Vegetables.

Introduction

Vitamins are very important to our health. They play a role in maintaining a healthy diet and required for metabolism and biological processes. Among all vitamins, vitamin C is an essential micronutrient needed for normal metabolic function of the human body [1]. Vitamin C, which also known as ascorbic acid, is a water-soluble and anti-oxidant compound [2-5] that is generally obtained from fruits and vegetables, such as blueberry, orange, lemon, strawberry, pepper and tomato. It has a molecular formula of $C_6H_8O_6$, a molecular weight of 176.13 g/mol, and a melting point of about 190°C.

Vitamin C is known to prevent cold disease, lower blood pressure and cholesterol levels [6], and enhance human immune system. However, deficiency of vitamin C is proved to lead to scurvy in humans [3]. These diseases can be prevented with a small amount of about 10 mg of vitamin C taken per day [7]. With the exception to humans, this vitamin naturally occurs in many plants and animals [8]. This makes it necessary to obtain this vitamin from other sources to be included in daily diet.

Several analytical techniques have been reported in literature for the evaluation of vitamin C, such as the redox titrimetric [9], spectrophotometric [10], capillary zone electrophoretic [11], and derivative spectrophotometric methods [12]. However, the titrimetric method, which is concerned in this study, is considered as simple, rapid and applicable method for the determination of vitamin C in food items.

The objective of this work is to determine the vitamin C content in some commonly consumed fruits and vegetables in the city of Sabratha, northwestern Libya employing the titrimetric method. The obtained results were compared with previously published results obtained by similar and different techniques.

Materials and methods

Samples of fresh fruits and vegetables were purchased from a local market located in Sabratha city, Libya. All the samples were thoroughly cleaned with distilled water to remove adhering contaminants. All reagents used were of analytical grade.

Sample preparation

100 g of each sample was cut into small pieces, blended together with 50 mL of distilled water using an electric blender, and then filtered. The filtrate was transferred into a 500 mL

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volumetric flask and the flask was filled up to the mark with distilled water.

Preparation of the solutions [13]

A 0.005 M iodine solution was prepared as follows: 2 g of KI and 1.3 g of I_2 were accurately weighed, and then dissolved in distilled water. The iodine solution was transferred to a 1000 ml volumetric flask and the volume was completed up to the mark. Finally, the iodine solution was standardized with a solution of ascorbic acid. To prepare a 0.5% starch indicator solution, 0.25 g of starch was solubilized in a 100 ml beaker and 50 mL of distilled water was added. The solution was heated with stirring at 79^{o}C for 5 min. The resultant solution was allowed to cool to room temperature.

Titration of the extract

20 mL of the sample solution was pipetted into a 250 mL conical flask. 150 mL of distilled water was added into the flask followed by 1 mL of starch indicator solution. The sample was then titrated with the 0.005M iodine solution until a dark blue-black color was persisted due to the starch-iodine complex. Titration was repeated until three titres are obtained that agree within 0.1 ml.

Results and discussion

The vitamin C content of various fresh fruits and vegetables is given in Tables 1 and 2. Results showed that all fruits and vegetables studied in this work contain vitamin C, but in different concentrations. For fruits; guava has the maximum vitamin C content (217.32 mg/100g) indicating that it is a good source of vitamin C. Its content could cover more than 362% of the recommended daily intake (RDI) of Vitamin C, which is 60 mg/d for healthy and nonsmoking adults [14]. 28g of guava is sufficient to cover more than100% of the RDI of Vitamin C. However, lemon was found to have the lowest concentration of vitamin C. For vegetables; green pepper was the richest vegetable in vitamin C with 123.94 mg/100g and green pepper grown in greenhouse was the poorest. This means that green pepper provides about 207% of the RDI and 48g of it can cover more than 100% of RDI of vitamin C.

Table 3 presents a comparative study of our findings with previous works. As it can be seen, although our values are higher than the ones reported in the literature in general, there is fairly good agreement with the literature. This variation is accepted since there are a number of factors that can affect the vitamin C level in fruits and vegetables, such as analytical method, production process, degree of ripeness, temperature, climate, maturity state and soil nutrients [15]. In addition, it has been demonstrated that fruit position on a tree [16] and sunlight exposure [17] can affect the vitamin C content.

Table 1. Vitamin C content (mg/100g sample) of some fruits

Serial No.	Fruit	Vitamin C (mg/100g)	Coverage of RDI (%)	Sufficient amount for covering 100% of the RDI of vitamin C (g)
1	Guava	217.32	362	28
2	Kiwi	90.20	150	67
3	Orange	82.34	137	73
4	Lemon	58.12	97	103

Table **2**. Vitamin C content (mg/100g sample) of some vegetables

Serial No.	Vegetable	Vitamin C (mg/100g)	Coverage of RDI (%)	Sufficient amount for covering 100% of the RDI of vitamin C (g)
1	Green pepper,	123.94	207	48
2	Red pepper	107.01	178	56
3	Parsley	71.86	120	83
4	Tomato	26.73	45	222
5	Green pepper grown in greenhouse	24.12	40	250

Table 3. Comparison of the vitamin C content (mg/100g sample) in some fruits and vegetables samples between the current study and previous studies

Sample	Previous studies Value/Ref./method*	Present study
Guava	98.40 / [9] /TM 101.40/ [9] /MFM 69.60/ [18] / TM 491.6/ [19] / SP 22.35/ [20] / TM	217.32
Kiwi	79.9/ [12] / DSP 242.05/ [21] / TM	90.20
Orange	74.67/ [18] / TM 43.37/ [10] /SP 67.37/ [22] /TM 47.84/ [23] /TM 41.2/ [19] / SP 43.55/ [20] / TM 56.02/ [21] / TM/	82.34
Lemon	53.15/ [10] /SP 40.48/ [24] / TM 46.80/ [9] /TM 60.20/ [9] /MFM 23.2/ [19] / SP 48.0/ [25] / SP 51.78/ [21] / TM	58.12
Green pepper	110.63/ [23] /TM 27.62/ [18] / TM 15.00/ [10] /SP 117.03/ [22] /TM 14.4/ [25] / SP	123.94
Red pepper	81.53/ [18] / TM 139.48/ [22] /TM	107.01
Parsley	42.27/ [10] /SP 110.2/ [25] / SP 94.8/ [12] / DSP 97.0/ [11] /CZE	71.86
Tomato	17.80/ [9] /TM 19.00/ [9] /MFM 24.91/ [23] /TM 27.93/ [18] / TM 8.41/ [10] /SP 36.46/ [22] /TM 15.2/ [19] / SP 12.3/ [25] / SP/	26.73
Green pepper grown in greenhouse		24.12

*TM (titrimetric method), SP (spectrophotometry), DSP (derivative spectrophotometry), MFM (microflurometry), CZE (capillary zone electrophoresis).

Conclusions

In the present work, the titration method was applied for vitamin C determination on various types of fruits and vegetables commonly consumed in north-western Libya. Results showed that a considerable variation in vitamin C in these fruits and vegetables was observed. Guava and green pepper were found to be the richest fruit and vegetable in vitamin C, respectively. These findings may serve as a good guide on selection of a particular fruit or vegetable for the daily requirement of vitamin C. In addition, the titration method was found to be advantageous comparing with other methods reported in literature. This method is simple, convenient and less time consuming. Further studies should be conducted to investigate the vitamin C content of more fruits and vegetables which are grown/consumed in this country.

Conflicts of interest

The authors declare that there is no conflict of interests relevant to this paper.

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