Analytical Chemistry: An Indian Journal

Research | Vol 17 Iss 1

Determination of Ascorbic Acid Content of Some Local Fruits in Nigeria

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Received: November 23, 2016; **Accepted:** February 26, 2017; **Published:** March 10, 2017

Abstract

Ascorbic acid contents of some fruits locally available were determined by titrimetric method using 2, 6-dichlorophenol-indophenol. The results obtained confirmed the presence of ascorbic acid in these fruits. The highest percentage yield was obtained from Guava, followed by Paw paw, Orange, Ugiri, Pineapple, Red fruit (Terminalia Catapa), and Apple. The fruits are thus of medical importance and their acidity can be employed in several activities. The reducing action of ascorbic acid on silver and gold salts to give the metals is so effective that the action has been recommended as an analytical method for their determination. Ascorbic acid is incorporated in beverages, drugs and chemicals.

Keywords: Fibromyalgia; Duloxetine HCl; Milnacipran HCl; Pregabalin; Stability-indicating HPTLC

Introduction

Ascorbic acid occurs in living tissues, fresh fruits such as citrus fruits, straw-berries, hip-bones, melons, vegetables, dairy products, meat etc. [1-3]. It is one of the important antioxidants in biological system and is frequently added to processed foodstuffs as an antioxidant [1]. Ascorbic acid (AA), a member of the water-soluble group of vitamins is necessary for the formation of intercellular substances that bind cells in tissues such as capillaries, bones and teeth [4]. Hodges reported that deficiency of ascorbic acid in the body precipitates preosteal bleeding, loosening of teeth tissues and weak bones [5]. According to kinsman and Hood [6]. Ascorbutic patients experience fatigue weakness and vasomotor instability. Nicol suggested that ascorbic acid plays a role in detoxification reactions [7].

Parker listed man and other primates, guinea pigs, red vented bubul, fruit eating bats and salmon as animals that must consume ascorbic acid in their diet in order to prevent scurvy [8]. Hulme reported that animals that do not require ascorbic acid in their diet have ability to synthesize it in their liver and kidney using carbohydrate as base [9].

Citation: Ojukwu UP, Nwobi SC. Determination of Ascorbic Acid Content of Some Local Fruits in Nigeria. Anal Chem Ind J. 2017;17(1):118.

Determination of ascorbic acid in food stuffs is relevant since they are an indicator of freshness [10]. Measurement of ascorbate levels in clinical samples (urine, blood etc) is also of interest. Ascorbic acid is oxidized in the cold by halogens in neutral or in acid solution to give dehydroascorbic acid ($C_6H_6O_6$). Other oxidizing agents such as potassium permanganate, methylene blue, phenol indophenol and ferric salts have the same effect. These and other reagents have been utilized for the assay and determination of ascorbic acid [11,12]. Ascorbic acid content of locally available fruits like guava, pawpaw, orange, pineapple, red fruit (Terminalia Catapa), ugiri and apple were determined. The method adopted was redox titration using 2, 6 dichlorophenol indophenol [13]. Percentage yield of ascorbic and was also calculated for each fruit.

Materials and Methods

Preparation of Materials

0.0167 M potassium iodate, 0.1 M sodium thiosulphate, 0.1 M iodine, 10% w/v potassium iodide, 2 N tetraoxosulphate (vi) acid, 1% w/v starch solution and 0.05 M, 2, 6 dicholorophenolindophenol solution used in the analysis were prepared and standardized according to Vogel [14]. Pure ascorbic acid was analyzed iodimetrically according to British Pharmacopoeia [15].

Six types of fruits namely orange, pawpaw, pineapple, ugiri (irvingia gabonensis), guava, apple and red fruit (Terminalia catapa) were obtained from Eke market of Awka, Anambra State Nigeria. A sizeable quantity of the fruit sample was peeled and the edible portion was grounded. 10g of the pulp was weighed out and the juice extracted with the aid of a muslin cloth into a 100 cm^3 volumetric flask containing 80 cm^3 of freshly boiled and cooled distilled water. Extraction of the juice was repeated twice using 10 cm^3 of distilled water each time bringing the total volume of distilled water in the volumetric flask to 100 cm^3. The solution in the flask was shaken vigorously and filtered into an air-tight reagent bottle that had been previously labeled accordingly. The procedure was repeated for all the fruit samples analyzed in this research work.

Determination of Ascorbic Acid

5 cm^3 of diluted fruit juice was pipetted into a conical flask. 1 cm^3 of glacial acetic acid was added (to increase the specificity of this method) and the solution was titrated to a faint permanent pink colour. The titre value (T) was recorded. The titration was repeated with 5 cm^3 of boiled and cooled distilled water for the blank (Bl) and 5 cm^3 standard ascorbic acid solution (St). The titrations above were repeated twice and the average titre value was calculated and recorded in TABLES 1 and 2. The ascorbic acid (Vitamin C) content of the fruit sample was calculated using the formula:

$$\text{Vitamin C of test (mg/100 cm}^3\text{)} = \frac{T - BI}{St - BI} \times \text{Conc of standard solution (mg/100 cm}^3\text{)} \times \text{Dilution}$$

Where T = Titre value of test solution

BI = Titre value of blank

St = Titre value of standard ascorbic acid solution

Concentration of standard ascorbic acid solution = 2 mg/100 cm^3

The result got in mg/100 cm^3 was recorded in TABLE 3.

Deduction

100 cm^3 of diluted solution of the test sample contains 10 g of the sample. Therefore the ascorbic acid value in mg/100 cm^3 can be converted to mg/10 g. The percentage yield from the 10 g of the sample analyzed was also calculated for each fruit as shown in TABLE 4.

Results and Discussion

Ascorbic acid (Vitamin C) is a strong reducing agent which reacts stoichiometrically with oxidizing agents such as iodine and 2, 6 dichloro phenolindophenol. These reagents were used in the titrimetric determination of ascorbic acid and the results of the analysis were as shown in TABLES 1-4. A preliminary analysis was carried out on pure ascorbic acid sample (E-MERCK) and was used to determine its level of purity. The result showed that the sample was of analytical grade (TABLE 1). The 99.7% mean recovery recorded proved the use of iodine solution in the determination of ascorbic acid in pure solutions as a standard reagent for this purpose [15]. The results obtained from analysis carried out confirmed the presence of ascorbic acid in the fruit samples analysed. The highest percentage yield was obtained from Guava, followed by paw-paw, orange, ugiri, pineapple, red fruit (Terminalia catapa) and apple. The relatively high values of ascorbic acid content of the seven fruit samples analysed proved the use of 2, 6-dichlorophenolindophenol solution in the estimation of ascorbic acid in liquid diet as a satisfactory analytical method (13). The very high ascorbic acid values from guava and paw-paw were in conformity with their widely acclaimed medicinal potentials, Oke and Desroiser [16,17]. Ascorbic acid value from orange was quite high thereby proving its current use in the preparation of vitamin C drugs. Low ascorbic acid value was obtained from red fruit (Terminalia catapa) and this could be attributed to the presence of coloured pigments as its dilute solution was heavily coloured. The percentage ascorbic acid yields obtained from all the fruit samples investigated though low were in order considering the fact that they were calculated from only 10g of each sample. In further research, colorimetric and spectrophotometric methods should be used for comparative purposes.

Finally, the use of guava and pawpaw for the preparation of vitamin C drugs by pharmaceutical industries is highly recommended.

TABLE 1. **Result of assay of standard solutions of ascorbic acid with 0.1 M iodine solution.**

S/No	Volume of iodine added (cm^3)	Amount of Ascorbic acid taken(mg)	Amount of Ascorbic acid recovered (mg)	% Recovered	% Mean Recovery
1	200	23.00	199.90	99.9	
2	250	28.60	248.60	99.4	99.7
3	300	34.50	299.90	99.8	

TABLE 2. **Average burette reading for the seven fruit samples, blank and standard ascorbic acid solution.**

S/No	Sample	Volume of 2,6-Dichlolrophenolindophenol Used (cm^3)
1	Standard Ascorbic Acid Solution	1.80
2	Blank	0.60
3	Orange	11.80
4	Pineapple	1.60
5	Ugiri(Irvingia gabonensis)	1.90
6	PawPaw	14.55
7	Guava	93.95
8	Apple	0.80
9	Red fruit (Terminalia catapa)	1.35

TABLE 3. **Ascorbic acid content of the seven fruit samples in mg/100 cm^3.**

S/No	Sample (ten of each)	Average Titre Value (cm^3)	Amount of Ascorbic Acid (mg/100 cm^3)
1	Orange	11.80	373.33
2	Pineapple	1.60	33.33
3	Ugiri (*Irvingia gabonensis)*	1.90	43.33
4	Pawpaw	14.55	465.00
5	Guava	93.95	3111..67
6	Apple	0.80	6.67
7	Red Fruit (*Terminalia catapa)*	1.35	25.00

TABLE 4. **Ascorbic acid content of the seven fruit samples in mg/10g and percentage yield.**

S/No	Sample(10g of each)	Average Titre Value (cm^3)	Amount of Ascorbic Acid mg/10g	Percentage Yield Per 10g
1	Orange	11.80	373.33	3.73
2	Pineapple	1.60	33.33	0.33
3	Ugiri *(Irvingia gabonensis)*	1.90	43.33	0.43
4	Pawpaw	14.55	465.00	4.65
5	Guava	93.95	3111.67	31.12
6	Apple	0.80	6.67	0.07
7	Red Fruit (*Terminalia catapa*)	1.35	25.00	0.25

REFERENCES

1. Korell U, Lennox RB. Determination of ascorbic acid using an organic conducting salt electrode. Anal Chem. 1992;64:147-51.
2. Kishida E, Nishimoto Y, Kojo S. Specific determination of ascorbic acid with chemical derivatization and high-performance liquid chromatography. Anal Chem. 1992;64:1505-7.
3. Aznnoni VC, Sato PH (1975) Effects of Ascorbic Acid on Microsomal Drug Metabolism. Ann N Y Acad Sci. 1975;254:119-31.
4. Ajibade GA. An evaluation of potassium permanganate as a substitute for dichlorophenolindophenol in Ascorbic acid analysis of vegetables. NJTE. 1997;14(1):143.
5. Hodges M. Experimental scurvy in man. AM J Clin Nutr. 1969;22:535.
6. Kinsman RA, Hood J. Some behavioural effects of ascorbic acid deficiency. AM J Clin Nutr. 1971;24:455.
7. Nicol BM (1950) The metabolism of folic acid. proc soc expt biol and med. 1950;24:72.
8. Parker SB. encyclopedia of science and Technology. New York: McGraw Hill. 1960;748-49.
9. Hulme AC. The biochemistry of fruits and their products. London: Academy Press. 1970;42-7.
10. Oliver M. In the vitamins, 2nd ed. Sehrell, WH, Harris RS Editor. New York: Academic Pressl 1967;1:359-67.
11. Jaselskis B, Nelapaty SJ (1972) Spectrophotometric determination of micro amounts of ascorbic acid in citrus fruits. Anal Chem. 1972;44(2):379-81.
12. Eldawy MA, Tawfik AS, El Shabouri. Rapid, sensitive spectrophotometric method for the determination of ascorbic acid. Anal Chem. 1975;47(3):461-5.
13. Plummer DT. An introduction to practical, bio-chemistry. Maidenhepid, Berkshire, England: McGraw-Hill Book Comply Limited; 1978.
14. Vogel AI. A textbook of quantitative inorganic analysis. 3rd ed. London; Longmans, Green and W Ltd London;1961.
15. British Pharmacopoeia, Volume II, The pharmaceutical press, london;1980:39.
16. Oke OL. the ascorbic Acid Content of Nigerian Vegetables. J food Sc. 1976;32:85.
17. Desroiser NW. Technology of food preservation. Connecticut; Avi Publishing Co, Inc. 1970;21.