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Determination Of Ascorbic Acid Content Of Some Local Fruits In Nigeria

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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.

I. INTRODUCTION

Ascorbic acid occurs in living tissues, fresh fruits such as citrus fruits, straw-berries, hip-bones, melons, vegetables, dairy products, meat etc. (Korell and Lennox 1992, Kishida et al, 1992 and Aznnoni and Sato 1975). It is one of the important antioxidants in biological system (Kichida et al 1948) and is frequently added to processed foodstuffs as an antioxidant (Korell and Lennox, 1992).

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 (Ajibade, 1997).

Hodges (1969) reported that deficiency of ascorbic acid in the body precipitates preosteal bleeding, loosening of teeth tissues and weak bones.

According to kinsman and Hood (1971) Ascorbutic patients experience fatigue weakness and vasomotor instability. Nicol (1950) suggested that ascorbic acid plays a role in detoxification reactions.

Parker (1960) 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. Hulme (1970) 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.

Determination of ascorbic acid in food stuffs is relevant since they are an indicator of freshness (Oliver, 1967). 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, phenolindophenol and ferric salts have the same effect. These and other reagents have been utilized for the assay and determination of ascorbic acid (Jaselkis and Nelapaty, Eldawy et al 1975).

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 (Plummer, 1978).

Percentage yield of ascorbic and was also calculated for each fruit.

II. MATERIALS AND METHODS

PREPARATION OF MATERIALS

0.0167M potassium iodate, 0.IM sodium thiosulphate, 0.IM iodine, 10% w/v potassium iodide, 2N tetraoxosulphate (vi) acid, 1% w/v starch solution and 0.05M, 2, 6 dicholorophenolindophenol solution used in the analysis were prepared and standardized according to Vogel (1963).

Pure ascorbic acid was analyzed iodimetrically according to British Pharmacopoeia (1980).

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 100cm^3 volumetric flask containing 80cm^3 of freshly boiled and cooled distilled water. Extraction of the juice was repeated twice using 10cm^3 of distilled water each time bringing the total volume of distilled water in the volumetric flask to 100cm^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

5cm^3 of diluted fruit juice was pipetted into a conical flask. 1cm^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 5cm^3 of boiled and cooled distilled water for the blank (Bl) and 5cm^3 standard ascorbic acid solution (St). The titrations above were repeated twice and the average titre value was calculated and recorded in Table II. The ascorbic acid (Vitamin C) content of the fruit sample was calculated using the formula:

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

Sample (mg/100cm^3)

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 = 2mg/100cm^3

The result got in mg/100cm^3 was recorded in Table III

DEDUCTION

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

III. 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 Table I, II, III and IV.

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 I). 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 (B.P 1980).

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 (Plummer, 1978).

The very high ascorbic acid values from guava and paw-paw were in conformity with their widely acclaimed medicinal potentials, Oke (1976) and Desroiser (1970). 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.

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 1: Result of Assay of Standard Solutions of Ascorbic acid with 0.1M Iodine 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 2: Average Burette Reading For The Seven Fruit Samples, Blank And Standard Ascorbic Acid Solution

S/No	Sample(ten of each)	Average Titre Value(cm3)	Amount of Ascorbic Acid(mg/100 cm3)
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 3: Ascorbic Acid Content of the Seven Fruit Samples in mg/100cm3

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

Table 4: Ascorbic Acid Conttent of The Seven Fruit Samples In mg/10g and Percentage Y ield

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