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## **ORIGINAL ARTICLE**

# Determination of Ascorbic acid content of fruits and vegetables available in Assam, India

<sup>1</sup>Manoj Kumar Deka, <sup>1</sup>Bhaskarjyoti Deka, <sup>1,2</sup>Kunal Bhattacharya\*

<sup>1</sup>NETES Institute of Pharmaceutical Science, Mirza, Assam, India <sup>2</sup>Pratiksha Institute of Pharmaceutical Sciences, Guwahati, Assam, India **\*Corresponding Author's** Email- kunal22101994@gmail.com

#### ABSTRACT

Vitamin C is scientifically known as L-ascorbic acid. The titration technique was used to measure the ascorbic acid content in fruits and vegetables. Various fruits like lemon, dragon fruit, orange, and Mosambi, and vegetables like potatoes, tomatoes, bell pepper, and cauliflower were collected from a local market. After the collection of these fruits and vegetables from the market, the pulp and seed-free juice were prepared. The juice solution was titrated against iodine solution by using starch as an indicator. Among the fruits analyzed, Mosambi has the highest ascorbic acid content in fruits, whereas dragon fruits have the lowest. In the case of vegetables, cauliflower has the highest, and bell pepper has the lowest ascorbic acid content. This analysis proves that fruits and vegetables can effectively meet daily vitamin C requirements.

Keywords: Vitamin C, Ascorbic acid, Fruits, Vegetables, Iodimetric titration

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## INTRODUCTION

Vitamin C is commonly known as L-ascorbic acid, which is a water-soluble vitamin and is also found naturally in a range of ingredients and also can be purchased in the form of a dietary supplement. Because humans are incapable of generation of vitamin C on their own, it is a necessary nutritional component<sup>1</sup>. Ascorbic acid is necessary for collagen, L-carnitine, and certain neurotransmitters biosynthesis, as well as protein synthesis and it is also involved in the synthesis of proteins [1,2]. Collagen is a type of protein found in fibrous connective tissue and performs an important function when it comes to wound healing. Vitamin C is a key physiological antioxidant and has been demonstrated to allow the patient to regenerate other antioxidants [3]. It also enhances nonheme iron absorption, which is a type of iron found in plantbased foods [5]. Vitamin C (ascorbic acid) concentrations in the body range from 300 mg (near scurvy) to around 2g [4]. Higher vitamin C levels (millimolar concentrations) are found in tissues and cells, with the greatest concentrations in white blood cells (leukocytes), eyes, adrenal glands, pituitary gland, and brain. Vitamin C (micromolar) is present in extracellular fluids at low concentrations including plasma, red blood cells, and saliva[4].





Vitamin C (ascorbic acid) can be discovered in a wide variety of natural foods, especially fresh fruits and vegetables. Gooseberry from India, citrus fruits like lemons, limes, and oranges, tomatoes, potatoes, papaya, green and red pepper, kiwi fruits, strawberries, and cantaloupes, as well as green leafy vegetables

like broccoli and fortified cereals, and its juice are all high in ascorbic acid. Animals are an additional source of vitamin C because they can synthesis it on their own, so it is highly concentrated in the liver[5]. In this study, the quantity of ascorbic acid in various fruits and vegetables which is collected from the local market Guwahati, Assam, India was determined by using the titration method. The juice of the different fruits and vegetables was titrated against iodine solution by using starch as an indicator. The ascorbic acid (vitamin C) concentration of these fresh fruits and vegetables is important for effectively understanding the relationship between daily vitamin C needs and human health[6].

#### **Deficiency of vitamin C**

Vitamin C deficiency occurs as a result of the insufficient amount of vitamin C (ascorbic acid) in the diet. A lack of vitamin C causes the body's collagen to disassemble, causing various tissues to break down and the health and repairing mechanism of the body to suffers[7]. Scurvy is a disease caused by a long-term vitamin C deficiency for at least three months. It is an illness that is mainly related to socioeconomic status and dietary consumption. Symptoms and signs of vitamin C deficiencies are often visible in the body that develops this scurvy. Perifollicular hemorrhage and gingival bleeding are indicative of vitamin C insufficiency in the presence of corkscrew hairs[8].

#### Role of Ascorbic acid in Covid-19

According to this study, for individuals who have pneumonia and sepsis with decreased vitamin C levels, the effects of oxidative stress was observed more. Vitamin C application can help to reduce the severity and duration of pneumonia. There are now multiple randomized controlled studies (RCTs) throughout the world that have evaluated ascorbic acid in COVID-19 patients. Deficiency and hypovitaminosis C, on the other hand, are frequent in low and middle-income households, and many of the risk factors for vitamin C deficiency overlap with the risk factors for COVID-19[9].

In this study, the redox-titration method was adopted to analyze the vitamin C contents in the collected juice samples. The very idea behind this redox titration is that with the drop-wise addition of iodine in the sample during the titration, the ascorbic acid present in the sample starts being converted to dehydroascorbic acid, whereas the iodine is reduced to colorless iodide ions which do not react with starch to produce colored complex. When all the ascorbic acid of the sample gets oxidized then additional iodine added in the sample from the burette will be as molecular iodine which on combining with the starch indicator solution present in the sample, changes the color of the solution which is the indicator that now the end point has been achieved. This approach has also been used by various other worker in the past, some with slight modification and some with almost the same [10-12]. Data on vitamin C content of fruits are available for various other countries and regions [13-17]. However, this information is absolutely lacking for Guwahati, Assam, India.

#### **MATERIAL AND METHODS**

This experiment is carried out through the titration method. The study of this experiment is based on quantity in the form of ascorbic acid found in various fruits and vegetables which is the subject of this investigation.

#### **Procurement of samples**

Sample for the study of different fruits and vegetables were collected from the local market in Guwahati city, Assam, India. Collection of various fruits like lemon, dragon fruit, orange, and mosambi, and vegetables like potatoes, tomatoes, bell pepper, and cauliflower were thoroughly washed with water to remove unwanted contaminants. After cleaning, the pulp and seed-free juice were prepared.

Fruits	Scientific Name
Lemon	Citrus limon
Dragon fruit	Selenicereusundatus
Orange	Citrus sinensis
Mosambi	Citrus limetta
Vegetables	Scientific Name
Tomatoes	Solanum lycopersicum
Potatoes	Solanum tuberosum
Bell pepper	Capsicum annuum
Cauliflower	Brassica oleracea

Table No. 1. Scientific names of Fruits and Vegetables investigated for ascorbic acid content **Reagents** 

# Iodine, Potassium iodide, Starch and Distilled water were used in this experiment which were provided by Pharmaceutical Chemistry Laboratory of NETES Institute of Pharmaceutical Science, Mirza, Assam.

## Vitamin C standard sample preparation

10 mg of vitamin C in the 10 ml of water. This will give the concentration of 1 mg vitamin C/ml.

## **Iodine solution preparation**

For the preparation of iodine solution, 0.254 gm of solid iodine and 4 gm of solid potassium iodide were weighed and dissolved with distilled water. Transferred this solution to a volumetric flask by adding the required quantity of distilling water to prepare the iodine solution.

#### Starch solution preparation

For the preparation of the starch solution, a spatula of starch was added to 100 ml of distilled water and dissolved.

## Analysis of Ascorbic acid content of the sample juices

For the determination of the amount of vitamin C, (ascorbic acid) content within the samples, the analysis was carried out by using the titration method. 0.254gm of solid iodine was taken in a dry beaker and also added 4gm of solid potassium iodide, which was dissolved by adding distilled water. After that, this solution was transferred to a 100ml of volumetric flask for preparing the required iodine solution. Again, the Starch solution was made by combining a spatula of starch with 100 mL of water and was heated.

A muslin cloth is being used to extract and filter fruit and vegetable juices. Using 1ml of starch as an indicator, 5ml of filtered juice (sample) was placed in the conical flask and titrated in opposition to the prepared iodine solution in the burette. The procedure was terminated when the color of the solution in the conical flask changed from fruit or vegetable juice to violet, and the amount of vitamin C in the solution was determined.

Ascorbic acid  $(C_6H_8O_6) + I_2 \rightarrow 2I + Dehydroascorbic acid <math>(C_6H_6O_6)$ 

#### (Reduced form) (Oxidized Form)

## Calculation

The ml of iodine solution used in the titration of the vitamin C standard solution as well as the mL of Iodine solution was used in the juice titration were subsequently recorded. The vitamin C (ascorbic acid) content of the samples was determined using an ml of titrant for the vitamin C standard solution and sample solutions. 10 mg vitamin C in standard vitamin solution is reduced by 12 mL standard iodine solution. This is a constant value. The quantity of vitamin C in each unknown sample juice is estimated using this value using the following formula:

ml of iodine solution used for vitamin C standard solution

10mg vitamin C

ml of iodine solution used for juice samples

X mg vitamin C where X= is the quantity of vitamin C in mg as estimated for the juice samples after calculation using the formula, which is unknown.

## **Statistical Analyses**

Analyses of samples were performed in triplicates (n=3). Evaluation of statistics and graphical representation of the obtained data were performed using the Microsoft Excel.

## RESULTS

In the present study, fresh fruits and vegetable juice samples were analyzed for their vitamin C (ascorbic acid) contents. The results for this analysis are tabulated in the Table2 and Table 3. This analysis revealed the importance of vitamin C (ascorbic acid) concentration in fresh juice samples from various fruits and vegetables. Data for this have been tabulated in Table. The fresh mosambi juice was found to have the highest ascorbic acid content among the analyzed fruits (42 %), while cauliflower juice was found to have the highest among analyzed vegetables (29%). However, this analysis of ascorbic acid content showed the quantity containing ascorbic acid found in many different fruits and vegetables varies, which is very beneficial for the human diet.

S/No.	Names of Fruits	Initial burette reading (ml)	Final burette reading (ml)	Iodine soluion volumes required (ml)	Vitamin C (mg)/100ml
01	Lemon	0.0	1.5	1.5	25
02	Dragon fruit	0.0	0.5	0.5	8.33
03	Orange	0.0	1.9	1.9	31.66
04	Mosambi	0.0	2.2	2.2	36.66

Table No.2.Vitamin C concentration of fruits investigated

S/No.	Names of Vegetables	Initial burette reading (ml)	Final burette reading (ml)	lodine solution volumes required (ml)	Vitamin C (mg)/100 ml
01	Tomatoes	0.0	0.4	0.4	6.6
02	Potatoes	0.0	0.9	0.9	15
03	Bell pepper	0.0	0.3	0.3	5
04	Cauliflower	0.0	1.4	1.4	23.20



Figure No.2. Percentage of Ascorbic acid found in different fruits and vegetables

## DISCUSSION

According to the results, each juice sample from various fruits and vegetables has a distinct titre value to reach its endpoint. This is due to the fact that various fruits and vegetables have varying vitamin C content (ascorbic acid). The juices with less formalized levels of vitamin C precipitated the use of less titrant to reach their endpoint, whereas those with greater levels of vitamin C precipitated the addition of more titrant to reach the endpoint color. It is because the color when everything changes of vitamin C in the incident is removed and nothing but starch remains within the solution when combined using the titrant's iodine creates a violet color. The results of these freshly squeezed fruits and vegetable juices show the importance of Vitamin C intake for human health. In this study, the highest ascorbic acid content among fruits was found in musubi juice, i.e; 36.66 %, while in the case of vegetables cauliflower juice was found to be the highest ascorbic acid content i.e; 23.20%. However, the measured ascorbic acid value was discovered to be different depending on the kind of fruits and vegetables in this investigation.

## CONCLUSION

Ascorbic acid (vitamin C) is essential for bodybuilding and the avoidance of a variety of illnesses. The results for this present experiential work suggest that to get the maximum benefits in terms of vitamin C (ascorbic acid) content, vitamin C must be obtained through fruits and vegetables in order to satisfy daily needs. Therefore, it is recommended that nutrition and health education is necessary to encourage increased consumption of fresh fruits and vegetables. Also, awareness should be given on the matter that from the varieties of fruits and vegetables available in the local market, which should be consumed to achieve maximum vitamin C intake daily. Further, labelling of the fruits and vegetables in terms of vitamin C (ascorbic acid) content should be done for more nutrition. This will do a lot to assist consumer attention and the nutritional status of the population to avoid deficiency diseases of vitamin C like scurvy. The results of this study are very essential to satisfy Vitamin C needs daily intake to stay healthy.

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