

ORIGINAL ARTICLE

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

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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 component¹. 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 plant-based 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].

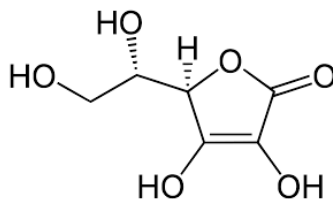


Figure No.1. Structure of Ascorbic Acid

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	<i>Citrus limon</i>
Dragon fruit	<i>Selenicereusundatus</i>
Orange	<i>Citrus sinensis</i>
Mosambi	<i>Citrus limetta</i>
Vegetables	Scientific Name
Tomatoes	<i>Solanum lycopersicum</i>
Potatoes	<i>Solanum tuberosum</i>
Bell pepper	<i>Capsicum annum</i>
Cauliflower	<i>Brassica oleracea</i>

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.

S/No.	Names of Vegetables	Initial burette reading (ml)	Final burette reading (ml)	Iodine 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

TableNo.3.Vitamin C concentration of vegetables investigated

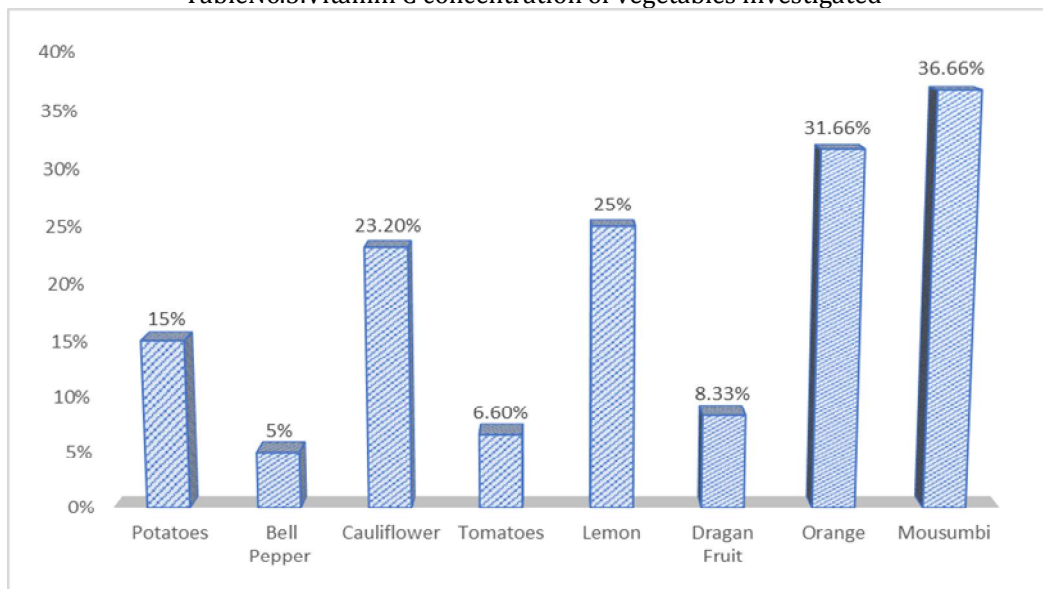


Figure No.2. Percentage of Ascorbic acid found in different fruits and vegetables

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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