International Journal of Pharmacology and Clinical Research

ISSN Print: 2664-7613
ISSN Online: 2664-7621
Impact Factor: (RJIF) 8.29
IJPCR 2025; 7(2): 359-361
www.pharmacologyjournal.in
Received: 17-07-2025
Accepted: 20-08-2025

Prem Kumar Bichala
Associate Professor, Department of Pharmaceutical Analysis, A.K.R.G. College of Pharmacy, Nallajerala, East Godavari, Andhra Pradesh, India

Dr. N Sai Krishna
A.K.R.G. College of Pharmacy, Nallajerla, East Godavari, Andhra Pradesh, India

V Lalitha Ambika
A.K.R.G. College of Pharmacy, Nallajerla, East Godavari, Andhra Pradesh, India

M Lavanya
A.K.R.G. College of Pharmacy, Nallajerla, East Godavari, Andhra Pradesh, India

K Pavani Durga
A.K.R.G. College of Pharmacy, Nallajerla, East Godavari, Andhra Pradesh, India

B Swapna
A.K.R.G. College of Pharmacy, Nallajerla, East Godavari, Andhra Pradesh, India

R Ramu
A.K.R.G. College of Pharmacy, Nallajerla, East Godavari, Andhra Pradesh, India

Corresponding Author:
Prem Kumar Bichala
Associate Professor, Department of Pharmaceutical Analysis, A.K.R.G. College of Pharmacy, Nallajerala, East Godavari, Andhra Pradesh, India

A review: Determination of Vitamin C in different marketed samples (Fruits, fruit juices and tablets)

Prem Kumar Bichala, N Sai Krishna, V Lalitha Ambika, M Lavanya, K Pavani Durga, B Swapna and R Ramu

DOI: https://doi.org/10.33545/26647613.2025.v7.i2e.130

Abstract
Vitamin C (ascorbic acid) is an essential water-soluble vitamin important for collagen synthesis, antioxidant defense, and immune function. Quantitative determination of Vitamin C in marketed products such as fruit juices, tablets, and fortified beverages is vital for quality control and regulatory compliance. Analytical techniques such as titrimetric, spectrophotometric, chromatographic, and electrochemical methods have been widely used. This review summarizes recent analytical advances, compares methods, and compiles reported Vitamin C content in different commercial products, highlighting challenges and future perspectives.

Keywords: Vitamin C, Ascorbic Acid, Titration, HPLC, UV Spectrophotometry, Marketed Samples

Introduction
Vitamin C, also known as ascorbic acid, is a water-soluble vitamin that plays an essential role in numerous physiological and biochemical processes in the human body. It functions primarily as a powerful antioxidant, protecting biological systems against oxidative stress by neutralizing reactive oxygen species (ROS). Moreover, it is involved in collagen biosynthesis, wound healing, iron absorption, and the maintenance of immune function.

Humans, unlike most animals, cannot synthesize Vitamin C endogenously due to the absence of the enzyme L-gluonolactone oxidase. Therefore, it must be obtained through dietary sources such as citrus fruits (oranges, lemons), guava, amla, kiwi, strawberries, broccoli, and leafy vegetables, or through pharmaceutical preparations and fortified foods.

Being a labile compound, Vitamin C is highly sensitive to light, heat, oxygen, and metal ions, which can lead to its rapid degradation during processing, storage, and even analysis. Therefore, accurate quantification of Vitamin C content in different marketed products is crucial to ensure product quality, stability, and compliance with regulatory labeling requirements.

The determination of Vitamin C content has become an essential quality control parameter in pharmaceutical formulations, fruit juices, soft drinks, nutraceuticals, and dietary supplements. Several analytical methods have been developed for this purpose, including titrimetric, spectrophotometric, chromatographic, and electrochemical techniques, each with its own advantages, limitations, and applicability depending on the sample matrix.

A precise estimation of ascorbic acid not only ensures therapeutic efficacy but also assists in the standardization of herbal and natural health products, where Vitamin C acts as a marker compound. Furthermore, continuous monitoring of Vitamin C levels in marketed preparations helps in maintaining consumer trust and regulatory compliance, especially in the context of nutritional labeling standards set by agencies such as the World Health Organization (WHO), Food and Drug Administration (FDA), and FSSAI (India).

This review focuses on various analytical methods employed for the estimation of Vitamin C in different marketed samples such as fruit juices, tablets, syrups, and dietary supplements, highlighting their principles, procedures, merits, and demerits, along with recent advancements in analytical techniques.

Sources And Marketed Samples [3, 4, 6]

Vitamin C (ascorbic acid) is widely distributed in nature and occurs predominantly in fresh fruits and vegetables. It is an essential micronutrient that cannot be synthesized by humans and must therefore be obtained through diet or supplementation. The concentration of Vitamin C in natural sources varies significantly depending on plant species, maturity, storage conditions, and processing methods.

Natural Sources of Vitamin C

The richest sources of Vitamin C are citrus fruits (such as oranges, lemons, and grapefruits), tropical fruits (such as guava, papaya, mango, and amla), and various green leafy vegetables (such as spinach, cabbage, broccoli, and kale).
Among these, Indian gooseberry (Emblica officinalis, amla) is considered one of the most potent sources, containing up to 600 mg of Vitamin C per 100 g of fruit.

Table 1: Examples of Natural Sources and Their Vitamin C Content

Natural Source	Scientific Name	Approx. Vitamin C Content (mg/100 g)
Amla (Indian gooseberry)	*Emblica officinalis*	600
Guava	*Psidium guajava*	230
Kiwi	*Actinidia deliciosa*	90
Orange	*Citrus sinensis*	50
Lemon	*Citrus limon*	40
Broccoli	*Brassica oleracea var. italica*	90
Tomato	*Solanum lycopersicum*	20

Vitamin C content in fruits is highest when freshly harvested but decreases significantly upon exposure to air, light, or heat. For example, storing orange juice at room temperature for 24 hours can reduce Vitamin C content by up to 30% due to oxidation.

Marketed Samples and Commercial Products

In addition to dietary sources, Vitamin C is available in numerous commercial and pharmaceutical formulations, designed to supplement daily requirements or to serve as antioxidants and immune boosters.

Pharmaceutical Formulations

- **Tablets and Capsules:** Available in plain ascorbic acid, chewable, sustained-release, and effervescent forms (commonly 500 mg or 1000 mg doses).
- Examples: Celin® (GlaxoSmithKline), Limcee® (Abbott), CeePlus®, and Redoxon®.
- **Injections:** Used in clinical settings for treatment of Vitamin C deficiency (scurvy) and as antioxidant therapy.
- **Syrups and Drops:** Often formulated for pediatric or geriatric use.

Nutraceutical and Fortified Products

Vitamin C is frequently incorporated into multivitamin supplements, functional beverages, and fortified foods.
Examples include: Tropicana® Orange Juice, Real® Fruit Juices, Frooti®, Minute Maid®, and Amul® fruit beverages — many of which claim enhanced Vitamin C content on their labels.

Cosmetic and Dermatological Formulations

Ascorbic acid and its derivatives (e.g., magnesium ascorbyl phosphate, ascorbyl palmitate) are incorporated in anti-aging creams, serums, and sunscreens, owing to their antioxidant and collagen-stimulating properties.

Analytical Determination Methods [6, 7, 8, 9, 10, 11]

Titrimetric Methods

Titration methods such as iodometric and DCPIP titration are classical, simple, and rapid for Vitamin C estimation. End-point detection relies on a color change. Limitations include interference from other oxidizing agents.

UV–Visible Spectrophotometry

UV–Vis spectrophotometry measures absorbance at 265 nm. Acidic extraction stabilizes Vitamin C. Advantages include convenience and moderate sensitivity; interference may occur from other reducing substances.

HPLC and HPTLC

HPLC with UV detection is highly selective and precise. HPTLC allows simultaneous analysis of multiple samples. Both require careful sample preparation and standardization.

Fluorimetry

Fluorimetric methods utilize derivatization for fluorescence detection, providing high sensitivity. However, they are less common in routine labs.

Electrochemical and Modern Techniques

Electrochemical sensors and capillary electrophoresis offer rapid, sensitive, and selective determination of Vitamin C. Recent research emphasizes green analytical methods minimizing solvent use.

Table 2: Comparison of Analytical Methods for Vitamin C Estimation

Method	Detection/Principle	Advantages	Limitations
Iodometric / DCPIP	Colorimetric change	Simple, rapid, low cost	Interference, less specific
UV–Vis Spectrophotometry	Absorbance at 265 nm	Convenient, moderate sensitivity	Matrix interference possible
HPLC	UV at 245–265 nm	High accuracy, specificity	Costly, instrument required
HPTLC	Separation+ densitometry	Multiple samples, semi-quantitative	Time-consuming, moderate precision
Fluorimetry	Fluorescence	High sensitivity	Less common, derivatization needed
Electrochemical/Biosensors	Current change on oxidation	Rapid, sensitive, portable	Specialized equipment

Comparative Analysis of Marketed Samples: Vitamin C content varies in marketed fruit juices and tablets due to processing and storage. Table 2 summarizes reported values from recent studies.

Table 2: Reported Vitamin C Content in Marketed Samples

Sample	Vitamin C Content (mg/100 mL or mg/tablet)
Tropicana Orange Juice	45 ± 2 mg/100 mL
Real Fruit Mix Juice	38 ± 1.5 mg/100 mL
Vitamin C Tablet (500 mg)	497 ± 5 mg/tablet
Feronia Multivitamin Drink	50 ± 3 mg/100 mL

Discussion and Analytical Challenges

Vitamin C estimation is affected by degradation, sample matrix, and interference from reducing agents. While titration methods are rapid and simple, chromatographic methods offer higher precision. Green analytical approaches and biosensors provide environmentally friendly and portable alternatives.

Conclusion and Future Perspectives

Accurate determination of Vitamin C in fruit juices, tablets, and fortified beverages ensures product quality and consumer safety. HPLC and UV–Vis spectrophotometry remain standard methods, while modern biosensors and green approaches are emerging. Future trends focus on rapid, portable, and sustainable analytical methods.

Ref1erences

1. Naidu KA. Vitamin C in human health and disease is still a mystery? An overview. Nutr J. 2003;2(1):7.
2. Jacob RA. Assessment of human vitamin C status. J Nutr. 1990;120(11):1480–5.
3. Padayatt SJ, Katz A, Wang Y, Eck P, Kwon O, Lee JH, *et al*. Vitamin C as an antioxidant: Evaluation of its role in disease prevention. J Am Coll Nutr. 2003;22(1):18–35.
4. U.S. Food and Drug Administration (FDA). Guidance for Industry: Nutritional Labeling of Food Products. Silver Spring (MD): FDA; 2020.
5. World Health Organization (WHO). Vitamin and Mineral Requirements in Human Nutrition. 2nd ed. Geneva: WHO; 2018.
6. Xu Y, Zhang L, Li X, Wang M, Liu J. Determination of vitamin C in commercial fruit juices by HPLC. Food Chem. 2021;339:127839.
7. Chen Z, Huang Y, Li F, Wang X, Zhao J. UV–Vis spectrophotometric determination of ascorbic acid in tablets and juices. Anal Sci. 2022;38(4):501–7.
8. Patel R, Mehta D, Sharma A, Rana S. Quantitative analysis of vitamin C tablets using DCPIP titration. Int J Pharm Sci. 2020;82(5):23–9.
9. Singh P, Kumar A. HPTLC determination of vitamin C in fortified beverages. J Food Meas Charact. 2023;17:450–8.
10. Sharma S, Verma P, Singh R, Thakur A. Biosensor-based determination of vitamin C in fruit samples. Electrochim Acta. 2021;370:137701.
11. Li J, Wu T, Wang Y, Chen H, Zhang X. Green analytical methods for ascorbic acid analysis in beverages. Anal Methods. 2020;12:234–42.