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ASSESSMENT OF PHYSICO-CHEMICAL QUALITY ATTRIBUTES OF FRESH RIPE GUAVA (*Psidium guajava* L.) FRUITS AS RAW MATERIAL FOR GUAVA LEATHER PROCESSING

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ABSTRACT

The present investigation was carried out to assess the physico-chemical quality attributes of fresh ripe guava (*Psidium guajava* L.) cv. Lalit fruits as raw material for guava leather processing. Guava (*Psidium guajava* L.) is one of the most nutritious tropical fruits owing to its high vitamin C content, balanced sugar-acid composition and desirable processing characteristics. Uniformly ripe, healthy and defect-free fruits of cv. Lalit were selected and their physico-chemical characteristics were analyzed and recorded. The fruits were round in shape with an average fruit length of 6.87 ± 0.87 cm, fruit diameter of 7.66 ± 0.55 cm and fruit weight of 197.43 ± 39.75 g, indicating their suitability for processing. The fresh guava pulp contained 86.42 ± 1.04% moisture, 8.42 ± 0.18 °Brix Total Soluble Solids (TSS), 0.431 ± 0.002% titratable acidity, pH 4.42 ± 0.19, 187.01 ± 0.18 mg/100 g ascorbic acid, 6.54 ± 0.02% total sugar, 5.33 ± 0.03% reducing sugar and 1.22 ± 0.02% non-reducing sugar. The observed physico-chemical characteristics indicated that fresh ripe guava fruits of cv. Lalit possessed desirable quality attributes suitable for guava leather processing. The high moisture and ascorbic acid contents, together with balanced acidity and sugar composition, indicate that cv. Lalit is a promising raw material for the preparation of high-quality guava leather and other value-added functional fruit products.

Keywords **:** Guava, Physico-chemical characteristics, TSS, Ascorbic acid, Fruit processing, Guava leather

Introduction

Guava (*Psidium guajava* L.) is a highly popular edible fruit crop cultivated extensively across tropical and subtropical regions in more than 60 countries worldwide. It belongs to the family Myrtaceae and possesses a chromosome number of 2n = 2x = 22. This perennial fruit tree originated in the tropical areas of the Americas (Rodriguez *et al.*, 2004). Among approximately 150 recognized species within the genus *Psidium*, *P. guajava* is the most commercially important and widely cultivated species globally (Murugan *et al*., 2024). Commonly known as the “Poor Man’s Fruit” and the “Apple of the Tropics” (Pandey *et al*., 2016), guava has recently attracted considerable interest due to its exceptional nutritional value. Owing to its abundance of sugars, proteins, dietary fiber and other essential nutrients, it is increasingly being recognized as the “Queen of Fruits” (Hussain *et al*., 2021).

Guava was first reported in the West Indies in 1526 and was subsequently introduced to the Philippines by the Spanish and to India by the Portuguese during the early seventeenth century (Menzel, 1985). Thereafter, its cultivation spread widely across tropical and subtropical regions of the world. At present, guava is grown extensively in countries such as India, Brazil, Mexico, Thailand, New Zealand, the Philippines, Indonesia, China, Malaysia, Cuba, Sri Lanka, Venezuela, Australia, Myanmar, Israel, Pakistan, Bangladesh and the United States (Hawaii) (Agnihotri, 2002).

Guava fruit is well known for its high vitamin C content along with essential minerals such as calcium, iron and phosphorus, in addition to its pleasant aroma and flavour. It possesses considerable nutritional value, making it an important fruit for maintaining balanced nutrition. Guava is regarded as one of the most economical and richest natural sources of vitamin C (210–305 mg/100 g of pulp) and pectin (0.5–1.8 %), although it is relatively low in energy content (approximately 66 kcal/100 g). The ripe fruit contains 12.3–26.3% dry matter and 77.9–86.9 % moisture, along with 0.51–1.02 % ash, 0.10–0.70 % crude fat, 0.82–1.45 % crude protein and 2.0–7.2 % crude fibre. In addition, the pulp is rich in minerals such as phosphorus (22.5–40.0 mg/100 g), calcium (10.0–30.0 mg/100 g) and iron (0.60–1.39 mg/100 g), as well as vitamins including thiamine (0.03–0.07 mg/100 g), riboflavin (0.02–0.04 mg/100 g), pantothenic acid and vitamin A (Mitra & Bose, 2001).

Owing to its rich nutritional composition and numerous health-beneficial properties, guava has attracted considerable attention as a potential nutraceutical, particularly because of its strong antioxidant capacity (Ho *et al*., 2012). Several studies have reported a wide range of biological and pharmacological activities associated with guava, including antioxidant, hepatoprotective, antiallergic, antimicrobial, antigenotoxic, antiplasmodial, cytotoxic, antispasmodic, cardioactive, antitussive, antidiabetic, anti-inflammatory and antinociceptive effects. These findings provide scientific support for its extensive use in traditional medicine (Gutierrez *et al*., 2008; Shruthi *et al.*, 2013; Mishra *et al*., 2022).

Guava seeds are a rich source of omega-3 and omega-6 polyunsaturated fatty acids as well as dietary fiber. They contain several important phytoconstituents, including tannins, triterpenes, flavonoids (such as quercetin), guajanoic acid, saponins, carotenoids, lectins, leucocyanidin, ellagic acid, amritoside, β-sitosterol, uvaol, oleanolic acid and ursolic acid. These compounds have been reported to play a preventive role in the development of certain diseases (Kamath *et al.*, 2014).

Guava, often referred to as a "super fruit," is highly nutritious and contains significant amounts of B-complex vitamins as well as vitamins A, C and E. It possesses approximately 3-6 times higher levels of vitamins A and C compared to oranges. In addition, it provides about 3 times more protein and 4 times more dietary fiber than pineapple, nearly twice the lycopene content of tomatoes and slightly higher potassium levels than bananas (Moon *et al*., 2018; Reddy, 2017).

In India, Guava was grown over an area of 371.16 thousand hectares in 2024-25 with an annual production of 5606.62 thousand metric tonnes (Anonymous, 2024-25). It is mainly grown in Madhya Pradesh, Uttar Pradesh, Andhra Pradesh, Bihar and Chhattisgarh. The area and production of Guava in Chhattisgarh was approx 20.063 thousand hectares and 198.967 thousand metric tonnes (Anonymous GOI 2024-25). The area and production of Guava in Bastar was approx 0.121 thousand hectares and 0.919 thousand metric tonnes (Anonymous, 2024-25).

Materials and Methods

Experimental Site

The study on "Assessment of Physico-chemical Quality Attributes of Fresh Ripe Guava (*Psidium guajava* L.) as raw material for guava leather processing" was conducted during the year 2025–26 in the Department of Post-Harvest Management, Krantikari Debridhur College of Horticulture and Research Station, Jagdalpur, under Mahatma Gandhi Udyanikee Evam Vanikee Vishwavidyalaya (MGUVV), Durg, Chhattisgarh, India.

Collection of Fruit Samples

The well-matured, healthy, uniform-sized, ripe and disease-free guava (*Psidium guajava* L.) fruits of cv. Lalit were procured from the local market of Jagdalpur, Chhattisgarh, India. The fruits were selected based on uniform size, characteristic light green to yellow peel colour and freedom from mechanical damage, insect infestation and disease symptoms. The selected fruits were thoroughly washed with potable water to remove adhering dust and other foreign matter, air-dried at room temperature and used for the determination of physical and physico-chemical quality attributes.

Sample Preparation

The washed fruits were peeled manually and cut into small pieces. Seeds were removed and the pulp was homogenized using a laboratory blender to obtain a uniform sample for physico-chemical analysis. The prepared pulp was immediately used for the determination of physico-chemical characteristics.

Physico-chemical Analysis

The physico-chemical properties of fresh ripe guava (*Psidium guajava* L.) cv. Lalit pulp were determined using standard analytical procedures. Fruit length and diameter were measured using a Vernier calliper, while fruit weight was recorded using a triple beam balance. The average values were calculated from ten randomly selected fruits. Moisture content was determined according to AOAC (2000), Method No. 925.45, by drying 10 g of pulp in a pre-weighed china dish at 105°C in a hot-air oven until constant weight was obtained. Total Soluble Solids (TSS) were determined according to AOAC (1990), Method No. 932.12, using a hand refractometer calibrated with distilled water and the values were expressed as °Brix. Titratable acidity was estimated according to AOAC (2000), Method No. 942.15, by diluting 10 mL of pulp to 100 mL with distilled water, adding 2–3 drops of phenolphthalein indicator and titrating against 0.1 N NaOH until a persistent light pink end point was obtained. Total sugar and reducing sugar were determined according to AOAC (2000), Method No. 925.35, using the Lane and Eynon titration method with Fehling's solution. Non-reducing sugar was calculated as the difference between total sugar and reducing sugar. The pH of the pulp was measured using a digital pH meter calibrated with pH 4.0 and pH 7.0 buffer solutions before analysis. All determinations were carried out in triplicate and the results were expressed as mean ± standard deviation (SD).

Statistical Analysis

Since the study was based on a single composite sample prepared from ten uniformly ripe guava fruits, the results were expressed as observed values for each physico-chemical parameter. The experimental observations were interpreted by comparing the obtained values with published literature to assess the suitability of the fruits for processing into probiotic guava leather.

Results and Discussion

Physico-chemical Characteristics of Fresh Guava (*Psidium guajava* L.) cv. Lalit Fruits

The physico-chemical characteristics of fresh ripe guava (*Psidium guajava* L.) cv. Lalit fruits are presented in Table 1. Evaluation of the physico-chemical attributes of fresh fruits provides valuable information on their nutritional composition and overall quality. Parameters such as fruit size, fruit weight, moisture content, total soluble solids (TSS), titratable acidity, pH, ascorbic acid and sugar composition are widely used to assess fruit quality and maturity. These characteristics serve as important indicators for quality evaluation and provide baseline information for future postharvest and processing studies.

Table 1 : Physico-chemical characteristics of fresh guava fruits

Parameters	Value	Mean ± SD
Physical parameters of Fruit		
Shape	**Round**	**Round**
Length (cm)	6.87	6.87 ± 0.87
Diameter (cm)	7.66	7.66 ± 0.55
Weight (g)	197.43	197.43 ± 39.75
Chemical composition of Pulp		
Moisture (%)	86.42	86.42 ± 1.04
pH	4.42	4.42 ± 0.19
TSS (°Brix)	8.42	8.42 ± 0.18
Acidity (%)	0.431	0.431 ± 0.002
Ascorbic Acid (mg/100g)	187	187.01 ± 0.18
Total Sugar (%)	6.54	6.54 ± 0.0
Reducing Sugar (%)	5.32	5.33 ± 0.03
Non-reducing Sugar (%)	1.22	1.22 ± 0.02

Physical Characteristics

The guava fruits selected for the present investigation were round in shape with an average fruit length of 6.87 ± 0.87 cm, fruit diameter of 7.66 ± 0.55 cm and fruit weight of 197.43 ± 39.75 g. These physical attributes indicate that the fruits were well developed and possessed desirable size for processing. Fruit size and weight greatly influence pulp recovery, processing efficiency and product yield. Similar observations were reported by Kadam *et al*. (2012) and Leite *et al*. (2009), who reported that fruit dimensions and weight vary with cultivar, maturity stage and growing conditions.

Moisture Content

The fresh guava fruits recorded a moisture content of 86.42 ± 1.04%. The high moisture content reflects the succulent nature of guava and contributes to its desirable texture and juiciness. Moisture is an important quality parameter that affects the extraction efficiency of pulp and the drying behaviour during fruit leather preparation. Comparable moisture contents in ripe guava fruits have been reported by Kadam *et al*. (2012), Chavan *et al*. (2014) and Bhasha *et al*. (2018)

Total Soluble Solids (TSS)

Fresh guava fruits exhibited a Total Soluble Solids (TSS) content of 8.42 ± 0.18 °Brix. TSS mainly represents the soluble sugars and other dissolved solids present in the fruit and serves as an important indicator of sweetness and maturity. The observed TSS value indicated that the fruits possessed desirable sweetness suitable for processing into fruit leather. Similar TSS values have been reported in ripe guava fruits by Kadam *et al*. (2012), Chavan *et al*. (2014) and Bhasha *et al*. (2018).

Titratable Acidity (%)

Fresh guava fruits exhibited a titratable acidity of 0.431 ± 0.002%. Titratable acidity is an important physicochemical attribute that influences the characteristic taste, flavour and overall quality of fruits. It reflects the organic acid content and plays an important role in maintaining a desirable sugar–acid balance, which serves as an indicator of fruit maturity and quality. The acidity value recorded in the present study was within the normal range reported for ripe guava fruits. Similar findings were reported by Kadam *et al*. (2012), Chavan *et al*. (2014) and Bhasha *et al*. (2018), although slight variations may occur due to differences in cultivar, maturity stage and environmental conditions.

pH

The fresh guava pulp exhibited a pH of 4.42 ± 0.19. The moderately acidic nature of the pulp is favourable for processing, as it helps suppress microbial growth and enhances product stability during storage. The observed pH is also desirable for the preparation of guava leather, as it contributes to better flavour balance and preservation. Comparable pH values in ripe guava fruits have been reported by Leite *et al*. (2009), Kadam *et al*. (2012), Chavan *et al*. (2014) and Bhasha *et al*. (2018).

Ascorbic Acid (mg/100g)

An average ascorbic acid content of 187.01 ± 0.18 mg/100 g was recorded in fresh guava fruits. Ascorbic acid is an important nutritional quality attribute due to its antioxidant properties and its role as a natural source of vitamin C. The high ascorbic acid content observed in the present study indicates that the fruits are nutritionally rich and suitable for the preparation of guava leather and other functional fruit products. Similar values have been reported by Kadam *et al*. (2012), Chavan *et al*. (2014) and Bhasha *et al*. (2018).

Total Sugar (%)

A total sugar content of 6.54 ± 0.02% was observed in fresh guava fruits. Total sugars play an important role in determining the sweetness, flavour and consumer acceptability of fresh and processed fruits. They also influence the texture and overall quality of guava leather by contributing to its desirable taste and sensory characteristics. The observed sugar level suggested that the fruits were adequately mature and suitable for processing into guava leather and other value-added products. Comparable results have been reported by Kadam *et al*. (2012), Chavan *et al*. (2014) and Bhasha *et al*. (2018).

Reducing Sugar (%)

The reducing sugar content of fresh guava fruits was 5.33 ± 0.03%. Reducing sugars contribute to the natural sweetness of the fruit and play an important role in flavour development and consumer acceptability. They also participate in non-enzymatic browning reactions during processing, which influence the colour, flavour and overall quality of fruit-based products such as guava leather. The observed reducing sugar content indicated that the fruits had attained an appropriate stage of ripeness and were suitable for processing. Comparable reducing sugar values in ripe guava fruits have been reported by Kadam *et al*. (2012), Chavan *et al*. (2014) and Bhasha *et al*. (2018).

Non-reducing Sugar (%)

The average non-reducing sugar content recorded in fresh guava fruits was 1.22 ± 0.02%. Non-reducing sugars, predominantly sucrose, contribute to the overall sweetness, flavour and palatability of the fruit. They also play an important role in maintaining the sugar balance, which influences the sensory quality and acceptability of processed products. The observed non-reducing sugar content indicated a balanced sugar composition, making the fruits suitable for guava leather processing and other value-added products. Similar observations have been reported by Kadam *et al*. (2012), Chavan *et al*. (2014) and Bhasha *et al*. (2018).

Conclusion

The present investigation was undertaken to assess the physico-chemical quality attributes of fresh ripe guava (*Psidium guajava* L.) cv. Lalit fruits as raw material for guava leather processing. The selected fruits were round in shape with an average fruit length of 6.87 ± 0.87 cm, fruit diameter of 7.66 ± 0.55 cm and fruit weight of 197.43 ± 39.75 g, indicating good physical quality for processing. The fruits contained 86.42 ± 1.04% moisture, 8.42 ± 0.18 °Brix Total Soluble Solids (TSS), 0.431 ± 0.002% titratable acidity, pH 4.42 ± 0.19, 187.01 ± 0.18 mg/100 g ascorbic acid, 6.54 ± 0.02% total sugar, 5.33 ± 0.03% reducing sugar and 1.22 ± 0.02% non-reducing sugar.

The observed physico-chemical quality attributes indicated that fresh ripe guava (*Psidium guajava* L.) cv. Lalit fruits possessed desirable characteristics required for guava leather processing. The high moisture and ascorbic acid contents, together with balanced acidity and sugar composition, suggest that the selected fruits are suitable as raw material for the preparation of high-quality guava leather. These baseline quality characteristics may also serve as useful reference data for future studies on guava processing and value-added fruit products.

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