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Dr. Pallavi Phalke
Matoshri Radha College of D. Pharmacy, Virgaon, Akole, Maharashtra, India

Mrs. Pratiksha Mhaske
Matoshri Radha College of D. Pharmacy, Virgaon, Akole, Maharashtra, India

Ahire Diksha
Matoshri Radha College of D. Pharmacy, Virgaon, Akole, Maharashtra, India

Gunjal Vaishnavi
Matoshri Radha College of D. Pharmacy, Virgaon, Akole, Maharashtra, India

Avhad Srushti
Matoshri Radha College of D. Pharmacy, Virgaon, Akole, Maharashtra, India

Navale Vrushali
Matoshri Radha College of D. Pharmacy, Virgaon, Akole, Maharashtra, India

Corresponding Author:
Dr. Pallavi Phalke
Matoshri Radha College of D. Pharmacy, Virgaon, Akole, Maharashtra, India

An extensive analysis of Guava (*Psidium Guajava L.*) Nutritional Makeup & Bioactive Potential

Pallavi Phalke, Pratiksha Mhaske, Ahire Diksha, Gunjal Vaishnavi, Avhad Srushti and Navale Vrushali

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Abstract
Guava (*Psidium guajava* L.) is an evergreen tree from the *Myrtaceae* family, native to Mexico and Central America. This fruit is typically found in tropical and subtropical regions throughout several countries. Guava is a great source of minerals and vitamins such as vitamins C, B, and potassium. Lycopene, manganese, iron, fibre, and calcium. Guava plant parts, including fruit and leaves, offer nutritional and medical benefits. Extracts from guava fruits and leaves can improve health. It exhibits numerous therapeutic qualities, including anticancer, antimalarial, antiobesity, antifungal, antibacterial, antidiabetic, and antihypertensive characteristics. The leaves contain phytochemicals that can alleviate coughs and colds. Nutraceuticals, including caffeic acid, gallic acid, flavonoids, apigenin, and hyperin, are believed to offer health advantages.

Keywords: *Psidium guajava*, Extract, Anti-inflammtory, Guava peel, anticancer, antimalarial, antiobesity, antifungal, antibacterial, antidiabetic, Myrtaceae

Introduction
Since ancient times, plants have been utilised extensively as a fundamental component of human nutrition and health because they include a number of phytochemicals, or secondary metabolites, that are essential to biological processes [1]. Since they help treat and prevent a variety of illnesses, these bioactive chemicals have been utilised in traditional medicines and provide a host of health benefits, promoting general well-being [2]. Although there are about 70, 000 plant species that can be used to treat illnesses, only 15% of them have had their medicinal qualities thoroughly investigated. It should be mentioned that plants are the source of almost 25% of the medications used today [3]. Malnutrition accounts for an average of 53% of deaths, with children under the age of five being particularly vulnerable [4]. As a result, there is a growing need to provide vital nutrients using affordable dietary supplements. The market for protein supplements is growing rapidly every day. In order to reduce the risk of health problems and enhance the nutritional value of the food, researchers and the food industry are actively looking for a substitute to animal protein. It is claimed that plantbased proteins are affordable for people of all income levels and that there are no compromises in the nutritional value [5]. Only the extraction procedure and the type of solvent system used can validate medicinally significant phytocompounds. The researchers prefer solvents with varying states of polarity in order to maximise active extraction. It was discovered that the solvent dissolves the phytocompounds with the same polarity by penetrating the leaf substance. Other variables that affect the extraction process include temperature, the type of solvent employed, duration, and metabolite makeup [6]. Drawn a lot of attention recently due to their potential for use in the creation of functional meals and nutraceuticals. These materials provide the leaves contain phytochemicals that can alleviate coughs and colds. Nutraceuticals, including caffeic acid, gallic acid, flavonoids, apigenin, and hyperin, are believed to offer health advantages. Seful option for food and pharmaceutical formulations as a functional ingredient because they are abundant in bioactive compounds like phenolics, flavonoids, and pigments. [7] Among these plants, the guava (*Psidium guajava* L.), a perennial fruit crop of tropical and subtropical regions

worldwide, is native to tropical America and is a member of the Myrtaceaceae family. It has gained commercial significance in a number of nations due to its hardiness, prolific output, and low maintenance needs. India, China, Mexico, Brazil, the Netherlands, and the Philippines are among the top guava-producing nations.

The guava (*Psidium guajava* L.), a small, evergreen tree that is considered a key member of the clan, is a member of the *Myrtaceae* family. According to reports, the plant first appeared in South American countries before migrating to other parts of the planet, particularly to different tropical and subtropical nations [8]. In tropical areas like India, Bangladesh, Indonesia, and South America, it is extensively planted and cultivated as a commercial fruit crop.The fruits of the tree are edible and high in nutrients, and all portions of the tree are said to have some therapeutic qualities. Due to its ability to thrive in a variety of edaphic climates, this commercial crop is quite practicable to cultivate [9]. It is gathered for its ability to treat a variety of human ailments in addition to its commercial worth. [10]

The biological effects of guava extracts, such as their hepatoprotective, antibacterial, anticancer, antioxidant, and ant-diarrheal qualities, have been studied. The constituents in guava extracts have a variety of biological properties, including anti inflammatory, hypoglycemic, anti-cancer, and antioxidant properties. [13]

Brief Overview of Guava: Taxonomical Classification, Distribution

Traditional uses.

Taxonomical classification

- **Division:** Spermophyta
- **Sub-division:** Angiospperm
- **Class:** Dicotyledons
- **Order:** Myrtales
- **Sub-order;** Myrtineae
- **Family:** *Myrtaceae*
- **Genus:** Psidium
- **Species:** guajava [14, 16]

Although there are over 100 species of tropical shrubs and small trees in the genus Psidium, *Psidium guajava* is the one that is most commonly grown for its delicious fruit. Depending on the cultivar, the guava fruit can be round or pear-shaped, with flesh that ranges in color from white to pink or red and skin that is green to yellow.

Distribution

Native Range

Parts of Mexico, the Caribbean, and northern Brazil are among the tropical regions of Central America and northern South America where guavas are indigenous.

Cultivation

Guava has been imported and naturalized in tropical and subtropical regions around the world because of its appeal and adaptability. It is grown extensively throughout: o Asia: Bangladesh, Pakistan, Indonesia, Thailand, the Philippines, and India (biggest producer is South America: Venezuela, Colombia, and Brazil, Africa, Egypt, South Africa, and Kenya.

Other: A portion of the Pacific and Caribbean islands

Climate and Soil

Warm tropical and subtropical temperatures, typically between 15 °C and 30 °C, are ideal for guava growth. Although it may grow in a variety of soil types, it favors sandy loams that drain well over clay loams. It is susceptible to cold, although it can tolerate moderate salt and dehydration.

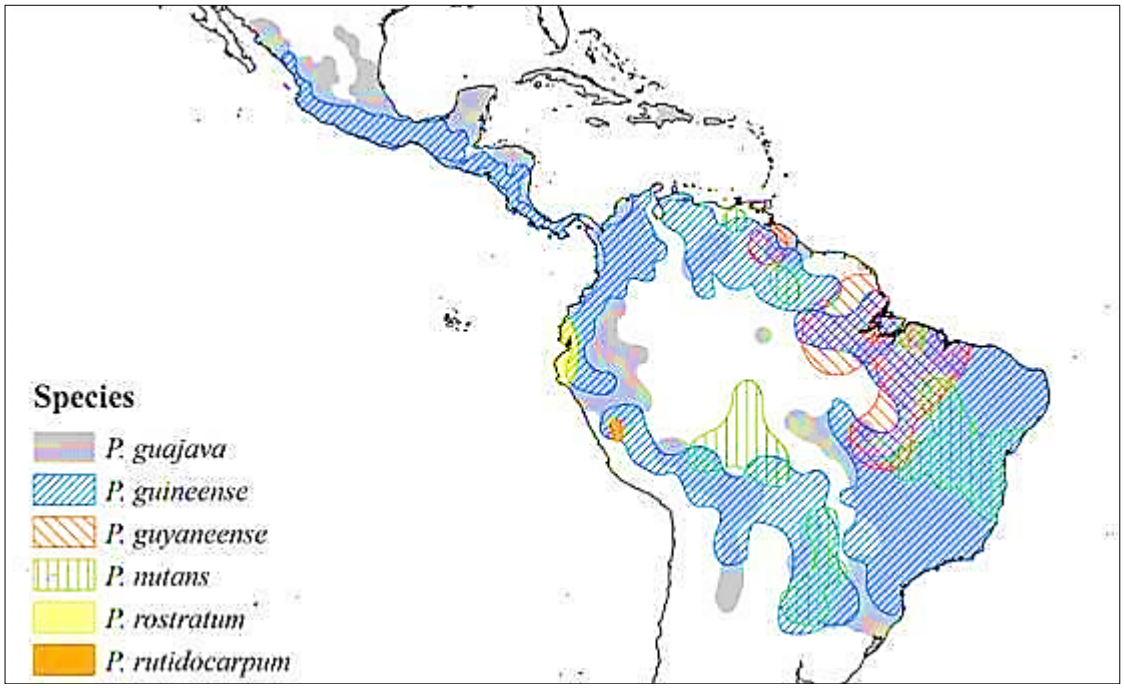

Fig 1: Distribution of guava species [15].

Traditional Uses

Guavas are eaten fresh all throughout the world, however in some cultures they are frequently topped with chile or salt.

The fruit is turned into sauces, ice creams, candies, preserves, jams, jellies, and juices.
Guava leaves can occasionally be used to drinks or food to enhance their flavor.

Medicinal uses

- **Digestive Health:** Guava leaves and fruit have long been used in traditional medicine to treat indigestion, diarrhea, and dysentery. Compounds with antibacterial and antiinflammatory properties are present in the leaves.
- **Wound Healing:** Because crushed guava leaves or pulp have antiseptic qualities, they are applied to cuts and wounds.
- **Anti-Diabetic:** Guava leaves are used in certain cultures' traditional medicine to help control blood sugar levels.
- **Respiratory Conditions:** Guava leaf tea helps treat bronchitis, sore throats, and coughs. Skin
- **Care:** Guava extracts are used to improve the condition of the skin and cure acne. [17, 18]

Table 1: Top Guava-Producing Countries in 2025; [16]

Rank	Country	Annual Production (Million Tonnes)
1	Indonesia	26.3
2	India	25.0
3	Iran	4.1
4	China	4.0
5	Taiwan	3.8
6	Palestine	2.8

Nutritional Composition of guava

Guava fruit has four to ten times more vitamin C than citrus fruit and contains nutritional fiber. About 56-500 mg of ascorbic acid can be found in a fresh, firm guava, however the skin contains the most ascorbic acid [18]. Guava contains about 84% moisture along with fat, protein, and carbs. Guava is regarded as a super fruit since it contains nutrients including vitamin A and C, folic acid, dietary minerals like manganese, copper, and potassium, and enhanced dietary fiber. [19]

Table 2: Nutrient Composition

Nutrient	Composition
Protein	0.1-0.6 mg
Moisture	2.79-5.5 g
Lipids	0.43-0.71 mg
Crude fibre	0.90-1 g
Carbohydrate	9.1-17.1 mg
Ash	9.6-10 mg
Iron	200-400 I.U.
Calcium	17.9-30 mg
Phosphorous	0.3-0.7 mg
Thiamine	0.03-0.05 mg
Riboflavin	0.6-1.067 mg
Vitamin	0.047mg
Vitamin C	37-50 mg
Niacin	40.0 I.U.

Pharmacological Benefits of Guava

Several different disease specialists have demonstrated that guava can treat a wide spectrum of ailments. Guava has been shown in ethnopharmacological evaluations, research centres, and clinical exploratory studies to be effective in the treatment of a variety of illnesses. Furthermore, hazardous quality evaluations of the plant's roots, bark, leaves, natural products, flowers, and seeds have been confirmed safe for therapeutic uses, both oral and topical, when employed in blends and development structures. [22]

Anti-inflammatory activity

Guava extract in ethyl acetate has been shown to reduce germ contamination and thymus development. It has the ability to operate as an antiviral agent. It can increase the expression of mRNA. Guava may have an effect on the protein heme oxygenase-1. Consequently, it can be utilised as a topical anti-inflammatory drug. [23]

Anti-cancer

Guava contains lycopene, an antioxidant that plays an important role in cancer prevention and treatment. Breast and prostate cancers respond best of all. Guavas' red flesh contains more lycopene than the other varieties. Lycopene acts by scavenging free radicals and keeping new
ones from forming. Many researches have demonstrated that an aqueous extract of guava developing leaves has antiprostate cancer activity in a cell line model, implying that it could be a feasible anti-androgen-sensitive prostate cancer treatment. Guava also has a high concentration of carotene, which is[24].

Antioxidant activity

Psidium guajava is an abundant source of phytochemical antioxidants. Guava is a powerful antioxidant and a high source of vitamin C. Guava's leaves contain polyphenols, which provide them antioxidant characteristics. Guava leaf extracts and essential oil from the stem and bark will scavenge free hydrogen peroxide and superoxide anion radicals, and prevent hydroxyl radical formation. Guava's antioxidant capabilities can be attributed to quercetin, carotenoids, vitamin C, and polyphenols Dakappa [25]

Antibacterial

Guava extracts are bactericidal against both Gramme positive and Gramme negative pathogens. In vitro, an aqueous mixture and a water-soluble methanol extract from guava leaves and bark shown strong antibacterial activity against multidrug-resistant Vibrio cholera [26]

Wound healer

According to Ravi and Divyashree (2014) [21], the gingival and periodontal ligaments are composed of collagen fibres. The most common cell type found in periodontal connective tissue is fibroblasts. Vitamin C is essential for the periodontium's overall health. Guava has an abundance of vitamin C (ascorbic acid).
Through its effects on the extracellular matrix, ascorbic acid can regulate the expression of the procollagen gene, resulting in collagen organisation and changing fibroblast separation. Sore gums should be treated with a root bark mouthwash, whereas swollen, bleeding gums should be treated with a leaf gargle [28]

Fig 2: Raw guava [21]

Conclusion

Guava (*Psidium guajava* L.) is well-known around the world for its culinary and nutritional value. Guavas were added to the list of super fruits due to their high levels of folic acid, dietary fibre, potassium, and minerals. Some post-harvest losses occurred as a result of faulty handling, shipping, and processing, with 20 - 25% of guava spoiling before it reached consumers. Guava goods such as RTS, nectar, guava leather, and many others are very essential. The produced goods tasted fantastic, had a high nutritional value, retained the original fruit flavour, and were safe to consume.

Guava also has pharmacological effects and has been shown to help treat a variety of diseases. Numerous research and published literature have shown that it possesses strong antioxidant, anti-cancer, antibacterial, ant-inflammatory, wound healer, effects. [27]

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