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NUTRITIONAL VALUES AND PHARMACOLOGICAL EFFECT OF GUAVA (PSIDIUM GUAJAVA L.)

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Abstract

The fruit crop guava (Psidium guajava L.) is widely employed in traditional medicine and diets throughout the tropical and subtropical regions. The scientific name for guava is Psidium guajava L., and it is a member of the Myrtaceae family. There are about 150 types of guava that grow worldwide, with the common guava, cattley guava, peer guava, and apple guava being the most popular. The world was anticipated to produce 500,000 metric tonnes of guavas, with significant production coming from South American nations including Brazil, Colombia, and Mexico.Based on its nutritional content, it is rich in specific elements including protein, carbohydrates, vitamins, and minerals that act as health boosters for the human body. A few of the commercial goods made with guava are guava pulp, guava leathers, guava juice and nectars, guava wine, guava dehydrated slices, and blended ready-to-serve beverages. Antioxidants, anti-inflammatory, antiviral, antiparasitic, antibacterial, wound-healing, and anticancer properties are among the pharmacological potentials of guava.

Keywords; Psidium guajava L., production, variety, bioactive potential, nutrients.

Introduction

Vitamins and minerals are abundant in fruits. With an annual production of roughly 45 MT, India is the world's second-largest fruit grower. Guava is one of the most significant and extensively cultivated fruits of all. It's regarded as one of the most abundant sources of vitamin C. It is accessible in the winter and throughout the wet season. Twenty to twenty-five percent of guava fruit spoils before it reaches the consumer as a result of improper handling, transportation, and processing. Because of its inexpensive price, guava is referred to as the "apple of the poor." The southern regions of Mexico and Central America are where it first originated [1]. Guava is scientifically known as Psidium guajava L. Of the approximately 150 guava species found globally, the common guava, cattley guava, peer guava, and apple guava are the most significant varieties. Because of its deliciousness, the common guava (Psidium guajava L.) species is commonly grown in Pakistan, producing between 100 and 300 fruits per tree. The guava is a tropical fruit that ripens quickly and is one of the most perishable fruits. Guava fruit can therefore be stored for two to three days at room temperature. Depending on the kind, this fruit has come in a range of sizes, shapes, and flavors. The distinctively musky flavor of guava fruit is diminished by processing [2]. Guava fruit typically weighs between 150 and 250 grams [3]. Typically, the fruit has a diameter of 3 to 10 cm and is shaped like a circle. It's a very successful and productive fruit crop [4]. It is rich in dietary fiber, vitamins A and C, folic acid, and minerals like potassium, copper, manganese, etc. because of its nutritional makeup [5]. In all tropical and subtropical climates, including India, guava is commonly grown. It was first

grown in India in the seventeenth century. Many kinds are grown in many Indian states, including Banglore, Dharwar, Hafshi, ArkaAmulya, Harija, Lucknow-49, Chittidar, Nagapur seedless, and Allahabad Safeda [12]. There are a wide variety of guava-based items on the market, including squash, yogurt, ice cream, jellies, juices, and ice cream. It can be consumed and is also eaten uncooked. Due to its nutritional makeup, it is high in folic acid, potassium, copper, manganese, and other minerals, as well as dietary fiber, vitamins A and C, and folic acid (Prabhudesai et al., 2019) [20]. In all tropical and subtropical climates, including India, guava is commonly grown. It was first grown in India in the seventeenth century. Many kinds are grown in many Indian states, including Banglore, Dharwar, Hafshi, Arka Amulya, Harija, Lucknow-49, Chittidar, Nagapur seedless, and Allahabad Safeda [6]. There are a wide variety of guava-based items on the market, including squash, yogurt, ice cream, jellies, juices, and ice cream. It can also be eaten fresh and used to make sweet dishes like guava paste or cheese [7].

Common Names [8]

Guava is known as various names in various regions of the world. The common names of Psidium guajava include.

Arabic	Guwafah
Bengali	Piara
Brazil	Araca
Cambodia	Trapaeksruk
Chinese	Fan shiliu
English	Apple guava
French	Gouyave
Germany	Guavenbaum
India	Amarood; jamba
Portuguese	Goiaba
Spanish	Guayaba
Thailand	Farang
Philippines	Bayabas

Taxonomical Classification [9]

The taxonomical classification of the plant is

Kingdom	Plantae
Subkingdom	Tracheobionta
Division	Magnoliophyta
Class	Magnoliopsida
Sub-class	Rosidae
Order	Myrtales
Family	Myrtaceae
Genus	Psidium
Species	Psidium guajava

Plant Description [10] Psidium guajava is a shrub or small tree that typically grows to a height of 1-6 m, however it can occasionally reach a height of 10 m. The smooth, light reddish-brown bark of the elder stems peels off in flakes. As a result, the trunks can occasionally appear mottled due to the recently exposed bark's slightly greenish-brown hue. The younger stems are somewhat quadrangular (quadrangular), hairy (pubescent), and greenish in color. The simple leaves are carried on short stalks, called petioles, that are 4–10 mm long and are arranged in opposition along the stems. The leaf blades are rather oval in shape, measuring 7–15 cm long and 3–7 cm wide. They have rounded (obtuse) bases and pointy (ovate-elliptic or oblong-elliptic) tips.

They are typically drab green in color, have complete borders, and hairy (pubescent) undersides, especially when they are young. Every leaf includes 10–20 pairs of quite noticeable side veins, known as lateral veins, in addition to a prominent center vein known as the midrib. Usually, the flowers are borne singly in the axils of the top leaves. These 25 mm-diameter flowers are carried on a 1-2.5 cm-long pubescent peduncle, which is a hairy stalk. Each flower has four or five white petals (10–20 mm long) and four or five green sepals (6–15 mm long) that are joined together at the base. They also feature a style that is 6 to 12 mm long and has a stigma on top, along with a huge number of little white stamens (200–250) that are 6 to 10 mm long.

The fruit has three different shapes: globose, ovoid, and pyriform. As it ages, its green color changes to a yellowish hue. These berries, which are 2.5–10 cm long, have a rich flesh that is pink, white, or yellowish in color and contains a large number of seeds. On top of the berries are the remnants of the persistent sepals, known as calyx lobes. The seeds have a kidney-shaped morphology and are yellow in color (reniform). Fruit from both domesticated and untamed trees is utilized to promote their spread.

Fig.1; Guava Fruits

Nutritional composition of guava fruit

The guava fruit is a nutritious and beneficial fruit since it is rich in various essential components. Guava also has medicinal as well as pharmacological qualities. A neutral amount of beta-carotene can be found in guavas[11]. Mature fruits are a recommended component of a daily diet due to their high nutritional value [12]. Included are high concentrations of triterpene, carotenoids, cellulose, hemicellulose, lignin, fiber, phenols, flavonoids, essential oils, fatty acids, and vitamins. Vitamin A, thiamine (B1), niacin (B3), riboflavin (B2), and pantothenic acid (B5) are present in significant amounts in the fruit.

There are also a fair number of minerals present, including calcium, phosphorus, sodium, potassium, and iron[13]. Two of the most prevalent antioxidants found in fruits are polyphenols and ascorbic acid [14]. Esters and glycosides are the main forms of polyphenols, the majority of which are flavonoids. Guava also contains glycosides and free elagic acid of myricetin and apigenin [15].

Guava leaves

The width and length of guava leaves (Psidium guajava L.) are approximately 1 to 2 inches and 2 to 6 inches, respectively. When crushed, they release a strong scent and have a rigid, dull-green appearance, but they are also coriaceous and have noticeable veins. Their biological features have led to their use as a traditional medicine for a number of years. Its leaf yields large amounts of phenolic phytochemicals, which prevent the body's peroxidation reaction and can therefore be assumed to prevent a variety of chronic illnesses, including diabetes, heart disease, and cancer [16].

Composition of guava leaves

Guava leaves contain the following: asparagine, trans-aconic acid, cis-aconic acid, xanthine, epicathechin, glutamic acid, ascorbic acid, acetic acid, asparagine, and maleic acid. P. guajava Linn leaves yield essential oils that are rich in triterpenes, tannins, and cineol. Additionally, it was discovered that the leaves contained three flavonoids: guaijaverin, avicularin, and quercetin [17].

Bioactive compounds of guava leaves

Guava leaves are abundant in bioactive compounds, which are extracted using ethyl acetate in order to use them in the creation of value-added products. It has been reported that guava compounds can also be extracted using water, ethanol, and methanol, and that water extracts contain the highest concentration of phenolic compounds [18]. Guava leaves include eight flavonoids: kaempferol, quercetin, iso-quercetin, guaijaverin, avicularin, hyperoside, and reynoutrin. They also contain one diphenyl methane and one benzophenone [19]. The roles of a few of the bioactive substances are displayed in the following table:

Properties of guava

Anti-oxidant, medicinal/pharmacological, antiinflammatory and anti-microbial properties of guava are following.

Nutrient	Value per 100g	Unit	Benefits	References
Water	80	g	Regulate or maintain body temperature	[20]
Energy	68	Kcal	Helps to perform whole day activities	[20]
Dietary Fibers	5.4	g	Health of digestive system remains good	[20]
Carbohydrate	14.32	g	Provide energy and spare protein and fat for other body functions	[20]
Protein	2.55	g	Helps in growth, development and repair damaged cells	[20]
Fat	0.95	G	Provide/store energy and spare protein to perform its functions	[20]

Table 1 : Nutritional value for 100g of Guava

Minerals	Value per 100g	Unit	Benefits	References
Iron (Fe)	0.26	mg	Vital mineral for proper function of hemoglobin	[21]
Potassium (K)	417	mg	Increase muscles strength Maintain blood pressure	[21]
Calcium (Ca)	18	mg	Strengthen bones Built teeth and bones	[21]
Zinc (Zn)	0.23	mg	Important in wound healing	[21]
Sodium (Na)	2	mg	Control fluid balance in body	[21]
Selenium (Se)	0.6	mg	Prevent from heart disease Cure asthma	[21]

Table 2 :Minerals value for 100g of Guava

Vitamins	Value per 100g	Unit	Benefits	References
Vitamin C	228.3	mg	Form collagen Increase iron absorption	[12]
Vitamin K	2.6	mg	Helps in blood clotting	[12]
Vitamin E	0.73	mg	Protect cells from damage	[12]
Vitamin B6	0.110	mg	Assist body to deal with stress	[12]
Beta-carotene	374	mg	Vital for healthy skin	[12]
Folate	49	mg	Helps in body growth and development	[12]
Riboflavin	0.040	mg	Helps to convert carbohydrates into energy (ATP)	[12]
Thiamin	0.067	mg	Important for metabolism of pyruvate	[12]
Niacin	1.084	mg	Assist body to convert the carbohydrates into glucose	[12]

Table 3: Vitamins value for 100g of Guava

Bioactive compounds of guava leaves and their functions

Bioactive compounds	Functions	References
Gallic acid	Reduce cholesterol levels, inhibit protein glycation and anti-diabetic	[22]
Catechins	Reduce cholesterol levels, inhibit protein glycation, prevent from diabetes type 2 and obesity	[22]
Epicathechin	Reduce cholesterol levels	[22]
Quercetin	Hypocholesterolemic, antioxidant, reduces heart diseases and inhibit protein glycation	[23]
Rutin	Inhibiting adipocytes from accumulating triglycerides and hepatoprotective	[23]
Naringenin	Cytostatic activity (against all cell lines)	[24]
Kaempferol	Cytostatic activity (against all cell lines), anti-cancer as well as hepatoprotective	[24]
Betulinic acid	Anti-diabetic, prevention from atherosclerosis, obesity and cardiovascular diseases	[25]
Lupeol	Anti-diabetic, prevention from atherosclerosis, obesity and cardiovascular diseases	[26]
Avicularin	Inhibition of urease	[27]

Guaijaverin	Inhibition of urease	[27]

Pharmacological Effect

Different solvents are employed to extract the sample, and different parts of the plant or fruit have been used for various pharmacological activities. Different activities employ extracts at different concentrations.

Pharmacological Effect	Extract	Conc.	Pharmacological Activity	Ref.
Antioxidant activity	Water	0.63 g/L	Respectively showed effects on scavenging hydroxyl radicals and inhibiting lipid peroxidation.	[28]
	65% Ethanol	0.47 g/L		
	95% Ethanol	0.58 g/L		
Treatment of cough	Water	2 and 5 g/kg	Decreased frequency of cough by 35% and 54%, as compared to the control, within 10 min after injection of the extract.	[29]
Anti-diabetic activity	Water	250mg/kg	Showed statistically significant hypoglycaemic activity.	[30-31]
	Methanol	0.2-1.0 ml	The % inhibitory activity against the alpha-amylase enzyme increased in a dose-dependent manner. Plant extract demonstrated a percentage of inhibition of 27.8% at a concentration of 0.2 ml and 96.3% at 1.0 ml.	
Antibacterial activity	Water	10.0, 5.0 & 0.16 mg/ml	Showed antibacterial activity against S. suis, P. multocida, E. coli and S. typhimurium.	[32]
	75% Methanol	5.0 & 0.16 mg/ml		
	Acetone	20.0 & 0.31 mg/ml	Showed antibacterial activity against only S. Suis and P. Multocida.	
Hepatoprotective Activity	Water	250 and 500mg/kg	Significantly reduced the elevated serum levels of aspartate aminotransferase, alanine aminotransferase, alkaline phosphatise and bilirubin	[33]
Anti-diarrhoeal Activity	Water	50-400 mg/ kg	Significant protection of rats and mice against castor oil-induced diarrhoea, inhibited intestinal transit, and delayed gastric emptying.	[34]
		1 mg/kg	Significant antimotility effect, and caused dose-related inhibition of castor oil-induced enteropooling in the animals.	
		10 mg/kg	Significant delayed the onset of castor oil-induced diarrhoea.	
Contractile effect	Water	0.25-2 mg/ ml	Psidium guajava significantly contracted aorta rings. The effect of P. guajavawas to a large extent mediated by activation of alpha-adrenoceptor and to a lesser extent by acting via calcium ion channel.	[35]
Anti-hypotensive effect	Water	50-800 mg/ kg	Reductions in systemic arterial blood pressures and heart rates of hypertensive were examined in normal and diabetic rats	[36]
Analgesic & antiinflammatory	Water	50-800 mg/ kg	P. guajava leaf aqueous extract produced dose-dependent and	[37]

Activity			significant ($p < 0.05$-0.001) inhibition of fresh egg albumin-induced acute inflammation (edema) in rats	
Anticancer activity	Acetone	250µg/ml	Showed 35.5% inhibition against growth of HT-29 cells	[38]
	Water	1.5 mg/day	A Psidium guajava leaf has been shown to possess antiprostate cancer activity. It diminished both the prostate specific antigen (PSA) serum levels and tumor size in a xenograft mouse tumor model.	[39]
	Essential oil	0.019-4.962 mg/ml	Psidium guajava was highly effective in reducing the growth of human mouth Epidermal carcinoma (KB) and murine leukemia (P388) cell lines	[40]
Anti-hypertensive effect	Water and ethanol	0.5 g/kg body weight 2.0 g/kg body weight	Final systolic blood pressure values from the beginning and the end of the experimental Spontaneous Hypertensive Rats in 0.5 and 2.0 mg/ml were 231-179 mmHg and 246- 169mm Hg. These results were significantly lower when the beginning until the end of the experiment	[41]
Antifungal activity	Hexane	50mg/ml	It showed the best antifungal activity against Trichophyton rubrum, Trichophyton tonsurans, Sporotrix schenckii, Microsporum canis, Cryptococcus neoformans, Candida parapsilosis, and Candida albicans	[42]
	Acetone		Only showed the activity against Cryptococcus neoformans, Candida parapsilosis, and Candida albicans	
	Methanol		Only showed the activity against Cryptococcus neoformans, Candida parapsilosis, and Candida albicans.	
Anti-proliferative activity	Water	29.0 ± 0.4 µg/ml	P. guajava extracts exhibited equivalently potent antiproliferative activity towards KB cells with IC50 values.	[43]
Antipyretic activity	Water	200 mg/kg	The extract and aspirin produced comparable antipyretic effects up to 60 min.	[44]
Treatmentof plaque	Methanol	2mg/ml, 4mg/ml	The active flavonoid compound, quercetin-3-Oalpha-l-arabinopyranoside (guaijaverin) isolated from Psidium guajava demonstrated high potential antiplaque agent by inhibiting the growth of the Strep. Mutans	[45]
Spermato protective activity	Ethanol	250 mg/ kg/d and 500 mg/ kg/d	The extracts of the leaves of Psidium guajava Linn. possess beneficial effects on sperm production and quality, and may	[46]

			thus improve the sperm parameters of infertile males with oligospermia and nonobstructive azoospermia.	
Spasmolytic effect	Methanol	-	The spasmolytic activity of the Psidium guajava leaf is mainly due to the aglycone quercetin, present in the leaf and in the extract mainly in the form of five flavonols, and whose effect is produced when these products are hydrolyzed by gastrointestinal fluid.	[47]
Immuno modulatory activity	-	55 microg/ ml	Extracts derived from Psidium guajava revealed immunomodulatory activities.	[48]
Anti-malarial activity	Acqueous	10-20 microgra/ml	The leaves are used as an ingredient in the preparation of fever "teas". They are also used as a part of the pot herb used in steam treatment for malaria. The stem bark extract contained anthraquinones, flavonoids, seccoirridoids and terpenoids and was found to be effective for the treatment and/or prophylaxis of malaria	[49]

Conclusion

Worldwide, guava (Psidium guajava L.) is highly renowned for its culinary and nutritional qualities. Because guavas are rich in potassium, minerals, dietary fiber, and folic acid, they were also listed among the super fruits. Due to inappropriate handling, shipping, and processing, 20–25% of the guava crop rotted before it was consumed, resulting in some post-harvest losses. Guava-derived goods, including guava leather, juice, RTS, and many more, are highly significant. The created items retained the original fruit flavor, tasted fantastic, and were safe to consume. They also had a high nutritional content. Guava has been shown to be helpful in the treatment of a number of illnesses and has some pharmacological advantages as well. Numerous research and published literature have demonstrated its potent antioxidant, antiparasitic, antibacterial, anti-inflammatory, wound-healing, and antimicrobial activities.

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