WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.074
Volume 7, Issue 8, 201-211. Review Article ISSN 2277– 7105

PHARMACOLOGICAL ACTIVITY OF *Psidium guajava* LEAVES - A REVIEW

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Article Received on
28 Feb. 2018,

Revised on 20 March 2018,
Accepted on 10 April 2018,

DOI: 10.20959/wjpr20188-11782

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ABSTRACT

Plants for thousands of years have been used to enhance health and for medicinal purposes. *Psidium guajava* is one which has an enormous wealth of medicinal value. One of such nutritionally fit and commonly available plant is *Psidium guajava* (Guava) belongs to the family Myrtaceae. Guava (*P. guajava Linn.*) is a traditionally used plant because of its food and nutritional value. Guava is widely grown in tropical areas like India, Bangladesh, Florida, and West Indies. Different parts of the *P. guajava* are reported to be used in folk medicine. There are three different varieties of guava, ripe apple guavas (*Psidium guajava*), lemon guava *(Psidium littorale vas. littorale*) and strawberry guava (*Psidium littoralevar. cattleianum*). All parts of this tree, including fruits, leaves, bark, and roots, have Been used for treating stomach ache and diarrhea in many countries The chemical constituents present in the leaves of *Psidium guava* and *Psidium guajava L* were found out using different solvents The goal of this review represents chemical constituents and pharmacological activities of the *Psidium guajava.* The pharmacological activity of its major components, and the results indicate antimicrobial activity, anti-diabetic activity, radiomodulatory role, anti-inflammatory activity, hepatoprotective activity**,** antioxidant, antitumor, anticancer activity, cardiovascular, hypotensive effects activities.

KEYWORDS: *Psidium guajava*, antimicrobial activity, anti-diabetic activity, radiomodulatory role, anti-inflammatory activity, hepatoprotective activity, pharmacological activities.

INTRODUCTION

The use of plants as medicines predates written human history. Ethno botany (the study of traditional human uses of plants) is recognized as an effective way to discover future medicines.[1] The World Health Organisation (WHO) estimates that 80% of the population of some Asian and African countries presently uses herbal medicine for some aspect of primary health care.[2]

Many antioxidant compounds can be found in fruits and vegetables including phenolics, carotenoids, anthocyanins, and tocopherol.[3] Approximately 20% of known plants have been used in pharmaceutical studies, impacting the healthcare system in positive ways such as treating cancer and harmful diseases.[4] Plants are able to produce a large number of diverse bioactive compounds. High concentrations of phytochemicals, which may protect against free radical damage, accumulate in fruits and vegetables.[5] Plants containing beneficial phytochemicals may supplement the needs of the human body by acting as natural antioxidants.[6] Various studies have shown that many plants are rich source of antioxidants. For instance, vitamins A, C, E, and phenolic compounds such as flavonoids, tannins, and lignins, found in plants, all act as antioxidants.[5] The consumption of fruits and vegetables has been linked with several health benefits, a result of medicinal properties and high nutritional value.[7]

Antioxidants control and reduce the oxidative damage in foods by delaying or inhibiting oxidation caused by reactive oxygen species (ROS), ultimately increasing the shelf-life and quality of these foods.[8] Beta carotene, ascorbic acid, and many phenolics play dynamic roles in delaying aging, reducing inflammation, and preventing certain cancers.[9] Increasing the consumption of fruits and vegetables has been recommended by many agencies and health care systems throughout the world.[10] The objective of this paper is to provide a review of phytochemical studies that have a supporting evidence for pharmacological activity of *Psidium guajava* leaves.

Distribution

Guava (*Psidium guajava* Linn.) is native to and widely distributed in Mexico and Central America. However, the plant is cultivated today from the west coast of Africa to the Pacific region, including India and China, with varieties originally introduced over the past 300 years from the United States.

Plant Description

It is a low evergreen tree or shrub 6 to 25 feet high, with wide-spreading branches and square, downy twigs. The branches are crooked, bringing opposite leaves. The flowers are white, incurved petals, 2 or 3 in the leaf axils, they are fragrant, with four to six petals and yellow anthers.

Fig 1: *Psidium guajava* leaves.

The leaves

The leaves contains essential oil with the main components beings α-pinene, *β*-pinene limonene, menthol, terpenyl acetate, isopropyl alcohol, longicyclene, caryophyllene, *β*-bisabolene, caryophyllene oxide, *β*-copanene, farnesene, humulene, selinene, cardinene and curcumene. The essential oil from the leaves has been shown contain, nerolidiol, *β*-sitosterol, ursolic, crategolic, and guayavolic acids have also been identified.[11]

The fruit

The fruits also contain vitamin C[12] vitamin A, iron, calcium and phosphorus.[11,13] Guavas are up to 5 times richer in vitamin C than oranges.[14] Manganese is also present in the plant in combination with phosphoric, oxalic and malic acids.[15] The fruit contains saponin combined with oleanolic acid. Morin-3-O-α-L-lyxopyranoside and morin-3-O-α-L-arabopyranoside and flavonoids, guaijavarin and quercetin.[16]

The fruit skin

Ascorbic acid is mainly in the skin, secondary in the firm flesh and little in the central pulp– varies from 56 to 600 mg. and may range to 350-450 mg in nearly ripe fruit. It can decline to 50- 100 mg. The strong odour of the fruit is attributed to carbonyl compounds.

The bark

The bark contains 12-30 % of tannin and one source says it contains tannin 27.4 % or polyphenols,[13] resin and crystals of calcium oxalate.[15] The roots are also rich in tannin [Quisumbing]. The plant also contains leukocyanidins, sterols, and gallic acid in the roots. There is a high percentage of carbohydrate and salts. Root, stem – bark and leaves contain a large percentage of tannic acid.[11]

The seeds

The seeds which are very small but abundant in the fruit and have been reported to contain 14 % oil on dry weight, with 15 % proteins and 13 % starch Ten phenolic and flavonoid compounds including one new acylated flavonol glycoside were isolated.

The twigs

Twigs contain calcium, magnesium, phosphorus, potassium, and sodium. It also contain minerals such as fluoride, copper, iron, zinc, manganese, and lead in minute amounts.[17]

Scientific Classification

Botanical name: *Psidium guajava*

Family: Myrtaceae

Taxonomic classification

Kingdom: Plantae

Division: Magnoliophyta

Class: Magnoliopsida

Order: Myrtales

Genus: Psidium

Species: guajava

Vernacular Names

1. **Hindi-** Amrood, Amarut
2. **English-** Guava
3. **Sanskrit-** Draksa, Perala, Amaratafalam
4. **Gujarat-** Jamrukh

Ethanobotany

P. guajava has a long history of traditional use, a good proportion of which have been validated by scientific research. The ethno-medicinal uses include the crushing of the leaves and the application of the extract on wounds, boils, skin and soft tissue infectious site. Stem, bark and root-bark are astringent. Unripe fruit is indigestible, causes vomiting and feverish. Fruit is laxative, leaves are astringent. Locally, decoction of the leaves is with much benefit to the prolapsus ani of children; ache upsets and for vertigo. *P. guajava* leaf is a phytotherapic used to treat gastrointestinal and respiratory disturbances and is used as anti-inflammatory medicine. Its anti-amoebic and antimalarial effects have also been documented.

The plant *P.guajava* Linn. has an ethanomedical history as it has various activities especially functionally against the hyperglycemia.

Pharmacological Studies

1. Antimicrobial activity

A strong microbial action of guava leaves on Gram negative and Gram positive organisms has been reported The Psidium guajava leaves extracts (aqueous and methanolic) show antimicrobial activity against on bacterial elastase from Pseudomonas aeruginosa and human neutrophil elastase (HNE) but the methanolic extract of the leaves showed good inhibitory capacity, more than that of the aqueous extract against both enzymes, elastase of P. aeruginosa and HNE.[18] The extract also showed *in vitro* anti microbial activity *Escherichia coli, Salmonella typhi, Staphylococcus aureus,*[19] *Proteus mirabilis,* and *Shigella dysenteria*.[11] The leaves are rich in tannin, and have antiseptic properties.[12] Three antibacterial substances have been detected in the leaves which are derivatives of quercetin.

The flavone derivatives isolated were reported to inhibit the growth of *Staphylococcus aureus* in a dilution of 1:10,000.[20] The bark was also shown to exhibit antibacterial effects,[21] it might well be that this activity could be attributed to the tannins present.[22] The effectiveness of Guava as an antimicrobial was confirmed by,[23] four antibacterial compounds were isolated from leaves of guava (*P. guajava)* two new flavonoid glycosides, morin-3-O-α-L-lyxopyranoside and morin-3-O-alpha-L-arabopyranoside, and two known flavonoids, guaijavarin and quercetin.[16]

Bark tincture exhibited higher efficacy in controlling the mycelial growth of dermatophytes than the leaf tincture. The tincture showed fungicidal property in different concentrations

against *Trichophyton tonsurans*, *T. rubrum*, *Trichosporon beigelii*, *Microsporum fulvum* and *M. gypseum* but exhibited only fungistatic property in case of *C. albicans*.[24,25]

2. Anti-diabetic activity

The effect of *Psidium guajava* bark, leaves and fruit as anti-diabetic agents has been studied by several authors.[26] The administration of aqueous extract of *Psidium guajava* leaves for 30 days showed a significant reduction in blood glucose, urea, body weight, liver glycogen and serum cholesterol.when a decoction of *Psidium guajava* leaves was assessed for hypoglycaemic activity on alloxan-induced diabetic rats a statistically significant hypoglycaemic activity,[27,28] was screened. It was observed that in *vitro* alpha–glucosidase inhibition that slowed down the digestion of carbohydrate *in vivo*.[29] Diabetes was induced by streptozotocin in rats and 6 streptozotocin induced diabetic rats was used. The leaf extract of *Psidium guajava* consists of many compounds and among it, the phenolic compound showed effective inhibition on glycation of albumin. Tannins, flavonoids, pentacyclic triterpenoids, guiajaverin, quercetin, and other chemical compounds present in the plant are speculated to account for the observed hypoglycaemic and hypotensive effects of the leaf extract.[30]

3. Anti-Ulcer activity

Study showed rats pretreated with *P guajava* extract from fresh tender leaves showed antiulcer activity in aspirin-induced gastric ulcer model with a significant reduction of ulcer index, pepsin activity, free and total acidity, volume and mucus content of gastric juice. Antioxidants and reduced oxidative stress and also increase the level of HDL cholesterol significantly.[31]

3. Radiomodulatory Role

The hydroalcoholic leaf extracts of *Psidium guajava* (P.G) had radioprotective activity among rats exposed to X rays. The X rays damage normal tissues leading to their death or transforming them into cancerous tissues. *Psidium guajava* leaf extract increased the levels of antioxidant enzymes which prevented the tissue damage, so that the *Psidium guajava* have powerful antioxidant activity *in vitro* and could be beneficial in combating radiation induced damage in living systems.[32]

4. Anti-inflammatory Activity

Psidium guajava L. has been used traditionally against gastrointestinal disturbances and respiratory ailments. The inhibition of lipoxygenase by essential oil of both leaves and fruits rationally explain their pharmacological use in the form of inhalation to improve several upper respiratory tract ailments associated with inflammation.[33]

5. Hepatoprotective activity

The hepatoprotective and antioxidant effect of the aqueous extract of Psidium guajava leaf in Wistar albino rats is well documented and supported by histopathology.[34]

6. Antioxidant, Antitumor, Anticancer Activity

Psidium guajava L leaves are used in traditional medicines for the treatment of cancer, inflammation and other ailments. *P. guajava* leaf extracts play a substantial role against oxidant, cancer and tumour by virtue of its ferric-reducing antioxidant power (FRAP) and 2, 2-diphenyl-1-picryl hydrazil (DPPH) assay.[35,36] Dried leaves of *Psidium guajava* were extracted with hot water. The aqueous extract of *Psidium guajava* leaves inhibited (the viability) of the cancer cell line DU-145 in a dose-dependent manner.[37] Essential oil extracted from leaves of *Psidium guajava* was highly effective in reducing the growth of human mouth epidermal carcinoma (KB) and murine leukemia (P388) cell lines when they were treated with the oil.[38]

7. Cardiovascular, hypotensive effects

Cardiovascular diseases are common in the general population, affecting the majority of adults, past the age of 50 years.[39] An aqueous leaf extract of *Psidium guajava* significantly reduced high-energy phosphates and malondialdehyde (MDA) in the reperfused hearts on myocardial injury in the model of global ischemia followed by reperfusion. Further aqueous leaf extract of *Psidium guajava* exhibited cardioprotective effects against myocardial ischemia-reperfusion injury in isolated rat hearts. Augmentation of endogenous antioxidants, maintenance of the myocardial antioxidant status and significant restoration of most of the altered hemodynamic parameters may have contributed to its cardioprotective effect.[40] it was observed that aqueous and ethanolic leaf extracts of *Psidium guajava* inhibits intracellular calcium release. A guava leaf extract may therefore be beneficial for the prevention of cardiovascular diseases, also since its traditional use in hypertension is well established.[41]

8. Anti dengue Activity

Psidium guajava leaf extract showed the inhibition properties against the growth of dengue virus as it helps to increases platelet counts in patients with the dengue fever. Boiled water with guava leaves was used to avoid bleeding in dengue haemorrhagic fever with increase in platelet counts to 100000/mm3 within a period of nearly 16 hours.[42]

CONCLUSION

Psidium guajava (Linn.) is popularly known as 'poor man's apple of the tropics', has a long history of traditional use for a wide range of diseases. Much of the traditional uses have been validated by scientific research. Toxicity studies in mice and other animal models as well as controlled human studies show both leaf and fruit are safe without any side effects. The plant has been extensively studied in terms of pharmacological activity of its major components, and the results indicate antimicrobial activity, anti-diabetic activity, radiomodulatory role, anti-inflammatory activity, hepatoprotective activity**,** antioxidant, antitumor, anticancer activity, cardiovascular, hypotensive effects activities. In recent years, emphasis of research has been on utilizing traditional medicines that have a long and proven history of treating various ailments.

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