



E-ISSN: 2278-4136

P-ISSN: 2349-8234

[www.phytojournal.com](http://www.phytojournal.com)

JPP 2021; 10(2): 807-810

Received: 18-12-2020

Accepted: 05-02-2021

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## Rich medicinal qualities of poor man's apple- *Psidium guajava* L.

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**Abstract**

*Psidium guajava* L. is eugolized as 'Apple of Tropics' due to its high nutritive value and diversified uses. The medicinal properties of guava fruit, leaf and other parts of the plant are also well known in traditional system of medicine. Guava is also a rich source of antioxidants and thus can help to prevent degenerative diseases. Different parts of guava have been traditionally used in the folk medicine of several civilization. The extracts from guava leaves exhibited good antioxidant activity as well as free radical-scavenging capacity. It contains important phytoconstituents such as tannins, triterpenes, quercetin, guajanoic acid, saponins, carotenoids, lectins, leucocyanidin, ellagic acid, beta-sitosterol, uvaol, oleanolic acid and ursolic acid. *Psidium guajava* possess enormous medicinally important activities such as antioxidant, antimicrobial, anti-inflammatory antiplasmodial, antispasmodic, cardioactive, antidiabetic, antiinflammatory and antinociceptive activities, supporting its traditional uses.

**Keywords:** *Psidium guajava*, medicinal properties, antimicrobial, anti-inflammatory

**Introduction**

*Psidium guajava* L. is eugolized as 'Apple of Tropics' due to its high nutritive value and diversified uses. The medicinal properties of guava fruit, leaf and other parts of the plant are also well known in traditional system of medicine. Guava is also a rich source of antioxidants and thus can help to prevent degenerative diseases. Different parts of guava have been traditionally used in the folk medicine of several civilization. The extracts from guava leaves exhibited good antioxidant activity as well as free radical-scavenging capacity. It contains important phytoconstituents such as tannins, triterpenes, quercetin, guajanoic acid, saponins, carotenoids, lectins, leucocyanidin, ellagic acid, beta-sitosterol, uvaol, oleanolic acid and ursolic acid. *Psidium guajava* possess enormous medicinally important activities such as antioxidant, antimicrobial, anti-inflammatory antiplasmodial, antispasmodic, cardioactive, antidiabetic, antiinflammatory and antinociceptive activities, supporting its traditional uses.

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**Introduction**

*Psidium guajava* L. is one of the most important tropical fruit and claims superiority over other fruits by virtue of its commercial, medicinal and nutritional values. It belongs to phylum Magnoliophyta, class Magnoliopsida and Myrtaceae family [Shruthi *et al.* 2013] [31]. It has about 133 genera and more than 3,800 species. It is commonly referred as guave, goyave in French; guave, guavenbaum in German; banjiro in Japanese; goiaba in Portugal; arac, guaiaba in Brazil; and guava in English. *P. guajava* used as an important food as well as a medicinal plant in tropical and subtropical countries, therefore its nickname as the poor man's apple [Anand *et al.* 2016]. It is an evergreen shrub like tree which reaches to the height of 6 to 25 ft's. Mostly its branches are curved which display opposite leaves with the small petioles of about 3 to 16 cm. The leaves are wide and clear green in colour and have clear and prominent veins [Arima and Danno, 2002; Rouseff *et al.*, 2008] [4, 29]. The plant produces white flowers with in curved petals having a nice fragrant. The fruit is small, 3 to 6 cm long, pear-shaped, reddish-yellow when ripe. The whole fruit is edible, round to pear-shape, from 3 to 10 (cm) in diameter. It has a thin delicate rind, pale green to yellow at maturity in some species, pink to red in others, a creamy white or orange flesh with many small hard seeds and a strong characteristic aroma. Generally, guava plant has spread widely throughout the tropics because it thrives in a variety of soils, propagates easily, and bears fruit relatively quickly. The guava berry is an important tropical fruit that is mostly consumed fresh. The fruit contains several small seeds and consists of a fleshy pericarp and seed cavity with pulp (Lapik *et al.* 2005; Jimenez-Escrig *et al.* 2001; Lozoya *et al.* 2002) [16, 18, 14].

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Guava contains a large number of antioxidants and phytochemicals including essential oils, polysaccharides, minerals, vitamins, enzymes, and triterpenoid acid alkaloids, steroids, glycosides, tannins, flavonoids and saponins [Smith and Siwatibau, 1975] <sup>[31]</sup>. The leaves of guava are rich in flavonoids, in particular, quercetin. Much of guava's

therapeutic activity is attributed to these flavonoids. Ethanolic extracts of stem have a high anti-diabetic activity [Rai *et al.* 2007; Mukhtar *et al.* 2006] <sup>[28,21]</sup>. Keeping in view the historical background, important ingredients of *Psidium guajava*, current review focus on the phytochemistry and medicinal importance of this useful plant.



A. Guava Fruit (Red Fleshed)



B. Guava Fruit



C. Guava Flower and Bud

### Biochemical constituents

Guavas are often marketed as "super fruits" being rich in vitamins A and C with seeds that are rich in omega-3, omega-6 polyunsaturated fatty acids and especially dietary fiber. Guavas contain both carotenoids and polyphenols – the major classes of antioxidant pigments – giving them relatively high potential antioxidant value among plant foods (Jimenez- Escrig *et al.*, 2001) <sup>[14]</sup>. As these pigments produce the fruit skin and flesh colour, guavas that are red-orange have more pigment content as polyphenol, carotenoid and pro-vitamin A, retinoid sources than yellow-green ones (Shruthi *et al.*, 2013) <sup>[31]</sup>. Guava fruits are also a good source of pectin - a dietary fiber. The fruit contains saponin, oleanolic acid, lyxopyranoside, arabopyranoside, guajavarin, quercetin and flavonoids [Arima and Danno, 2002; Das, 2011] <sup>[4,8]</sup>. Ascorbic acid and citric acid are the major ingredients of guava that play important role in anti-mutagenic activity [Grover and Bala, 1993] <sup>[12]</sup>. Essential oil is present in leaves which contain  $\alpha$ -pinene, limonene,  $\beta$ -pinene, isopropyl alcohol, menthol, terpenyl acetate, caryophyllene, longicyclene and  $\beta$ -bisabolene. Oleanolic acid is also found in the guava leaves [Begum *et al.* 2004] <sup>[5]</sup>. Leaves have high content of limonene about 42.1% and caryophyllene about 21.3% [Ogunwande *et al.* 2003] <sup>[23]</sup>. Leaves of guava have a lot of volatile compounds [Taylor *et al.* 2001; Fu *et al.* 2010] <sup>[33,11]</sup>. Guava's main plant contain various chemicals like alanine, alpha-linolenic acid, ascorbic acid, aspartic acid, benzaldehyde, carotenoids, catechol-tannins, D-galactose, D-galacturonic acid, ellagic acid, essential oils, flavonoids, gallic acid, glutamic acid, guajiverine, guajivolic acid, histidine, hyperin, isoquercetin, lectins, limonene, linoleic acid, linolenic acid, lysine, myricetin, oxalic acid, pectin, polyphenols, quercetin, serine, tannins, terpenes [Joseph and Priya 2011] <sup>[15]</sup>.

### Medicinal Importance

*Psidium guajava* L. is consumed not only as food but also as folk medicine in subtropical areas all over the world due to its pharmacologic activities [Deguchi and Miyazaki, 2010] <sup>[9]</sup>. Medicinal plants find a very important place in medical systems almost in the entire world. It is well known that guava is frequently employed in numerous parts of the world for the cure of a lot of sickness like diarrhoea, reducing fever, dysentery, gastroenteritis, hypertension, diabetes, pain relief and wounds [Naseer *et al.* 2018] <sup>[22]</sup>.

### Antimicrobial Activity

Four antibacterial flavonoids (morin-3-*O*-lyxoside, morin-3-*O*-arabinoside, quercetin, and quercetin-3-*O*-arabinoside) of the

leaf extract of *Psidium guajava* are found to be effective against the pathogenic bacteria including *Bacillus stearothermophilus*, *Brochothrix thermosphacta*, *Escherichia coli*, *Listeria monocytogenes*, *Pseudomonas fluorescens*, *Salmonella enterica*, *Staphylococcus aureus* and *Vibrio cholera* [Pongsak and Parichat, 2010] <sup>[25]</sup>.

It was shown that *P. guajava* leaf extracts might be beneficial in treating acne especially those that have anti-inflammatory activities (Qadan *et al.* 2005) <sup>[27]</sup>. Methanolic extract of guava contains a remarkable antimicrobial activity. Species of *Bacillus* and *Salmonella* bacteria can be controlled by these extracts. It also has anti-plaque activity due to the presence of active flavonoids compounds [Limsong *et al.* 2004] <sup>[17]</sup>.

Guava leaves have high antibacterial activity in extracts that can inhibit the growth of *S. aureus*. Plant leaf and bark methanolic extracts of *P. guajava* have high antimicrobial activity. These extracts can inhibit the *Bacillus* and *Salmonella* bacteria. [Joseph and Priya 2011] <sup>[15]</sup>. The methanolic plant leaf extracts of *P. guajava* and barks of this plant have antimicrobial activity. The organism inhibited is *Salmonella* species, *Bacillus* species, and the concentrations vary according to the organisms [Abdelrahim *et al.* 2002] <sup>[1]</sup>, Metwally *et al.* (2010) <sup>[20]</sup> isolated five flavanoids from *P. guajava* leaves and found good antimicrobial activity of the extracts, as well as the isolated compounds.

### Anti-Diarrhoeal Activity

Anti-diarrhoea effect is also contributed due to the quercetin. Among the major effect of the plant extract are antibacterial and trypanocidal activities which may be attributed mainly to the broad antimicrobial property of the flavonoids and iron chelating property of tannins. [Adeyemi *et al.* 2009] <sup>[2]</sup>. Quercetin, the major component of the guava leaf extract is responsible for the inhibition of the intestinal movement and reduce capillary permeability in the abdominal cavity and inhibition of increased watery secretion that occur in the acute diarrhoeal disease [Lozoya *et al.* 2002] <sup>[18]</sup>. It is thought that quercetin in guava leaf are responsible for its spasmolytic activity.

Many authors had postulated that the gallic acid, catechins, epicatechins, rutin, naringenin and kaempferol in the leaves are responsible for the inhibition of the enzyme, pancreatic cholesterol esterase resulting in lower cholesterol in the blood. Catechins are important as a preventive therapy for hypercholesterolemia [Deguchi and Miyazaki, 2010] <sup>[9]</sup>.

### Anti-Inflammatory Activity

A decoction of guava leaves was used worldwide for the treatment of various inflammatory diseases including rheumatism. The anti-inflammatory property of an aqueous leaf extract was investigated in rats using fresh egg albumin induced paw edema while the analgesic effect of the plant extract was evaluated by the hot plate and acetic acid test models of pain in mice (Ojewole, 2006) [24].

Extract in ethyl acetate has the ability to minimize the antigen. It can stop the release of the  $\beta$ -hexosaminidase with histamine into RBL-2H3 cells. Due to this reason the appearance of TNF- $\alpha$  and IL-4 mRNA stops. In this way the antigen inhibits and I $\kappa$ B- $\alpha$  become spoil. Benzophenone and flavonoids are important compounds found in guava. These compounds are responsible for the histamine inhibition and nitric acid production [Matsuzaki *et al.* 2010] [19].

Ethyl acetate extract of *P. guajava* suppressed the interferon gamma (IFN- $\gamma$ )/TNF- $\alpha$ -co-induced production of thymus and activation-regulated chemokine protein and mRNA in HaCaT cells. It also inhibited the TNF- $\alpha$ /IFN- $\gamma$ -co-induced activation of STAT1 and NF- $\kappa$ B as well as increased the expression of mRNA and heme oxygenase-1 protein. This demonstrates that *P. guajava* inhibits expression of chemokine in keratinocytes by inducing heme oxygenase-1 expression and it highlight the therapeutic uses of *P. guajava* in atopic dermatitis and inflammatory skin diseases [Han *et al.* 2011] [13].

### Antioxidant Activity

Guava is highly rich in antioxidants which are helpful in decreasing the incidences of degenerative diseases such as brain dysfunction, inflammation, heart disease, cancer, arteriosclerosis and arthritis [Feskanich *et al.* 2000] [10]. Guava has a high content of protocatechuic acid, quercetin, ferulic acid, ascorbic acid, quercetin, gallic acid and caffeic acid which are important antioxidants. Some studies suggest that guava has radio-protective ability with antioxidant activity (Jimenez-Escrig *et al.*, 2001) [14].

Studies have been reported that guava fruits with a red-coloured pulp flesh contained a significant amount of carotenoids, especially lycopene, and a high concentration of phenolic compounds. These compounds were largely responsible for the antioxidant activity [Correa *et al.* 2011] [6]. Akinola *et al.* (2007) [3] suggested that ethanolic leaf extract of *P. guajava* possesses the beneficial effect on gossypol-induced sperm toxicity, and hence it may enhance male fertility due to rich natural antioxidants in it. The total flavonoids are primarily identified in the aqueous and ethanolic leaf extracts of *P. guajava* which may possess the potential antioxidative activities [Wang *et al.* 2007] [34].

### Hepatoprotective Activity

The hepatoprotective effect of an aqueous leaf extract of *Psidium guajava* were studied. Aqueous leaf extract (250 and 500 mg/kg) on oral administration have shown too significantly reduce the elevated serum levels of alanine aminotransferase, alkaline phosphatase, bilirubin, and aspartate aminotransferase in acute liver damage induced by hepatotoxins in rats (Poonam *et al.* 2017; Roy *et al.* 2006) [26, 30].

### Conclusion

*Psidium guajava* (Linn.) has a long history of traditional use for a wide range of diseases. The phytochemical and pharmacological investigations carried out on *P. guajava* vindicate the immense potential of this plant in the treatment of several diseases. Guava possesses anti-viral, anti-microbial,

anti-inflammatory, antinociceptive activity and anti-mutagenic activities. Hence, extensive investigation on its pharmacodynamics, kinetics and clinical trials is needed to exploit their therapeutic utility to combat various diseases.

### References

1. Abdelrahim SI, Almagboul AZ, Omer ME, Elegami A. Antimicrobial activity of *Psidium guajava* L. *Fitoterapia* 2002;73(7):713-5.
2. Adeyemi OS, Akanji MA, Oguntoye SA. Ethanolic leaf extract of *Psidium guajava*: phytochemical and trypanosome brucei. *Journal of Medicinal Plant Research* 2009;3:420-423.
3. Akinola OB, Oladosu OS, Dosumu OO. Ethanol extract of the leaves of *Psidium guajava* Linn enhances sperm output in healthy Wistar rats. *Afr J Med Sci* 2007;36(2):137-40.
4. Arima H, Danno G. Isolation of antimicrobial compounds from guava (*Psidium guajava* L.) and their structural elucidation. *Biosci Biotechnol Biochem.* 2002;66:1727-30.
5. Begum S, Hassan SI, Ali SN, Siddiqui BS. Chemical constituents from the leaves of *Psidium guajava*. *Nat Prod Res* 2004;18(2):135-40.
6. Correa C, Luiz F, Carlos Antonio Santos, Fabio V, Giuseppina Pace PL. Antioxidant content in guava (*Psidium guajava*) and araca (*Psidium spp.*) germplasm for different Brazilian regions. *Plant Genetic Resources* 2009;9:384-391.
7. Coutino RR, Hern´andez, CP, Giles RH. Lectins in fruits having gastrointestinal activity: their participation in the hemagglutinating property of *Escherichia coli* O157:H7. *Archives of Medical Research* 2001;32:251-257.
8. Das AJ. Review on nutritional, medicinal and pharmacological properties of *Centella asiatica* (Indian pennywort). *J Biol Act Prod from Nat* 2011;1(4):216-28.
9. Deguchi Y, Miyazaki K. Anti-hyperglycemic and anti-hyperlipidemic effects of guava leaf extract. *Nutritional Metabolism (Lond)* 2010;7:9.
10. Feskanich D, Ziegler RG, Michaud DS, Giovannucci EL, Speizer FE, Willett WC, *et al.* Prospective study of fruit and vegetable consumption and risk of lung cancer among men and women. *J. Natl. Cancer Inst* 2009;92:1812-23.
11. Fu HZ, Luo YM, Li CJ, Yang JZ, Zhang DM. Psidials A-C, three unusual monoterpenoids from the leaves of *Psidium guajava* L. *Org Lett* 2010;12(5):5135-8.
12. Grover IS, Bala S. Studies on antimutagenic effect of guava (*Psidium guajava*) in *Salmonella typhimurium*. *Mut Res* 1993;300:1-3.
13. Han EH, Hwang YP, Choi JH, Yang JH, Seo JK, Chung YC, *et al.* *Psidium guajava* extract inhibits thymus and activation-regulated chemokine (TARC/ CCL17) production in human keratinocytes by inducing heme oxygenase-1 and blocking NF- $\kappa$ B and STAT1 activation. *Environ Toxicol Pharmacol* 2011;32(2):136-45.
14. Jimenez-Escrig M, Rincon M, Pulido R, Saura-Calixto F. Guava fruit (*Psidium guajava* L.) as a new source of antioxidant dietary fiber. *Journal of Agricultural and Food Chemistry* 2001;49(11):5489-5493.
15. Joseph B, Priya Mini. Review on nutritional, medicinal and pharmacological properties of guava (*Psidium guajava* Linn.). *International Journal of Pharmacy and Bioscience* 2011;2:53-69.
16. Lapiak O, Klejdus B, Kokoska L. Identification of isoflavones in *Acca sellowiana* and two *Psidium species* (Myrtaceae), *Biochem Syst Ecol* 2005;33:983-992.

17. Limsong J, Benjavongkulchai E, Kuvatanasuchati J. Inhibitory effect of some herbal extracts on adherence of *Streptococcus mutans*. *J Ethnopharmacol* 2004;92:281-9.
18. Lozoya X, Reyes-Morales H, Chavez-Soto M, Martinez-Garcia Mdel C, Soto-Gonzalez Y, Doubova SV, *et al.* Intestinal anti-spasmodic effect of a phytodrug of *P. guajava* folia in the treatment of acute diarrheic disease. *Journal of Ethnopharmacology* 2002;83:19-24.
19. Matsuzaki K, Ishii R, Kobiyama, K. New benzophenone and quercetin galloyl glycosides from *Psidium guajava* L. *J Nat Med* 2010;64:252-6.
20. Metwally AM, Omar AA, Harraz FM, El Sohafy SM. Phytochemical investigation and antimicrobial activity of *Psidium guajava* L. leaves. *Pharmacogn Mag* 2010;6(23):212-8.
21. Mukhtar HM, Ansari SH, Bhat ZA, Naved T, Singh P. Antidiabetic activity of an ethanol extract obtained from the stem bark of *Psidium guajava* ( Myrtaceae). *Die Pharmazie* 2006;61:725-7.
22. Naseer S, Hussain S, Naeem N, Pervaiz M, Rahman M. The phytochemistry and medicinal value of *Psidium guajava* (guava). *Clinical Phytoscience* 2018;4:32.
23. Ogunwande IA, Olawore NO, Adeleke KA, Ekundayo O, Koenig WA. Chemical composition of the leaf volatile oil of *Psidium guajava* L. growing in Nigeria. *Flavour Fragr. J* 2003;18:136-8.
24. Ojewole JAO. Anti-Inflammatory and analgesic effects of *Psidium guajava* Linn. leaf aqueous extracts in rats and mice. *Methods Find Exp. Clin. Pharmacol* 2006;28:441-446.
25. Pongsak R, Parichat P. Contents and antibacterial activity of flavonoids extracted from leaves of *Psidium guajava*. *Journal of Medicinal Plants and Research* 2010;4:393-396.
26. Poonam G, Daswani M, Gholkar S, Tannaz J Birdi. *Psidium guajava*: A single plant for multiple health problems of Rural Indian population. *Pharmacognosy Rev* 2017;11(22):167-174.
27. Qadan F, Thewaini AJ, Ali DA, Afifi R, Ikhawad A, Matalka KZ. The antimicrobial activities of *Psidium guajava* and *Juglans regia* leaf extracts to acne-developing organisms. *American Journal of Chinese Medicine*. **2005;33**:197-204.
28. Rai PK, Rai NK, Rai AK, Watal G. Role of LIBS in elemental analysis of *Psidium guajava* responsible for glycemic potential. *Instrum Sci Technol* 2007;35:507-22.
29. Rouseff RL, Onagbola EO, Smoot JM, Stelinski LL. Sulfur volatiles in Guava (*Psidium guajava* L.) Leaves: Possible defense mechanism. *J Agric Food Chem* 2008;56:8905-10.
30. Roy CK, Kamath JV, Asad M. Hepatoprotective activity of *Psidium guajava* Linn. Leaf extract. *Indian J Exp Biol* 2006;44(30):5-11.
31. Shruthi SD, Adhikari R, Timilsina SS, Sajjekhan S. A review on the medicinal plant *Psidium guajava* Linn. (Myrtaceae). *J Drug Deliv Ther* 2013;3(2):162-8.
32. Smith RM, Siwatibau S. Sesquiterpene hydrocarbons of fujian guavas. *Phytochemistry* 1975;14(9):2013-5.
33. Taylor P, Pino JA, Agüero J, Marbot R, Fuentes V, Pino JA, *et al.* Leaf oil of *Psidium guajava* L. from Cuba. *J Essent Oil Res* 2001;13:61-2.
34. Wang B, Jiao S, Liu H, Hong J. Study on antioxidative activities of *Psidium guajava* Linn leaves extracts. *Wei Sheng Yan Jiu* 2007;36(3):298-300.