International Journal of Engineering Technology and Management Sciences
Website: ijetms.in Issue: 6 Volume No.8 November - December – 2024
DOI:10.46647/ijetms.2024.v08i06.005 ISSN: 2581-4621

An updated review of Psidium guava L. Miracle plants, Ethnomedicine, tea preparation and Pharmacological applications

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Abstract
Psidium guava L., generally called as guava, is an important tropical food plant with various medicinal values. In ethnomedicine, it is used in the treatment of different diseases such as diarrhoea, diabetes, ulcers, malaria, cough and bacterial infections. The aim of this updated review is to provide up-to-date information on the ethnomedicinal uses, bioactive compounds and pharmacological activities of *P. guajava* with emphasis on its therapeutic applications. *P. guava* extract has antioxidant, anti-microbial, anti-diabetic activity. Guava tea contains high amounts of protein, carbohydrates, total fats, and vitamin C, which are responsible for its medicinal effects. Available reports on traditional medicine, antioxidant, antimicrobial, antidiabetic, anticancer, diarrheal activity of guava are discussed in this review.
Key words: Ethnomedicine, antioxidant, antimicrobial, antidiabetic, anticancer,Guava

1.Introduction

Worldwide, medicinal plants and their biological components are used to treat different diseases. It has been reported that more than 80% of the world's population uses medicinal plants or their bioactive compounds for the prevention, management or treatment of many diseases[1-2]. Precently, the applications of medicinal plants or their biologically active compounds have attracted the attention of many scientists/researchers as they are used in drug discovery or discovery of natural constituents for therapy[3-4] and in ethnomedical applications to treat life-threatening diseases such as cancer, diabetes, and high blood pressure[5-6]. *Psidium guajava* is one of the plants used in traditional medicine to treat various ailments.

Psidium guajava L. Generaly known as Guava and it's also tropical shrub tree and food, medicinal plant, family Myrtaceae[7]. It grows up to 10 m and is broadly distributed in many countries. Psidium guajava L. is an economically important food plant with various medicinal properties. It has a short drunk, flat, smooth and exfoliating bark. The leaves are fleshy dark green with prominent veins[8-9]. It has white flowers and fruit with pulp and small hard seeds[8]. In ethnomedicine, the different parts of *P. guajava* – stem, bark[10], fruits, leaves and roots[11] are used in the treatment of diseases like diarrhea, rheumatism and diabetes[12-13] digestive problems, laryngitis, ulcers, malaria, cough and bacterial infections[7] wound healing and pain relief[14]. Various natives consume decoction, infusion and/or boiled products of P. guajava either orally or topically depending on the type of diseases[15]. For example, *P. guajava* leaves can be applied to wounds, whereas aqueous leaf extract can be taken orally to lower blood glucose levels in diabetics patients[12]. Psidium guajava contains flavonoids, tannins, phenols, alkaloids, triterpenes, saponins, carotenoids, lectins, vitamins, carbohydrate, fiber fatty acids and glycosides [11]. The leaves are rich in beneficial phenolic compounds such as guaijaverin, quercetin, kaempferol, apigenin, catechin, chlorogenic acid, hyperin, gallic acid, epicatechin, myricetin, caffeic acid and epigallocatechin gallate[16]. *P. guajava* extract is antimutagenic, lipid-lowering, pain-relieving, antioxidant[17-18], anticancer[19] , antimicrobial[20] .

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The pharmacological activities exhibited by *P. guajava* may be attributed to various bioactive compounds present in the plant. The aim of this study is to comprehensively review the past scientific literature and provide up-to-date information on the ethnomedicinal uses, tea preparation, and invitro pharmacological activities of P. gujava.

1.1Ethnomedicine

Leaves: A decoction or infusion of plant parts used as leaves is used in India for fever, antispasmodic and rheumatism[21]. The leaves are used in USA as an antibiotic in the form of a poultice or decoction for ulcers, wounds and toothaches in the United States[22-23]. Guava tea can also treat bronchitis, asthma, pulmonary diseases, cough and lung diseases[24-25].

Bark: In the Philippines, the bark in the form of a decoction and poultice is used as an astringent in the treatment of ulcers and diarrhea, and in Panama, Bolivia, and Venezuela, the bark is used in the treatment of diarrhea and skin diseases. Decoction and poultices are also used to expel the placenta after delivery, skin infections, genital bleeding wounds, fever, dehydration and respiratory disorders.

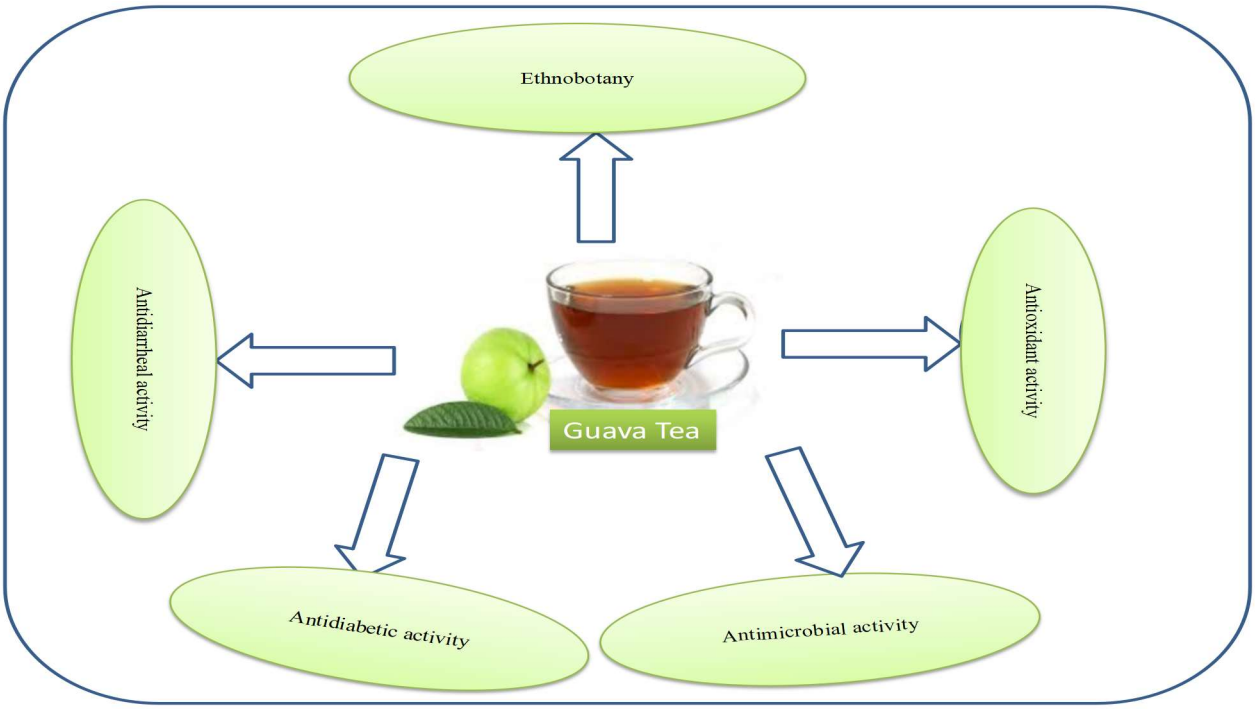
Root: The root is used as a decoction in West Africa to relieve loose motion , cough, stomachache, toothache, indigestion and constipation; In the Philippines, Fiji, and South Africa, the roots are used as a decoction and poultice in the treatment of sores, wounds, and diarrhea as an astringent[26].

Whole plant: Commonly, the whole plant or its shoots are used in Tahiti and Samoa as a skin tonic in infusion, decoction, paste form and as an analgesic for painful menstruation, wounds, uterine bleeding, premature labor, and miscarriages[26].

1.2 Preparation of Tea with Guava Leaves

Both ripe and unripe guava leaves were collected and then the collected leaves were thoroughly washed to remove any impurities. Washed leaves remove excess particles and pat dried kept aside, when water starts to boiling put water on stove and add jaggery, cloves, ginger and fennel along with guava leaves and then oil for 10 to 15 minutes, once done, serve the tea in small glasses shows the Fig1.

Figure 1. An overview of Psidium guava tea preparation and health uses.



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1.3Nutritional Analysis of the Guava Leaves Tea

Nutritional analysis of selected sample had an energy Energy is 372.22 Kcal/100g, Protein 12g/100g, Carbohydrate 90.63g/100g, Total Fats 0.58g/100g, Moisture 6.90g/100g, Ash 0.77g/100g, calcium 18mg/100g and vitamin C 228.3 mg/100g. According to[27], guava leaves contain 16.60 mg of calcium per 100 g and 103.3 mg. of vitamin C per 100g.

1.4Antioxidant activity

Antioxidants are molecules that inhibit the oxidation process. Oxidative reactions can generate free radicals, which can damage cells by starting a variety of chain reactions. Cell-damaging free radicals cause cancer and many other diseases. Antioxidants destroy free radicals and stop chain reactions. Examples of antioxidants include beta-carotene, lycopene, vitamins A, C, E and other substances. Oxidative reaction is one of the very important destructive reactions. Free radical damage is responsible for many human disorders such as concussions, nervous disorders, inflammation, and viral infections. Free radicals are produced when drugs are metabolized in the body. Sometimes, environmental changes and hormones cause free radical production. These free radicals are incharge for all oxidative reactions[28-47] Guava contains high levels of antioxidants and anti-aging nutrients that are not only essential for life but also help control free radical activity. It also contains phytochemicals that are beneficial for human health such as obesity, diabetes and high blood pressure. There are two common methods by which antioxidants neutralize free radicals, the DPPH and FRAP assays. Guava extract in water and organic solvents contains high levels of antioxidants that inhibit the oxidation reaction. The concentration of these compounds increases with the increase in concentration[48] .

Quercetin, quercetin-3-O-glucopyranoside and morin can be isolated from the leaves. These compounds show antioxidant activity. Quercetin has free radical balancing activity. Its reducing power is much higher than all other compounds. It is considered to be the most active and powerful antioxidant in guava leaves[49-50].The antioxidant capacity of guava extract has provided a new therapeutic approach against various problems and diseases. Further investigations are needed in this regard to find out the actual mechanism involved in the antioxidant and other pharmacological activities of guava[51].

1.5Antimicrobial activity

Psidium guava has more antimicrobial activity. Guava leaf extract levels reduce the amount of cough due to its anti-cough activity. Aqueous, chloroform and methanol extracts of the leaves inhibit the growth of various bacteria. It is recommended in curing the cough condition due to its anti-cough action[52]. Guava leaves extract have high antibacterial activity which inhibits the growth of S. aureus. Guava whole plant like leaf and bark methanolic extracts of P. guajava have high antimicrobial activity. These extracts inhibit Bacillus and Salmonella bacteria[53]. Methanolic extract of guava has significant antimicrobial activity. Species of Bacillus and Salmonella bacteria are controlled by this extract. It also has anti-plaque activity owing to the presence of active flavonoid compounds[54] .

1.6Antidiabetic activity

Guava leaves are peeled and eaten on an empty stomach in China to fight diabetes. Guava fruits and leaves when eaten without the skin are capable of lowering blood sugar levels, according to a study conducted on mice by the Medical Research Laboratory, Allahabad. Numerous authors have studied the effects of Psidium gujava leaves on intestinal glycosidases associated with postprandial hyperglycemia, suggesting an improvement in the treatment of diabetes (type II). Also, the high fiber in guavas slows the absorption of glucose from the stomach, preventing a rapid rise in blood sugar levels after a meal. People who drank guava tea after eating white rice had significantly lower blood glucose levels than those who drank plain water as a control. Guava (both fruit and leaves)

also lowers fasting glucose. One study found that people with type 2 diabetes who drank guava leaf tea at every meal for three months had lower blood glucose levels than before the trial[55- 58].

1.7Anticancer activity

Guava contains lycopene, an antioxidant that plays a vital role in cancer prevention and treatment. Breast cancer and prostate cancer all do well. When guavas are cut, the red flesh contains more lycopene than other varieties. Lycopene works by scavenging free radicals while preventing the production of new ones. Several studies have shown that aqueous extract of guava flowering leaves has anti-prostate cancer activity in a cell line model, suggesting that it may be an anti-androgen-sensitive prostate cancer agent. Guava is high in carotene, which has been linked to preventing lung and oral malignancies.

Lycopene, an antioxidant rich in Guava, plays an important function in cancer prevention and treatment. Breast cancer and prostate cancer react the best of all. When guavas are dissected, the red flesh contains more lycopene than the other kinds. Lycopene works by scavenging free radicals while also preventing the production of new ones. Many studies have shown that an aqueous extract of guava blossoming leaves has anti-prostate cancer activity in a cell line model, suggesting that it may be a potential anti-androgen-sensitive prostate cancer agent. Guava also has a high content of carotene, which has been linked to the prevention of lung and oral malignancies. Lin and Lin (2020)[19] evaluated the anticancer activity of guava seed polysaccharides in MCF-7 cells. The findings of this study revealed significant inhibition of MCF-7 cell viability in a dose-dependent manner.

1.8Antidiarrheal

Boiling 6-10 fresh guava leaves in a pot of warm water and drinking it warm on an empty stomach has been found to be very helpful in reducing diarrhea. *P. gujava* leaves, according to the researchers, exhibit a wide range of antibacterial activity (antigiardial and antirotaviral activity) used to successfully treat diarrhea of pathogenic origin. The significant concentration of flavonoids in guava leaves may be associated with antidiarrheal activity. Guava is also used to treat diarrhea in children due to its astringent properties. A tea made from guava leaves or juice in a cup of hot water can help with bowel movements. In 2008, the Journal of Smooth Muscle Research published an article in which researchers investigated the effects of guava leaves on rat peristalsis and found that guava leaf extract could delay the onset of castor oil-induced diarrhea and reduce the frequency of bowel movements and reduces the severity of diarrhea in rats.

Alkaline composition of guava leaves provides excellent response against hyperacidity of stomach. In numerous villages, guava leaves are used for tea to combat acidity[59]. This mixture is prepared by boiling 12 to 15 young guava leaves in 2 to 4 cups of water. Methanolic extract demonstrated the greatest antacid and ulcer healing properties in vitro out of all extract solvents[60]. Guava fruit and leaves contain flavonoids and saponins that have been proven to be effective in reducing stomach acidity and the subsequent development of ulcers. Stomach ulcers were induced after ethanol ingestion in Wister rats, and methanolic extract of *P. gujava* leaves at doses between 500 and 1000 mg/kg significantly reduced ulceration[61] .

Conclusion

This study revealed that the *P. gujava* has antioxidant, phytochemicals present and can be used in the treatment of health disorders such as cancer, antimicrobial infection, diarrhea and diabetes. The health promoting ability of *P. gujava* tea has been linked to the important phytochemicals, mineral and vitamines present in the plant. Based on the beneficial effects of *P. guajava* and its bioactive components, it can be used in the development of pharmaceutical products and functional foods. However, extensive studies in clinical trials are needed to establish safe doses and efficacy of *P. gujava* tea for the treatment of many diseases.

DOI:10.46647/ijetms.2024.v08i06.005 ISSN: 2581-4621

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