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## THE NUTRITIONAL FRUIT GAUVA AND IT'S VARIOUS ACTIVITIES

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### Abstract

Guava (*Psidium guajava* Linn.) commonly known for its food and nutritional values throughout the world. The medicinal properties of guava fruit, leaf and other parts of the plant are also well known in traditional system of medicine. Since, each part of guava tree possesses economic value; it is grown on commercial scale. Guava plant is considerable process has been achieved regarding the biological activity and medicinal application of guava and the fruit considered as poor man apple of tropics. The guava plant parts are used for the development of various industrial and pharmaceutical products. In the present review, nutritional value of guava fruit and medicinal properties its various parts have been discussed to provide collective information on its multi purpose commercial values.

**Key Words :** Antibacterial effects of guava and aloe , Medicinal applications , Anti-inflammatory activity .

### INTRODUCTION:

Guava is of numerous trees and shrubs of the genus *Psidium* (family Myrtaceae) native to tropical America. The term “guava” appears to derive from Arawak guayabo “guava tree”, via the Spanish guayaba. It has been adapted in many European and Asian languages, having a similar form. The common types of guava include apple guava, yellow fruited cherry guava, strawberry guava, and red apple guava. It is mostly eaten raw (ripe or semi-ripe) or consumed in the form of juice, jams, and jellies. The common guava has a fruit with a yellow skin and white, yellow, or pink flesh. [1] Guavas are known for their sweet and tangy flavor and many uses, but there’s much more to this fruit than meets the eye. Many consider it a “magical” fruit because of its array of nutrients and medicinal uses.[2] *P. guajava* has a rich ethno-medicinal history. Different parts of the plant are used in various indigenous systems of medicine, primarily for the treatment of gastrointestinal disorders [3]. Some of the ethno-medicinal uses includes the crushing of the leaves and the application of the liquids coming out from them on wounds, cuts, ulcers, boils, skin and soft tissue infectious site, rheumatic places. [4]

Psidium guajava (common name-guava) is well known tropic tree which is abundantly grown for fruit. It belongs to phylum Magnoliophyta, class Magnoliopsida and Myrtaceae family [5]. It has about 133 genera and more than 3,800 species. Psidium guajava and its all parts have an old history of medicinal value [6]. The plant is well known by a common name "Guava" in English, guayabo in Spanish, goyave and goyavier in French, guyabaorgoejaab in Dutch, goiaba and goaibeira in Portuguese and jambubatu in Malaya. Pichi, posh and enandi are the names commonly used in Mexico and America [7]. Guava plant grows widely in the tropic areas because it is a plant that can be grown on a big range of soils [8]. In Mexico guava is one of very important crop which is cultivated over 36,447 acres and production is about 192,850 tons. According to records the first money-making guava planting was reputable around 1912 in Florida at Palma Sola [7]. Psidium guajava is an evergreen shrub like tree which reaches to the height of 6 to 25 ft's. Figure 1 displays various parts of the plant i.e., leaves, flowers, fruit, seeds and bark. The plant has a wide spreading network of branches. 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 color and have clear and prominent veins [9,10]. The plant produces white flowers with incurved petals having a nice fragrant. Flowers have four to six petals and yellow colored anthers and pollination occurs by the insects. Guava fruit ranges from small to medium sized with 3 to 6 cm length. It has pear like shape and yellow color in ripen condition [11]. It has a musky special odor when ripened which is strong but pleasant [7]. Its pulp is slightly darker in color which contains slightly yellowish seeds. The size of seeds is very small and they are easily chewable. They are arranged in regular patterns; their number ranges from 112 to 535 [7, 12]. The guava bark is thin and has green colored spots. It is very easy to remove it in long straps. It has a huge content of antimicrobial and antibacterial compounds [13]. Ethanolic extracts of stem have a high anti-diabetic activity [14,15]. 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 [16]. Guava contains a higher content of vitamin C and vitamin A. Guava is also a very good source of the pectin which is an important dietary fiber. It has high content of flavonoids [11], fructose sugar [17] and carotenoids [18]. Keeping in view the historical background, important ingredients and common uses of Psidium guajava (guava), current studies focus on the phytochemistry and medicinal value of this useful plant.

#### Common name: (19)

Guava is known as a various names in various regions of the world. The common name of psidium guajava includes.

Arabic guwafah
Bengali piara
Brazil araca
Cambodia trapaeksruk
Chinese fan shilia

**Taxonomical classification:(20)**

<b>Kingdom</b>	plantae
<b>Subkingdom</b>	Trachrobionta
<b>Division</b>	Magnoliophyta
<b>Class</b>	Magnoliopsida
<b>Sub class</b>	Rosidae
<b>Order</b>	Myrtales
<b>Family</b>	Myrtaceae
<b>Genus</b>	Psidium
<b>Species</b>	guajava Psidium

**Plant Description :(21)**

Psidium guajava is a shrub or small tree usually growing 1-6 m tall, but occasionally reaching 10 m in height. The older stems are covered in a smooth, light reddish-brown, bark that peels off in flakes. This sometimes gives the trunks a mottled appearance, because the newly revealed bark is somewhat greenish-brown in colour. Younger stems are greenish in colour, hairy (pubescent), and somewhat four-angled (quadrangular). The simple leaves are oppositely arranged along the stems and are borne on short stalks (petioles) 4-10 mm long. The leaf blades (7-15 cm long and 3-7 cm wide) are somewhat oval in shape (ovate-elliptic or oblong-elliptic) with rounded or pointed tips (obtuse or acute apices) and rounded (obtuse) bases. They have hairy (pubescent) undersides (especially when young), entire margins, and are generally dull green in colour. Each leaf has a prominent central vein (midrib) and 10-20 pairs of side veins (lateral veins) that are also relatively obvious. The flowers are usually borne singly in the upper leaf forks (axils). These flowers are about 25 mm across and are borne on a hairy stalk (pubescent peduncle) 1-2.5 cm long. Each flower has four or five green sepals (6-15 mm long) that are fused together at the base and four or five white petals (10-20 mm long). They also have large numbers (200- 250) of small white stamens (6-10 mm long) and a style (6-12 mm long) topped with a stigma

**Overview of Guava :**

Psidium guajava is a phytotherapeutic plant commonly known as Guava. It is also known as poor man's apple [22]. It belongs to the Family Myrtaceae which contains at least 133 genera and more than 3800 plant species [23]. It grows in the tropical and subtropical areas of the world, adapts to different climatic conditions but prefers dry climates. Psidium guajava is a fruit and can be consumed fresh and processed forms, which including beverages, syrup, ice cream and jams[24]. Guava is well accepted by the consumers and makes a beneficial contribution to the human diet due to rich in minerals and functional components such as vitamins and phenolic compounds [25]. The leaves and bark of P. guajava tree have a long history of medicinal uses that are still employed today and led modern day researchers to study guava extract **Phytochemical constituent of**

## **Guava:**

The composition of guava varies significantly with variety, stage of maturity and season [26]. The budding leaves of *Psidium guajava* contained huge amounts of soluble polyphenolics including gallic acid, catechin, epicatechin, rutin, quercetin and rutin [27]. Different flavonoidal and triterpenoids compounds were isolated from *Psidium guajava* leaves through extraction, fractionation and isolation on the basis of comprehensive spectroscopic methods and molecular modelling calculation [28].

## **Pharmacological Activities of and Guava:**

### **Anti-Bacterial Effects of Aloe and Guava:**

Guava extracts of methanol (MEG) exerted antibacterial effects, preventing the growth of different strains from several bacteria such as *Staphylococcus aureus*, *Escherichia coli* and *Shigella* spp. [29]. Furthermore, different extracts of the leaves such as aqueous, acetone water, methanolic, spray-dried extracts and the essential oil, showed potential inhibitory activity against Gram-positive and Gram-negative bacteria and fungi [30]. Moreover, Bezerra et al. [31] evaluated the effect of guava leaves on different bacterial strains, concluding that the synergistic action between the leaves and various antibiotics boosted its anti-bacterial activity **Anti-Viral Activity of and Guava:**

Guava leaf tea helped control of the growth of influenza viruses via the prevention of viral entry into host cells, probably due to the presence of flavonols [32]. *Psidium guajava* showed good curative effect on infantile ritaviral entrities (33)

### **Anti-Tumor Effects of and Guava:**

The aqueous extract of *Psidium guajava* leaves (AEG) bears an extremely high content of polyphenolic and isoflavonoids; it could be used as an anti-tumor chemoprevention in view of anti-angiogenesis and anti-migration. *Psidium guajava* extract was able to exert anti-cancer activity on cultures in vitro and in vivo, supporting the hypothesis of its anti-malignant pro-apoptotic modulation [34]. Treatment with *Psidium guajava* budding leaves of aqueous extract significantly diminished both the prostate specific antigen (PSA) serum levels and tumor size in a xenograft mouse tumor model. Guava leaf essential oil has been shown to possess cytotoxic effect on Human cervical cancer cell lines [35]

### **Anti-microbial activity of gauva :**

Guava has a high antimicrobial activity. Guava leaf's extract doses can reduce the amount of cough due to its anti-cough activity. Aqueous, chloroform and methanol extract of leaves can reduce the growth of different bacteria. Due to its anti-cough activity it is recommended in the condition of cough [36]. 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 anti microbial activity. These extracts can inhibit the *Bacillus* and *Salmonella* bacteria [37]. 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 [38]. The flavonoid compounds and their derivatives can be isolated from the guava. These compounds can inhibit the growth of different bacteria in different dilutions. Terpinene and pinene are present into the aqueous extract of plant's leaves which shows antimicrobial activity. Due to bacteriostatic effects on pathogenic bacteria it is also used as medicine in cough, diarrhea, oral ulcers and in some swollen gums wound [1, 38]. Aqueous and ethanol extracts show low antimicrobial activity or minimum inhibitory concentration (MIC) whenever methanol extract shows high MIC. Due to its high activity methanolic extract is most effective. This extract also displays anti hemolytic potential as it shows activity against hemolysis [39].

The antibacterial activity of guava is high against gram positive bacteria and moderate against the gram negative bacterial strains [40]. In 2012 it was reported that guava leaves have many compounds which act as fungistatic and bacteriostatic agents. They can stop the growth of a lot of bacteria and act as anti-viral agents. They can control the viral infections like influenza virus. They can hold and occupy the viral resistance. The actual reason of guava anti-viral activity is protein degradation ability of the guava extract [41]. Essential oil of guava also has activity against the *Salmonella* and *S. aureus* [42]. Guava also possesses anticancer and antioxidant activities. There are a lot of compounds like Gallic acid, galangin, kaempferol, homogentisic acid and cyanidin 3-glucoside which are found in peels, seeds and pulp of guava. But it is surprising that the amount of these compounds is high in seeds and skin as compared to the pulp. Due to the presence of these compounds guava's food importance becomes high [43]. It is very clear that aqueous and methanol extract of the guava leaves inhibit the growth of bacteria and can produce a remarkable zone of inhibition. The extracts in methanol and water show maximum MIC whenever ethanol extract shows minimum anti-fungal activity. Conclusively leaves, seeds, skin and pulp of guava have a remarkable anti-microbial activity [44].

### **Medicinal importance of guava:**

*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 [45]. Medicinal plants find a very important place in medical systems almost in the entire world. These observations are reflected from traditional knowledge. It is well known that guava is frequently employed in numerous parts of the world for the cure of a lot of sickness like diarrhea, reducing fever, dysentery, gastroenteritis, hypertension, diabetes, caries, pain relief and wounds. The countries which have a long history of using medicinal plants are also using guava at a big level like Mexico, Africa, Asia and Central America. With its medicinal uses it is also used as food and in the preparation of food products. It is also used in house construction and toys making. Guava contains high content of organic and inorganic compounds like secondary metabolites e.g. antioxidant, polyphenols, antiviral compounds and anti-inflammatory compounds. Guava has a lot of compounds which have anti-cancerous activities. It has a higher number of vitamins and minerals. Phenolic compounds like flavonoids also find an important place in the guava. Lycopene and flavonoids are important antioxidants. They help in the cure of cancerous cells and help to prevent skin aging before time [46]. Guava can affect the myocardium inotropism [47]. Guava skin extract can control level of diabetes after 21 days treatment [48].

### **Antidiarrheal activity:**

Diarrhea is one of the most common and well recognized health problem and a global issue. It is very common even in developed countries. It is estimated that about 2.2 million people die annually by diarrhea; most of them, are children or infants [49]. Guava leaves have quercetin-3-arabinoside and quercetin which can be isolated from leaves. Its leaves contain a compound which has morphine like action. It controls the muscular tone. Quercetin repressed intestinal contraction encouraged by enhanced absorption of calcium. Quercetin has a strong effect on ileum. It is thought that quercetin in guava leaf are responsible for its spasmolytic activity. Guava has high cytotoxicity [50]. Guava can be used to treat the diarrhea caused by the *E. coli* or *S. aureus* toxins [51]. Ethanolic and aqueous extracts of *Psidium guajava* at a concentration of 80 g/ml in an organ bath, display more than 70% embarrassment of acetylcholine and/or KCl solution-induced reduction of isolated guinea-pig ileum. The rates of impulsion in the small intestine into male Sprague Dawley rats as it means of evaluate anti-diarrhoeal activity of the aqueous extracts of leaf of *Psidium guajava* using morphine like the standard drug for reference was measured [52]. Locomotor coordination can be improved by the ethylacetate extract of guava fruit [53]. Ojewole 2008 examined anti-diarrheal activity of guava leaves extract in water provoked diarrhea in the rodents. This extract produces important protection to rats and the mice in opposition to castor oil induced diarrhea. It inhibits the intestinal transit in rats. The activity of this extract is dose dependent. Atropine dose have significant anti motility effect due to which castor oil-induced diarrhea is inhibited. Loperamide dose significantly delays the onset of the castor oil-induced diarrhea. By comparison of animals it was noticed that intestinal fluid secretion is reduced significantly. Guava extract have anti diarrhoeal activity and it can be used for the treatment

and prevention of diarrhoea [54]. Guava have significant antidiabetic and antidiarrhoeal activities in ethanolic extracts [55, 56].

### **Anti-inflammatory activity:**

Extract of guava in ethyl acetate can stop the germ infection and thymus production. It can act as anti-viral agent. It can enhance the mRNA expression. Guava can alter the heme oxygenase-1 protein's work. And due to this reason, it can be used as anti-inflammatory agent for skin. Extract of guava in ethanol inhibits the lipopolysaccharide from manufacturing of nitric oxide. It suppresses the expression of E2. In this way it works as anti-inflammatory agent [57]. 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 spoiled. Benzophenone and flavonoids are important compounds found in guava. These compounds are responsible for the histamine inhibition and nitric acid production [58]. Guava extract also shows anti-nociceptive activity. It happens by acetic acid production. Phenol is an important compound which is present in guava and dependable for the anti-allergic and anti-inflammatory activity [59]. The dose of guava extracts are effective in liver damage inflammation and serum production [60].

### **Antioxidant activity:**

Antioxidants are molecules which retard the oxidation process. The oxidation reactions may produce free radicals which damage the cells by starting various chain reactions. Free radicals which damage the cells cause cancer and many other diseases. Antioxidants terminate the free radicals and stop the chain reactions. Examples of antioxidants include beta-carotene, lycopene, vitamins C, E, and A and other substances. Oxidative reaction is one of the most important destructive reactions. Free radical's damage is responsible for a lot of disorders in human like nervous disorders, inflammation, diabetes and viral infections. When drugs are metabolized in the body the free radicals are produced. Sometimes the environmental changes and hormones become the reason of free radical production. These free radicals are responsible for all the oxidation reactions [61]. Guava contains high amount of antioxidants and anti-providing nutrients which are essential not only for life but also help to control the free radical activities. It also has a variety of phytochemicals which are beneficial for human health like diabetes, obesity and high blood pressure. There are two common methods by which antioxidants neutralize free radicals that is DPPH and FRAP assay. Extracts of guava in water and organic solvents have a large quantity of antioxidants which can stop the oxidation reaction. The concentration of these compounds become high with the increase in concentration [62]. Pink guava also has a high antioxidant activity [63]. 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 [64]. In fruits, the most abundant oxidants are polyphenols and ascorbic acid. The polyphenols are mostly flavonoids and are mainly present in glycoside and ester forms [65]. The free elagic acid and glycosides of apigenin and myricetin are found to be present in guava [66].

DPPH method shows that the guava has remarkable antioxidant contents and these antioxidants do not damage the human neutrophils. Extracts in different solvents show that antioxidant activity of guava depends upon phenolic compounds rather than flavonoids. Methanol and aqueous extraction shows maximum activity [67–68]. Ethanolic extract of guava shows low activity in all antioxidant assays like DPPH and FRAP assay [69]. Due to antioxidant activity of guava it can control the diabetes. It shows a significant diabetic control in mice [70]. Quercetin, quercetin-3-O-glucopyranoside and morin can be isolated from leaves. These compounds show the anti-oxidant activity. Quercetin has free radical balancing activity. Its reducing power is much higher than all other compounds. It is considered as most active and strong antioxidant in the leaves of guava [71, 72]. A comparison was made between the antioxidant properties of convection oven-dried and fresh guavas. Convection oven-drying was resulted to retain most of the total phenolic contents (TPC), ascorbic acid

equivalent antioxidant capacity (AEAC) and ferric reducing power (FRP) assay of guava. However, the drying resulted in a significant decrease of AEAC, TPC and FRP [73].

### Conclusions:

*Psidium guajava* (guava) is well known tropic tree grown in tropic areas for fruit. It is found to be effective in diarrhea, dysentery, gastroenteritis, hypertension, diabetes, caries, pain relief, cough, oral ulcers and to improve locomotors coordination and liver damage inflammation. Its skin contains a lot of phytochemicals in its fruit which is rich in vitamins (A & C), iron, phosphorus and calcium and minerals. The phenolic compounds in guava help to cure cancerous cells and prevent skin aging before time. The leaves contain many fungistatic and bacteriostatic agents and important oxidants. Its ethyl acetate extract contains quercetin which can germ infection and thymus production. Guava possesses anti-viral, anti-inflammatory, anti-plaque, antinociceptive activity and anti-mutagenic activities. Due to these biological activities it is can be quite helpful for the preventions and treatments of diseases. Ethanolic extract of guava can increase the sperm quality and quantity and can be used for the treatment of infertile males.

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