

Guava: A Nutraceutical Miracle

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Guava fruit and leaves have wide range of beneficial and nutritional aspects for human and livestock. Due to evergreen nature and current season habit of flowering in guava, lot of pruned material is available and there is every need to utilize the sheared leaves and twigs to enhance health of rural people. Extracts of guava leaves also used to manage disease and pest management in crop production.

Psidium guajava L., is a small tree belongs to the family Myrtaceae and native to tropical areas from southern Mexico to northern South America. It grows widely in the tropic areas because it is a plant that can be grown on wide range of soils. It is an evergreen shrub like tree which reaches to the height of 6 to 25 feet. The plant has a wide spreading network of branches. Branches are curved which display opposite leaves with the small petioles of about 3 to 16 cm. Leaves are wide, clear green in color and have clear prominent veins. Fruit ranges from small to medium sized with 3 to 6 cm length. It has pear like shape and yellow color on ripening. It has a musky special odor when ripened and is strong but pleasant. 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. It is also a very good source of the pectin which is an important dietary fiber. It has high content of flavonoids, fructose sugar and carotenoids.

Fruit contains saponin, oleanolic acid, lyxopyranoside, arabopyranoside, guaijavarin, quercetin and flavonoids. Ascorbic acid and citric acid are the major ingredients of guava that play important role in anti-mutagenic activity. Skin of fruit contains ascorbic acid in very high amount but it may be destroyed by heat. The strong pleasant smell of fruit is credited to the carbonyl compounds. Guava fruit

contains terpenes, caryophyllene oxide and p-selinene in large quantity which produce relaxation effects. Pickle guava contains a higher number of phenolic compounds including flavonoids compared to fresh guava, hence it can a good source of polyphenols in the diet (Ramli and Saadon, 2021).

A study conducted by Allo *et al.* (2021) revealed that consuming pink guava juice increase hemoglobin levels of pregnant women to prevent themselves from the occurrence of anemia in Indonesia. Sushmitha *et al.*, (2021) reported that best quality blended juice with higher sensory acceptability can be obtained using 80 per cent banana pseudostem sap, 5 per cent noni juice, 5 per cent Aloe vera juice and 10 per cent guava pulp. It can be stored successfully for 6 months in PET bottles in ambient temperature. Inclusion of 25 g of guava into the ICDS-SNP (Integrated Child Development Services of India - Supplementary Nutrition Program) meal for 140 days had multiple benefits that included improved hemoglobin, iron stores, plasma vitamin C, and folate status, along with a reduction in ARI (Acute Respiratory Infection) morbidity among preschoolers (Choudhury *et al.*, 2020). Ojiuko *et al.* (2021) suggests that guava twigs contain compounds that are active against *Streptococcus mutans* and can be used in oral hygiene in Nigeria.

Essential oil is present in leaves which contain α -pinene, limonene, β -pinene, isopropyl alcohol, menthol, terpenyl acetate, caryophyllene, longicyclene and β -bisabolene. Oleanolic acid is also found in the guava leaves. Leaves have high content of limonene about 42.1% and caryophyllene about 21.3%. Leaves of guava have a lot of volatile compounds. Bark contains tannin 27.4%, or polyphenols, resin and the crystals of calcium oxalate. Tannin is also present in roots. Leukocyanidins, gallic acid and sterols are also present in roots. Carbohydrates with salts are present

in abundance. Tannic acid is also its part. Leaf extract that contains high concentrations of vitamin E, flavone (apigenin), or β -caryophyllene show significant antiproliferative activity against colon carcinoma and various forms of human cancer) (Cerio *et al.*, 2017). Aqueous and organic extracts of guava leaves have antibacterial activity (*Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Proteus* spp).

Leaf acetone extract of guava exhibited moderate acaricidal and insecticidal activities (*Hippobosca maculata* adult). Ethanol extract from the leaves function as a trypanocide agent. Guava leaves are proposed for the treatment of diarrhea that caused by enteric pathogens, since it showed significant inhibitory activity against *Vibrio cholerae* and *V. parahemolyticus*, *Aeromonas hydrophila*, *Shigella* spp. and *Salmonella* spp. Guava leaf tea control the growth of influenza viruses probably due to the presence of flavonols. Aqueous extract of budding guava leaves displayed an anti-tumor effect against human prostate epithelial (PZ-HPV-7) and carcinoma (DU-145) cells in view of the cell-killing-rate coefficients, as well as anti-angiogenesis and anti-migration activities, respectively. Guava leaves act as immune-stimulant agent because they modulated the lymphocyte proliferation response. Budding guava leaves also showed their ability as an anticoagulant in plasma, since they reduced thrombin clotting time and inhibited the activity of antithrombin III. Thus, they could help to reduce the development of cardiovascular complications.

Guaijaverin, isolated from guava leaves, displayed high inhibitory activity against *Streptococcus* mutans. Guava leaves showed greater bactericidal effect on early (*Streptococcus sanguinis*) and late (*S. mutans*) colonizers compared to *Mangifera indica* L. and *Mentha piperita* L. leaves, whereas, when they are compared with the plant extract mixture, the effect is slightly lower. Guava extract shows their potential for preventing dental caries due to the growth inhibition of the oral flora by flavonoids. Methanolic guava leaves extract inhibits tyrosinase, that is the key enzyme in melanin synthesis, and ORAI1 channel that has shown to be associated with UV-induced

melanogenesis. Guava leaves have shown their potential against diabetes mellitus.

Guava leaves act as supplementary feed for the fish species *Labeo rohita*, due to the immune-stimulatory effect. Guava leaf powder, mixed with a commercial diet, strengthened the immunological response of *Oreochromis mossambicus*, and recommended the leaves as feed complement in aquaculture. The aqueous extract of leaves of guava (*P. guajava* Linn.) at the investigated doses (500, 750, and 1000 mg/kg) and concentration (0.33g/ml) is detrimental to the morphology of the testicle in rats. So, cautious especially if large amounts need in folk-traditional medicine for the treatment of acute and chronic health problems or diseases such as diabetes and other ailments (Etim *et al.*, 2021). Guava leaf extract can be used as a reducing agent to synthesize zinc oxide nanoparticles as a green route method instead of a chemical method that uses hazardous chemicals (Zayed *et al.*, 2021). The guava agro-industrial waste (GAW) has the potential to be used in animal feed reducing feed cost and/ or providing bioactive substances enabling beneficial effects on product quality and consumer health. GAW is mainly pulp seeds, which also have significant amounts of unsaturated fatty acid and fibrous matter. The protein content is about 7.9-9.6%, 10.5-16% fat and 53.6-67.7% crude fiber. GAW (upto 42% inclusion) increased the consumption of natural and dry matter and decreased feed efficiency in goats (Santos *et al.*, 2021).

Conclusion

Now a days to meet needs for increasing population there is need to enhance utilization of crop produce and its byproducts effectively. Guava fruit is rich in minerals, nutrients and vitamins. Along with fruit consumption, utilization of guava leaves and its extracts with potential beneficial aspects may enhance better utilization of poor man's fruit crop.

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