Journal of Materials and Environmental Science
ISSN : 2028-2508
e-ISSN : 2737-890X
CODEN : JMESCN
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J. Mater. Environ. Sci., 2025, Volume 16, Issue 12, Page 2279-2292

http://www.jmaterenvironsci.com

A Mini Review on Phytochemical Constituents, Medicinal and Environmental Applications of Guava Leaves

Kabir D.[1]*, Hussaini M.[2], Lawan I.[3], Hamza M.[4], Mohammed A.S.[5], Abdu K.[6]

[1]*Department of Science Laboratory Technology, Federal Polytechnic Idah, PMB 1037, Kogi State, Nigeria*
[2] *Department of Chemistry, College of Natural and Applied Sciences, Al-Qalam University Katsina, Nigeria*
[3-5]*Department Chemistry/Biochemistry, Federal Polytechnic Idah, Kogi State*
[6]*Department of Pure and Industrial Chemistry, Bayero University Kano, Nigeria*

**Corresponding author, Email address: kabirdanjumaa@gmail.com*

Received *11 Oct 2025,*
Revised *13 Dec 2025,*
Accepted *14 Dec 2025*

Keywords:
- ✓ *Guava Leaves;*
- ✓ *Medicinal Plants;*
- ✓ *Bioactive Compounds;*
- ✓ *Waste Water Management;*
- ✓ *Phytochemicals.*

Citation*: Kabir D., Hussaini M., Lawan I., Hamza M. Mohammed A.S., Abdu K. (2025) A Mini Review on Phytochemical Constituents, Medicinal and Environmental Applications of Guava Leaves, J. Mater. Environ. Sci., 16(12), 2279-2292*

Abstract: The leaves of guava (*Psidium guajava L.*) have been extensively known to possess a rich phytochemical composition and a variety of biological properties and thus are useful in the fields of medicine, nutrition and the environment. This review discussed the phytochmical constituents, medicinal and environmental applications of guava leaves. The Phytochemistry reports of guava showed that the plant contains bioactive compounds including flavonoids (quercetin, catechin, and kaempferol), tannins, saponins, triterpenoids, phenolic acids, essential oils, and alkaloid, all of which add up to the therapeutic potential of the plant. Guava leaves have good antimicrobial, anti-inflammatory, antioxidant, antidiarrheal, antidiabetic, hepatoprotective, and antihyperlipidemic effects used medicinally. They have long been used in the treatment of gastrointestinal conditions, skin infections, respiratory conditions, and metabolic disorders and have increasingly shown themselves to be effective in the treatment of different ailments in the modern context. In the environment, the guava leaves are becoming an emerging source of environmentally friendly resources in wastewater treatment, biosorption of heavy metals, natural pesticide formulations, and green production of nanoparticles. They are biodegradable, available, and containing large amounts of polyphenol, which makes them suitable to the sustainable environmental technologies. In general, guava leaves are a versatile natural resource that has considerable applications in the field of phytomedicine and environmental sustainability and should be studied more regarding the mechanisms of action and their possible industrial applications.

1. Introduction

In herbal medicine, plants are one of the most popular options (Rumiyati *et al.,* 2024; Eman *et al.,* 2025; Mrayej *et al.,* 2025). Plant-based products are readily accessible, inexpensive, and have the least propensity to become resistant, which may make them advantageous for health (Kadda and Belabed, 2021; Eb Ahmad *et al.,* 2023; Diass *et al.,* 2023; Luecha *et al.,* 2024; Rashid *et al.,* 2024). According to Dalal *et al.* (2023), the lowest and middle classes employ herbal remedies extensively for prevention, promotion, and recovery. Because of their pharmacological properties that have been reported recently, plants have also been utilized as an alternative to antiparasitic medications (Kadda *et al*., 2022; Ghany *et al*., 2023; Mubarik *et al.,* 2023; Aljohani, 2024; Hussain *et al.,* 2024; Eman *et al.,* 2025). The use of medicinal plants is a custom that is passed down from one generation to the next. The knowledge and use of medicinal plants are influenced by factors such as ethnicity, ecological zone, and educational level (Andualem, 2023; Hegazy *et al.,* 2023; El Hassania *et al.,* 2024; Eman *et al.,* 2025).

Plants are used as traditional medicine by about 80% of the world's population. According to the World Health Organization (WHO), 11% of medications used to treat human health are derived from plants. The global market has grown to 59.45 billion US dollars due to the usage of herbal products, according to a 2017 study on the subject by Behavior Change Communication. At an annual rate of 6.5%, this market is projected to grow to 104.78 billion US dollars in 2026 (Bareetseng, 2022; Eman *et al.,* 2025). Beyond their nutritional worth, functional foods are currently being utilized to offer health benefits (Çalışkan and Emin, 2023; Eman *et al*., 2025).

Psidium guajava, or guava, is a medicinal plant widely grown in tropical areas and has long been known to have medicinal uses (Mohapatra *et al.,* 2024; Luo *et al.,* 2019). **Table 3** lists a variety of bioactive substances found in the leaves, such as phenols, flavonoids, terpenoids such gallic acid, and water-soluble tannins (Beidokhti *et al.,* 2020). The leaves have exceptional inhibitory effects against a variety of diseases, including bacteria and fungus, thanks to its complex chemical profile, especially gallic acid (Mohapatra *et al*., 2024). The leaves' diverse medicinal potential is demonstrated by compounds like pyrocatechol, taxifolin, psiguadials, guaijaverin, and avicularin, among others, which contribute to its hypoglycemic, antioxidant, anticancer, and antidiarrheal activities (Chandra *et al.,* 2017; Sabbahi *et al*., 2022; Mohapatra *et al*., 2024).

Figure 1: Sample guava leaves and fruits

Because of their porous structure and functional groups, guava leaves have been linked to the adsorption of heavy metals (**Table 1**) like zinc, cadmium, arsenic, lead, iron, and chromium as well as dyes like methylene blue, congo red, brilliant green, amaranth, auramine, nile blue, and photocatalytic dyes from contaminated water sources (Biswal *et al.,* 2020; Ali *et al*., 2022; Behera *et al*., 2022; Dey *et al.,* 2022; Mohapatra *et al.,* 2024). Compounds found in the leaves function as natural coagulants and adsorbents, facilitating flocculation, sedimentation, and impurity removal (Mohapatra *et al.,* 2024). This review discussed the phytochemical components of guava leaves as well as their applications in medicine and the environment.

2. Proximate Composition of Guava Leaves

Guava leaves (GLs) are a rich source of bioactive chemicals and a variety of health-promoting macronutrients and micronutrients (**tables 1, 2, and 3**). According to Shabbir *et al.* (2020) and

Kumar et al. (2021), they have 82.47% moisture, 3.64% ash, 0.62% fat, 18.53% protein, 12.74% carbs, 103 mg ascorbic acid, and 1717 mg gallic acid equivalents (GAE)/g total phenolic compounds.

Table 1: Compositions of elements and ascorbic acid found in guava

SN	Element/Ascorbic acid	Composition	Reference
1	Ascorbic acid	142.55 mg/100 g	Kumar *et al.*, 2021
2	Nittrogen	1.02 %	Kumar *et al.*, 2021
3	Phosphorus	0.23 %	Kumar *et al.*, 2021
4	Potassium	1.11	Kumar *et al.*, 2021

Table 2: Compositions of Carbohydrates/phenols/sulfates in guava

SN	Carbohydrates/phenols/sulfates	Composition	References
1	Glucose	33.79	Kim *et al.*, 2016
2	Mannose	0.59	Kim *et al.*, 2016
3	Fructose	1.44	Kim *et al.*, 2016
4	Rhamnose	3.88	Kim *et al.*, 2016
5	Arabinose	22.6	Kim *et al.*, 2016
6	Galactose	29.41	Kim *et al.*, 2016
7	Xylose	7.71	Kim *et al.*, 2016
8	Sulfate polysaccharide	66.71	Kim *et al.*, 2016
9	Carbohydrate	48.13	Kim *et al.*, 2016
10	Sulfate	18.58	Kim et al., 2016
11	Phenol	15.28	Kim *et al.*, 2016

Table 3: Some bioactive compounds isolated from guava

SN	Bioactive Compound	Reference
1	Quercetin	Kumar *et al.*, 2021
2	avicularin	Kumar *et al.*, 2021
3	apigenin	Kumar *et al.*, 2021

4	guaijaverin	Kumar *et al.,* 2021
5	kaempferol	Kumar et al., 2021
6	hyperin	Kumar *et al.,* 2021
7	myricetin	Kumar *et al.,* 2021
8	Gallic acid	Wang *et al.,* 2017
9	catechin,	Wang *et al.,* 2017
10	epicatechin,	Wang *et al.,* 2017
11	chlorogenic acid	Wang *et al.,* 2017
12	epigallocatechin gallate	Wang *et al.,* 2017
13	Caffeic acid	Wang *et al.,* 2017
14	Proanthocyanidins	Díaz-de-Cerio *et al.,* 2016
15	chlorogenic acid	Kumar *et al.,* 2021
16	epicatechin	Kumar *et al.,* 2021
17	rutin	Kumar *et al.,* 2021
18	Larabinofuranoside, quercetin-3-O-β-D-xylopyranoside	Kumar *et al.,* 2021
19	avicularin	Kumar *et al.,* 2021
20	quercitrin	Kumar *et al.,* 2021
21	kaempferol-3-arabofuranoside	Kumar *et al.,* 2021

3. Applications of Guava Leaves in Waste Water Management

All living things need on water to survive and thrive, making it a vital resource for life. As the foundation of appropriate hydration and sanitation, clean water is essential for preserving human health (Mohapatra *et al.,* 2024). Ecological equilibrium depends on the sustainable management of water resources. Two important contaminants in water bodies are dyes and heavy metals (Elgarahy *et al.,* 2021; Mohapatra *et al.,* 2024). According to Mohapatra *et al*. (2024), heavy metals, which are metallic elements with an atomic density higher than 4 g cm^{-3}, pose a special environmental problem. Due to their great density and possible toxicity, these elements can enter ecosystems through a variety of routes, so we must pay attention to how they affect the environment and living things. They are widely distributed in the environment as a result of their considerable use in industrial, residential, agricultural, medicinal, and technical applications (Mishra *et al.,* 2019). Lead, mercury, arsenic, chromium, and cadmium are examples of heavy metals that are frequently found (Joseph *et al.,* 2019). Although these metals are necessary for many physiological and biological functions, high concentrations can have harmful consequences (Jaishankar *et al.,* 2014). According to Ungureanu *et al.* (2022) and Nguyen (2023), heavy metal poisoning can harm or diminish brain and central nervous system function, lower energy levels, and harm important organs such as the liver, kidneys, lungs, and blood composition. Thus, regulating and comprehending heavy metals is essential for both environmental sustainability and public health. Heavy metal ions are extracted from contaminated water using guava leaves as an adsorbent (Mohapatra *et al.,* 2024).

Dyes contaminate water bodies in a similar way to heavy metals. Textiles, paper, and cosmetics are just a few of the many industries that employ dyes extensively to color their products. Dyes can enter water streams through a variety of channels if they are not properly handled before being disposed of, which could have mutagenic and carcinogenic consequences on humans and aquatic life (Oladoye *et al.*, 2022; Mohapatra *et al*., 2024). Using a variety of physical and chemical techniques, guava leaves have been employed as an adsorbent for dyes such brilliant green, congo red, and methylene blue (Bulgariu *et al.,* 2019). Guava leaves may physically absorb color molecules on their surface due to their porous structure. Guava leaves may physically absorb color molecules on their surface due to their porous structure. The adsorbent (guava leaves) and the dye molecules can interact on a vast surface area due to the leaves' porous nature. Guava leaf functional groups, including hydroxyl groups, may interact with dye molecules (Mohapatra *et al.,* 2024).

4. Medicinal Applications of Waste Water Management

4.1 Anti-Inflammatory Activity of Guava Leaves

Guava leaf extract in ethyl acetate can prevent germ infection and thymus production. It could have antiviral properties. It might make mRNA more expressed. Additionally, it can alter the heme oxygenase-1 protein's function, which allows it to be used as a skin anti-inflammatory. Guava leaf extract in ethanol stops lipopolysaccharide from producing nitric oxide. It prevents the synthesis of E2. It also acts as an anti-inflammatory in this manner. Antigen levels can be lowered by the extract in ethyl acetate. It can stop RBL-2H3 cells from releasing β-hexosaminidase and histamine. As a result, the production of TNF-α and IL-4 mRNA stops. Consequently, the antigen is blocked and IκB-α is spoiled. Essential compounds including benzophenone and flavonoids are found in guava leaves. These compounds are responsible for the generation of nitric acid and the suppression of histamine (Naseer *et al.,* 2018; Eman *et al.,* 2025).

4.2 Applications of Guava Leaves in Rising Haemoglobin

One of the vital minerals in guava is iron (0.6–1.4 mg/100 g). Increasing vitamin C consumption is the best dietary advice for treating and preventing anemia. 29 expectant mothers getting prenatal care at the Kalasan Community Health Center took part in a quasi-experiment. The subjects were divided into two groups: the treatment group and the control group. Each group received two doses of iron supplement therapy over the course of two weeks, and the treatment group also received 200 milliliters of guava juice every day. The creation of red blood cells during bone growth and the maintenance of normal hemoglobin levels were found to be impacted by vitamin C in guava fruit juice. This is because guava juice inhibits hemolysis of red blood cells, which can increase hemoglobin levels. Guava juice can help halt the lipolysis process because of the antioxidant properties of red guava. Guavas also contain five times more vitamin C than oranges. This study found that giving pregnant women 200 ml of guava juice every day for two weeks effectively increased their hemoglobin levels (Wahyuntari and Wahtini, 2020).

4.3 Anti-diabetic Activity of Guava Leaves

One of the metabolic problems that affect the majority of people worldwide is diabetes. The insufficient synthesis of insulin by the pancreatic cells causes this illness. According to Luo *et al.* (2019), guava leaves have been widely utilized as a therapeutic medication for the treatment of diabetes. Numerous triterpenoids found in guava leaves have been shown to reduce insulin resistance in adipocytes in rats with diabetic peripheral neuropathy. Higher leaf triterpenoid corosolic acid is a potent α-glucosidase inhibitor that helps cure diabetes mellitus by reducing the postprandial blood glucose increase and slowing down the digestion of carbohydrates. Furthermore, by reducing HbA1c blood glucose levels and increasing plasma insulin levels, guava extract has a preventative and antidiabetic effect on altered glucose metabolism (Takeda *et al.,* 2023). About 10% of people worldwide have blood glucose metabolic disorders, which are mostly defined by hyperglycemia. Diabetes is a serious chronic illness. Type 1 diabetes is characterized by insufficient insulin secretion from pancreatic islets' β-cells, while type 2 diabetes is characterized by cells' incapacity to respond to the released insulin (Punia *et al.,* 2020). According to the International Diabetes Federation, 451 million individuals worldwide had diabetes mellitus in 2017, which led to 5 million fatalities. By 2045, there are expected to be 693 million cases worldwide (Cho *et al*., 2018). Long-term hyperglycemia causes dyslipidemia and increased ROS generation, which can result in serious cellular damage and problems (Hu *et al*., 2018). In vivo administration of P. guajava leaf extracts to streptozotocin/alloxan-induced diabetic rats decreased hyperglycemia by controlling glucose homeostasis and insulin sensitization. Naringenin, (epi)-catechin, guavinoside C, and stachyuranin A were found to be DPP4 inhibitors. DPP4 inhibition would increase insulin secretion and provide blood glucose levels more time to recover to normal by extending the half-life of the incretin hormones (Diaz-de-Cerio *et al.,* 2023). In ethnomedicine, guava leaves have been used extensively to treat diabetes. Numerous researches have proven the antidiabetic potential of guava leaves flavonoids and polysaccharides. The Bioactive compounds obtained in guava such as guaijaverin, avicularin and other flavonoids were linked to a notable improvement in the hepatocyte shape and β-cell function of pancreatic islets in diabetic mice (Punia *et al.,* 2020; Kumar *et al.,* 2021). While avicularin prevented intracellular lipid accumulation by blocking glucose absorption through GLUT-4 in vitro and showed no discernible toxicity for 3T3-L1 adipose cells, guaijaverin decreased the function of the blood glucose homeostasis enzyme dipeptidyl-peptidase IV (Kumar *et al.,* 2021). Guava leaf polysaccharides were isolated, and their antidiabetic properties were further investigated in streptozotocin-induced diabetic mice fed a high-fat diet. The scientists found that guava leaf extract was linked to an increase in total superoxide dismutase and total antioxidant capacity enzyme activity in vivo, as well as a substantial decrease in total cholesterol, triglycerides, glycated serum protein, creatinine, fasting blood glucose, and malonaldehyde content. Elevated postprandial glucose concentrations may result from inadequate glycemic control. Inhibitors of the enzymes α-amylase and α-glucosidase have been proposed as potential targets for managing diabetes because they can reduce postprandial glucose absorption. The Santiglycation activity of the extracted polysaccharides was examined after they were separated from guava leaves using ultrasound-assisted extraction (Kumar *et al*., 2021).

4.4 Anticancer Activity of Guava Leaves

An acetone extract from guava branches was tested for anticancer effects using the HT-29 cell line. Following a 24-hour incubation period, the extract demonstrated a dose-dependent reduction of cell vitality, lowering cell viability by 30–70% as compared to the reference. The guava branch extract stopped the cells from forming colonies, with an IC50 value of less than 100 µg/mL. The extract also caused a dose-dependent increase in the cells' leakage of lactate dehydrogenase (LDH), an indicator of cellular damage. Lactate dehydrogenase release and colony formation assays show how deadly the extract is to colon cancer cells. Furthermore, the cells treated with the guava branch extract had about thirty times as many apoptotic cells in the sub-G1 phase as the control group, according to flow cytometry. This led to the conclusion that guava branch acetone extract offers significant promise as a natural anticancer chemotherapeutic treatment for colon cancer (Lok *et al.,* 2023; Eman *et al*., 2025).

4.5 Antimicrobial Activity of Guava Leaves

The extract of guava leaves were found to penetrates the cell membrane's lipid bilayer, increasing permeability and causing cytoplasmic content to be lost (Kwamin *et al.,* 2019). After seven days of use, mouthwashes containing extract from guava leaves dramatically reduced the amount of Streptococcus mutans colonies. Among the bioactive components thought to be in charge of the antibacterial qualities of guava leaf extract include flavonoids, polyphenols, and tannins. Guava leaves contain flavonoids called quercitin and guaijeverin that dissolve in bacterial cell walls, form complexes with extracellular proteins, and disrupt the bacterial life cycle. Tannins are polyphenolic compounds present in guava leaves that bind proline-rich proteins. This damages the metabolism of bacteria by preventing the synthesis of new proteins and denaturing existing ones. Furthermore, by dissolving the fatty layer of the cell wall that permits cell fluid to escape, they effectively eradicate the bacterial cell (Kassem *et al.,* 2022).

4.6 Anti-diarrheal Activity of Guava Leaves

Tannins, saponins, polysaccharides, and cardiac glycosides found in P. guajava leaf extract may have an antidiarrheal effect (Naseer *et al.,* 2018). The extract also demonstrated its potential as an antidiarrheal drug by slowing stomach emptying and obstructing intestinal transit. In a castor oil-induced diarrheal paradigm, the ethanolic of guava leaves shown notable antidiarrheal benefits in comparable in vivo trials using Wistar rats (Mazumdar *et al.,* 2015). The initial line of treatment for digestive diseases was the use of guava leaves and other typical traditional medicines to treat children's diarrhea. Quercetin and quercetin-3-arabinoside were extracted from guava buds and leaves. At doses of 1.6 g/mL, these compounds showed a painkiller-like suppression of neurotransmitter unharness within coaxially stirred-up the small intestine and caused a corresponding rise in muscle tone that gradually decreased. Asiatic acid was also extracted from the leaves and shown a dose-dependent (10–500 g/mL) spasmolytic effect (Dange *et al*., 2020).

4.7 Antioxidant Activity of Guava Leaves

It has been demonstrated that P. guajava fruit has an antioxidant effect by restoring enzymatic antioxidants and inhibiting the activation of nuclear factorkappa B (NF-kB). Guava fruits with pink pulp essence have been found to contain a high concentration of phenolic compounds and a significant amount of carotenoids, particularly lycopene, which were mostly responsible for the antioxidant activity (Eman *et al.,* 2025). Free radicals are the primary cause diseases in humans, including immune deficiency disorder, are caused by metabolic processes. Guava leaves' antioxidant properties are caused by phenolic substances such gallic acid, pyrocatechol, taxifolin, ellagic acid, ferulic acid, and several more (Farag *et al.,* 2020). Seven major flavonoids—quercetin, hesperetin, kaempferol, quercitrin, rutin, catchin, and apigenin—as well as other bioactive substances like kaempfertin, isoquinoline, and corilaginoline alkaloids were found in guava leaf extracts using high-performance liquid chromatography (Taha *et al.,* 2019). Numerous studies have demonstrated the importance of antioxidant components from guava leaves in reducing the negative effects of free radicals. A DPPH experiment revealed that essential oils isolated from guava leaves functioned as moderate antioxidants with an IC50 value of ~460.37 ± 1.33 µg/mL (Kumar *at al*., 2021). Additionally, the study demonstrated a linear relationship between the phenolic content of guava leaf extract, the antioxidant's efficacy, and its capacity to scavenge free radicals (Farag *et al*., 2020). Zebrafish were used to test the protective properties of the polysaccharide found in guava leaves. By preventing the production of reactive oxygen species, lowering lipid peroxidation, and preventing cell death, the authors found that the polysaccharides in guava leaves had a protective effect against oxidative stress brought on by hydrogen peroxide (Kim *et al.,* 2016). According to a different study, guava leaves extracts at 4000 ppm or more can stop fresh pork sausages from oxidizing, indicating that they could be used as a functional food ingredient (Tran *et al.,* 2020). Guava leaves were co-fermented with yeast and bacterial strains to liberate insoluble bound polyphenol components, and it was found that fermentation improved the antioxidant capacity of soluble guava leaf polyphenols (Wang *et al.,* 2017). In a sophisticated investigation, guava leaf crude polysaccharides were used to create silver nanoparticles, which demonstrated strong DPPH radical and ABTS radical cation scavenging activities (Wang *et al*., 2017).

4.8 Anti-hypertensive Activity of Guava Leaves

Controlling high blood pressure is essential to reducing the risk of stroke and coronary heart disease. The important photochemical present in guava fruit may help prevent cardiovascular disease, according to several epidemiological researches (Nath *et al.,* 2023). In vitro (Caco-2 cells) and in vivo (C57BL/6 N mice), several guava leaf extracts have been demonstrated to inhibit glucose transport mediated by sodium-dependent glucose cotransporter 1 (SGLT1) and glucose transporter 2 (GLUT2). Furthermore, eating 500–1000 g of guava fruit daily can lower blood pressure and lipoprotein levels without lowering high-density lipoprotein cholesterol, according to certain randomized, controlled trials (Singh *et al*., 2022). Along with other flavonoids, quercetin, a member of the flavonoid family, is frequently found in guava leaves. Quercetin successfully reduces high blood pressure by inhibiting xanthine oxidase and restricting RAAS. Quercetin inhibited angiotensin 1-induced hypertension and activated bradykinin. The antioxidant quercetin has antihypertensive properties because it suppresses the RAAS, which dilates blood vessels and lowers blood pressure. Additionally, quercetin may improve endothelial function, which produces the vasodilator chemical NO (Ahmad *et al.,* 2025; Eman *et al.,* 2025).

4.9 Anti-obesity Property of Guava Leaves

The leaf extracts of P. guajava showed strong anti-obesity effect by inhibiting the α-amylase, glucosidase, and lipase enzymes that contribute to the development of obesity. The aqueous extract's pancreatic lipase inhibitory activity ranged from 19.25 to 38.51%, whereas the methanolic extract's ranged from 22.96 to 46.66%. Nephrolithiasis risk is also increased by obesity. Thus, the ability of the guava stem bark extract to inhibit the obesity-related enzymes pancreatic lipase and 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase was investigated. The reference pancreatic lipase inhibitor orlistat (1.08 ± 0.03 µg/mL) has a higher IC50 value than the extract (21.66 ± 1.47 µg/mL). The guava bark extract may reduce overweight and obesity by slowing down the rate at which dietary lipids are broken down and subsequently absorbed as fatty acids by inhibiting pancreatic lipase (Eman *et al*., 2025).

4.10 Guava Leaves as Food Ingredients

Because guava leaf extract contains a wide range of compounds, including rutin, naringenin, gallic acid, catechin, epicatechin, kaempferol, isoflavonoids, vitamins, citric acid, and flavonoids like quercetin and guaijaverin, which are well known for their antimicrobial, antioxidant, and anti-inflammatory actions, numerous reports suggest the positive effects of using it as a functional food ingredient (Kumar *et al.,* 2019; Nishad *et al*., 2021; Kumar *et al.,* 2021). According to a study on the hypoglycemic effects of guava leaf extract, rats with diet-induced obesity showed improved vascular dysfunction because of the extract's phenolic components (Díaz-de-Cerio *et al*., 2017). Mass spectrometry analysis of guava leaf extract, which was recently used to make jelly with pectin, confirmed the presence of quercetin, gallocatechin, esculin, 3-sinapoylquinic acid, ellagic acid, gallic acid, and citric acid, which are responsible for antimicrobial and antioxidant qualities. Furthermore, the textural characteristics of the jelly were unaffected by the inclusion of guava leaves (Kumar *et al*., 2021). Due to their high concentration of phenolic and antioxidant chemicals, guava leaves' potential as a functional immunostimulant ingredient in fortified meals was also thoroughly investigated (Kumar M., 2021). Another study evaluating the food-drug interactions of guava leaf tea, a functional food and beverage that is sold commercially in Japan, revealed no potential interactions between guava leaf tea and medications, demonstrating the tea's safety in this regard. Guava leaf tea is used by borderline diabetics, who are at high risk of developing diabetes, to prevent a sharp rise in blood sugar levels following meals. Carbohydrates and dietary polyphenols included in guava leaf tea bind to digestive enzymes and are known to improve health by reducing the absorption of dietary fats or sugars (Kumar *et al*., 2021). According to a recent study on herbal tea, guava tea did not interact with medications. Another study found that adding yellow strawberry guava leaves, which are rich in phenolic and flavonoid compounds, to laying hens' diets had antimicrobial and antioxidant effects that could improve the quality of eggs by blocking the pathways of the enzyme cyclooxygenase (COX), which is essential as an inflammatory mediator (Dos Santos *et al.,* 2021; Kumar *et al*., 2021).

5. Traditional Applications of Guava Leaves

The guava plant is cultivated all over the world. Its numerous nutritional and therapeutic properties, which go beyond its pleasing flavor and scent, make it a valuable resource in both modern nutrition and traditional medicine. Traditional medicine has employed the guava plant's leaves, bark, and fruit to treat a variety of ailments. Consuming guavas has been linked to improved immunological, skin, and digestive health. Because of its high fiber content and low glycemic index, it is also an excellent choice for those who wish to regulate their blood sugar levels and promote weight loss (Silvakumar, 2024; Eman *et al.,* 2025).

6. Conclusion

Guava (Psidium guajava) leaves are a good natural resource that is rich in a variety of phytochemical compounds including flavonoids, tannins, saponins, terpenoids, and phenolic compounds. These bioactive molecules form the basis of the extensive spectrum of medicinal properties that have been identified to guava leaves such as antimicrobial, anti-inflammatory, antidiabetic, antioxidant, antidiarrheal, and wound-healing effects. Their therapeutic potential has been proven over time in traditional medicine and their applicability to the contemporary pharmaceutical studies is justified. In addition to the health of human beings, guava leaves have significant uses in the environment. Their phytochemicals make them eco-friendly as pesticides, natural water purification agents, and as green synthesizers of nanoparticles--they prove useful in their contribution towards sustainability and less dependency on synthetic chemicals. Generally, guava leaves provide a versatile platform that fuses the natural product chemistry, community health and environmental management. Their role in medicine, industry and ecological sustainability will be further increased by continuous study of their bioactive compounds, mechanism of action and scalable uses.

Acknowledgement, Not applicable**.**

Disclosure statement: *Conflict of Interest:* The authors declare that there are no conflicts of interest. ***Compliance with Ethical Standards:*** This article does not contain any studies involving human or animal subjects.

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(2025) ; http://www.jmaterenvironsci.com