Pharmacy Reports https://doi.org/10.51511/pr.85

REVIEW Open Access

Clinical efficacy of guava (*Psidium guajava* L.) in human trials: A review of therapeutic and nutritional applications

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Abstract: This review examines clinical evidence for guava's therapeutic efficacy across multiple health domains. Randomized controlled trials reveal guava's significant impacts on metabolic health, demonstrating reduced postprandial glucose responses, improved lipid profiles, and decreased blood pressure. Nutritional intervention studies establish guava as an effective food-based strategy for improving iron status in vulnerable populations through enhanced iron absorption, particularly in children and pregnant women. Additional clinical evidence supports guava's applications in musculoskeletal health (reducing knee pain), dermatological care (controlling sebum production), oral health (preventing gingivitis and reducing oral pathogens), and gastrointestinal disorders (alleviating diarrheal symptoms). These diverse therapeutic effects stem from guava's rich phytochemical profile, including flavonoids, carotenoids, and exceptionally high vitamin C content. The review highlights guava's versatility as a well-tolerated, accessible intervention that aligns with sustainable, food-based approaches to health management. While current evidence provides a foundation for guava's clinical applications, future research should further elucidate mechanisms of action, optimize preparations, and explore additional therapeutic potential. Guava emerges as a scientifically validated therapeutic agent with significant potential to improve health outcomes across diverse populations and conditions.

Keywords: antihyperglycemic, clinical trials, guava, iron deficiency, natural therapeutics

Introduction

Guava (*Psidium guajava* L.), a tropical fruit of the Myrtaceae family, has been used for centuries in traditional medicine across Asia, Africa, and the Americas. Traditional healers have employed their fruits, leaves, bark, and roots to address conditions ranging from diarrhea and respiratory infections to diabetes management [1]. Recent scientific inquiry has identified numerous bioactive compounds in guava, including flavonoids, carotenoids, essential oils, and exceptionally high vitamin C content, that may explain its diverse therapeutic properties [2]. These compounds have demonstrated antioxidant, anti-inflammatory, antimicrobial, and hypoglycemic activities in preclinical studies, providing a scientific rationale for guava's traditional applications.

The growing prevalence of conditions such as diabetes, cardiovascular disease, anemia, and oral health disorders has created an urgent need for accessible interventions, particularly in regions where conventional treatments may be limited by cost or availability. Guava's dual role as both a nutritious food and a potential therapeutic agent aligns with growing interest in sustainable, food-based approaches to health management [3]. This approach enables integration into existing dietary patterns without the barriers often associated with pharmaceutical interventions, potentially enhancing adherence and effectiveness.

Despite extensive traditional use and promising preclinical evidence, there remains a critical gap between laboratory findings and clinical applications of guava. While numerous in vitro and animal studies have demonstrated guava's antioxidant, anti-inflammatory, antimicrobial, and hypoglycemic properties, systematic evaluation of human clinical trials has been limited. Existing reviews have typically focused on either specific health conditions or particular guava preparations, lacking a comprehensive assessment across diverse therapeutic domains. Furthermore, methodological variations across clinical studies—including differences in guava preparations, dosages, and outcome measures—have complicated the interpretation and clinical translation of findings.

This review synthesizes clinical evidence regarding guava's therapeutic applications across multiple health domains. By examining randomized controlled trials and interventional studies, we bridge traditional knowledge and evidence-based practice, providing healthcare professionals with scientific guidance for recommendations. The analysis encompasses guava's effects on metabolic health, iron status, musculoskeletal conditions, dermatological care, oral health, and gastrointestinal function. Through critically evaluating these findings, we aim to establish guava's therapeutic potential while identifying priorities for future research, ultimately supporting its informed integration into contemporary healthcare approaches.

Methods

Search strategy and study selection

This narrative review was conducted to synthesize the clinical evidence regarding the therapeutic efficacy of guava (*Psidium guajava* L.) across multiple health domains. A comprehensive literature search was performed using the PubMed database from inception through October 2024. The primary search terms included "Psidium guajava," "guava," "guava extract," and "guava leaf" combined with terms such as "clinical trial," "randomized controlled trial,". Only English language articles reporting outcomes of human clinical trials involving guava or guava-derived products were included in this review.

Eligibility criteria

Studies were eligible for inclusion if they: (i) involved human participants; (ii) utilized guava or guava-derived products as the primary intervention; (iii) employed a clinical trial design with appropriate controls; (iv) reported quantifiable health outcomes; and (5) were published in peer-reviewed journals. Case reports, observational studies, preclinical investigations, and review articles were excluded.

Data extraction and analysis

From each eligible study, we extracted the following information: authors, publication year, study design, participant characteristics, intervention details (formulation, dosage, duration), control or comparator, outcome measures, and key findings. The extracted data were organized by health domains, including metabolic health, nutritional interventions, musculoskeletal applications, dermatological applications, oral health, and gastrointestinal effects. Narrative synthesis was performed to identify patterns, consistencies, and potential mechanisms across studies within each health domain. The quality of included studies was assessed based on methodological rigor, sample size adequacy, and strength of reported outcomes.

Metabolic health effects

Glucose metabolism and diabetes management

Guava has demonstrated promising effects on glucose metabolism in clinical trials. König and colleagues (2019) found that guava fruit extract prepared using supercritical CO_2 extraction significantly reduced postprandial glucose response compared to placebo at 30 minutes (Δ control 2.60 ± 1.09 mmol/L versus Δ intervention 1.96 ± 0.96 mmol/L; p = 0.039) and 90 minutes (Δ control 0.44 ± 0.74 mmol/L versus Δ intervention -0.18 ± 0.88 mmol/L; p = 0.023). This effect was attributed to the inhibition of sodium-dependent glucose cotransporter 1 (SGLT1) and glucose transporter 2 (GLUT2)-mediated glucose transport, which was previously demonstrated in both in vitro and animal models [4].

The glycemic impact of guava varies with preparation method and consumer age. Tey et al. (2017) compared different fruit forms (bite-size, puree) of guava and papaya in both elderly and young adults, finding that all preparations qualified as low glycemic index (GI) foods—guava bites with a GI of 29 and guava puree with a GI of 47. While significant differences existed between preparations, all remained within the low GI category, suggesting guava's versatility as a nutritious food regardless of preparation. The study also noted that elderly participants exhibited significantly greater glycemic responses than younger adults (p = 0.019), highlighting the importance of age considerations in dietary recommendations [5].

Several bioactive compounds may contribute to guava's favorable effects on glucose metabolism. König et al. (2019) identified kojic acid (0.33 mg/mL) and 5-hydroxymethylfurfural (2.76 mg/mL) in their extract, potentially contributing to inhibited intestinal glucose resorption and reduced insulin secretion. These findings support guava's role as an adjunctive dietary approach for individuals with impaired glucose tolerance or diabetes, offering a food-based strategy to complement conventional management approaches [4].

Cardiovascular health

Beyond glucose regulation, guava consumption positively influences multiple cardiovascular parameters. Singh et al. (1992) conducted a 12-week intervention study, finding that daily guava fruit consumption resulted in significant reductions in serum total cholesterol (9.9%) and triglycerides (7.7%), while simultaneously increasing high-density lipoprotein (HDL) cholesterol by 8.0%. These improvements were attributed to guava's significant soluble fiber content and ability to modulate dietary fatty acid and carbohydrate metabolism.

Guava's impact on platelet function provides additional insight into its cardioprotective mechanisms. Thaptimthong et al. (2016) evaluated the platelet inhibitory effects of guava fruit juice in healthy volunteers, finding attenuated collagen-induced platelet aggregation following ingestion. Unlike other juices showing similar anti-platelet effects through nitrate-nitrite-NO pathways, guava's mechanisms appeared to involve different bioactive compounds, suggesting multiple cardioprotective pathways [6].

The collective evidence indicates that guava consumption can simultaneously address multiple cardiovascular risk factors. Its natural integration into regular dietary patterns offers a food-based approach to cardiovascular disease prevention that aligns with sustainable dietary recommendations while potentially complementing conventional medical interventions. These benefits are particularly significant given guava's accessibility and cultural acceptability across many regions with high prevalence of cardiovascular disease.

Nutritional interventions and iron status

Guava has emerged as a promising food-based intervention for addressing iron deficiency due to its high vitamin C content. Roy Choudhury et al. (2021) demonstrated that adding guava to institutional supplementary meals significantly improved iron status in preschoolers, with the guava group showing higher hemoglobin and serum ferritin levels alongside decreased soluble transferrin receptor concentrations. The iron to vitamin C molar ratio improved dramatically from 1:1.4 to 1:12, highlighting the nutrient synergy mechanism. This dietary modification not only reduced iron deficiency prevalence but also decreased respiratory infection-related morbidity [3].

These benefits extend across various populations and consumption formats. Monárrez-Espino et al. (2011) found that children with mild iron deficiency anemia receiving guava juice (providing approximately 200 mg ascorbic acid daily) for 10 weeks exhibited 0.64 g/dL higher hemoglobin and 2.47 ng/mL higher plasma ferritin than the placebo group. Similarly, Rani et al. (2024) observed that children consuming vitamin C-rich guava with mungbean dal demonstrated increased hemoglobin concentration (3.7 g/L; 95% CI: 1.6, 5.6; $p = 0.001$) and reduced anemia prevalence (-51%; 95% CIs: -74, -10; $p = 0.022$) compared to controls. These effects were particularly pronounced in initially iron-deficient children [7].

The benefits extend to pregnancy, as Wijaya-Erhardt et al. (2011) found that iron-deficient pregnant women receiving supplementary food combining fermented soyabean with vitamin C-rich fruits (including guava) experienced smaller decreases in iron status markers compared to controls [8]. This finding is particularly significant given increased iron requirements during pregnancy and implications for maternal and infant outcomes. These trials demonstrate that guava, whether consumed as whole fruit or juice, represents an effective and culturally acceptable approach to addressing iron deficiency across diverse populations, aligning with recommendations for dietary diversification as a sustainable solution to micronutrient deficiencies.

Musculoskeletal applications

Guava leaf extract has shown efficacy in addressing knee pain, as demonstrated in a randomized, double-blind, placebo-controlled study by Kakuo et al. (2018). Japanese participants with knee pain received either 1 g of guava leaf extract or a placebo daily for 12 weeks. Using the Japanese Knee Osteoarthritis Measure (JKOM) score and visual analogue scale (VAS) for assessment, the researchers found significantly lower pain and stiffness in the guava group compared to placebo by the study conclusion [9]. The VAS scores showed a significant association between treatment effect and duration, with progressively lower pain ratings in the guava group over time.

These findings provide clinical validation for traditional applications of guava leaf in joint discomfort management. The researchers noted that guava leaf extract had previously demonstrated the ability to suppress osteoarthritis progression in animal models, suggesting potential preventative benefits beyond symptom management. While the specific bioactive compounds responsible were not fully characterized in this study, the positive outcomes indicate that continuous intake of guava leaf extract may offer relief for existing knee pain and preventative benefits against osteoarthritis symptoms.

Future research should address limitations, including modest sample size, identification of active constituents, optimization of dosage regimens, and examination of longer-term outcomes. Comparative studies with conventional osteoarthritis treatments would help determine guava leaf extract's position within the therapeutic landscape for musculoskeletal conditions. Nevertheless, this clinical evidence provides a foundation for considering guava leaf extract as a natural intervention for knee pain with potential applications to other joint-related discomforts.

Dermatological applications

Guava extract has effectively addressed skin concerns, particularly sebum control and post-exercise skincare. Pongsakornpaisan et al. (2019) investigated a guava toner containing 6% extract in a split-face, randomized trial, finding significant reductions in skin oiliness on both forehead (13.10%, $p < 0.05$) and nose (21.43%, $p < 0.001$) compared to base toner. Effects were observable by the third week of application, with no adverse reactions reported throughout the 28 days [10].

Complementing these findings, Wongsanao et al. (2021) examined a guava leaf extract-menthol toner for post-exercise use, finding that it significantly reduced perspiration to approximately half of baseline values ($p < 0.05$) without negatively impacting heat dissipation or cardiovascular recovery [11]. The researchers attributed these effects primarily to guava leaf's astringent properties, making it valuable for post-workout skincare without compromising normal physiological cooling processes.

The efficacy of guava-based skincare appears to be influenced by both extraction methods and formulation factors. Pongsakornpaisan et al. (2019) tested various concentrations (3%, 4.5%, and 6%) before selecting the most effective for clinical evaluation, highlighting the importance of optimizing active compound delivery [10]. Future research should identify specific bioactive constituents to enhance formulation approaches and evaluate longer-term benefits. Current findings, however, strongly support guava extract's potential in skincare products targeting sebum control and post-exercise skin management.

Oral health applications

Guava consumption has demonstrated significant oral health benefits through systemic and topical applications. Amaliya et al. (2018) investigated the effects of guava and synthetic vitamin C supplementation on experimental gingivitis development. Participants receiving either 200 g of guava daily or 200 mg of synthetic vitamin C showed significantly less increase in Gingival Index compared to controls (ΔGI: 0.10, 0.24, and 0.87, respectively), with the guava group also developing significantly less plaque [12]. These findings suggest that guava consumption can help maintain gingival health even during periods of suboptimal oral hygiene, likely due to its high vitamin C content and potentially other bioactive compounds.

Guava-based formulations have also demonstrated antimicrobial efficacy comparable to conventional treatments. Singla et al. (2018) evaluated mouthwashes prepared from various plant extracts, finding that guava extract showed effective antibacterial action against oral streptococci in school-aged children [13]. Building on this, Nayak et al. (2019) conducted a randomized clinical trial comparing guava leaf extract mouthrinse to chlorhexidine (0.2%) and placebo following professional cleaning [14]. The guava formulation produced clinical improvements similar to chlorhexidine in reducing gingival inflammation, plaque accumulation, and microbial counts, without the side effects commonly associated with chlorhexidine, such as tooth staining and taste alterations.

These combined findings highlight guava's potential in comprehensive oral health strategies. Its dual action—anti-inflammatory effects protecting gingival tissues and antimicrobial properties reducing oral pathogens—positions guava-based products as valuable components in preventive and therapeutic oral care. The comparable efficacy to established treatments and improved tolerability suggest significant clinical value, particularly in populations where conventional products may be less accessible or acceptable.

Gastrointestinal applications

Guava's efficacy in managing gastrointestinal disorders has been clinically validated, particularly

Table 1. Summary of clinical trials investigating therapeutic applications of guava (*Psidium guajava* L.)

Health domain	Study design	Participants	Intervention	Duration	Key findings	Ref.
Glucose metabolism	Randomized, double-blind	31 healthy adults	Guava fruit extract prepared by supercritical CO_2 extraction	Single OGTT	Significantly reduced postprandial glucose response at 30 min ($p=0.039$) and 90 min ($p=0.023$)	[4]
	Randomized, crossover	19 participants (9 elderly, 10 young adults)	Guava bites and guava puree	Single meal test	All guava forms yielded low GI (29-47); the elderly showed higher glycemic response than young adults	[5]
Cardiovascular health	Randomized, single-blind	120 patients with essential hypertension	Guava fruit before meals	12 weeks	Decreased total cholesterol (9.9%), triglycerides (7.7%), and blood pressure (9.0/8.0 mmHg); increased HDL (8.0%)	[2]
	Randomized, single-blind	145 hypertensive patients	0.5-1.0 kg of guava daily	4 weeks	7.5/8.5 mmHg net decrease in blood pressure; reduced total cholesterol (7.9%) and triglycerides (7.0%)	[15]
	Randomized controlled	30 healthy volunteers	500 ml fresh guava fruit juice	Acute intervention	Attenuated collagen-induced platelet aggregation; reduced heart rate and blood pressure	[6]
Iron status	Cluster-randomized controlled	399 preschoolers	25g of guava with a supplementary meal	140 days	Higher hemoglobin and serum ferritin, lower soluble transferrin receptor, and decreased iron deficiency prevalence	[3]
	Randomized controlled	200 school children	Mungbean dal with fresh guava	7 months	Increased hemoglobin (3.7 g/L); reduced anemia prevalence (51%); no significant change in iron stores	[16]
	Randomized placebo-controlled	95 anemic school children	300 ml guava juice with ~200 mg ascorbic acid	10 weeks	0.64 g/dL higher hemoglobin and 2.47 ng/mL higher plasma ferritin vs. placebo	[7]
	Randomized controlled	252 pregnant women	Supplementary food with guava and other vitamin C-rich fruits	Until term	Iron-deficient women showed smaller decreases in hemoglobin, ferritin, and body iron vs. controls.	[8]
Musculoskeletal health	Randomized, double-blind, placebo-controlled	Japanese subjects with knee pain	1g of guava leaf extract daily	12 weeks	Significantly lower pain and stiffness scores on JKOM; lower VAS scores for knee pain vs. placebo	[9]

Health domain	Study design	Participants	Intervention	Duration	Key findings	Ref.
Dermatological applications	Split-face, randomized, single-blind	21 volunteers	Toner with 6% guava extract	28 days	Reduced oiliness of forehead (13.10%) and nose (21.43%) vs. base toner	[10]
	Randomized, placebo-controlled	64 participants	Guava leaf extract-menthol toner	Post-exercise application	Reduced post-exercise perspiration to approximately half of baseline	[11]
Oral health	Randomized controlled	Adults with experimental gingivitis	200g guava/day or 200mg synthetic vitamin C	14 days	Lower Gingival Index increase (ΔGI: 0.10, 0.24, and 0.87 for guava, vitamin C, and control)	[12]
	Randomized controlled	40 school children aged 8-10 years	Mouthwash from guava extract	7 days	Significant reduction in oral streptococci colony-forming units	[13]
	Randomized placebo-controlled	60 subjects	0.15% Guava mouth rinse	30 days	Comparable efficacy to 0.2% chlorhexidine in reducing the gingival index, plaque index, and microbial counts	[14]
Gastrointestinal health	Randomized, double-blinded	50 adult patients	Phytodrug (QG-5) from standardized guava leaves, 500 mg every eight h	3 days	Decreased duration of abdominal pain in acute diarrheal disease	[1]

for acute diarrheal conditions. Lozoya et al. (2002) evaluated a standardized guava leaf phytodrug (QG-5) in a randomized, double-blinded trial involving 50 adult patients with acute diarrhea. Patients received 500 mg capsules every 8 hours for 3 days, with results showing a significant reduction in abdominal pain duration compared to placebo [1]. This clinical outcome provides objective evidence for guava's traditional use in managing gastrointestinal discomfort.

The observed intestinal antispasmodic effect likely contributes to symptom relief by reducing painful gut contractions and potentially normalizing intestinal motility. Standardizing quercetin content—a flavonoid with demonstrated antispasmodic and anti-inflammatory properties—may have been crucial for consistent therapeutic outcomes. While this study focused primarily on symptomatic relief rather than antimicrobial action against enteric pathogens, it nonetheless provides compelling support for guava-based interventions in managing acute gastrointestinal distress.

Future research should explore various guava preparations, investigate benefits in other gastrointestinal conditions such as irritable bowel syndrome, and further characterize mechanisms of action. The existing evidence, however, strongly supports guava's role as a complementary approach in managing acute gastrointestinal symptoms, particularly valuable in regions where guava is readily available and traditional medicine practices are integrated with conventional healthcare.

Future research directions

Future research on guava's therapeutic applications should expand investigation into metabolic syndrome, given demonstrated effects on individual components, including glucose regulation [4] and cardiovascular parameters [15]. The anti-inflammatory properties observed in oral health applications [12] warrant exploration in other inflammatory conditions (Table 1). Research should systematically compare guava preparations (whole fruit, juice, various leaf extracts) to determine optimal formulations for specific health outcomes.

Deeper mechanistic studies are needed to identify key bioactive compounds beyond vitamin C and quercetin, examining their synergistic interactions, bioavailability, and human metabolism. Such investigations would guide targeted applications and standardized interventions, potentially enhancing therapeutic outcomes. Pharmacokinetic studies are notably lacking in current literature and would provide valuable insights for optimizing dosing regimens.

From a public health perspective, cost-effectiveness analyses comparing guava-based interventions to conventional treatments deserve attention. Implementation research examining integration models for dietary guidelines, institutional feeding programs, and healthcare recommendations would bridge the gap between clinical evidence and practical application. Studies on potential interactions between guava preparations and pharmaceutical treatments would provide important safety information for clinical practice. These research priorities would strengthen the evidence base for guava's applications across diverse healthcare contexts while supporting sustainable, food-based approaches to health management.

Conclusion

Clinical evidence establishes guava (*Psidium guajava L.*) as a versatile therapeutic food with applications across metabolic, nutritional, musculoskeletal, dermatological, oral, and gastrointestinal health. Validating traditional uses through randomized trials, guava's efficacy highlights its dual role as a nutrient-dense food and source of pharmacologically active compounds, offering sustainable, cost-effective solutions for conditions like anemia, diabetes, knee pain, and oral infections, often matching conventional treatments in efficacy with better tolerability. However, gaps persist in mechanistic insights, long-term safety, and pharmaceutical interactions, necessitating future research to optimize formulations, validate large-scale benefits in metabolic syndrome, and integrate guava into evidence-based, culturally resonant healthcare strategies, exemplifying the potential of food-based interventions in global disease prevention and management.

Acknowledgement

None.

Funding

None.

Author contributions

NPMADS, IGRP: conceptualization, methodology design, data curation, formal analysis, and manuscript writing.

Declaration of Interest

The authors declare that none of them has any conflict of interest with any private, public, or academic party related to the information contained in this manuscript.

Received: November 24, 2024
Revised: January 8, 2025
Accepted: May 5, 2025
Published: May 6, 2025

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