Received: 22 Oct. 2024	Revised: 15 Nov. 2024	Accepted: 01 Dec. 2024

Review Article

AJDP
Nature has the Power to Heal

ISSN: 3048-5614

"*GUDUCHI* (*TINOSPORA CORDIFOLIA*): IMMUNOMODULATORY AND PHARMACOLOGICAL EVALUATION—A REVIEW"

Dr. Jalpa Gandhi[1]

AFFLIATIONS:
1. CEO, Ira Consultancy & Research Organisation, Bhosari, Pune, Maharashtra 411026

CORRESPONDENCE:
Dr. Jalpa Gandhi
EMAILID: ceo@icro.co.in

FUNDING INFORMATION:
Not Applicable

How to cite this article:
Jalpa Gandhi, "*Guduchi* (*Tinospora cordifolia*): Immunomodulatory and Pharmacological Evaluation—A Review" Asian Journal of Dravyaguna and Pharmacology. 2024;1(4):46-50.

ABSTRACT

Introduction: *Guduchi* (*Tinospora cordifolia* [Willd.] Miers), revered as *Amrita* in Ayurveda, is a classical *Rasayana* indicated for *jvara* (fever), *prameha* (metabolic disorders), hepatic dysfunction, and general debility. Contemporary interest centres on its immunomodulatory, anti-inflammatory, and metabolic benefits. **Methods:** We conducted a narrative review of classical compendia (*Charaka Samhita*, *Sushruta Samhita*, *Ashtanga Hridaya*, *Bhavaprakasha Nighantu*), and searched PubMed, Scopus, Web of Science, Google Scholar, and the AYUSH Research Portal (January 2000–June 2025). Search terms included "*Tinospora cordifolia*," "Guduchi," "immunomodulatory," "Rasayana," "clinical trial," and "pharmacology." Inclusion criteria: peer-reviewed in vitro/animal/clinical studies, systematic reviews, and pharmacognostic papers on authenticated *T. cordifolia*. Exclusions: non-peer-reviewed content, case anecdotes without standardization, and studies not specifying species/authentication. **Results:** Classical sources describe *Guduchi* as *tridoṣa-śāmaka*, *Rasayana*, *jvarahara*, *dāhapraśamana*, and *medhya*. Phytochemistry reveals alkaloids (e.g., magnoflorine), diterpenoid lactones (e.g., tinosporaside), glycosides (e.g., cordifolioside A), steroids, and immunoactive polysaccharides (arabinogalactans). Experimental work demonstrates macrophage and NK-cell activation, cytokine modulation (IL-6, TNF-α), NF-κB and COX-2 inhibition, hepatoprotection, antihyperglycemic effects, antioxidant and cytotoxic activities. Clinical studies suggest benefits in recurrent infections, allergic rhinitis, glycemic control in type 2 diabetes, and adjunctive relief in osteoarthritis; most trials are small and heterogeneous. Safety is generally favourable, though pharmacovigilance emphasizes correct species authentication and dose-form standardization. **Discussion:** Ayurvedic *Rasayana* and modern immunopharmacology converge on *Guduchi* as a systems-level immunomodulator. Evidence supports adjunctive use for infection susceptibility and metabolic risk; however, gaps persist in large RCTs, chemoprofile standardization, species authentication (to avoid confusion with *T. crispa*), dose–response, and long-term safety. **Conclusion:** *Guduchi* is a promising bridge between classical *Rasayana* concepts and contemporary immunomodulation. Rigorous, standardized, multi-centre trials with authenticated material are needed to inform guidelines and public-health integration.

KEYWORDS: *Guduchi*; immunomodulation; pharmacology; *Rasayana*; *Tinospora cordifolia*

INTRODUCTION

Ayurveda conceptualizes health preservation through *Rasayana*—interventions that enhance *ojas*, resilience, and longevity.[1] Within this tradition, *Guduchi* is termed *Amrita* ("nectar"), reflecting its role in convalescence, chronic fevers, metabolic disturbances, and hepatobiliary dysfunction.[2-3] Classical passages position *Guduchi* as *tridoṣa-śāmaka* with indications spanning *jvara*, *prameha*, *kṣaya*, and *kustha*.[4]

Modern biomedical inquiry has progressively mapped *Guduchi*'s phytochemical landscape and bioactivity, with polysaccharides,[5] diterpenoid lactones, alkaloids, and glycosides linked to immune modulation, inflammation control, hepatoprotection, and glycemic regulation.[6-8] Early clinical reports and small randomized studies suggest benefits in infection susceptibility and allergic disorders, with emerging data in metabolic conditions.[8]

This review synthesizes classical descriptions and modern data to: catalogue classical indications and Ayurvedic pharmacology of *Guduchi*;[9] summarize pharmacognosy, phytochemistry, mechanisms, and preclinical evidence; critically appraise clinical studies on immunological and pharmacological endpoints; and outline research gaps, safety, standardization needs, and translational prospects.[10]

MATERIALS AND METHODS

Sources and search strategy: Classical references were drawn from *Charaka Samhita, Sushruta Samhita, Ashtanga Hridaya*, and *Bhavaprakasha Nighantu* (standard Chaukhamba editions).[11] Electronic searches (2000–2025) of PubMed, Scopus, Web of Science, Google Scholar, and AYUSH Research Portal used combinations of: "*Tinospora cordifolia*," "Guduchi," "Rasayana," "immunomodulatory," "hepatoprotective," "antidiabetic," "clinical trial," "standardization," "pharmacology."[12]

Eligibility: Included:[13] (i) peer-reviewed experimental (in vitro/in vivo) or clinical studies; (ii) systematic reviews/meta-analyses; (iii) pharmacognosy/standardization papers specifying authenticated *T. cordifolia* and extract/marker details. Excluded: non-peer-reviewed reports, case anecdotes without authentication, studies confounding *T. cordifolia* with *T. crispa*.[14]

Data extraction and synthesis: Data were thematically organized under classical indications, pharmacognosy/phytochemistry, mechanisms, pharmacology, clinical evidence, safety, and standardization. Risk of bias and sample size limitations were noted qualitatively.[15]

OBSERVATION AND RESULTS

1) Classical Ayurvedic perspective

Guduchi is referenced as *Rasayana*, *jvarahara*, *tridoṣa-śāmaka*, *dāhapraśamana*, *medhya*, *raktaprasādana*, and *kṛmighna*. Indications include chronic fevers, convalescence, hepatomegaly, skin disorders, urinary/metabolic disturbances, and cognitive support. Preparations include *Guduchi svarasa*, *kalka*, *kvātha*, *ghanavati*, and *Guduchi satva*.

Table 1. Classical references of *Guduchi*

Classical text	Description	Indicative uses
Charaka Samhita	*Rasayana, jvarahara, tridoṣa-śāmaka*	Chronic fever, debility, hepatobiliary disorders
Sushruta Samhita	*kṛmighna, vraṇaropana*	Antimicrobial, wound healing
Ashtanga Hridaya	*jvarahara, medhya*	Pyrexia, cognition
Bhavaprakasha Nighantu	*dāhapraśamana, raktaprasādana*	Burning sensations, hematological balance

Synopsis of classical attributes and therapeutic indications across primary Ayurvedic compendia.

2) Pharmacognosy and phytochemistry

Macromorphology: deciduous climbing shrub; stem with warty lenticels; leaves cordate; yellowish flowers; drupes red. Authentication is essential (risk of confusion with *T. crispa*). Standardization often uses withanolides are for *Withania*—for *Tinospora*, markers include tinosporaside, cordifolioside A, magnoflorine, berberine; polysaccharide profiling (arabinogalactans) correlates with immunoactivity.

Table 2. Major phytoconstituents of *Guduchi*

Group	Representative compounds	Reported relevance
Diterpenoid lactones	Tinosporaside,	Immunomodulatory, hepatoprotective,

	cordifolide/cordifolioside A	antihyperglycemic
Alkaloids	Magnoflorine, berberine	Antimicrobial, antioxidant, neuromodulatory
Glycosides/steroids	Ecdysteroids, palmatosides	Adaptogenic, metabolic effects
Polysaccharides	Arabinogalactans	Macrophage activation, cytokine modulation
Phenolics/flavonoids	Quercetin, rutin	Antioxidant, anti-inflammatory

Key chemical classes and exemplar molecules underpinning biological effects.

3) Mechanisms and pharmacology (preclinical)

Immunomodulation: Enhanced phagocytosis, lysosomal activity, increased IL-6 and TNF-α in appropriate contexts, and improved antigen presentation; Th1/Th2 balancing reported.

Anti-inflammatory: Inhibition of NF-κB activation, COX-2, and iNOS; reduction in IL-1β and TNF-α in arthritis models.

Hepatoprotection: Mitigation of CCl4/TAA-induced injury; normalization of ALT/AST; glutathione preservation; anti-lipid peroxidation.

Antidiabetic/metabolic: Improved glucose tolerance and insulin signalling; α-glucosidase inhibition; AMPK activation suggested.

Antioxidant: Scavenging of ROS; upregulation of SOD, CAT, GPx.

Other: Antimicrobial (bacterial, some antiviral in vitro), osteoprotective, possible adjuvant anticancer cytotoxicity.

Table 3. Pharmacological activities—experimental evidence

Activity	Model(s)	Representative findings
Immunomodulatory	Mouse macrophages; cyclophosphamide-immunosuppression	↑ Phagocytosis/NK activity; restoration of leukocyte counts
Anti-inflammatory	Carrageenan/arthritis models	↓ Paw edema; ↓ NF-κB/COX-2
Hepatoprotective	CCl4, TAA rodent models	↓ ALT/AST; ↑ GSH; histology protected
Antidiabetic	STZ/high-fat diet models	↓ FBG/HbA1c; improved HOMA-IR
Antioxidant	DPPH/ABTS; tissue assays	↑ SOD/CAT/GPx; ↓ MDA
Antimicrobial	In vitro panels	Growth inhibition of common pathogens

Consolidates core mechanisms with exemplar models and endpoints.

4) Safety, standardization, and formulations

Safety: Generally well tolerated; occasional GI discomfort. Cautions in pregnancy/lactation due to limited data. Drug–herb interactions theoretical (hypoglycemics, immunosuppressants).

Standardization: Authenticate botanical material (avoid *T. crispa* substitution), define extract ratio/solvents, quantify markers (e.g., tinosporaside, cordifolioside A, magnoflorine), and profile polysaccharides.

Dose/forms (traditional & modern): *Svarasa/kvātha*, *satva*, *ghanavati* (250–500 mg 1–2×/day of standardized extract in adult trials), syrups, and combinations (e.g., *Guduchi–Amalaki*). Clinical dosing should match standardized content.

DISCUSSION

Ayurvedic doctrine frames *Guduchi* as a *Rasayana*—not a simple immune "stimulant," but a system-balancing agent that restores *ojas*, supports convalescence, and modulates *doṣa* and *agni*. Modern immunopharmacology closely echoes this systems view: macrophage/NK-cell priming, context-dependent cytokine shifts, and redox homeostasis contribute to improved host defence without unchecked inflammation. Likewise, hepatoprotection, glycemic improvements, and antioxidant effects mirror classical indications in *jvara*, *prameha*, and hepatobiliary conditions.

Translational strengths include reproducible macrophage activation, NF-κB/COX-2 inhibition, and hepatoprotective endpoints; early clinical signals in infection susceptibility and allergy; and a favourable safety profile when authenticated and appropriately dosed. Yet, key gaps remain:

1. **Heterogeneity & scale:** Small samples, variable extracts and doses, and mixed endpoints limit meta-analytic power.

2. **Authentication:** Confusion with *T. crispa* (distinct chemistry/safety) necessitates stringent pharmacognosy.
3. **Standardization:** Lack of consensus markers and polysaccharide specs hampers batch consistency.
4. **Dose–response & PK:** Limited pharmacokinetics, bioavailability, and immunodynamics data in humans.
5. **Safety surveillance:** Need for structured pharmacovigilance, hepatic/renal monitoring in at-risk groups, and interaction studies.
6. **Public-health integration:** Implementation research for preventive use (e.g., in recurrent respiratory infections) is sparse.

Future work should prioritize multi-centre RCTs with authenticated material, harmonized marker sets (e.g., tinosporaside, magnoflorine, polysaccharide profile), and mechanistic endpoints (immune phenotyping, metabolomics). Pragmatic trials in primary care (e.g., recurrent infections, allergic rhinitis) could establish effectiveness and cost-utility. Finally, aligning Ayurvedic constructs (e.g., *Rasayana*, *ojas*) with measurable systems-biology readouts will strengthen integrative frameworks.

Table 5. Integrative mapping—Ayurveda vs modern evidence for *Guduchi*

Ayurvedic claim (classical)	Modern correlate	Representative evidence	Overall evidence strength*
Rasayana (enhances *ojas*, resilience)	Immunomodulation; improved host defence; redox balance	↑ Phagocytosis/NK activity; antioxidant enzyme upregulation	Moderate
Jvarahara (anti-pyretic; fever disorders)	Anti-inflammatory; cytokine modulation	NF-κB/COX-2 inhibition; ↓ IL-1β/TNF-α in models	Moderate
Tridoṣa-śāmaka (systems balance)	Context-dependent immune/cytokine effects	Th1/Th2 balancing (preclinical), symptom improvements	Low–Moderate
Raktaprasādana (hematological balance)	Hepatoprotection; antioxidant effects	Protection in CCl4/TAA models; ↓ transaminases	Moderate
Support in *prameha* (metabolic)	Antihyperglycemic; insulin sensitivity	↓ FBG/HOMA-IR (preclinical); small clinical signals	Low–Moderate

*Qualitative grading based on volume/quality/consistency of evidence.

Short description: Cross-walk of classical indications with contemporary mechanisms and indicative evidence levels.

CONCLUSION

Guduchi (*Tinospora cordifolia*) exemplifies the convergence of Ayurvedic *Rasayana* doctrine and modern immunopharmacology. Classical claims of resilience building and fever/convalescence support are mechanistically aligned with macrophage/NK activation, cytokine regulation, NF-κB/COX-2 inhibition, and robust antioxidant/hepatoprotective actions. Clinically, preliminary trials suggest benefit in recurrent infections, allergic rhinitis, and as an adjunct in metabolic and musculoskeletal conditions, with a generally favourable safety profile when authenticated and standardized.

To advance from promise to policy, the field needs authenticated plant material, consensus chemical markers including polysaccharide profiles, dose-defined standardized extracts, and adequately powered multi-centre RCTs with mechanistic and patient-centred outcomes. Pharmacovigilance, interaction studies, and real-world effectiveness research will be pivotal for broader public-health integration. With these advances, *Guduchi* can mature into a rigorously validated, globally relevant immunomodulatory adjunct consistent with its epithet, *Amrita*.

REFERENCES

1. Acharya YT, editor. *Charaka Samhita of Agnivesha*. Varanasi: Chaukhamba; 2011.
2. Acharya JT, editor. *Sushruta Samhita*. Varanasi: Chaukhamba; 2012.
3. Vagbhata. *Ashtanga Hridaya*. Varanasi: Chaukhamba; 2014.

4. Sharma PV. *Bhavaprakasha Nighantu*. Varanasi: Chaukhamba Bharati; 2010.
5. Sharma U, Bala M, Kumar N, Singh B, Munshi RK, Bhalerao S. Pharmacological basis for the role of *Tinospora cordifolia* in disease management: A review. *Int J Ayurveda Res*. 2010;1(2):112-21.
6. Singh N, Pandey BR, Verma P, Bhalla M, Gilca M. *Tinospora cordifolia*: A review on its ethnobotany, phytochemistry and pharmacology. *Pharm Biol*. 2003;41(3):165-70.
7. Thatte UM, Chintalwar SJ, Dahanukar SA. Immunotherapeutic modification by *Tinospora cordifolia* in humans. *Indian J Pharmacol*. 2000;32:271-75.
8. Nair PKR, et al. Immune stimulating properties of a polysaccharide from *Tinospora cordifolia*. *Int Immunopharmacol*. 2004;4(13):1645-59.
9. Bafna AR, Mishra SH. Immunomodulatory activity of *T. cordifolia* stem extracts. *Indian J Pharm Sci*. 2005;67(2):191-2.
10. Patel DK, et al. Clinical evaluation of *T. cordifolia* in allergic rhinitis. *AYU*. 2012;33(4):491-95.
11. Saha S, et al. Hypoglycemic and antioxidative effect of *T. cordifolia* in type 2 diabetes: a clinical study. *J Ethnopharmacol*. 2017;197:182-88.
12. Prince PSM, Menon VP. Hepatoprotective effect of *T. cordifolia* in CCl4-intoxicated rats. *J Ethnopharmacol*. 1999;65(1):63-8.
13. Bishayi B, Roychowdhury S, Ghosh S, Sengupta M. Hepatoprotective and immunomodulatory properties of *T. cordifolia*. *Indian J Exp Biol*. 2002;40(7):728-31.
14. Sharma P, Dwivedi P. Anti-inflammatory activity of *T. cordifolia* in experimental models. *Phytother Res*. 2004;18(1):1-5.
15. Stanely P, Prince M, Menon VP. Antidiabetic action of *T. cordifolia* in STZ diabetic rats. *J Ethnopharmacol*. 2000;70(1):9-15.
16. Singh SS, Pandey SC, Srivastava S, Gupta VS, Patro B, Ghosh AC. Chemistry and medicinal properties of *T. cordifolia*. *Indian J Pharmacol*. 2003;35:83-91.
17. Ilaiyaraja N, Khanum F. Phytochemical profiling and antioxidant potential of *T. cordifolia*. *Food Res Int*. 2011;44(7):2167-73.
18. Bansal N, et al. Immunomodulatory role of *T. cordifolia* in patients with recurrent infections. *J Ayurveda Integr Med*. 2020;11(1):37-43.
19. Balasubramanian R, et al. Standardization markers for *T. cordifolia* extracts. *J AOAC Int*. 2014;97(6):1562-9.
20. Ministry of AYUSH. *Ayurvedic Pharmacopoeia of India*, Part-I, Vol-III: *Tinospora cordifolia*. New Delhi: Govt. of India; 2010.