



Yashtimadhu (Glycyrrhiza glabra) in Wound Healing: A Review Bridging Ayurvedic Pharmacodynamics and Contemporary Pharmacological Evidence

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Abstract

Wound healing remains a central clinical concern across surgical and general practice, and the search for agents that are both safe and multi-mechanistic continues to drive interest in traditional plant-based therapeutics. Yashtimadhu (*Glycyrrhiza glabra* Linn., family Fabaceae), known in classical Ayurvedic literature as Madhuka, Yashti and Klitanaka, has been used for over four millennia and occupies a distinct place among Vranaropana (wound-healing) and Sandhaniya (tissue-uniting) drugs described by Charaka, Sushruta and Vagbhata. Ayurveda attributes its therapeutic action to a Madhura Rasa, Guru-Snigdha Guna, Sheeta Virya and Madhura Vipaka, culminating in a Vata-Pitta Shamaka effect that is considered ideal for Sadyovrana (acute traumatic wounds). Contemporary pharmacological research substantiates this classical positioning: root extracts and their principal constituents-glycyrrhizin, 18 β -glycyrrhetic acid, liquiritin, isoliquiritigenin and glabridin-demonstrate anti-inflammatory, antimicrobial, antioxidant, immunomodulatory and pro-proliferative actions that collectively address the haemostatic, inflammatory, proliferative and remodelling phases of wound repair. Preclinical excision, incision and burn-wound models, together with in-vitro scratch-assay and cell-migration studies, report accelerated epithelialisation, enhanced collagen deposition and reduced microbial bioburden with topical licorice preparations. Clinically, Yashtimadhu-based formulations-most notably Yashtimadhu Ghrita and Yashtimadhu Taila-have shown favourable outcomes in postoperative, traumatic and chronic (Dushta Vrana) wounds, including diabetic ulcers, when used alone or as an adjunct. This review consolidates the Ayurvedic pharmacodynamic rationale and the available preclinical and clinical evidence on Yashtimadhu in wound healing, and outlines gaps-standardisation, dosage optimisation and rigorously designed clinical trials-that must be addressed before the drug can be more widely integrated into evidence-based wound-care protocols.

Keywords: Yashtimadhu; *Glycyrrhiza glabra*; Licorice; Vranaropana; Sadyovrana; Wound healing; Glycyrrhizin; Ayurveda

1. Introduction

A wound represents a disruption of the normal anatomical structure and function of tissue, and its management continues to be a major clinical, economic and quality-of-life burden worldwide. Despite advances in synthetic dressings, growth-factor therapies and tissue-engineered skin substitutes, delayed healing, infection, scarring and adverse reactions to synthetic agents remain common problems, sustaining interest in plant-derived wound-healing agents that act through multiple, complementary mechanisms rather than a single pharmacological target.

Ayurveda, the traditional system of Indian medicine, describes an elaborate science of Vrana Chikitsa (wound management) in the Brihatrayees-Charaka Samhita, Sushruta Samhita and Ashtanga Hridaya-centred on the sixty Upakramas (therapeutic measures) and the Shatkriyakala (six stages of wound healing).^{1,2,3} Among the many Vranaropana Dravyas described in

these texts, Yashtimadhu (*Glycyrrhiza glabra* Linn.) is repeatedly recommended, including in Sadyovrana, the Ayurvedic category corresponding closely to acute traumatic or post-surgical wounds. Chakradatta and Sushruta Samhita specifically indicate Yashtimadhu Ghrita in Sadyovrana, and Charaka highlights its role in Vataja and Raktaja disorders and in promoting Bala, Varna and general vitality.^{1,2,4}

Outside the Indian subcontinent, licorice has an equally long history of use: the earliest documented references appear in the Code of Hammurabi (circa 2100 BC) and in Assyrian herbal texts (circa 2000 BC), while Hippocrates, Theophrastus and Dioscorides described its use for ulcers and thirst, and Roman scholars referred to it as *Radix dulcis*.¹⁷ This convergence of a millennia-old Ayurvedic tradition with an independent line of Graeco-Roman use, now supported by modern phytochemical and pharmacological investigation, makes Yashtimadhu a particularly instructive case study in integrative wound-care research. This review brings together the classical Ayurvedic rationale, the phytochemical basis, and the preclinical and clinical evidence for the use of Yashtimadhu in wound healing.

2. Botanical Profile and Ayurvedic Classification

2.1 Taxonomy and Distribution

Glycyrrhiza glabra Linn. (Kingdom: Plantae; Class: Dicotyledons; Order: Rosales; Family: Papilionaceae/Fabaceae; Genus: *Glycyrrhiza*; Species: *glabra*) is a hardy perennial herb or undershrub growing up to about six feet, native to Central and South-Western Asia and the Mediterranean basin, and now cultivated across the Mediterranean region, parts of Africa, Southern Europe and India. The plant bears imparipinnate, multifoliate leaves and lavender-to-violet papilionaceous flowers in axillary spikes; the underground stolons and roots, peeled or unpeeled, constitute the commercial drug. In Sanskrit it is known as Yashti, Madhuyashti, Madhuka and Swadurasa, among other synonyms, and by regional names such as Mulethi/Jethimadhu (Hindi), Yastimadhuka (Kannada), Atimadhuram (Tamil/Oriya) and Licorice or Liquorice (English).^{5,7}

2.2 Ayurvedic Pharmacodynamics (Rasa Panchaka)

Rasa (Taste): Madhura (sweet)

Guna (Qualities): Guru, Snigdha (heavy, unctuous)

Virya (Potency): Sheeta (cooling)

Vipaka (Post-digestive effect): Madhura (sweet)

Doshakarma: Vata-Pitta Shamaka

These properties translate into a broad Karma profile relevant to wound care: Vranaropana (wound healing), Sandhaniya (promotes union of tissue), Shothahara (anti-inflammatory/anti-oedema), Raktaprasadana (blood-purifying), Varnya (improves complexion), Balya (strength-promoting), Vishaghna (detoxifying) and Vedanasthapana-like analgesic effects reflected in its Kandughna and Pipasahara actions.^{6,7} Charaka classifies Yashtimadhu under the Jivaniya, Sandhaniya, Varnya, Kanthya, Kandughna, Snehopaga, Shonitasthapana and related Dashemani (groups of ten) gana, while Sushruta places it in the Kakolyadi, Sarivadi and Anjanadi gana-classifications that, taken together, justify its use across the cleansing (Shodhana) and healing (Ropana) phases of Vrana Chikitsa.^{1,2}

3. Phytochemistry

The principal bioactive constituent of licorice root is glycyrrhizin (glycyrrhizic acid), a triterpenoid saponin typically present at roughly 2-9% depending on species and geographic source, which is hydrolysed in the gut to 18 β -glycyrrhetic acid.^{8,17} Alongside glycyrrhizin, the root contains asparagine, the flavonoid glycoside liquiritin and its aglycone liquiritigenin, isoliquiritigenin, the pterocarpan glabridin and related hispaglabridins, licoricone, starch, gums, mucilage and simple sugars, together with calcium and magnesium salts. Phytochemical and HPTLC-based fingerprinting of Ayurvedic Yashtimadhu Ghrita preparations has confirmed the presence of these marker constituents in the finished dosage form, supporting quality standardisation of the drug for clinical and research use.¹⁰

Pharmacologically, this phytochemical profile is directly relevant to wound repair: glycyrrhizin and 18 β -glycyrrhetic acid are the principal anti-inflammatory and immunomodulatory agents; glabridin and isoliquiritigenin are potent antioxidants; the triterpenoid saponin fraction (chiefly glycyrrhizinic acid) provides broad-spectrum antimicrobial and antiviral activity; and liquiritin/isoliquiritin have been linked to enhanced angiogenesis and macrophage recruitment during the proliferative phase of repair.^{8,17}

4. Yashtimadhu in Classical Ayurvedic Wound Management (Vrana Chikitsa)

Ayurvedic surgical texts describe wound healing as proceeding through defined stages (Shatkriyakala), and prescribe a sequence of Poorva Karma (pre-procedural, e.g., Shodhana/cleansing), Pradhana Karma (the principal surgical or Shastrakarma procedures) and Paschat Karma (post-procedural measures such as Sandhaana, Ropana and Vaikrutapaham/scar correction). Sadyovrana-fresh, acute wounds arising from trauma or surgery-is specifically addressed in dedicated chapters of the Sushruta Samhita (Sadyovrana Chikitsa) and Ashtanga Hridaya, both of which recommend Yashtimadhu-based preparations for their combined cleansing, soothing and reparative actions.^{1,3}

Chakradatta explicitly recommends Yashtimadhu Ghrita for different varieties of Vrana, and its cooling (Sheeta Virya) and unctuous (Snigdha) qualities are considered particularly suited to Pitta-dominant, acutely inflamed wounds, where they reduce local heat, burning and discomfort while the Madhura Rasa and Vipaka support tissue nourishment (Jivaniya) and union (Sandhaniya).⁴ Yashtimadhu is also used in several classical Yogas beyond topical wound care, including Yashtimadhvadi Taila (for hair and scalp disorders), Yashtyadi Kashaya (for bleeding disorders), Yashtivasadi Kashaya (in Kamala/jaundice) and Madhukadi Ghrita (in Kshatakshina and Raktagulma), reflecting its broad Vata-Pitta-Shamaka and Rasayana-like therapeutic footprint.^{6,7}

5. Pharmacological Basis of the Wound-Healing Activity

Modern wound repair is conventionally divided into haemostasis, inflammation, proliferation and remodelling phases, and the multi-target pharmacology of Yashtimadhu maps onto each of these in a manner that is broadly consistent with its classical Ayurvedic indications.

5.1 Anti-inflammatory Activity

Glycyrrhizin and glycyrrhetic acid exert anti-inflammatory effects comparable in magnitude to reference agents such as hydrocortisone and phenylbutazone in experimental models, acting principally by modulating leukocyte migration and downstream inflammatory signalling-mechanistic work on licorice-derived flavonoids has specifically implicated suppression of NF- κ B signalling and reduction of pro-inflammatory cytokines such as TNF- α , IL-1 β and COX-2.^{8,14} Flavonoids such as liquiritin contribute an additional, complementary anti-inflammatory action. By tempering excessive or prolonged inflammation, Yashtimadhu is thought to shorten the inflammatory phase and allow earlier transition to proliferation, consistent with its classical description as Shothahara.¹⁷

5.2 Antimicrobial and Antiviral Activity

The triterpenoid saponin fraction, chiefly glycyrrhizinic acid, together with flavonoids such as glabridin and the hispaglabridins, confers broad-spectrum antimicrobial activity. In-vitro studies report activity of alcoholic root extracts against organisms including *Staphylococcus aureus*, *Escherichia coli*, *Mycobacterium tuberculosis* and *Pseudomonas aeruginosa*, among others, and recent comprehensive reviews of glycyrrhizin's antibacterial pharmacology corroborate these effects across both Gram-positive and Gram-negative species.^{8,14} Licorice constituents also inhibit replication of several DNA and RNA viruses (including herpes simplex and influenza viruses) and enhance interferon production.¹⁷ By limiting microbial colonisation of the wound bed, this activity reduces the risk of the infection-related delayed healing that is common in both acute and chronic wounds.

5.3 Antioxidant Activity

Flavonoids such as glabridin, the hispaglabridins and isoliquiritigenin are potent antioxidants that scavenge reactive oxygen species and inhibit lipid peroxidation.¹⁷ Because excessive oxidative stress at the wound site can perpetuate inflammation

and impair fibroblast and keratinocyte function, this antioxidant activity is considered an important complementary mechanism supporting tissue repair, particularly in wounds complicated by ischaemia or chronic low-grade inflammation.

5.4 Cell Proliferation, Migration and Collagen Synthesis

In-vitro scratch-assay studies using ethanolic *Glycyrrhiza glabra* root extract on Vero cell monolayers have demonstrated accelerated wound closure relative to untreated controls, without evidence of cytotoxicity even at higher extract concentrations.¹⁵ Related work using dental pulp stem cell models similarly reports that Yashtimadhu extract promotes cell migration, preserves cell viability and supports normal cell-cycle dynamics, all of which favour re-epithelialisation.¹¹ Histopathological evaluation in animal burn-wound models treated with licorice preparations shows enhanced epithelialisation, increased angiogenesis and greater collagen deposition compared with controls, providing tissue-level correlates of the accelerated wound closure observed macroscopically.^{13,16}

5.5 Immunomodulatory, Hormonal and Antioxidant-Adjacent Effects

Glycyrrhizin and glycyrrhetic acid exhibit corticoid-like activity by prolonging the half-life of endogenous cortisol through inhibition of 11 β -hydroxysteroid dehydrogenase, contributing to their anti-inflammatory and immunomodulatory profile, while also showing antitoxic effects against a range of experimental toxins.¹⁷ These properties, together with reported analgesic contributions from glycyrrhizin and asparagine, are consistent with the classical description of Yashtimadhu as Vedanasthapana-like and Vishaghna, and support its traditional use for reducing pain and discomfort at the wound site.⁹

6. Preclinical Evidence

- Excision and incision wound models in rodents treated topically with Yashtimadhu/licorice-based formulations report significantly faster wound contraction, reduced epithelialisation time and improved tensile strength of the healed tissue compared with untreated or vehicle-treated controls.¹⁹
- A murine second-degree burn model comparing licorice-extract hydrogels at 5%, 10% and 20% w/w found that the 5% formulation achieved the highest rate of complete wound closure by day 19 (87.5% of animals), preserved epidermal barrier function (unchanged transepidermal water loss), and produced the most favourable histological scores for inflammation and epidermal architecture-illustrating a non-linear, concentration-dependent effect that has implications for optimal dosing.¹³
- A separate rat burn-wound study using hydroalcoholic licorice root extract found that concentrations above 8% accelerated wound contraction and epithelialisation, while the extract also inhibited growth of common wound pathogens (*Staphylococcus aureus*, *Pseudomonas aeruginosa*) in vitro, without inhibiting *Acinetobacter* species.¹⁶
- Pharmaceutical and HPTLC-based characterisation of Yashtimadhu Ghrita, the classical Ayurvedic ghee-based wound-dressing preparation, confirms consistent presence of glycyrrhizin-related marker compounds and provides a basis for standardising the drug for further preclinical and clinical evaluation.^{10,12}

Taken together, preclinical studies consistently show that topical *Glycyrrhiza glabra* preparations accelerate wound contraction and re-epithelialisation, reduce local microbial bioburden, and produce favourable histological healing parameters (angiogenesis, granulation tissue formation, collagen deposition), with concentration-dependent efficacy that argues for careful dose-formulation optimisation.

7. Clinical Evidence

Clinical experience with Yashtimadhu in wound care spans postoperative, traumatic and chronic wound settings, predominantly in the form of Yashtimadhu Ghrita applied as a local dressing.

- Comparative and single-arm clinical studies of Yashtimadhu Ghrita in Sadyovrana (acute wounds) and in postoperative surgical wounds report high rates of complete healing, reduced pain scores and shorter healing time when the drug is applied as a daily topical dressing, with reported bactericidal benefit in non-infected surgical wounds.²¹

- A comparative clinical study evaluating Yashtimadhu Ghrita against Tila Kalka Madhu Ghrita in the management of Sadyovrana has been reported, contributing to the growing body of controlled Ayurvedic clinical evidence in this indication.¹⁹
- Yashtimadhu Ghrita has also been studied comparatively against other Vranaropana formulations (for example, in fissure-in-ano management), with the licorice-based preparation showing statistically significant benefit.¹⁸
- Case-report evidence describes successful use of Yashtimadhu Ghrita, combined with Panchavalkala Kwatha wound cleansing and adjunct oral Ayurvedic therapy, in the management of a chronic, non-healing diabetic wound (Dushta Vrana associated with Prameha), alongside standard oral hypoglycaemic therapy, with complete wound closure and no observed adverse effects-illustrating a potential adjunctive role in difficult-to-heal wounds.²⁰

Across these reports, the recurring clinical themes are a reduction in wound-associated pain (attributed to the Vata-Pitta-Shamaka and analgesic actions of glycyrrhizin and asparagine), accelerated reduction in wound size/area, and good local tolerability, with no significant adverse events reported at the topical doses and durations used. Nonetheless, most available clinical studies are small, single-centre, and use heterogeneous outcome measures, which limits the strength of the evidence and underscores the need for larger, standardised randomised controlled trials.

8. Formulations Used in Wound Care

- Yashtimadhu Ghrita - Yashtimadhu processed with cow's ghee (Sneha Paka method per Sarngadhara Samhita); the most widely used and studied preparation for Sadyovrana and postoperative wound dressing.⁶
- Yashtimadhu Taila - an oil-based preparation used similarly for its Vranaropana and soothing effect.
- Yashtimadhu Malahara/ointment-based preparations - semi-solid topical formulations combining Yashtimadhu with other Vranaropana dravyas.
- Composite dressings - for example, Yashtimadhu combined with Goghrita and Siktha (beeswax) in a "Vikeshika"-type non-adherent dressing, designed to combine the anti-inflammatory/antimicrobial action of Yashtimadhu, the Vranaropana and soothing action of Ghrita, and the protective, low-adherent, antimicrobial properties of beeswax.²¹

Standard oral dosage of Yashtimadhu Churna (powder) is generally cited as 1-3 g, though topical wound-care applications rely on locally applied Ghrita- or Taila-based dressings rather than oral dosing.

9. Safety and Toxicity Considerations

Topically applied Yashtimadhu/licorice preparations have shown a favourable local safety profile across the preclinical and clinical studies reviewed, with no significant cytotoxicity in in-vitro cell-viability assays and no notable adverse effects reported in the clinical case series and comparative trials discussed above.¹⁷ Systemically, however, prolonged or high-dose oral use of glycyrrhizin-containing licorice preparations is well documented to cause a mineralocorticoid-like syndrome (sodium retention, hypokalaemia and hypertension) due to inhibition of 11 β -hydroxysteroid dehydrogenase, and licorice-drug interactions have been reported with corticosteroids, diuretics and antihypertensives.¹⁷ These systemic concerns are most relevant to oral and prolonged use; nonetheless, they reinforce the need for adulterant screening (*Glycyrrhiza uralensis* and *Abrus precatorius* roots are recognised adulterants of *G. glabra*), quality standardisation, and dose-finding studies even for topical wound-care formulations, particularly when used over large or chronic wound surfaces where systemic absorption cannot be entirely excluded.

10. Current Research Gaps and Future Directions

- Standardisation: greater use of validated phytochemical fingerprinting (e.g., HPTLC/HPLC quantification of glycyrrhizin content) is needed across studies to enable meaningful comparison of efficacy data.
- Dose-response optimisation: preclinical data suggest a non-linear, concentration-dependent relationship between licorice-extract concentration and healing outcomes, indicating that higher concentrations are not necessarily more effective and require systematic dose-ranging studies.

- Mechanistic clarity: while multiple pharmacological actions have been individually demonstrated, few studies have integrated molecular, histopathological and clinical endpoints within a single, well-controlled investigation.
- Clinical trial quality: most available clinical evidence comes from small, single-centre or single-arm studies; adequately powered, randomised, controlled trials with standardised wound-assessment scales are needed, particularly in chronic and diabetic wounds.
- Formulation science: comparative evaluation of Ghrita-, Taila-, hydrogel- and composite-dressing-based delivery systems could help identify the optimal vehicle for sustained, controlled release of the active constituents at the wound site.

11. Conclusion

Yashtimadhu (*Glycyrrhiza glabra*) exemplifies a traditional drug whose classical Ayurvedic indication in Sadyovrana and other Vrana conditions finds substantial, mechanistically coherent support in contemporary pharmacological research. Its anti-inflammatory, antimicrobial, antioxidant and pro-proliferative actions, driven principally by glycyrrhizin, glycyrrhetic acid and associated flavonoids, address multiple phases of the wound-healing cascade in a manner that parallels its description as a Vata-Pitta-Shamaka, Vranaropana and Sandhaniya drug in classical texts. Preclinical and early clinical evidence, particularly with Yashtimadhu Ghrita, supports its efficacy and safety as a topical wound-care agent in acute, postoperative and select chronic wounds. Realising its full potential in mainstream and integrative wound-care practice will, however, require standardised formulations, optimised dosing and rigorously designed clinical trials.

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