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YASHTIMADHU (GLYCYRRHIZA GLABRA L.) IN PEDIATRIC UPPER RESPIRATORY TRACT DISORDERS: A NARRATIVE REVIEW OF CLASSICAL RATIONALE, PHARMACOLOGY AND CLINICAL EVIDENCE

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Abstract

Background: Acute cough, sore throat and common cold are among the most frequent reasons for pediatric consultation. Evidence for over-the-counter cough and cold medicines in young children is weak, and safety concerns are well recognised, which sustains interest in traditional remedies. Yashtimadhu (*Glycyrrhiza glabra* L., Fabaceae; liquorice) is a classical Ayurvedic drug described as Kanthya (beneficial to the throat) and used in cough and throat disorders.

Objective: To review the Dravyaguna profile of Yashtimadhu and to appraise contemporary pharmacological, clinical and safety evidence relevant to pediatric upper respiratory tract disorders.

Methods: Classical texts and the Ayurvedic Pharmacopoeia of India were reviewed. PubMed, Scopus, Google Scholar and AYUSH research portals were searched using the terms *Glycyrrhiza glabra*, liquorice, glycyrrhizin, Yashtimadhu, cough, pharyngitis, sore throat, upper respiratory tract infection and children.

Results: Yashtimadhu is Madhura in Rasa, Guru and Snigdha in Guna, Sheeta in Virya and Madhura in Vipaka, and it pacifies Vata and Pitta. Experimental studies report demulcent, anti-inflammatory, antiviral and antioxidant activity, largely attributed to glycyrrhizin and

flavonoids. Randomised trials of liquorice gargle for postoperative sore throat show benefit, but these were conducted in adults. Direct pediatric trials in infectious or allergic upper respiratory disorders are lacking. Glycyrrhizin can cause hypertension, hypokalemia and pseudohyperaldosteronism with excessive or prolonged intake.

Conclusion: The classical profile and experimental pharmacology support plausibility, but there is no adequate pediatric clinical evidence to recommend routine use. Pediatric dose-finding, safety and controlled studies with standardised, glycyrrhizin-characterised preparations are needed.

Keywords: Yashtimadhu, Glycyrrhiza glabra, liquorice, glycyrrhizin, pediatric cough, pharyngitis, Kaumarabhritya, Kanthya.

1. Introduction

Upper respiratory tract infections (URTIs) such as the common cold, pharyngitis and acute cough are the most common acute illnesses of childhood and a leading cause of outpatient visits and school absence. They are mostly viral and self-limiting. Cochrane evidence indicates that over-the-counter cough and cold medicines are not effective in children, and several regulators have advised against them in young children because of the risk of harm.¹ This leaves clinicians and parents with few options for symptomatic relief, and many families turn to traditional remedies, including honey, which has some trial support.^{2,3}

Ayurveda addresses these symptoms under Kasa (cough), Pratishyaya (rhinitis/coryza), Galagraha/Kanthashotha (throat conditions) and related headings. Children (Bala) are described as Kapha-predominant, Komala (delicate) and prone to Kaphaja disorders, which makes safe, gentle and palatable remedies central to Kaumarabhritya practice.

Yashtimadhu is one of the most widely used drugs in Ayurveda for throat and respiratory complaints and is a common ingredient in cough preparations. It is also one of the best-studied traditional botanicals globally. At the same time, its principal constituent, glycyrrhizin, has a well-documented toxicity profile that matters especially in children. This review examines what classical knowledge and modern evidence together support, and what remains unproven.

Aim: To correlate the Dravyaguna profile of Yashtimadhu with contemporary evidence on its actions relevant to pediatric upper respiratory disorders, and to appraise its safety.

2. Materials and Methods

Classical sources: Charaka Samhita, Sushruta Samhita, Ashtanga Hridaya, Kashyapa Samhita, Bhavaprakasha Nighantu, Dhanvantari and Raja Nighantu, the Ayurvedic Pharmacopoeia of India and standard Dravyaguna texts.⁴⁻⁸

Contemporary sources: PubMed, Scopus, Google Scholar and the DHARA/AYUSH portal, using the terms listed in the Abstract.

Inclusion: in vitro, animal and human studies on *G. glabra* or its constituents relevant to upper respiratory symptoms, inflammation, antiviral activity and safety, plus relevant reviews and regulatory documents.

Exclusion: studies of other *Glycyrrhiza* species without comparison, conference abstracts without full text, and non-English papers without translation.

Synthesis: narrative. No meta-analysis was performed because of heterogeneity. This is not a systematic review, and no formal risk-of-bias assessment was performed.

3. Ayurvedic and Dravyaguna Profile

3.1 Botany and nomenclature

Parameter	Details
Botanical name	<i>Glycyrrhiza glabra</i> L.
Family	Fabaceae
Sanskrit synonyms	Yashtimadhu, Madhuka, Madhuyashti, Klitaka, Atirasa
Part used	Root and stolon (Moola)
Common forms	Churna, Kwatha, Avaleha, Vati (as a throat lozenge/chewable), and as an ingredient in compound formulations

3.2 Dravyaguna profile

Parameter	Description [5,7,8]
Rasa	Madhura
Guna	Guru, Snigdha
Virya	Sheeta
Vipaka	Madhura
Doshakarma	Vata-Pittahara
Karma	Kanthya, Kasahara, Shwasahara, Swarya, Chakshushya, Balya, Varnya, Vranaropana, Rasayana, Jeevaniya

3.3 Classical references

Yashtimadhu appears in several Mahakashayas in the Charaka Samhita (Sutrasthana, Chapter 4), including the Kanthya and Jeevaniya groups.⁴ The Sushruta Samhita places it in gana groupings such as Kakolyadi.⁹ The Bhavaprakasha Nighantu records its Kanthya, Balya, Varnya

and Vata-Pittahara qualities.⁵ It is a recurrent ingredient in classical cough and Kasa formulations.

3.4 Interpretation for pediatric upper respiratory disorders

- **Kanthya and Swarya:** directly relevant to sore throat, hoarseness and irritated pharyngeal mucosa. This is the classical counterpart of its modern demulcent use.
- **Kasahara:** its use in dry, irritating cough corresponds to the soothing, Snigdha action. In Vata-Pitta-type or dry cough, Snigdha and Madhura qualities are appropriate.
- **Sheeta Virya and Madhura Rasa:** pacify Pitta and Vata but, being Guru and Snigdha, can aggravate Kapha. Because children are Kapha-predominant, classical practice often combines it with Ushna/Kapha-hara drugs (for example, Pippali, Tulasi, Sunthi) or honey as Anupana in Kaphaja cough, rather than using it alone.
- **Shothahara and Vranaropana:** correspond to anti-inflammatory and mucosal-healing effects.

Pediatric note: dosing in Kaumarabhritya follows age and body-weight scaling (Matra). No validated pediatric dose of Yashtimadhu exists, and this article does not recommend one.

3.5 Correlation with modern conditions

Modern condition	Ayurvedic correlate (approximate)	Relevant Yashtimadhu action
Acute dry/irritating cough	Vataja/Pittaja Kasa	Kasahara, Snigdha, Kanthya
Pharyngitis/sore throat	Galagraha, Kanthashotha	Kanthya, Shothahara
Common cold/coryza	Pratishyaya	Supportive; usually combined with other drugs
Hoarseness	Swarabheda	Swarya, Kanthya

4. Phytochemistry

The root contains triterpenoid saponins (chiefly glycyrrhizin, the glycoside of glycyrrhetic acid, typically a few per cent of dry weight), flavonoids (liquiritin, isoliquiritigenin and others), chalcones, coumarins and polysaccharides.^{10,11} Glycyrrhizin is roughly 50 times sweeter than sucrose, which explains the Madhura Rasa and the palatability that makes liquorice acceptable to children. It is also the compound mainly responsible for the toxicity described below. Composition varies with species, origin and processing, which matters for standardisation.

5. Contemporary Pharmacology

5.1 Demulcent and antitussive action

The mucilaginous polysaccharides and saponins are thought to coat and soothe irritated pharyngeal mucosa, in line with the classical Snigdha and Kanthya description. Reviews summarise antitussive and expectorant effects in animal models, although human mechanistic data are limited.^{10,11}

5.2 Anti-inflammatory and immunomodulatory action

Glycyrrhizin binds high-mobility group box 1 (HMGB1) protein and inhibits its cytokine activity.¹² Liquorice constituents have shown inhibition of pro-inflammatory mediators in experimental systems, and reviews describe broad anti-inflammatory and antioxidant effects.^{10,11}

5.3 Antiviral and antimicrobial action

Glycyrrhizin inhibited replication of SARS-associated coronavirus in vitro,¹³ and other antiviral and antibacterial activity has been reported in laboratory studies.^{10,11} These are in vitro findings. They do not show clinical efficacy against common pediatric respiratory pathogens.

5.4 Summary

The pharmacology provides biological plausibility for soothing and anti-inflammatory effects in the upper airway, but most data come from isolated compounds or laboratory models, at concentrations that may not be reached with oral use.

6. Clinical Evidence

6.1 Sore throat (adult data, indirectly relevant)

Setting	Study	Key finding
Postoperative sore throat after intubation (adults)	Agarwal et al., 2009 (randomised, single-blind, liquorice gargle)	Preoperative liquorice gargle reduced incidence and severity of postoperative sore throat [14]
Postoperative sore throat and post-extubation cough (adults)	Ruetzler et al., 2013 (randomised, double-blind, liquorice vs sugar-water gargle)	Liquorice gargle reduced postoperative sore throat and coughing [15]

These trials involve post-intubation irritation in adults, not infectious pharyngitis in children, and the gargle route differs from oral ingestion. They support the throat-soothing hypothesis but cannot be applied directly to pediatric URTI.

6.2 Cough

For the context of acute cough in children, the best-supported traditional remedy is honey, with Cochrane evidence suggesting it probably relieves symptoms better than no treatment and possibly better than some comparators, with low to moderate certainty,² and a trial showing improved nocturnal cough and sleep compared with no treatment in children over one year.³ Liquorice is often an ingredient in herbal cough syrups, which makes attributing effects to it difficult.

6.3 Pediatric upper respiratory disorders

To the authors' knowledge, there are no adequately controlled trials of Yashtimadhu in children with common cold, pharyngitis or tonsillitis. This is the central evidence gap.

7. Safety and Pediatric Considerations

- **Glycyrrhizin toxicity:** glycyrrhizin and its metabolite glycyrrhetic acid inhibit 11 β -hydroxysteroid dehydrogenase type 2, causing cortisol-mediated mineralocorticoid effects: sodium and water retention, hypertension, hypokalemia and, in severe cases, arrhythmia, myopathy and encephalopathy. This is documented with excessive or prolonged intake of liquorice.^{16,17}
- **Intake guidance:** a commonly cited guidance value for adults is around 100 mg of glycyrrhizin per day.^{17,18} This is not validated for children, who have lower body weight and may be more susceptible.
- **Duration:** risk rises with prolonged use. Short courses under supervision are the only context in which any caution can be supported.
- **Drug interactions:** potential additive potassium loss with diuretics and corticosteroids, and effects in patients with hypertension, cardiac or renal disease.
- **Prenatal exposure:** a cohort study linked heavy maternal liquorice consumption during pregnancy with adverse cognitive and psychiatric outcomes in offspring.¹⁹ This is not about direct pediatric use, but supports caution and is worth noting.
- **Honey as Anupana:** if Yashtimadhu is given with honey, honey must not be given to infants under 12 months of age because of the risk of infant botulism.²⁰
- **Quality:** adulteration, variable glycyrrhizin content and contaminants are potential problems. Standardised, tested preparations are essential for research and use.

- **Dosing:** no validated pediatric dose exists. This article makes no dosing recommendation.

8. Discussion

The classical Dravyaguna profile of Yashtimadhu, with Madhura Rasa, Snigdha and Guru Guna, Sheeta Virya, Kanthya, Kasahara and Shothahara actions, is coherent with its traditional use in throat and cough disorders, and experimental data on demulcent, anti-inflammatory and antiviral effects give it biological plausibility.¹⁰⁻¹³ The sore throat trials in adults give modest, indirect clinical support for a throat-soothing effect.^{14,15}

Several caveats must be stated plainly. First, the clinical data are not pediatric, and not for infectious URTI, so extrapolation is unjustified. Second, the strongest traditional evidence for pediatric cough belongs to honey, not liquorice.^{2,3} Third, glycyrrhizin is both a presumed active constituent and the main source of toxicity, so the line between benefit and harm depends on dose and duration, which are not defined for children. Fourth, most pharmacological data derive from isolated compounds at laboratory concentrations, whereas Ayurvedic use involves whole-root preparations, often in combination.

There is also a conceptual point. Because URTIs in children are mostly viral and self-limiting, any trial must show benefit beyond natural recovery and placebo, using symptom outcomes that are meaningful and measurable in children.

Research priorities for Kaumarabhritya:

- Standardised Yashtimadhu preparations characterised for glycyrrhizin and flavonoid content.
- Pediatric safety and dose-finding studies with blood pressure and potassium monitoring.
- Randomised, placebo-controlled trials in acute cough and pharyngitis with validated symptom scales.
- Comparison of single-drug use with classical compound formulations and with honey.

Limitations: narrative design without formal risk-of-bias assessment; classical correlations are interpretive; and the evidence base for children is minimal.

9. Conclusion

Yashtimadhu has a coherent classical rationale for throat and cough disorders, and experimental and adult clinical data support biological plausibility for soothing and anti-inflammatory effects. There is, however, no adequate pediatric clinical evidence to support its routine use, and glycyrrhizin-related toxicity requires careful attention to dose and duration in children. Pediatric safety, dose-finding and controlled studies with standardised preparations are needed before clinical recommendations can be made.

Conflict of Interest

None declared.

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