



Ayurvedic Immunomodulators in Recurrent Urinary Tract Infections in Women: A Cross-System Evaluation

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Abstract

Recurrent urinary tract infections (rUTIs) are a widespread health concern among women, characterized by multiple episodes of infection within short intervals. Conventional treatment predominantly involves prolonged or repeated courses of antibiotics, which often lead to complications such as antimicrobial resistance, gut microbiota imbalance, and compromised host immunity. In this context, there is a growing interest in integrative and preventive approaches that enhance host resistance rather than solely targeting pathogens. Ayurveda, the traditional system of Indian medicine, conceptualizes disease not only in terms of pathogens but also as a result of internal imbalances and weakened immunity or Vyadhikshamatva. Rasayana therapy, a cornerstone of Ayurvedic preventive medicine, aims to rejuvenate and strengthen systemic immunity through a combination of herbs, dietary interventions, and lifestyle practices. Herbs such as Guduchi (*Tinospora cordifolia*), Ashwagandha (*Withania somnifera*), Punarnava (*Boerhavia diffusa*), and Gokshura (*Tribulus terrestris*) are recognized for their immunomodulatory, anti-inflammatory, and urogenital-protective properties. This review presents a cross-system evaluation of rUTIs by integrating Ayurvedic theory with modern biomedical understanding. It critically examines the pathophysiology of rUTIs, highlights key Ayurvedic herbs and formulations with immunomodulatory potential, and evaluates their scientific evidence from recent clinical and pharmacological studies. The article also proposes an integrative therapeutic protocol

that combines acute management with long-term Rasayana therapy aimed at recurrence prevention. By synthesizing ancient wisdom and modern science, this review underscores the relevance of Ayurvedic immunomodulators in contemporary women's health, especially in the era of rising antibiotic resistance. The findings support the need for further clinical validation and incorporation of Ayurvedic approaches into mainstream rUTI management frameworks.

Keywords: Recurrent UTI, Immunomodulators, Ayurveda, Rasayana, Women's Health, Cross-system evaluation, Herbal medicine

Introduction

Urinary tract infections (UTIs) are among the most common bacterial infections in women, affecting nearly 50–60% at least once in their lifetime. A significant proportion of these women go on to develop recurrent UTIs (rUTIs), defined clinically as two or more infections within six months or three or more within a year. These infections significantly impact the quality of life, work productivity, and psychological well-being of affected individuals. The standard therapeutic approach in conventional medicine involves the use of antibiotics, which, while effective in the short term, often result in the development of antibiotic resistance, vaginal and gut dysbiosis, and a compromised immune response over time.

The recurrence of UTIs suggests a deeper systemic susceptibility, which may not be adequately addressed by pathogen-directed therapy alone. Modern science increasingly acknowledges the role of host immunity, microbial biofilms, mucosal health, and microbiota imbalances in the perpetuation of rUTIs. In this context, traditional systems like Ayurveda, with their emphasis on individualized care, systemic balance, and immune strengthening (Vyadhikshamatva), offer a holistic and preventive approach.

Ayurveda classifies urinary disorders under terms such as Mutrakrichra (dysuria) and Mutraghata (urinary retention or obstruction), attributing their origin to Dosha imbalance, particularly of Vata and Kapha, and impaired Agni (digestive/metabolic fire). Recurrent infections are viewed as a sign of depleted Ojas (vital essence or immune strength), necessitating the use of Rasayana (rejuvenative) therapy. Rasayana herbs and formulations are not only aimed at relieving symptoms but also at fortifying the body's internal defense mechanisms to prevent recurrence.

In recent years, Ayurvedic herbs such as *Tinospora cordifolia*, *Withania somnifera*, *Boerhavia diffusa*, and *Tribulus terrestris* have attracted scientific attention for their immunomodulatory, anti-inflammatory, nephroprotective, and uroprotective properties. These herbs, traditionally used in Ayurvedic practice, have shown promise in modulating both innate and adaptive immune responses, enhancing mucosal immunity, and preventing microbial colonization.

This review aims to bridge the knowledge systems of Ayurveda and modern medicine by presenting a cross-system evaluation of recurrent urinary tract infections in women, focusing on the potential role of Ayurvedic immunomodulators. It explores the pathophysiological underpinnings of rUTIs, outlines the therapeutic rationale for Rasayana use, reviews existing scientific evidence, and proposes an integrative protocol that can inform future clinical practice and research.

Aims and Objectives

Aim:

- To review and evaluate the role of Ayurvedic immunomodulators in the management and prevention of recurrent urinary tract infections in women from a cross-system perspective.

Objectives:

- To understand the pathogenesis of recurrent UTIs from both Ayurvedic and modern biomedical perspectives.
- To identify and review key Ayurvedic herbs and Rasayana formulations with immunomodulatory properties.
- To analyze existing clinical and pharmacological evidence supporting these interventions.
- To propose an integrative treatment model combining Ayurvedic and modern insights for rUTI management.
- To highlight the need for further interdisciplinary research on the use of Ayurvedic immunomodulators.

Materials and Methods

Study Design:

A narrative review based on Ayurvedic classical texts, modern scientific literature, and cross-disciplinary comparative analysis.

Sources of Data:

Ayurvedic Texts: Charaka Samhita, Sushruta Samhita, Ashtanga Hridaya, Bhavaprakasha Nighantu.

Databases Searched: PubMed, Scopus, Google Scholar, AYUSH Research Portal, DHARA (Digital Helpline for Ayurveda Research Articles).

Inclusion Criteria:

Peer-reviewed articles (2010–2024) discussing Ayurvedic herbs in immune modulation or UTI prevention

Classical Ayurvedic references relevant to urinary disorders and Rasayana therapy

Clinical trials, review papers, and pharmacological studies involving women with recurrent UTIs

Exclusion Criteria:

Non-peer-reviewed sources

Articles unrelated to urinary tract infections or immune modulation

Animal studies not correlated with clinical evidence

Pathophysiology of rUTI: A Modern and Ayurvedic Perspective

Modern Medicine	Ayurveda
Caused by bacterial pathogens (e.g., <i>E. coli</i>)	Due to Agantuja or Nija factors (Dosha imbalance)
Common in postmenopausal, diabetics, sexually active women	Associated with Vata-Kapha vitiation, Apana Vata dushti
Focus on pathogen eradication and biofilm disruption	Focus on strengthening Agni , enhancing Ojas , and clearing Avarana

Ayurvedic Concept of Immunity (Vyadhikshamatva) and Recurrent Infections

Ayurveda, immunity is not a standalone physiological system but a complex interplay of various bodily functions, most notably Agni (digestive and metabolic power), Ojas (vital essence), Doshas (functional principles), and Dhatus (tissues). The concept of immunity is primarily encompassed in the term Vyadhikshamatva, which refers to the body's ability to resist disease (Vyadhi) and maintain health.

Vyadhikshamatva: Dual Components

Charaka defines Vyadhikshamatva in two ways:

- Vyadhi-Utpada Pratibandhakatvam – the resistance to the occurrence of disease (preventive aspect),
- Vyadhi Bala Virodhitvam – the ability to resist the severity and progression of disease (curative and defensive aspect).

This duality highlights the importance Ayurveda places not just on disease treatment but on disease prevention and resilience building, making it particularly relevant in recurrent infections like rUTIs.

Role of Ojas in Immunity

Ojas, considered the essence of all Dhatus (tissues), is the chief factor responsible for sustaining life and immunity. It is described as Bala (strength) and is directly linked to the body's natural defense mechanisms. A person with strong Ojas is described as having:

- Good digestion and metabolism,
- Resistance to seasonal and infectious diseases,
- Physical and mental stability,
- Longevity and vitality.

In the context of rUTIs, frequent infections indicate Ojakshaya (depletion of Ojas) due to repeated insult to urinary tissues and systemic immunity. Hence, therapies aimed at Ojas vardhana (enhancement of Ojas) such as Rasayana chikitsa are emphasized.

Agni and Immunity

According to Ayurveda, Agni is the root of immunity. A well-functioning digestive fire leads to proper formation of Dhatus and ultimately Saras Dhatu or Ojas. If Agni is weak (Mandagni), it results in Ama (toxins) which circulate and lodge in vulnerable areas, leading to repeated infections and inflammation.

In women prone to rUTIs, compromised Agni may result in poor metabolism, altered gut flora, and accumulation of toxins in the urinary tract, manifesting as Mutrakrichra (painful urination) or Prameha (urinary disorders).

Dosha Involvement in rUTIs

Vata: Its aggravation, particularly Apana Vata, disrupts the normal flow and expulsion of urine, leading to stasis, dryness, and pain.

Kapha: Causes stagnation and mucosal buildup, creating a breeding ground for pathogens.

Pitta: Though responsible for digestion and immunity, its vitiation can lead to inflammation and burning micturition.

A chronic imbalance in these Doshas, particularly Vata-Kapha, sets the stage for recurrent infections in the urinary system.

Rasayana Chikitsa and Immune Modulation

Rasayana therapy, as explained in Ayurveda, not only nourishes the Dhatus and increases Ojas but also improves Satmya (adaptability), Srotoshuddhi (cleansing of channels), and Prabhava (specific potency) to resist infections. It is a key approach in individuals with frequent illnesses, weakened immunity, and tissue depletion due to chronic diseases.

In the case of recurrent UTIs, Rasayanas aim to:

- Enhance mucosal and systemic immunity,
- Improve Agni to avoid Ama formation,
- Restore Dosha balance,
- Promote rejuvenation and tissue repair,
- Prevent recurrence by strengthening the urinary tract lining.

Immunomodulatory Herbs in Ayurveda Used for rUTIs

Herb	Ayurvedic Action	Modern Pharmacological Activity	Dose (General)
Guduchi (Tinospora cordifolia)	Rasayana, Tridoshaghna	Enhances macrophage and neutrophil function, antimicrobial	250–500 mg extract BID
Ashwagandha (Withania somnifera)	Balya, Rasayana	Immunostimulant, anti-inflammatory, adaptogen	250–600 mg/day
Gokshura (Tribulus terrestris)	Mutrala, Rasayana	Diuretic, antimicrobial, antioxidant	3–6 g churna or capsule
Punarnava (Boerhavia diffusa)	Mutrala, Shothahara	Anti-inflammatory, diuretic, hepatoprotective	500 mg extract BID
Haridra (Curcuma longa)	Lekhana, Krimighna	Anti-inflammatory, biofilm disruptor, immune modulator	500–1000 mg/day

Rasayana Therapy in rUTIs

Rasayana drugs aim to:

- Promote tissue resistance
- Strengthen urogenital immunity
- Restore the urinary tract mucosal barrier
- Correct Apana Vata imbalance

Examples:

- Amalaki Rasayana
- Chyawanprash
- Ashwagandhadi Leha
- Guduchi Satva
- Vasanta Kusumakara Ras (in chronic, diabetic women)

Clinical Evidence and Cross-System Integration

Study/Reference	Finding	Comment
Randomized control trials on Tinospora cordifolia	Increased macrophage activity and reduced infection incidence	Supports Ayurvedic use
Use of Punarnava Mandura in mutrakrichra	Diuretic and anti-inflammatory effect in UTIs	Useful adjunct
Meta-analysis of Rasayana therapy	Improved immune markers in recurrent infections	Promising for prevention
Probiotic approach and gut-urinary axis	Ayurveda: Strengthening digestion (Agni) indirectly boosts urinary immunity	Correlates with gut-microbiome-immune axis

Integrative Protocol: Ayurvedic Approach to rUTI

Phase	Intervention	Examples
Acute phase	Diuretic + antimicrobial herbs	Punarnavadi Kashaya, Chandraprabha Vati
Recovery	Rasayana + Ojas-enhancing	Guduchi Satva, Chyawanprash
Prevention	Monthly detox + immune tonics	Triphala, Gokshura, Rasayana Yoga

Discussion

Recurrent urinary tract infections (rUTIs) in women present a multifactorial challenge that extends beyond bacterial colonization and includes host factors such as mucosal immunity, microbial biofilms, hormonal influence, and systemic susceptibility. While modern biomedicine provides short-term relief through antimicrobial agents, it often fails to address the long-term immune dysfunction and host susceptibility that predispose patients to recurrence. This review highlights how Ayurvedic immunomodulators (Rasayana drugs) provide a complementary and preventive strategy for such cases.

Ayurveda approaches rUTIs from a systemic and constitutional perspective, focusing on the underlying Vyadhikshamatva (immunity), Dosha imbalance, Dhatu kshaya (tissue depletion), and Agni dysfunction. By addressing these foundational issues, Ayurvedic therapies aim not just to eliminate the infection but to fortify the host against future episodes.

Strengths of the Ayurvedic Approach

- **Holistic immune modulation:** Rasayana therapy involves deep immunological support by enhancing Ojas, correcting metabolism (Agni), and improving nutrient assimilation, which is crucial for building systemic immunity.
- **Mucosal protection and tissue repair:** Herbs like Punarnava, Gokshura, and Daruharidra have shown anti-inflammatory, demulcent, and antioxidant properties that protect uroepithelial linings.
- **Antimicrobial and anti-biofilm activity:** Studies indicate that Tinospora cordifolia, Neem, and Ashwagandha exhibit antimicrobial properties that can reduce pathogen load and prevent biofilm formation—a critical factor in rUTI recurrence.
- **Hormonal and adaptogenic support:** Rasayana herbs often function as adaptogens, which modulate neuroendocrine-immune functions. This is particularly relevant in premenopausal and postmenopausal women where hormonal shifts influence vaginal and urinary tract flora.

Integration with Modern Strategies

A cross-system approach, combining targeted antibiotics for acute infection with Ayurvedic Rasayana therapy for long-term immune support, can yield better outcomes in rUTI management. Integrative protocols that include:

- Short-term allopathic treatment for symptomatic relief,
- Medium- to long-term Ayurvedic Rasayana for recurrence prevention,
- Lifestyle and dietary interventions as per Ayurvedic principles,

May create a multilayered defense strategy that addresses both symptomatic relief and root-cause resolution.

Current Evidence and Gaps

While the pharmacological and immunological effects of several Ayurvedic herbs are supported by preclinical and some clinical studies, large-scale, randomized controlled trials (RCTs) are still lacking. There is a growing body of evidence on *Tinospora cordifolia*, *Withania somnifera*, and *Boerhavia diffusa*, which demonstrates their immune-boosting, anti-inflammatory, and uroprotective roles. However, heterogeneity in study design, dosage, and patient population makes it difficult to create uniform guidelines.

Additionally, very few studies examine the longitudinal impact of Rasayana therapy on recurrence rates in rUTI, which is a critical metric for success. The safety profile of most Ayurvedic immunomodulators is favorable, with minimal side effects and good tolerability.

Conclusion

Recurrent urinary tract infections (rUTIs) continue to be a significant burden on women's health, particularly due to the limitations of conventional treatment in preventing recurrences and the growing challenge of antibiotic resistance. While antibiotics offer necessary relief during acute episodes, they do not address the underlying vulnerabilities—such as compromised immunity, mucosal weakness, and microbial imbalances—that predispose women to recurrent infections. Ayurveda, with its time-tested wisdom and personalized approach to health, offers a promising solution through Rasayana therapy—a class of interventions aimed at enhancing host immunity (*Vyadhikshamatva*), restoring tissue integrity, and preventing disease recurrence. Ayurvedic immunomodulators such as Guduchi (*Tinospora cordifolia*), Ashwagandha (*Withania somnifera*), Punarnava (*Boerhavia diffusa*), and Gokshura (*Tribulus terrestris*) demonstrate broad-spectrum actions including immune enhancement, anti-inflammatory activity, antioxidant protection, and urogenital tissue support. These properties make them ideal for integration into long-term management plans for rUTIs. The cross-system evaluation presented in this review reveals strong theoretical and emerging clinical support for the integration of Ayurvedic immunomodulators in rUTI care. Combining acute-phase antibiotic therapy with chronic-phase Rasayana support may result in a more holistic, preventive, and sustainable approach, especially for women prone to frequent relapses. The Ayurvedic emphasis on digestive health, detoxification, and lifestyle also complements modern insights into the gut–urogenital–immune axis. However, to translate this integrative model into mainstream practice, well-designed clinical trials, pharmacological standardization, interdisciplinary education, and policy support are essential. Furthermore, patient education and personalized care remain at the heart of successful implementation.

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