WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.453
Volume 14, Issue 10, 1421-1437. Review Article ISSN 2277–7105

AYURVEDIC INSIGHTS IN THE MANAGEMENT OF URINARY TRACT INFECTIONS: A REVIEW OF CLINICAL AND EXPERIMENTAL EVIDENCE

Dr. Amit Kataria[1*], Dr. Upasana[2] and Dr. Neerja Saini[3]

[1]Professor, Department of Kaumarbhritya, Institute for Ayurved Studies and Research, Shri Krishna AYUSH University, Kurukshetra, Haryana.

[2]Ayurvedic Medical Officer, Uttar Pradesh.

[3]PG Scholar Department of Kaumarbhritya, Institute for Ayurved Studies and Research, Shri Krishna AYUSH University, Kurukshetra, Haryana.

Article Received on
05 April 2025,

Revised on 25 April 2025,
Accepted on 15 May 2025

DOI:10.20959/wjpr202510-36969

***Corresponding Author**
Dr. Amit Kataria
Professor, Department of Kaumarbhritya, Institute for Ayurved Studies and Research, Shri Krishna AYUSH University, Kurukshetra, Haryana.

ABSTRACT

About 1-3% boys and 3-8% girls suffer with at least one attack of symptomatic UTI by 14yrs of age. In Urinary tract infection (UTI) there is the inflammatory response of the uro- epithelium to bacterial and other organism invasion. In *Ayurveda Lakshanas* of *Pittaja Mutrakruccra* shows close resembles with urinary tract infections specifically lower urinary tract infections as *Saruja* & *Muhurmuhu Mutrapravruti* indicates dysuria & with increasing frequency; *Sadaha Mutrapravruti* indicates burning sensation during micturition; and *Peeta Mutrapravruti* denotes yellowish colouring of urine, *Sarkta Mutrapravruti* is heamaturia. Antibiotic resistance has been on the rise globally due to antibiotics being prescribed unnecessarily or inappropriately. Prompt treatment is needed to reduce the morbidity of infection and minimize renal damage and subsequent complications. Material for this review paper was compiled from diverse sources, including research publications available in journals, Google Scholar, Pubmed, ResearchGate, and classical Ayurvedic literature. The gathered evidence collectively suggests that numerous herbal drugs, whether used individually or as part of compound formulations, have proven effective in the treatment of urinary tract infections.

KEYWORDS: Pediatric urinary tract infection, *Pittaja Mutrakrucchra*, Antibacterial herbs, Evidence Based medicine.

INTRODUCTION

In children, UTIs may serve as an important marker of structural or functional urinary tract abnormalities. Although the most common abnormality heralded by UTIs is Vescio ureteral reflux; UTIs may be the first symptom of obstructive uropathy or bladder dysfunction.[1] Numerous risk factors, including age, gender, history of antibiotic usage, fever, constipation, frequency of urination, bladder dysfunction, obstructive uropathy, and nitrates in urine, are linked to UTI in the paediatric age range.[2] Unsanitary conditions, immunocompromised children, and threadworm infections are the main causes of UTIs in underdeveloped nations. Studies discovered a link between childhood obesity and UTI.[3] Children with complex malnutrition had a higher incidence of UTIs.[4] Untreated urinary tract infections (UTIs) have a high prevalence of morbidity and death in children. If left untreated, they can become chronic and lead to kidney scarring, hypertension, and renal failure. It also burdens society financially.[5] In childhood period these type of ailments effects the proper growth and development also leads in comptonization in its physical activities, social behaviour, immunity, concentration, and performance.

AIMS AND OBJECTIVES

- To find out evidence-based herbs & other ayurvedic modalities employed in the treatment of urinary tract infection.
- To find out mechanism behind these herbs & ayurvedic modalities to treat urinary tract infection.

MATERIALS AND METHODS

The material for this review paper was collected from the articles searched through research publications available in journals, Google Scholar, Pubmed, ResearchGate, and classical Ayurvedic literature by using the key words Urinary tract infection, *Pittaja Mutrakruchra*, in paediatric domain mainly along with antibacterial properties of plants against UTI in humans. All the related research articles, clinical and experimental studies were reviewed for the required properties & gathered here into single & groups which are discussed here as.

Antimicrobial Potential

Tribulus terrestris: The antimicrobial activity of aqueous, ethanol, chloroform, and petroleum ether extracts of *Tribulus terrestris* fruits was tested against uropathogens *Escherichia coli, Pseudomonas aeruginosa, Proteus mirabilis, Klebsiella pneumoniae* and *Enterococcus faecalis* using the agar well diffusion method at 5%, 10%, and 15% concentrations. Ethanol extract at 15% showed the strongest effect against all tested bacteria. Aqueous extract was effective only against *P. aeruginosa* and *P. mirabilis*. Zones of inhibition were measured and compared with Azithromycin (1%) as the positive control and DMSO as the negative control, confirming the promising antibacterial potential of ethanol extract.[6] *Tribulus terrestris* is rich in saponins, a primary constituent responsible for antimicrobial activity. These saponins possess detergent-like and surface-active properties that can disrupt bacterial cell membranes, thereby exerting antibacterial effects.[7] In the given study, *T. terrestris* exhibited significant antibacterial activity against clinical isolates, further supporting its traditional use in managing infections.

Hemidesmus indicus and Vetiveria zizanoides: The ethanol extract of *Vetiveria zizanoides* demostraed the highest anti-bacterial activity against *S. typhi* (13 mm i.e. zone of inhibition), while the methanol extract showed moderate activity against all pathogens. *Hemidesmus indicus* ethanol extract exhibited the most potent inhibition against *V. cholerae* (13 mm), followed by *E. coli* (12 mm). The methanol extract showed maximum inhibition against *K. pneumoniae* (12 mm). Aqueous extracts of both herbs displayed no antibacterial activity against the tested pathogens.[8]

Studies revealed that the ethanolic extract of *Vetiveria zizanioides* (EEVZ) exhibited stronger inhibitory effects against Gram-negative bacteria compared to Gram-positive strains due to the presence of flavonoids and tannins in the plant extract. Flavonoids are known for their broad-spectrum antimicrobial potential, has capacity to form complexes with extracellular and soluble proteins, as well as with bacterial cell walls. Their lipophilic nature may also facilitate the disruption of microbial membranes. Tannins, on the other hand, inactivate microbial adhesion factors, enzymes, and membrane transport proteins, in addition to forming complexes with polysaccharides. The detection of tannins in the roots of *V. zizanioides* suggests that these compounds may play a key role in the observed in vitro antibacterial activity.[9] Also, Ethanol Extract of Hemidesmus indicus (HIEE) disrupt the membrane potential of *E. coli*, showed evident influx of FITC (fluorescein isothiocyanate) into *E. coli*.

Electron microscopy confirmed that HIEE treatment caused membrane blebbing (structural damage to the bacterial outer layer) and leakage of intracellular contents, suggesting formation of pores in bacterial membranes.[10]

Solanum Xanthocarpum: In vitro study was conducted to evaluate the antimicrobial potential of *Kantakari* (*Solanum xanthocarpum*) *Panchang* using **Antimicrobial Susceptibility Testing (AST)**.

METHODOLOGY

- **Forms Tested:** Swaras (juice), Kalka (paste), and Churna (powder).
- **Technique Used:** Ditch plate method.
- **Target Pathogen:** *Escherichia coli* (a major cause of urinary tract infections).

The **Swaras form** of *Kantakari* exhibited the most potent antimicrobial activity against *E. coli*.

The study confirmed the efficacy of the traditional juice form in combating *E. coli*-induced UTIs.[11] Phytochemical profiling of various extracts revealed the presence of bioactive constituents such as solamargine, solasonine, campesterol, β-sitosterol, cycloartenol, sitosterol, chlorogenic acid, and vanillic acid. These phytochemicals, particularly steroidal alkaloids and phenolic compounds, are believed to contribute to the observed antimicrobial activity.[12]

Hemidesmusindicus (*Anantmul*), Malva Sylvestris (*Gulkhair*) and Rubiacordifolia (*Manjishtha*): A study investigated the **antimicrobial potential** of three Ayurvedic herbs against urinary tract infection (UTI) pathogens. Showed **methanolic extracts** of all three herbs had **significant antimicrobial activity** against the tested UTI pathogens.[13] The active constituents present in these extracts may exert their antimicrobial effects through multiple mechanisms, including degradation of the bacterial cell wall, disruption of the cytoplasmic membrane, leakage of intracellular contents, protein denaturation, interference with enzymatic functions, inhibition of DNA and RNA synthesis, disruption of electron transport and nutrient uptake, impairment of energy production, and alteration in fatty acid and phospholipid composition of the microbial membranes.[14]

Boerhavia diffusa: The ethanolic extract of *Boerhavia diffusa* exhibited significant antimicrobial activity against all bacterial species isolated from urine samples. So, it was

concluded that the antimicrobial activity was due to the presence of compounds that dissolve in organic solvent like ethanol. HPTLC profiling of ethanolic extract showed the presence of β- sitosterol. But the β- sitosterol is absent in water extract. So, the antibacterial activity of Boerhavia diffusa may be due to the presence of this compound or the synergistic effect of β-sitosterol with other active constituents in the plant.[16]

Tribulus terrestris L. Phyllanthus amarus Sch. Hemidesmus indicus L.Br.: A study evaluated the **hydro-alcoholic (40:60) extracts** of three plants.

- **Tribulus terrestris** (fruit extract)
- **Phyllanthus amarus** (whole plant extract)
- **Hemidesmus indicus** (root extract)

All extracts demonstrated **more than 70% sensitivity** against the tested bacterial strains.

Gram-positive bacteria were **more susceptible** to the herbal extracts compared to Gram-negative bacteria.

Most effective groups

Group A (*T. terrestris* extract) and **Group F** (combination of *T. terrestris* and *H. indicus*) effectively inhibited both **Gram-positive and Gram-negative bacteria**.

Group G (combination of *T. terrestris*, *P. amarus*, and *H. indicus*) also showed **broad-spectrum activity**.

Group C (*H. indicus* extract) specifically inhibited **Gram-positive bacteria.**[17] The phytochemical analysis of ethanolic leaf extract of Phyllanthusamarus showed the presence of Alkaloids, Cyanogenic glycosides, Saponins, Tannins and Oxalates.[17]

The free radical scavenging ability of essential oil expressed in IC50 (50% of inhibition) value in this for DPPH, or 2,2-diphenyl-1-picrylhydrazyl the IC50 was 54.23µl/ml, whereas nitric oxide scavenging was 72. 91µl/ml. The antibacterial activity of C. Aromaticus essential oil is dosage dependent from lower to higher (20-80µl/ml) concentration. Whereas the maximum zone of inhibition was determined in Gram positive pathogens than Gram negative at the higher concentration of 80µl/ml. The highest percentage of growth inhibition was measured in 24hr incubated culture through optical density measurement study. study supports its traditional approach as a preventive therapy for the treatment of microbial diseases and replacement of artificial antioxidants.[18] The antibacterial activity of essential oils is primarily attributed to their lipophilic nature and the presence of specific functional groups.[19] Volatile compounds interfere with the phospholipid bilayer, disrupting processes

such as electron transport, ion gradient maintenance, protein translocation, phosphorylation, and various enzyme-mediated reactions[20], which result in the increase of bacterial cell membrane permeability.[21]

Combatting Multi Drug-Resistant Strains

Allium sativum Aqueous allicin extract from *Allium sativum* (garlic) cloves and leaves against **multi-drug-resistant (MDR) urinary pathogens**, including *Staphylococcus aureus***,** *Enterococcus faecalis***,** *Escherichia coli* **and** *Klebsiella pneumoniae through* **Disc diffusion method**. Antibacterial activity at five concentrations of allicin were **10, 20, 30, 40, and 50 µg**. The **maximum inhibitory activity** against all MDR isolates was observed at **40 µg** concentration.

The antibacterial effect of **allicin at 40 µg** was statistically significant (**P < 0.01**).[22] Garlic's antimicrobial activity is mainly attributed to allicin, a thiosulfate compound released when garlic bulbs are crushed. Additionally, other sulfur-containing bioactive compounds such as alliin and the enzyme alliinase contribute to its antibacterial effects.[23]

Urine culture and sensitivity

Moringa Oleifera: A study evaluated the **antibacterial efficacy** of *Moringa oleifera* extracts against bacterial strains cultured from **30 urine samples**. Using **EtMO (**Ethanolic extract of *M. oleifera)* and **HyMO (**Hydroalcoholic extract of *M. oleifera)*. Technique used was Disc diffusion method where 80% of the cultured samples responded to EtMO and 83.33% of the samples showed sensitivity to HyMO.[24]

Moringa oleifera contains a variety of phytochemicals such as alkaloids, flavonoids, carbohydrates, glycosides, proteins, saponins, tannins, terpenoids, and anthraquinones in various solvent extracts. Natural nitrogen-containing compounds like Alkaloids, are widely utilized in therapeutic and recreational applications. Flavonoids act as antioxidants, enhance the effectiveness of Vitamin C, and demonstrate protective effects against toxins, tumors, viruses, and microbes. Terpenoids with aromatic properties are traditionally used in herbal remedies they are being studied for their antibacterial, anticancer, and other therapeutic potentials. Tannins exhibit antiviral, antibacterial, and antiparasitic effects. These bioactive compounds collectively contribute to Moringa's notable antimicrobial activity against multiple pathogens.[25]

Ayurveda Treatment Protocol

- ***Dadhimashatak Churna***: 1 g TDS
- ***Godanti Bhasma***: 250 mg TDS
- ***Shankh Bhasma***: 250 mg TDS
- ***Chandraprabha Vati***: 125 mg TDS
- **Syrup Neeri (Aimil Pharmaceuticals)**: 5 ml TDS
- ***Trinpanchmool Kwath***: 5 ml BD

Symptomatic Relief: Significant improvement in UTI symptoms.

Pus Cell Reduction: Decreased from **13–14/hpf** to **4–6/hpf**.

Urine Culture & Sensitivity: *Escherichia coli* colony size reduced from **>1,00,000 CFU/ml** to **58,000 CFU/ml.**[26]

Dadimashtaka Churna, having *Punica granatum* (pomegranate) as main ingredient, exhibits *Deepana*, *Pachana*, and *Vatanulomana* effects by balancing the *Rasa-Panchaka*. Its *Vata-Kapha shamaka* action helps pacify *Amadosha*.Microscopically, it shows calcium oxalate crystals from *Punica granatum*, siliceous crystals attributed to *Bambusa arundinacea*, and oil globules from *Piper nigrum*. Volatile compounds such as camphene, geraniol, linalool, menthone, myrcene, sabinene, terpeneols, citral, and sitosterol contribute to its pharmacological actions. The formulation contains around 14 ingredients, enriched with carbohydrates, essential oils, flavonoids, terpenoids, and tannins supports its antimicrobial and digestive properties.[27]

Research findings highlight the detailed cellular mechanisms involved in the internalization of *Godanti Bhasma* (GB) particles, including vacuole formation and the degradation process of the internalized particles. These observations suggest that GB holds therapeutic potential in detecting impaired phagocytosis in various cell types and may be useful in assessing drugs that modulate the phagocytic pathway, either as activators or inhibitors.[28]

Shankha Bhasma having properties like *Madhura Rasa, Laghu Guna, Sheetal Veerya* and show Antacid, Antispasmodic effect.[29]

Chandraprabha Vati is a herbo-mineral formulation comprising 37 ingredients, with *Shilajit* and *Guggulu* being the primary components, each constituting 32 parts. It predominantly exhibits *Katu* (73.38%) and *Tikta* (69.78%) tastes, along with *Laghu* (76.98%) and *Ruksha* (74.10%) qualities. It is characterized by *Ushna Virya* (70.50%) and *Katu Vipaka* (69.06%),

and is chiefly *Tridosha Shamak*, with a stronger action on *Vata* (91.37%) and *Kapha* (84.89%) doshas. Therapeutically, it offers anti-inflammatory, anti-tumor, nephroprotective, hepatoprotective, and antidiabetic effects. It is particularly effective in managing jaundice, urinary tract infections (UTIs), and other genitourinary disorders. Additionally, it has antibacterial, antiseptic, astringent, diuretic, wound-healing, and cooling properties.[30]

Syrup Neeri The polyherbal formulation comprising *Daruharidra, Pasanbheda, Punarnava, Gokshura, Varuna, Apamarga, Sudha Shilajit, Lajjalu, Yavakshar, Mooli, Sheetal Chini, Saindhav, Ikshu, Kultha, Makoya, Chharilla, Samudra Namak,* and *Ark*. These ingredients known for their synergistic effects such as diuretic, anti-inflammatory, antibacterial, *Shothahara*, *Basti shodhak*, and *daha shamaka* actions. Herbs like *Pasanbheda*, *Punarnava*, and *Gokshura* facilitate diuresis and reduce local inflammation, while *Sheetal Chini (Piper cubeba)* Hot aqueous extract of Piper cubeba have activity on antimicrobial activity of bacteriocin of E. coli. Piper cubeba may serve as auxiliary agents that can enhance standard conventional antibacterial therapy in UTIs.[31] The inclusion of *Sudha Shilajit* enhances *Rasayana* and rejuvenative functions, supporting urinary mucosal integrity and *Shilajit* also contains minerals such as iron, aluminium, magnesium, potasium, calcium, chlorides, sulphate etc. Potassium salts are used as diuretic.[32] The collective pharmacological profile of these ingredients validates their use in managing UTI both from traditional Ayurvedic and modern pharmacological perspectives.

Trinpanchmool Kwath contains rootstock of *Kush* that is rich in terpenes. *Darbh* root possesses five key triterpenoids—cylindrin, arundoin, ferneon, isobarborneol, and cimilarenol—beneficial in urinary calculi and urine retention. *Kas* contains proteins, calcium phosphate, and hydrocyanic acid glycosides, acting as a galactagogue and diuretic. *Sar* stem is sweet, cooling, aphrodisiac, and relieves thirst and urinary issues. *Ikshu* root and stem provide sugars and amino acids like asparagine and glutamine, useful in fatigue and dehydration. These are traditionally used alone or in combination.[33] *Kusha, Kasha, Shara, Darbha*, and *Ikshu* are all described as having *Mutrakricchrahara, Pittavara*, and *Basti Shodhak* properties. These collective actions contribute significantly to breaking the pathogenesis of *Pittaja Mutrakricchra*, making the *Kwatha* effective in its management.[34]

Together, this synergistic combination addresses the *Samprapti* of *Pittaja Mutrakricchra* holistically—by removing *Aama*, restoring *Agnibala*, pacifying *vitiated Pitta*, and promoting *Mutravaha Srotoshuddhi*.

Treatment Protocol

- **Internal Medications**
  - ***Samshaman Vati****:* 1 tab BD for 7 days
  - ***Gokshuradi Guggulu****:* 1 tab BD for 7 days
  - ***Sheet-Prabha Vati****:* ½ tab QD for 3 days
  - ***Alka-5 Syrup****:* 5 ml, 4–6 times daily for 3 days

- **External Procedures**
  - **Avgaha (sitz bath)** with cold water
  - **Cold pack** applied to the lower abdomen

Pus Cell Reduction: Decreased from **20–25/hpf** to **4–6/hpf**.

Urine Culture & Sensitivity: *Escherichia coli* colony count reduced from **>1,00,000 CFU/ml** to **68,000 CFU/ml.**[35]

Shanshaman vati- Guduchi, the key component of all *Samshamani Vati* variants, pacifies all three doshas—*Vata*, *Pitta*, and *Kapha*—through its *Madhura Vipaka*, *Tikta-Kashaya Rasa*, and *Ushna Virya*. It enhances digestion, alleviates Jvara, and exhibits diverse pharmacological actions including antimicrobial, antioxidant, hepatoprotective, immunomodulatory, and anti-diabetic effects.[36] Phyto-chemical screening of alcoholic extract of *Guduchi* has been conducted and revealed the presence of alkaloids, tannins, flavonoids, saponins and terpenoid Evident that alcoholic extract of *Guduchi* has showed better antibacterial effect against *Klebsiella pneumoniae* UTI causing bacteria.[37]

Gokshuradi Guggulu, a classical formulation comprising *Gokshura*, *Guggulu*, *Triphala*, *Trikatu*, and *Musta*, is recognized for its *Tridoshahara* action, with pronounced *Vatashamaka* and *Basti Shodhak* properties.[38] *Guggulu*, a resinous substance, contains various bioactive constituents such as guggulsterone, eugenol, ellagic acid, quercetin, stigmasterol, and campesterol. These compounds contribute to its diverse pharmacological profile, including antimicrobial, lipid-lowering, anti-inflammatory, immunomodulatory, and antioxidant activities.[39]*Pippali*, a component of *Trikatu*, adds *Rasayana* effects by reducing oxidative stress. Additionally, aqueous, ethanolic, ether, and acetone extracts of *Triphala* and its components (*Amla*, *Haritaki*, and *Bibhitaki*) have shown notable antibacterial activity against UTI-causing pathogens.[40]

Sheetaprabha vati exhibits a cooling effect on the urinary tract, providing relief from burning and discomfort during urination. Due to the presence of *Hajarul Yahud Bhasma*, it supports the dissolution and expulsion of urinary stones and growths. Its *Dahashamak* property helps alleviate symptoms caused by excessive internal heat.[35]

ALKA-5 syrup is an herbal alkaliser that helps maintain normal urinary pH levels. Yavakshara serves as an effective alkalizing and mild diuretic agent, relieving burning during urination. *Dhanyak* (*Coriandrum sativum*) offers diuretic, antibacterial, and calming effects, while *Jirak* (*Cuminum cyminum*) adds antispasmodic and antibacterial benefits. *Gokshura* (*Tribulus terrestris*) supports diuresis and aids in breaking down urinary stones. Overall, ALKA-5 helps prevent recurrent UTIs and promotes the expulsion of urinary calculi.[35]

Treatment Protocol

- *Ervarubijadi Yog*: 5 g in 3 divided doses with Tandulodak (rice-wash water)-
- *Chandraprabha Vati*: 250 mg, 1 tab BD after meals-
  Pus Cell Reduction: Decreased from 0–5/hpf to 0/hpf
- Efficacy: The regimen showed over 75% effectiveness, indicating significant improvement.[41]

Ervarubijadi Yog is believed to work primarily through its *Mutral* (diuretic) action. This effect promotes increased urine flow, offering both cooling and nourishing benefits. According to Dravyaguna texts, *Ervarubij* possesses *Madhura Rasa*, *Sheeta Virya*, and *Madhura Vipaka*. Pain related to aggravated *Vata* and burning micturition caused by *Pitta* imbalance are alleviated due to these qualities. Its sweet taste and cooling potency help pacify both *Vata* and *Pitta*, thus easing discomfort and burning sensations during urination.[42]

Chandraprabha Vati Provides anti-inflammatory, anti-cancer, kidney-protective, liver-supportive, and blood sugar-regulating benefits.[30]

Symptomatic relief

Eladichooran : Clinical trial on 3 to 6 years age group

Dose: 2.5 g BD (before food) with **Guda (jaggery)**

Duration: 7 days treatment with a **14-day follow-up**

70% of children were completely cured. **30% showed improvement** in UTI symptoms.

Ingredients: *Ela*, *Pasanbheda*, *Gomutra Shilajithu*, and *Pippali* the drug likely acts through its predominance of *Laghu Guna*, which helps eliminate Kapha and cleanse bodily channels (*Srotoshodhana*). Its primary tastes (*Rasa*), Tikta and Katu, pacify Pitta and Kapha, which are the main doshas involved in *Mootrakrichra*, along with Vata. Additionally, the actions (*Karma*) of the ingredients such as *Mutrala* (diuretic), *Srotoshodaka* (channel-cleansing), and *Ashmaribhedaka* (litholytic) support its efficacy in urinary disorders. Notably, *Guda* is described by Vagbhatacharya in *Dravadravya Vijnana* as possessing *Mutrashodana* (urine-purifying) properties, further enhancing its therapeutic potential in *Mootrakrichra*.[43]

Integrating Ayurveda with Antibiotics

Haritakyadi Yoga: A randomized parallel-group clinical trial was conducted on 40 children aged 6 months to 10 years to evaluate the efficacy of Ayurvedic and allopathic treatments for urinary tract infections (UTIs).

Study Groups One Group Received **Syrup Haritakyadi Yoga -Dose:** 15 mg/kg/dose (45 mg/kg/day) every **8 hours** with lukewarm water or honey (Anupana) for **14 days**. –

Another group received**: Nitrofurantoin (antibiotic) -Dose:** 5–7 mg/kg/day every **8 hours** orally for **14 days**.

Nitrofurantoin was less effective against **drug-resistant microbes**, making it difficult to cure all UTI cases.

Haritakyadi Yoga had limited efficacy in treating **complicated UTI** associated with pyelonephritis.[44] Drugs like *Haritaki* and *Aragvadha* possess *Anulomana* and *Sansrana* properties that help eliminate *dushita mala*, normalize *vitiated Apana Vayu*, and cleanse the *Pakvashaya*, acting as *hetu-pratyanika*. This supports healthy urine formation. *Gokshura*, with its potent diuretic and nephroprotective effects, and *Pashanbheda*, known for its anti-urolithic action, work synergistically in relieving *Mutrakricchra*. *Charaka* recognizes Gokshura as *Mutrakricchra-Anilharanam Agrya* and includes it in *Mutravirechaniya Mahakashaya* along with *Pashanbheda*. Their use reduces pain and urinary frequency. Burning micturition is alleviated by the *guru*, *snigdha*, and *madhura* properties of *Aragvadha*, *Gokshura*, and *Dhanvayasa*. Due to *Shita Virya*, *Kapha* and *Kleda* increase, enhancing urine output. Appetite improvement is attributed to *Haritaki*'s *Ushna Virya*, *Deepana*, and *Pachana* effects, which improve *Jatharagni* and reduce *Ama*. Peri-orbital

swelling in UTI is reduced by *Gokshura* through its inclusion in *Shothahara Mahakashaya*. Its *Krimighna* property also addresses the symptom of "wandering ants," indicating its broad therapeutic potential in *Mutrakricchra*.[44]

***Gokshuradi Yog*: Henoch-Schönlein purpura (HSP)** is an IgA-mediated systemic small-vessel vasculitis with a predilection for the skin, gastrointestinal tract, joints, and kidneys The hallmark is a pressure – or gravity - dependent non thrombocytopenic purpuric or petechial rash. Abdominal pain, arthritis, and nephritis are common. Renal manifestations develop in 40 to 50% of patients, usually within 1 to 3 months of disease 8-year-old child presented with same and treated with '**Gokshuradi Yog'** along with the antibiotics brings early symptomatic relief in children suffering from culture proven UTI.[45]

Another Randomized controlled trial with *Gokshuradi Yog* and antibiotic in which *Gokshuradi Yog* with antibiotic treatment for 7 days and only antibiotic in other group conclude that Patients when treated with '*Gokshuradi Yog'* along with the antibiotics brings early symptomatic relief in children suffering from culture proven UTI.[42] The paste is prepared using equal quantities of the roots of *Gokshura*, *Talmakhana*, *Eranda*, *Vrihati*, and *Kantakari*, processed with milk and dissolved in sweet curd. *Gokshura* and *Talmakhana Madhura Rasa* and *Sheeta Virya*, exhibits *Vata-Pitta Shamana*, diuretic, and antimicrobial and anti-inflammatory effects. *Eranda*, possessing *Madhura Rasa* with *Katu-Kashaya Anurasa* and *Ushna Virya*, is *Vata-Kapha Shamak* and acts as a diuretic and analgesic. *Vrihati* and *Kantakari* with *Katu-Tikta Rasa*, offers *Vata-Kapha Shamana*, diuretic, and anti-inflammatory activity.[46] Collectively, this *Gokshuradi Yoga*, as referenced in Charaka Samhita.[47], exerts a strong diuretic effect that helps flush urinary pathogens and offers analgesic and anti-inflammatory action to relieve pain and burning sensation associated with urinary tract infections.

DISCUSSION

This review attempts to integrate Ayurvedic principles with contemporary biomedical evidence in the treatment of *Pittaja Mutrakricchra* (Urinary Tract Infection), especially within the paediatric population. The efficacy of classical Ayurvedic formulations such as *Gokshuradi Guggulu*, *Chandraprabha Vati*, *Ervarubeejadi Yoga*, Neeri Syrup, and *Samshamani Vati* has been demonstrated through clinical case reports, controlled clinical trials, and in vitro experiments, integrating both traditional principles and pharmacological validation.

Ayurvedic formulations demonstrate multi-level action diuretic, analgesic, anti-inflammatory and antimicrobial making them suitable for both symptomatic relief and pathogenesis interruption. Evidence-based support, such as the antibacterial effects of *Tribulus terrestris*, *Guduchi*, and *Allium sativum* against drug-resistant uropathogens, further strengthens the Ayurvedic rationale.

This integrative approach shows significant potential for paediatric care. Numerous classical medications possess *Madhura rasa*, *Sheeta virya*, and *Balya properties*, rendering them appropriate for paediatric use owing to their safety profile and gentle yet efficacious therapeutic effects.

The gentle detoxifying and immune-modulating actions of herbs like *Guduchi* and *Haritaki* also align well with pediatric physiology.

CONCLUSION

The current review highlights that both single and compound Ayurvedic formulations are effective in the treatment of urinary tract infections, including against specific bacteria where conventional antibiotics are ineffective due to multidrug resistance in urinary tract infection. Furthermore, Ayurveda presents a great opportunity in the management of systemic diseases that manifest with urinary complications and can offer a promising alternative in such cases. However, there is a significant lack of large-scale, controlled clinical trials in pediatric populations, which are essential for developing well-defined treatment regimens and ensuring evidence-based care for children.

REFERENCES

1. Avner ED, Harmon WE, Niaudet P, Yoshikawa N, editors. *Pediatric Nephrology*. 6th ed. Chapter: Urinary Tract Infection. Springer, p. 1299.
2. Dell OG, Pena KB. Urinary tract infections in pediatrics: clinical approach and follow up. Colomiba: salud Uninorte Barranquilla (Colomiba), 2018; 34(1): pg 203–11.
3. Hsu P, Chen SJ. Obesity and risk of urinary tract infection in young children presenting with fever. Medicine. Edition, 2018; Ch 97(49): pg 1–11.
4. Almofarreh M, Alowaa Z, Junainah E, Alshahrani N, Alharbi M, Alkhalifah W, et. al. Prevalence of urinary tract infection among children. Int J Contemp Pediatr. Edition, 2018; Ch5(6): pg2356–9.

5. Nji CP, Assob JCN, Akoachere J, Akoachere J. Predictors of Urinary tract infections in children and antibiotic susceptibility pattern in Buea health district, South West region, Cameroon. BioMed Res Int, 2020; doi:10.1155/2020/2176569.
6. Sharma R, Godatwar P. In Vitro Anti-microbial effect of various extracts of Gokshura (*Tribulus terrestris*) fruits on common pathogens causing Urinary Tract Infection. *J Ayu Int Med Sci*, 2022; 7(9): 64-69.
7. Arabski M, Wasik S, Dworecki K, Kaca W. Laser interferometric and cultivation methods for measurement of colistin/ampicilin and saponin interactions with smooth and rough of P.mirabilis lipopolysaccharides and cells. J Microbiol Methods, 2009; 77(2): 178-183.
8. Ratha M, Subha K, Senthilkumar G, Panneerselvam A. Screening of phytochemical and antibacterial activity of *Hemidesmus indicus* (L.) and *Vetiveria zizanoides* (L.). Eur J Exp Biol, 2012; 2(2): 363-8.
9. Borde B, Dubey S, Agrawal S, Bhalerao A, Kadam K, Borde G. Vetiver zizanioides and their pharmacological activity. *Int J Pharm Pharm Res (Human),* 2023 Nov; 28(4): 240–247.
10. Saritha, K., Rajesh, A., Manjulatha, K., Setty, O. H., & Yenugu, S. (2015). Mechanism of antibacterial action of the alcoholic extracts of Hemidesmus indicus (L.) R. Br. ex-Schult, Leucas aspera (Wild.), Plumbago zeylanica L., and Tridax procumbens (L.) R. Br. ex-Schult. *Frontiers in microbiology*, *6*: 577. https://doi.org/10.3389/fmicb.2015.00577
11. Sayali, Shintre, Ashok, R., Manju, P., & Vivek, P. Preliminary antimicrobial study of kantakari (solanum xanthocarpum schrad & wendl) by ditch plate technique. *International Journal of Ayurveda and Pharma Research*, 2019; *7*(5): 23-27.
12. Bhat P, Ghane SG, Hegde HV, Jayagoudar S. A comprehensive review on traditional therapeutic uses, bioactive principles and pharmacological activities of Kantakari (Solanum virginianum L.): An important Ayurvedic herb. Plant Sci. Today [Internet], 2023 Sep. 22 [cited 2025 Apr. 10]; 10(sp2): 35-41.
13. Rawat S, Swarup S. Antimicrobial activity of Ayurvedic herbs against urinary tract infection pathogens. J Chem Pharm Res, 2015; 7(4): 1461-5.
14. Rawat S, Swarup S. Antimicrobial activity of Ayurvedic herbs against urinary tract infection pathogens. *J Chem Pharm Res*, 2015; 7(4): 1461–5.
15. Vineeth T, Deepak M, Rema Shree AB. Antibacterial effect of *Boerhavia diffusa* and *Punarnavasavam* on urinary tract infection (UTI) causing pathogens. World J Pharm Res, 2014; 3(5): 423-37.

16. Priyadarshini P, Pritilata P, Banojini P, Susmita Kumari S. Antimicrobial effect of hydro-alcoholic extracts of *Tribulus terrestris*, *Phyllanthus amarus*, and *Hemidesmus indicus* against common bacterial urinary pathogens—an in vitro study. Int J Ayurveda Pharma Res, 2015; 3(11).
17. Nisar, M. F., He, J., Ahmed, A., Yang, Y., Li, M., & Wan, C. (2018). Chemical Components and Biological Activities of the Genus *Phyllanthus*: A Review of the Recent Literature. *Molecules (Basel, Switzerland)*, *23*(10): 2567.
18. Subramaniyan G, Padikasan IA. In vitro antioxidant, antibacterial activity of *C. aromaticus* essential oil against multidrug-resistant (MDR) urinary tract infected pathogens. Int J Pharmacogn Phytochem Res, 2014-15; 6(4): 996-1001.
19. Dorman HJD, Deans SG. Antimicrobial agents from plants: antibacterial activity of plant volatile oils. J. Appl. Microbiol, 2000; 88: 308–316.
20. Burt S, Essential oils: their antibacterial properties and potential applicationsin foods—a review. Int. J. Food Microbiol, 2004; 94: 223–253.
21. Lambert RJW, Skandamis PN, Coote PJ, Nychas GJE, A study of the minimum inhibitory concentration and mode of action of oregano essential oil, thymol and carvacrol. J. Appl. Microbiol, 2001; 91: 453–462.
22. Kumar A, Sharma VK. Antibacterial activity of allicin from *Allium sativum* against antibiotic resistant uropathogens. *Internet J Infect Dis*, 2010; 8(1).
23. Noman, Z. A., Anika, T. T., Sachi, S., Ferdous, J., Sarker, Y. A., Sabur, M. A., Rahman, M. T., & Sikder, M. H. (2023). Evaluation of antibacterial efficacy of garlic (*Allium sativum*) and ginger (*Zingiber officinale*) crude extract against multidrug-resistant (MDR) poultry pathogen. *Journal of advanced veterinary and animal research*, *10*(2): 151–156.
24. Maurya SK, Singh AK. Antibacterial activity of *Moringa oleifera* stem bark against urinary tract infections pathogenic bacteria. Int Arch Integr Med, 2015; 3(1): 1-6.
25. Patel N, Patel P, Patel D, Desai S, Meshram D. Phytochemical analysis and antibacterial activity of *Moringa oleifera*. *Int J Med Pharm Sci*, 2014; 4(2): 29–36.
26. Kaushik J, Sharma R. A case report on UTI w.s.r. to Mutrakriccha in children. *IRJAY*, 2020; 3(1): 26–30.
27. Narang R, Herswani I. Ayurveda review on "Dadimashtaka Churna" and its clinical importance. *J Drug Deliv Ther*, 2018; 8(4).
28. Subrata K. Das, Alpana Joshi, Laxmi Bisht, Vishakha Goswami, Abul Faiz, Gaurav Dutt, Shiva Sharma, Godanti bhasma (anhydrous CaSO4) induces massive cytoplasmic

vacuolation in mammalian cells: A model for phagocytosis assay, Methods, 2024; 230: 158-168.

29. Sanwal S, Goyal C, Rawat S, Sharma K. A critical review on Shankha. *World J Pharm, Res,* 2021 Jun 13.
30. *Sahoo P, Mahanta NR. A Critical Analysis on A Multipotent Drug Chandraprabha Vati - Review Article. irjay [Internet], 2022 Jan. 31 [cited 2025 Apr. 8]; 5(1): 105-17*
31. Verma A, Puranik SB, Saraswat R, Jhajharia MK, Sharma R. Anti-Bacterial Action of *Piper cubeba* Extract in UTIs. *Int Multispec J Health*, 2020 Sep; 6(9): 25.
32. Kaur N, Sardana A, Sharma S, Tripathi A, Bano S. Clinical evaluation of Shilajit in Mutrakricchra. *WJPMR*, 2018; 4(2): 109–111.
33. Anonymous (2000). The Ayurvedic Formulary of India, Part (II), Ministry of Health and Family Welfare, Department of Indian System of Medicine and Homeopathy (pp 70-72), Govt of India, New Delhi.
34. Khot JD, Jadhav DK. A comparative clinical study of *Trunapanchamula Kwatha* and *Haritakyadi Kwatha* in the management of *Pittaja Mutrakricchra*. *AYUSHDHARA*, 2015.
35. Ali S, Rathi R, Rathi B, Meshram M. Management of urinary tract infection with evidence-based Ayurveda medicines in pediatrics: A case report. Pediatr Urol Case Rep, 2022; 9(1): 149-152.
36. Anand S, Ajantha, Shashirekha KS, Anuradha B. A comparative study to evaluate efficacy of Gokshura and Guduchi against *Klebsiella pneumoniae* by urine culture and sensitivity in Pittaja Mutrakrichra (Urinary Tract Infection). *J Pharm Sci Innov,* 2019; 8(5): 165.
37. Rathod D, Vyas K. Therapeutic potential of Samshamni Vati – A review. *Int Educ Res J.*, 2023; 9:83–85.
38. Tomar R, Kaur G, Sannd R, Singh H, Sarkar B. A review on Guggulu formulations used in Ayurveda. *Ann Ayurvedic Med*, 2014; 3(3-4): 96–113.
39. Sharma M, Sindu AS. Assessment of antibacterial potential of Trifla churan and its components (Amla, Baheda and Harad) against UTI pathogens. *Ann RSCB*, 2020; 24(2): 1026–1034.
40. Bansal KS, Soni H. Efficacy of Gokshuradi Guggulu in the management of urinary tract infection – Case report. *World J Pharm Res*, 2020; 9(8): 1439–1445.
41. Bobade AR, Fadnavis K. Ayurvedic regimen on Pittaj Mutrakrucchra (Lower urinary tract infection) in child. J Pharmacogn Phytochem, 2024; 13(4): 50–3.
42. Gyandra Pandey. Dravyaguna Vijnyana. Part 1. 3rd Ed. Varanasi: Chaukhambha Krishnadas Academy, c2005. p. 660.

43. Shreeja A.S - A study On the Eficcacy of Eladichoorna in Mutrakruccra with respect to UTI, Kaumarbhritya. Alva's Ayurved Medical College, Moodbadri, 2012.
44. Katkar RS, Upadhyay PS, A Clinical study to evaluate the Efficacy of 'Haritakyadi Yoga' in Children suffering from Mutrakricchra (Urinary Tract Infection), Annals Ayurvedic Med, 2022; 11(3): 207-220.
45. Verma A. Early symptomatic relief in urinary tract infection in children. Asian J Clin Pediatr Neonatol, 2017; 5(3).
46. Verma N, Kalpana, Verma A. Role of 'Gokshuradi Yog' in Early Symptomatic Relief in Urinary Tract Infection in Children. Ann. of Int. Med. & Den. Res, 2015; 1(1): 18-20.
47. Sastri.Kashinath, Charak Samhita Vidhyotini Edition 2018. Varanasi: Chaukhamba Bharti Academy; Vol 2 Chikitsa Sthana Ch 26/62 pg no 726.