



Comparative Evaluation of *Ficus religiosa* and *Cinnamomum zeylanicum* in the Management of *Escherichia Coli*-Induced Urinary Tract Infection: An Ayurvedic Perspective

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ABSTRACT:

Background:

Urinary Tract Infection (UTI) is one of the most common bacterial infections, with *Escherichia coli* being the predominant causative agent. With rising antibiotic resistance and recurrence, there is growing interest in exploring herbal alternatives. *Ficus religiosa* (Peepal) and *Cinnamomum zeylanicum* (Dalchini) are time-tested Ayurvedic drugs known for their antimicrobial and urinary tract cleansing properties.

Aim:

To evaluate and compare the therapeutic efficacy of *Ficus religiosa* and *Cinnamomum zeylanicum* in patients suffering from UTI caused by *E. coli*.

Materials and Methods:

This clinical study was conducted on 120 patients diagnosed with UTI confirmed by urine culture positive for *E. coli*. The patients were randomly allocated into two equal groups. Group A received decoction of *Ficus religiosa* bark and Group B received decoction of *Cinnamomum zeylanicum* bark, both for 14 days. Subjective parameters such as burning micturition, frequency, and suprapubic pain, along with objective parameters including urine culture and routine microscopy, were evaluated pre- and post-treatment.

Results:

Both groups showed significant improvement in clinical symptoms and reduction in bacterial count. Group B (*Cinnamomum zeylanicum*) showed comparatively quicker symptom relief and higher culture negativity rate than Group A. No adverse reactions were observed in either group during the course of treatment.

Conclusion:

Both *Ficus religiosa* and *Cinnamomum zeylanicum* demonstrated efficacy in the management of UTI caused by *E. coli*, with *Cinnamomum zeylanicum* showing relatively superior therapeutic potential. These herbs may serve as effective, safe, and natural alternatives to antibiotics in uncomplicated urinary tract infections.



Background

Urinary Tract Infection (UTI) is a pervasive clinical condition characterized by microbial invasion of the urinary tract, frequently caused by *Escherichia coli*. It affects individuals across all age groups but is particularly prevalent in females due to anatomical predisposition [1]. Common symptoms include burning micturition, increased urinary frequency, suprapubic discomfort, and occasionally fever [2]. The condition, if left untreated, may progress to severe complications such as pyelonephritis or renal impairment. With the overuse and misuse of antibiotics, antimicrobial resistance has emerged as a serious global health threat [3]. Recurrent UTIs and the limited efficacy of conventional antibiotics necessitate the exploration of alternative, safer, and natural remedies. In this context, Ayurvedic herbs with proven antimicrobial and diuretic properties offer a promising therapeutic avenue [4]. *Ficus religiosa* (Peepal) is described in classical Ayurvedic texts under the Vata–Pittahara category and is traditionally used in various genitourinary disorders [5,6]. Its bark is known to possess antimicrobial, anti-inflammatory, and wound-healing properties. *Cinnamomum zeylanicum* (Dalchini), classified under Deepana and Krimighna dravyas, is widely used for its antimicrobial, antioxidant, and detoxifying actions. Both herbs exhibit broad-spectrum antibacterial activity, including efficacy against *E. coli* strains, as demonstrated in pharmacological and in vitro studies [7,8].

Despite their strong traditional and scientific rationale, clinical trials comparing the individual effects of these two herbs in UTI management are limited. This study aims to bridge that gap by evaluating and comparing the clinical efficacy of *Ficus religiosa* and *Cinnamomum zeylanicum* in patients with *E. coli*-induced urinary tract infection. The outcomes may contribute to integrative approaches in UTI treatment and support the rational use of Ayurvedic interventions in routine clinical practice.

Aim

To evaluate and compare the pharmacotherapeutic efficacy of *Ficus religiosa* (Peepal) and *Cinnamomum zeylanicum* (Dalchini) in the management of urinary tract infection (UTI) caused by *Escherichia coli*.

Objectives

1. To assess the clinical efficacy of *Ficus religiosa* in reducing symptoms and bacterial load in UTI caused by *E. coli*.
2. To assess the clinical efficacy of *Cinnamomum zeylanicum* in reducing symptoms and bacterial load in UTI caused by *E. coli*.
3. To compare the therapeutic effects of *Ficus religiosa* and *Cinnamomum zeylanicum* in terms of symptom relief, urine culture conversion, and overall patient response.
4. To evaluate the safety and tolerability of both herbal interventions during the treatment period.

Materials and Methods

Study Design and Duration

This was a prospective, comparative, interventional clinical study conducted over a period of two years from Feb 2012 to Jan 2014 at the Department of Dravyaguna, Government Ayurvedic College, Patna, Bihar.

Sample Size

A total of 120 patients clinically and microbiologically diagnosed with urinary tract infection (UTI) due to *Escherichia coli* were included in the study. The patients were randomly divided into two equal groups of 60 each.

Selection Criteria

Inclusion Criteria:

- Patients aged 18–60 years of either sex.
- Symptomatic UTI confirmed by urine culture positive for *E. coli*.
- Willingness to participate and provide informed consent.

Exclusion Criteria:

- Pregnant or lactating women.
- Patients with diabetes mellitus, renal impairment, or structural abnormalities of the urinary tract.
- Recurrent or complicated UTI.
- Known allergy to any of the trial drugs.



Intervention

- **Group A** received *Ficus religiosa* bark decoction – 50 ml twice daily before meals for 14 days.
- **Group B** received *Cinnamomum zeylanicum* bark decoction – 50 ml twice daily before meals for 14 days.

Both drugs were prepared freshly as per Ayurvedic pharmacopoeial standards under supervision.

Assessment Parameters

- Subjective Parameters: Burning micturition, urinary frequency, urgency, suprapubic pain.
- Objective Parameters:
 - Urine routine and microscopic examination
 - Urine culture and sensitivity for *E. coli*
 - Vital signs and general condition

Evaluations were conducted on Day 0 (before treatment), Day 7, and Day 14.

Statistical Analysis

Data were compiled and analyzed using appropriate statistical methods. Categorical variables were compared using Chi-square test, and continuous variables were analyzed using paired and unpaired t-tests. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

The study was approved by the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to enrollment.

Results

The study enrolled a total of 120 patients diagnosed with urinary tract infection caused by *Escherichia coli*, divided equally into two groups: Group A (*Ficus religiosa*) and Group B (*Cinnamomum zeylanicum*). The age and sex distribution were comparable between the groups. Both treatment groups showed significant improvement in subjective symptoms such as burning micturition, frequency, urgency, and suprapubic pain. Objective findings, including reduction in pus cells and conversion of urine culture to negative, were observed in both groups, with Group B showing marginally better efficacy in microbiological clearance. No adverse effects were reported during the study.

Table 1: Age-wise Distribution of Patients

Table 1 shows that most patients were in the age group of 21–30 years, followed by 31–40 years, with comparable age distribution across both groups.

Age Group (years)	Group A (n=60)	Group B (n=60)	Total (n=120)
18–20	5	4	9
21–30	21	23	44
31–40	16	15	31
41–50	10	9	19
51–60	8	9	17

Table 2: Sex Distribution of Patients

Table 2 indicates that females predominated in both groups, consistent with the epidemiology of UTI.

Sex	Group A (n=60)	Group B (n=60)	Total (n=120)
Male	18	17	35
Female	42	43	85

**Table 3: Baseline Symptom Distribution**

Table 3 presents the baseline symptom profile. Burning micturition was present in all patients, while urgency and suprapubic pain were observed in a majority.

Symptom	Group A (n=60)	Group B (n=60)
Burning micturition	60 (100%)	60 (100%)
Increased frequency	49 (81.7%)	51 (85.0%)
Urgency	43 (71.7%)	45 (75.0%)
Suprapubic pain	32 (53.3%)	34 (56.7%)

Table 4: Change in Burning Micturition Scores

Table 4 shows a statistically significant reduction in burning micturition scores from baseline to day 14 in both groups ($p < 0.001$).

Group	Day 0 (Mean \pm SD)	Day 14 (Mean \pm SD)	p-value
Group A	3.8 \pm 0.5	0.7 \pm 0.4	<0.001
Group B	3.9 \pm 0.4	0.5 \pm 0.3	<0.001

Table 5: Change in Urinary Frequency Scores

Table 5 reflects similar significant improvements in urinary frequency scores in both groups, with no statistically significant difference between the groups.

Group	Day 0 (Mean \pm SD)	Day 14 (Mean \pm SD)	p-value (intra)	p-value (inter)
Group A	3.5 \pm 0.6	1.0 \pm 0.5	<0.001	0.08
Group B	3.6 \pm 0.5	0.9 \pm 0.4	<0.001	

Table 6: Reduction in Pus Cells (Urine Microscopy)

Table 6 demonstrates a significant drop in pus cell count per high power field in both groups.

Group	Day 0 (Mean \pm SD)	Day 14 (Mean \pm SD)	p-value
Group A	18.2 \pm 4.5	4.2 \pm 1.3	<0.001
Group B	19.1 \pm 4.0	3.1 \pm 1.2	<0.001

Table 7: Urine Culture Conversion (E. coli Growth)

Table 7 shows that Group B had slightly better culture negativity at Day 14 compared to Group A.

Culture Status	Group A (n=60)	Group B (n=60)
Positive (Day 0)	60	60



Negative (Day 14)	48 (80.0%)	54 (90.0%)
Positive (Day 14)	12 (20.0%)	6 (10.0%)

Table 8: Symptom-free Status at End of Therapy

Table 8 shows that 88.3% of Group A and 93.3% of Group B became completely symptom-free.

Symptom-Free Status	Group A (n=60)	Group B (n=60)
Yes	53 (88.3%)	56 (93.3%)
No	7 (11.7%)	4 (6.7%)

Table 9: Adverse Effects Observed

Table 9 confirms no adverse effects were reported in either group.

Adverse Effects	Group A (n=60)	Group B (n=60)
Yes	0	0
No	60 (100%)	60 (100%)

Table 10: Patient Satisfaction at End of Study

Table 10 shows high satisfaction rates in both groups, slightly higher in Group B.

Satisfaction Level	Group A (n=60)	Group B (n=60)
Highly satisfied	45 (75.0%)	49 (81.7%)
Moderately satisfied	13 (21.7%)	10 (16.7%)
Not satisfied	2 (3.3%)	1 (1.6%)

Table 1 and Table 2 showed comparable age and sex distribution, with female predominance. Table 3 documented baseline symptom profiles, primarily burning micturition and urgency. Table 4 and Table 5 demonstrated significant reductions in burning sensation and urinary frequency in both groups ($p < 0.001$), with Group B showing slightly superior improvement. Table 6 revealed marked reduction in pus cells, while Table 7 showed better urine culture clearance in Group B (90% vs. 80%). Table 8 highlighted that symptom-free status was higher in Group B (93.3%). Table 9 confirmed safety of both interventions. Table 10 indicated higher satisfaction in Group B.

Discussion

The present study was undertaken to evaluate and compare the pharmacotherapeutic effects of *Ficus religiosa* (Peepal) and *Cinnamomum zeylanicum* (Dalchini) in the management of urinary tract infections (UTI) caused by *Escherichia coli* [9]. A total of 120 patients were enrolled, equally divided into two groups receiving either of the two drugs. The demographic data revealed that the highest prevalence of UTI was in females between the ages of 21 and 40 years, aligning with the known higher incidence of UTI in women due to anatomical and hormonal factors [10].



The majority of patients presented with typical UTI symptoms such as burning micturition, increased frequency, urgency, and suprapubic pain. Both Group A (*Ficus religiosa*) and Group B (*Cinnamomum zeylanicum*) showed significant symptomatic relief by the end of the 14-day treatment course. The resolution of burning micturition and frequency of urination was observed in over 88% of patients in both groups, suggesting that both herbs possess notable diuretic, anti-inflammatory, and antimicrobial properties [11,12].

Objective evidence from urine microscopy and culture further reinforced the clinical observations. The reduction in pus cells was statistically significant in both groups, and microbiological clearance of *E. coli* was achieved in 80% of Group A patients and 90% of Group B patients. This indicates that while both herbs were effective, *Cinnamomum zeylanicum* had a marginally superior bactericidal effect. This could be attributed to its known content of cinnamaldehyde and essential oils that possess antimicrobial activity, particularly against gram-negative organisms [13,14].

In terms of patient satisfaction and tolerability, both drugs were well accepted. No adverse events were reported throughout the study period, reflecting the safety profile of both herbal drugs when used in therapeutic doses. Satisfaction levels were high in both groups, with Group B again showing a slight edge, which may be linked to quicker symptomatic relief and better microbial clearance [15].

The findings of this study support the Ayurvedic principles of using dravyas (medicinal herbs) with *mutravirechaka*, *shothahara*, and *krimighna* properties in the management of urinary tract infections. *Ficus religiosa* is traditionally indicated in *mutrakricha* (dysuria) and known for its cooling and anti-inflammatory actions. *Cinnamomum zeylanicum* is cited in Ayurvedic texts for its antimicrobial and *krimighna* effects, which align well with the modern understanding of its pharmacology [16,17].

Although both drugs proved effective, *Cinnamomum zeylanicum* demonstrated slightly superior clinical and microbiological outcomes. This finding is significant considering the increasing resistance of *E. coli* to conventional antibiotics and the need for safer, plant-based alternatives. Moreover, the absence of side effects and high satisfaction rates strengthen the case for their

use as adjunct or standalone therapies in uncomplicated UTIs [18].

This study, however, has certain limitations. Being an open-label single-center study, it may carry observer bias. The sample size, though statistically reasonable, may still benefit from multicentric replication to validate the findings. Further studies assessing long-term recurrence rates, combination therapy, and pharmacodynamic profiling would enrich the understanding and application of these herbal agents.

Conclusion

The present clinical study establishes that both *Ficus religiosa* and *Cinnamomum zeylanicum* possess significant therapeutic potential in the management of urinary tract infections caused by *Escherichia coli*. Both herbal drugs were effective in alleviating classical symptoms such as burning micturition, urinary frequency, urgency, and suprapubic discomfort. Statistically significant improvement was observed in both subjective and objective parameters in each group over the 14-day treatment period.

However, *Cinnamomum zeylanicum* showed marginally better outcomes in terms of faster symptom resolution, greater reduction in pus cells, and higher bacterial clearance rate compared to *Ficus religiosa*. This suggests that *Cinnamomum zeylanicum* may have a stronger antimicrobial action against *E. coli*, making it slightly more efficacious in the treatment of uncomplicated UTIs. Both herbal preparations were well tolerated with no adverse reactions reported, underscoring their safety and suitability for therapeutic use. The findings support their use in Ayurvedic practice as effective and safe alternatives or adjuncts to conventional antibiotics, particularly in light of growing antimicrobial resistance.

In conclusion, the study reinforces the relevance of Ayurvedic herbs in the contemporary management of UTIs and advocates for further exploration and standardization of such interventions to enhance evidence-based integration of Ayurveda into clinical practice.

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