



Cinnamomum verum (Cinnamon): A promising natural alternative for urinary tract infection treatment

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Urinary tract infections (UTIs) remain a significant global health challenge, particularly affecting women, children, and the elderly. The rising prevalence of antibiotic resistance among common uropathogens, especially *Escherichia coli*, has complicated treatment strategies. In response, medicinal plants are increasingly investigated as accessible and cost-effective alternatives or adjuncts to conventional therapies [1–3]. Among them, *Cinnamomum verum* (cinnamon) has demonstrated notable broad-spectrum antibacterial activity, particularly against *E. coli*, the primary etiological agent of UTIs [4].

The antimicrobial efficacy of *C. verum* is mainly attributed to its bioactive phytochemicals, including trans-cinnamaldehyde, eugenol, flavonoids, and tannins. These compounds act by disrupting bacterial membranes, altering ionic gradients, inhibiting enzymatic pathways, and impairing energy metabolism [5,6]. Notably, trans-cinnamaldehyde induces bacterial cell death by disrupting metabolic activity and reducing surface adhesion [4]. In a murine model, dietary supplementation with trans-cinnamaldehyde significantly reduced *E. coli* colonization in the bladder and urethra, supporting its potential effectiveness *in vivo* [7].

Moreover, *C. verum* has shown promising efficacy against complicated UTIs, including catheter-associated infections. Its ability to inhibit biofilm formation and suppress resistant bacterial strains is particularly valuable [8]. For instance, cinnamaldehyde has been found to effectively prevent *E. coli* biofilm formation on materials such as polystyrene, latex, and urinary catheters [9], indicating its potential in medical device applications.

In addition to its intrinsic antimicrobial properties, *C. verum* exhibits synergistic effects when combined with conventional antibiotics. Several studies report enhanced inhibition zones when cinnamon extracts are used alongside standard antimicrobial agents [5,6,10]. Such synergy could reduce required antibiotic dosages, potentially slowing the emergence of resistance. Furthermore, essential oils derived from *C. verum* bark have demonstrated significant antibacterial activity against multidrug-resistant (MDR) strains, with low minimum inhibitory concentrations (MICs) comparable to those of standard antibiotics like norfloxacin [6,11].

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In conclusion, *Cinnamomum verum* represents a promising natural therapeutic candidate for the prevention and treatment of UTIs. Its multifaceted antibacterial mechanisms, efficacy against biofilms, and synergistic interactions with antibiotics highlight its clinical potential. To translate these findings into practical applications, further formulation research and clinical trials are essential.

Authors' contributions

Conceptualization, Literature search and Data collection: AM; Analysis and Interpretation of the literature: AM; Writing original draft: AM; Resource, Supervision, Critical revision: MH. All authors read and approved the final version of the manuscript.

Conflict of interest

No potential conflict of interest was reported by the authors.

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