

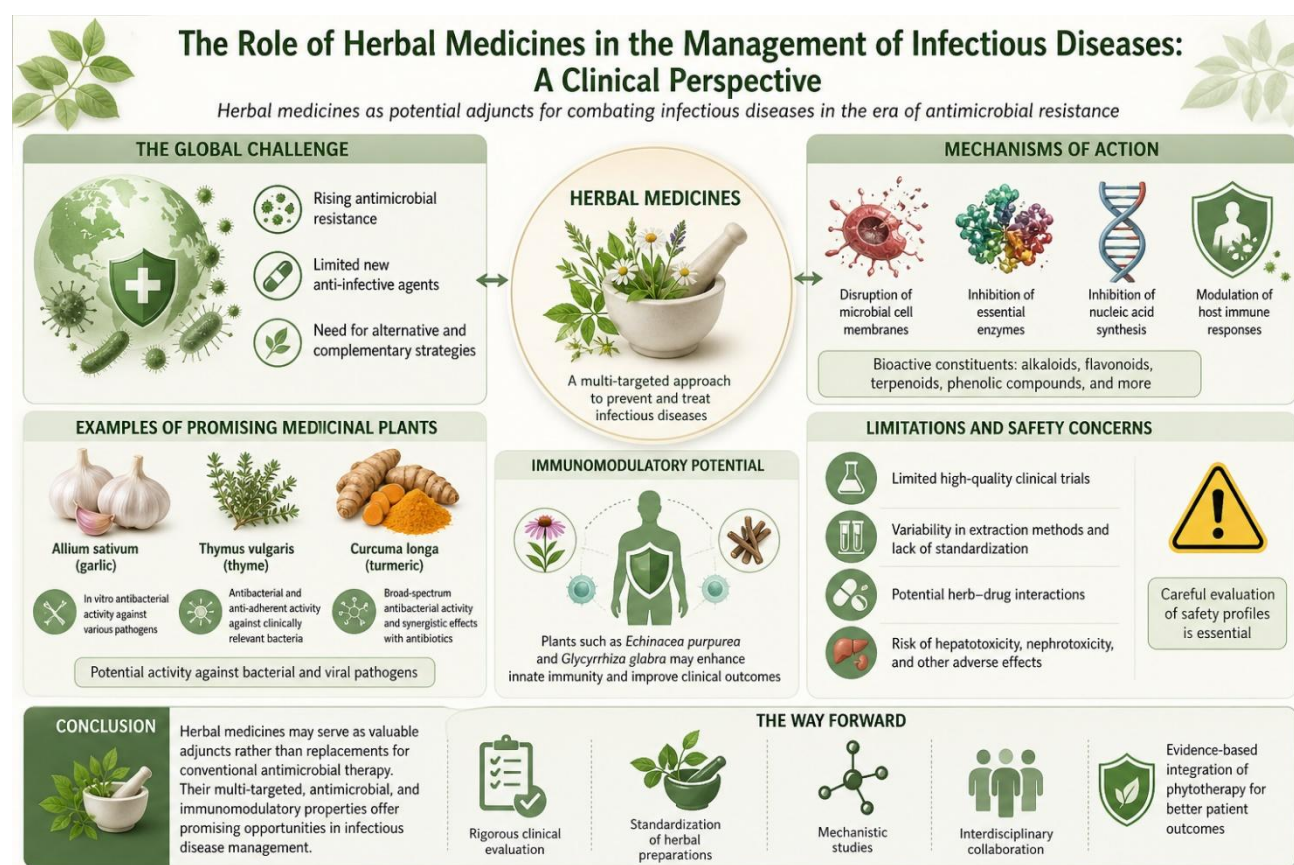


Role of Herbal Medicines in the Management of Infectious Diseases: A Clinical Perspective

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Graphical abstract: Role of herbal medicines in infectious disease management. Herbal medicines contain bioactive plant compounds that can inhibit microbes through multiple mechanisms and may enhance immune responses. They show potential as adjuncts to antibiotics, but variability and limited clinical evidence require further rigorous research.

Dear Editor,

We read with great interest the growing body of literature addressing the role of herbal medicines

in the prevention and treatment of infectious diseases. Given the increasing global challenge of antimicrobial resistance and the limited pipeline



of novel antibiotics, the exploration of alternative and adjunctive therapeutic strategies, including phytotherapy, has gained renewed attention in clinical and research settings. Herbal medicines have been used for centuries across different medical traditions, including Traditional Persian Medicine, Traditional Chinese Medicine, and Ayurveda, for the management of infectious conditions (1).

Many plant-derived compounds have demonstrated *in vitro* and *in vivo* antimicrobial activity against a wide range of pathogens, including bacteria, viruses, fungi, and parasites (2, 3). Bioactive constituents, such as alkaloids, flavonoids, terpenoids, and phenolic compounds, are believed to contribute to these effects through multiple mechanisms, including disruption of microbial cell walls, inhibition of nucleic acid synthesis, and modulation of host immune responses (4).

Regarding infectious diseases, one of the most compelling advantages of herbal medicines is their potential multi-target activity. Unlike conventional antibiotics that often act on a single molecular target, herbal extracts frequently exert synergistic effects through multiple pathways. This may theoretically reduce the likelihood of resistance development. For example, several studies have demonstrated *in vitro* antibacterial activity of medicinal plants, such as *Allium sativum* (garlic) (5), *Thymus vulgaris* (thyme) (6), and *Curcuma longa* (turmeric).

In addition to direct antimicrobial effects, certain herbal agents may play an adjunctive role by modulating host immune responses (7). Immunomodulatory properties have been described for plants, such as *Echinacea purpurea* and *Glycyrrhiza glabra*, which may enhance innate immune function and potentially improve clinical outcomes in selected infectious diseases. Furthermore, antiviral activities of several herbal compounds have been investigated in preclinical studies, particularly in the context of respiratory viral infections.

However, despite these promising findings, several important limitations must be acknowledged. The majority of available evidence is derived from *in vitro* studies or animal models, with relatively limited high-quality randomized controlled trials in human populations. Variability in extraction methods, lack of standardization of active ingredients, and heterogeneity in dosing regimens significantly limit the reproducibility and generalizability of results. Moreover, potential herb–drug interactions represent an important clinical concern, particularly in patients receiving concomitant antimicrobial or immunosuppressive therapies.

From a clinical standpoint, safety remains a critical issue. While herbal medicines are often perceived as “natural and safe,” this assumption is not always evidence-based. Hepatotoxicity, nephrotoxicity, and pharmacokinetic interactions have been reported with several herbal products. Therefore, careful evaluation of safety profiles is essential, especially in vulnerable populations, such as immunocompromised patients or those with chronic comorbidities.

In conclusion, herbal medicines represent a promising but still insufficiently validated adjunct in the management of infectious diseases. Their potential antimicrobial, immunomodulatory, and synergistic properties warrant further rigorous investigation through well-designed clinical trials. Integration of phytotherapy into evidence-based infectious disease practice should be approached cautiously, with emphasis on standardization, safety, and high-quality clinical evidence. We believe that continued interdisciplinary collaboration between infectious disease specialists, pharmacologists, and ethnopharmacologists will be crucial in clarifying the true clinical value of herbal medicines in this field.

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