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COMPARING THE EFFICACY AND SAFETY OF HERBAL MEDICINES Vs CONVENTIONAL DRUGS IN RESPIRATORY DISEASES

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ABSTRACT: Respiratory diseases remain one of the leading global health burdens, ranging from acute infections such as influenza and pneumonia to chronic conditions like asthma and chronic obstructive pulmonary disease. Conventional pharmacological agents, including bronchodilators, corticosteroids, antibiotics, and biologics, are widely recognized for their clinical efficacy and regulatory approval, yet their long-term use is often associated with adverse effects, drug resistance, and financial burden. In contrast, herbal medicines have been used for centuries in various cultural and traditional systems of medicine, offering potential anti-inflammatory, mucolytic, antiviral, antioxidant, and immunomodulatory benefits. Recent interest has increasingly focused on systematically comparing the effectiveness and safety of herbal therapies with conventional drugs, especially as patients actively seek holistic and integrative approaches to respiratory care. This review critically examines the available evidence on herbal interventions such as Echinacea, Pelargonium, licorice root, ginger, turmeric, and ivy leaf and contrasts them with standard pharmacological options including bronchodilators, corticosteroids, and mucolytic agents. Safety profiles, possible herb drug interactions, pharmacoeconomic aspects, and limitations of current studies are also evaluated. By synthesizing both traditional knowledge and modern clinical evidence, this review aims to highlight the potential role of herbal medicines as complementary or alternative therapies, while emphasizing the need for robust clinical trials, quality assurance, and standardized formulations. The ultimate goal is to provide a balanced, evidence-based perspective to guide clinicians, researchers, and patients toward safer, cost-effective, and informed decisions in the management of respiratory diseases, thereby supporting innovation, patient empowerment, and sustainable healthcare practices worldwide, particularly in diverse clinical and community settings.

INTRODUCTION: Respiratory diseases represent a significant global health challenge, contributing substantially to morbidity, mortality, and healthcare costs.

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Conditions such as asthma, chronic obstructive pulmonary disease (COPD), pneumonia, influenza, and acute upper respiratory tract infections account for millions of lost lives each year and place immense pressure on healthcare systems.

The burden is particularly pronounced in low- and middle-income countries, where pollution, smoking, occupational hazards, and limited healthcare access exacerbate the prevalence and severity of these disorders. Beyond their clinical

impact, respiratory illnesses diminish quality of life by restricting daily activities, reducing productivity, and increasing psychological stress for patients and their families [1].

Conventional medicine has long been the backbone of respiratory disease management. Treatments such as bronchodilators, corticosteroids, antibiotics, leukotriene antagonists, biologics, and supportive therapies have transformed the landscape of care. These drugs are often life-saving, offering rapid and measurable improvements in lung function, inflammation control, and infection clearance. However, their benefits are accompanied by well-recognized limitations. Long-term steroid use can lead to systemic complications such as osteoporosis, metabolic disturbances, and immunosuppression. Antibiotics are threatened by the alarming rise of antimicrobial resistance. Biologics, though promising, remain prohibitively expensive for most patients and health systems. Moreover, chronic conditions like COPD often require lifelong therapy, raising concerns about cumulative side effects and financial strain.

In parallel, the use of herbal medicines for respiratory conditions has persisted across cultures for centuries. Traditional Chinese Medicine, Ayurveda, Kampo, and other indigenous systems have incorporated plant-based formulations for coughs, breathlessness, and lung infections. Modern pharmacological research has begun to validate some of these practices, identifying bioactive compounds with anti-inflammatory, bronchodilatory, mucolytic, or immunomodulatory effects. For example, herbs such as ginger, licorice, and turmeric are valued for their anti-inflammatory properties, while ivy leaf and Pelargonium extracts are widely used for their mucolytic and antimicrobial activities. Unlike synthetic drugs, herbal therapies are often perceived as natural and safer, though this perception does not always align with scientific evidence.

The growing popularity of herbal interventions reflects a global trend toward integrative and patient-centered care. Many individuals, dissatisfied with the side effects or limitations of conventional drugs, turn to herbal remedies as alternatives or adjuncts. This shift poses both opportunities and challenges for healthcare providers. On one hand, herbal medicines may complement conventional therapy, improving symptom control, reducing drug doses, and enhancing overall well-being. On the other hand, variability in preparation, lack of standardization, limited regulatory oversight, and potential herb–drug interactions raise legitimate concerns regarding safety and efficacy [2].

Against this backdrop, it is crucial to critically compare the efficacy and safety of herbal medicines with established pharmacological treatments in respiratory diseases. Such comparisons can provide insights into whether herbal remedies can serve as effective stand-alone therapies, supportive agents, or merely adjuncts without substantial clinical benefit. A careful review of existing clinical trials, meta-analyses, and pharmacological studies is necessary to distinguish evidence-based practice from unverified traditional claims.

This article aims to present a comprehensive review of the available literature comparing herbal medicines and conventional drugs in respiratory diseases. It will examine their respective mechanisms of action, therapeutic outcomes, safety profiles, and limitations. In addition, the review will discuss the potential role of integrative medicine in respiratory care and highlight gaps in current knowledge that warrant further research. By providing a balanced analysis, the article seeks to inform clinicians, researchers, and policymakers while guiding patients toward safe and effective choices in managing respiratory illnesses.

Herbal Medicines in Respiratory Diseases: Herbal medicines have been widely utilized in traditional and modern systems of medicine for managing respiratory diseases due to their immunomodulatory, anti-inflammatory, antiviral, antibacterial, and mucolytic properties (represented in **Fig. 1**). Unlike conventional pharmaceuticals that target specific pathways, many herbal remedies exert broad-spectrum effects by modulating multiple biological targets simultaneously.

Echinacea: Echinacea species, especially *Echinacea purpurea*, have been extensively studied for their immune-enhancing effects. They stimulate phagocytosis, increase leukocyte activity, and

upregulate cytokine release, thereby strengthening host defence against viral respiratory tract infections. Clinical evidence suggests that Echinacea extracts reduce the frequency and duration of common cold episodes [3].

Umckaloabo (*Pelargonium sidoides*): *Pelargonium sidoides* root extract is used in bronchitis and upper respiratory tract infections. It enhances mucociliary clearance, exhibits antibacterial activity, and modulates interferon production [4]. Randomized trials indicate its role in reducing cough frequency and improving lung function in acute bronchitis [5].

Licorice (*Glycyrrhiza glabra*): Licorice root has expectorant, anti-inflammatory, and soothing properties, making it effective for cough and sore throat management [6]. Its active component, glycyrrhizin, reduces airway inflammation and inhibits viral replication [7].

Ivy Leaf (*Hedera helix*): Ivy leaf extract is widely used in pediatric and adult cough syrups. It exhibits mucolytic and bronchodilatory properties by relaxing airway smooth muscles and enhancing mucus clearance [8]. Clinical data support its efficacy in improving cough scores in acute bronchitis [9].

Turmeric (*Curcuma longa*): Curcumin, the bioactive constituent of turmeric, possesses strong antioxidant and anti-inflammatory properties. It reduces airway hyper responsiveness and downregulates NF-κB signaling, which is central to asthma pathogenesis [10].

Ginger (*Zingiber officinale*): Ginger has bronchodilatory and anti-inflammatory effects, attributed to compounds like gingerols and shogaols. Experimental studies show that ginger relaxes airway smooth muscle and enhances β_2-agonist activity [11].

Indian olibanum *(Boswellia serrata*): Boswellia resin contains boswellic acids, which inhibit 5-lipoxygenase and suppress leukotriene synthesis, thereby reducing bronchoconstriction and airway inflammation [12]. Clinical trials have demonstrated improvement in asthma symptoms with Boswellia supplementation [13] (represented in **Table 1**).

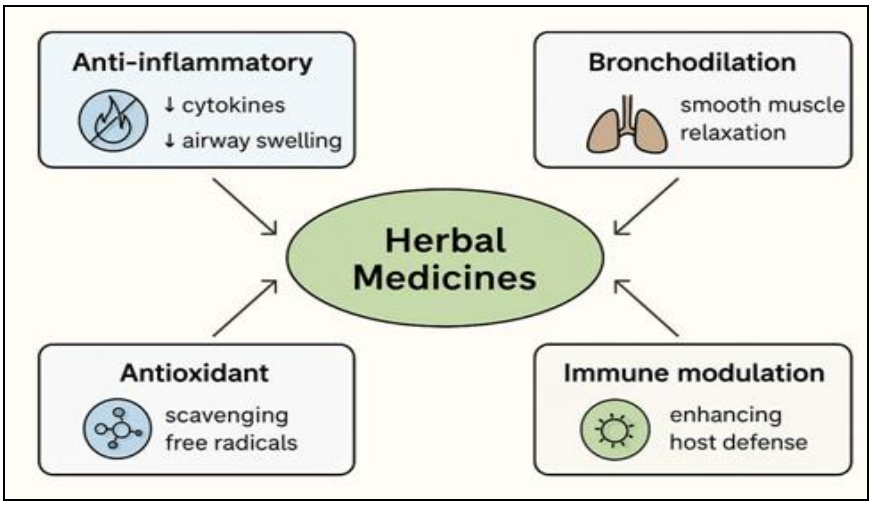

FIG. 1: MECHANISM OF HERBAL MEDICINES IN RESPIRATORY DISEASES

The above figure shows schematic illustration showing key mechanisms by which herbal medicines act on respiratory disorders, including anti-inflammatory activity, bronchodilation, antioxidant defence, and immune modulation.

TABLE 1: SELECTED HERBAL MEDICINES USED IN RESPIRATORY DISEASES & THEIR PRIMARY ACTIONS

Herbal Medicine	Common Name	Primary Actions	Clinical Uses
Echinacea	Green Chiretta	Immunostimulant, antiviral	Common cold, URTI
Pelargonium sidoides	African Geranium	Antibacterial, mucolytic, immune modulator	Acute bronchitis, URTI
Glycyrrhiza glabra	Licorice	Expectorant, anti-inflammatory, antiviral	Cough, sore throat
Hedera helix	English Ivy	Mucolytic, bronchodilator	Acute bronchitis, cough relief
Curcuma longa	Turmeric	Anti-inflammatory, antioxidant	Asthma, airway inflammation

Zingiber officinale	Ginger	Bronchodilator, anti-inflammatory	Asthma, bronchospasm
Boswellia serrata	Indian Olibanum	Leukotriene inhibitor, anti-inflammatory	Asthma, chronic bronchitis

In the above table, you can see the Mechanistic pathways of selected herbal medicines in respiratory diseases.

Conventional Drugs in Respiratory Diseases: Conventional pharmacotherapy forms the cornerstone of modern respiratory disease management. These drugs are standardized, well-studied, and act through defined molecular mechanisms that directly target pathophysiological processes (represented in **Table 2**). Unlike herbal medicines, which often act on multiple biological systems simultaneously, conventional drugs are designed to provide precise, evidence-based outcomes with established dosing regimens [13].

Bronchodilators: Bronchodilators, including β_2-adrenergic agonists, anticholinergics, and methylxanthines, are essential in managing obstructive airway diseases.

β_2-agonists (e.g., salbutamol, formoterol): Stimulate β_2 receptors on airway smooth muscles, causing rapid bronchodilation. Short-acting β_2 agonists (SABA) are used for acute symptom relief, while long-acting β_2 agonists (LABA) are combined with corticosteroids for maintenance [14].

Anticholinergics (e.g., ipratropium, tiotropium): Block muscarinic receptors, reducing bronchoconstriction and mucus secretion. Tiotropium has a prolonged action and is beneficial in chronic obstructive pulmonary disease (COPD) [15].

Methylxanthines (e.g., theophylline): Inhibit phosphodiesterase, increasing intracellular cAMP and promoting bronchodilation. Their use is limited by narrow therapeutic index and side effects [16].

Corticosteroids: Corticosteroids are potent anti-inflammatory agents that reduce airway hyperresponsiveness by suppressing cytokine release and inflammatory cell recruitment [17].

Inhaled Corticosteroids (ICS) like budesonide and fluticasone are the mainstay in asthma management, particularly for long-term control [18].

Systemic corticosteroids (e.g., prednisolone) are used for severe exacerbations but are associated with significant side effects including immunosuppression and osteoporosis [19].

Leukotriene Modifiers: Leukotriene receptor antagonists (LTRAs) such as montelukast block leukotriene D_4 at cysteinyl leukotriene receptors, reducing inflammation and bronchoconstriction. They are particularly effective in exercise-induced asthma and aspirin-sensitive asthma [20].

Mast Cell Stabilizers: Cromolyn sodium and nedocromil inhibit mast cell degranulation, thereby preventing histamine and cytokine release. Although less commonly used now, they remain options for mild asthma prophylaxis [21].

Immuno Modulators and Biologics: The advent of biologics has transformed management of severe asthma and eosinophilic phenotypes.

Anti-IgE Therapy (Omalizumab): Binds circulating IgE, preventing allergic cascade activation [22].

Anti-IL-5 agents (Mepolizumab, Reslizumab): Reduce eosinophilic inflammation, beneficial in severe eosinophilic asthma [23].

Anti-IL-4/IL-13 agents (Dupilumab): Target type 2 inflammatory pathways, improving asthma control [24].

Mucoactive agents: Agents like N-acetylcysteine (NAC) and carbocisteine are used to modify mucus properties, enhancing clearance and reducing airway obstruction [25].

These are particularly beneficial in chronic bronchitis and COPD where mucus hypersecretion is prominent.

TABLE 2: COMMON CONVENTIONAL DRUGS IN RESPIRATORY DISEASES MANAGEMENT

Drug Class	Examples	Mechanism of Action	Respiratory Uses	Adverse Effects
β_2 agonists	Salbutamol, Formoterol	Stimulate β_2 receptors → bronchodilation	Asthma, COPD	Tremors, tachycardia, hypokalemia, palpitations
Anticholinergics	Ipratropium,	Block muscarinic receptors →	COPD, severe	Dry mouth, blurred vision,

	Tiotropium	prevent bronchoconstriction	asthma	urinary retention, constipation
Methylxanthines	Theophylline	PDE inhibition → ↑cAMP → bronchodilation	Asthma (limited use)	Nausea, vomiting, insomnia, arrhythmias, seizures (narrow therapeutic index)
Corticosteroids	Budesonide, Prednisolone	Suppress airway inflammation	Asthma, COPD exacerbations	Oral candidiasis, hoarseness, osteoporosis, immunosuppression, adrenal suppression
Leukotriene Modifiers	Montelukast	Block leukotriene receptors → ↓inflammation	Asthma (exercise, aspirin-induced)	Headache, abdominal pain, neuropsychiatric effects (rare)
Mast Cell Stabilizers	Cromolyn, Nedocromil	Prevent mast cell degranulation	Asthma prophylaxis	Throat irritation, cough, unpleasant taste
Biologics	Omalizumab, Mepolizumab, Dupilumab	Target IgE / IL-5 / IL-4 pathways	Severe asthma	Injection site reactions, hypersensitivity, anaphylaxis (rare), eosinophilia
Mucoactive Agents	N-acetylcysteine, Carbocisteine	Reduce mucus viscosity, ↑clearance	Chronic bronchitis, COPD	Nausea, vomiting, diarrhea, bronchospasm (with inhaled use)

In the above table, the major therapeutic targets of conventional drugs in respiratory diseases.

Comparative Efficacy and Safety of Herbal Medicines *vs*. Conventional Drugs: The comparison between herbal medicines and conventional pharmacotherapy in respiratory diseases is complex, as both approaches offer unique benefits and limitations (represented in **Table 3**). Conventional drugs are widely accepted due to rigorous clinical testing and standardized dosing, whereas herbal therapies are often utilized for their holistic effects, favorable safety profiles, and cultural acceptance [26].

Efficacy in Asthma: Conventional therapies, particularly inhaled corticosteroids and β_2-agonists, remain first-line due to their proven efficacy in reducing airway inflammation and providing rapid bronchodilation. Biologics such as omalizumab have further advanced outcomes in severe phenotypes [27, 28].

Conversely, herbs such as *Glycyrrhiza glabra* (licorice) and *Adhatodavasica* demonstrate anti-inflammatory and bronchodilatory effects in preclinical and limited clinical studies. Randomized trials suggest that herbal formulations may reduce symptom scores and rescue medication use, though the effects are generally milder than corticosteroids [29, 30].

COPD and Chronic Bronchitis: Bronchodilators and corticosteroids form the backbone of COPD management, with long-acting muscarinic antagonists (LAMAs) and LABAs improving quality of life and reducing exacerbations [31].

Herbal therapies like *Ginseng* (*Panax ginseng*) and *Curcuma longa* (turmeric) have demonstrated immunomodulatory and antioxidant properties that may help alleviate oxidative stress and improve pulmonary function [32]. Meta-analyses report small but significant improvements in FEV_1 and symptom control compared to placebo [33], though less robust than conventional therapies.

Allergic Rhinitis: Antihistamines and intranasal corticosteroids are effective in reducing rhinorrhea, sneezing, and nasal congestion [34]. However, adverse effects such as sedation or mucosal dryness can limit compliance. Herbal alternatives like *Butterbur* (*Petasites hybridus*) have shown comparable efficacy to antihistamines in some trials, with fewer sedative effects [35]. Additionally, *Nigella sativa* has demonstrated antihistamine-like activity by inhibiting histamine release [36].

Safety Considerations: While conventional therapies are well-characterized, they are often associated with dose-dependent side effects (represented in **Fig. 2**). Corticosteroids can cause osteoporosis, adrenal suppression, and increased infection risk [37]. β_2-agonists may cause tachycardia and tremors, while biologics are expensive and carry risks of anaphylaxis [38]. Herbal therapies generally have favourable safety profiles, especially when used in traditional dosages. However, risks of contamination, adulteration, and herb–drug interactions must be considered [39]. For example, ginseng may potentiate hypoglycemia in diabetic patients on insulin [40].

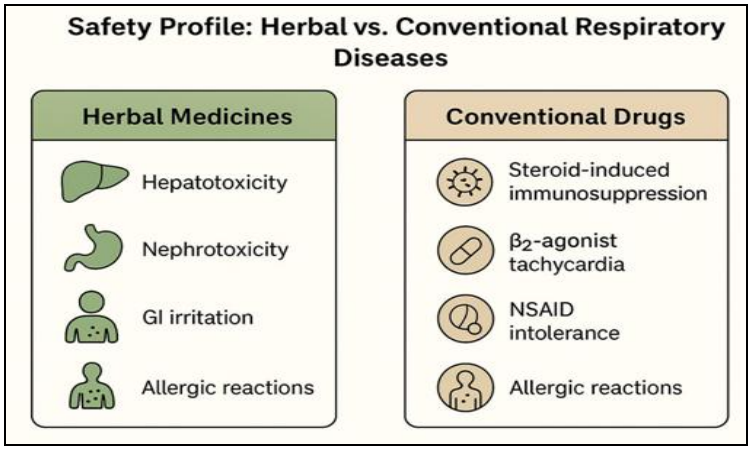

FIG. 2: SAFETY PROFILE: HERBAL VS CONVENTIONAL DRUGS IN RESPIRATORY SYSTEM

In the above figure, comparing the safety profile of herbal medicines versus conventional drugs. Common side effects (e.g., hepatotoxicity, nephrotoxicity, GI irritation, and allergic reactions) are contrasted with adverse events from conventional medications (e.g., steroid-induced immunosuppression, β2-agonist tachycardia, NSAID intolerance).

Patient-centred Outcomes: Patient adherence is typically higher with conventional drugs due to availability of inhalers and structured dosing [41]. Yet, in regions with cultural acceptance of herbal practices, patients may prefer herbal remedies for their natural perception and affordability [42]. Integration of both systems herbal adjuncts with conventional drugs has been reported to improve symptom control, reduce required corticosteroid doses, and enhance patient satisfaction [43].

TABLE 3: COMPARATIVE EFFICACY & SAFETY OF HERBAL VS CONVENTIONAL THERAPIES

Parameter	Herbal Medicines	Conventional Drugs
Efficacy (Asthma)	Moderate improvement; anti-inflammatory, bronchodilatory (*Adhatoda*, *Licorice*)	Strong evidence; ICS, β_2 agonists, biologics
Efficacy (COPD)	Mild to moderate benefit; antioxidant, immunomodulatory (*Ginseng*, *Turmeric*)	Robust improvements in FEV_1, QoL (LABA, LAMA, ICS)
Efficacy (Rhinitis)	*Butterbur*, *Nigella* effective in reducing symptoms	Antihistamines, corticosteroids highly effective
Safety	Generally safe but risk of contamination/adulteration; herb–drug interactions possible	Known side effects: ICS (osteoporosis), β_2 agonists (tachycardia)
Patient preference	Natural, culturally accepted, affordable	Widely available, standardized dosing

In the above table, you can see the comparative efficacy and safety of herbal vs. conventional drugs in respiratory diseases.

Integrative approaches: herbal ± conventional therapies

Many patients and clinicians are drawn to an "and/and" model pairing evidence-based conventional drugs with select herbal agents to reduce symptom burden, lower exacerbation risk, and potentially enable dose-sparing of steroids or bronchodilators [44]. The logic is pragmatic: conventional drugs deliver targeted, high-certainty effects; certain herbal agents may complement them through mucolysis, antioxidant activity, and immune modulation [45] (represented in **Fig. 3**).

Asthma: Add-on Botanicals to Reduce Steroid Load: In mild–moderate asthma, inhaled corticosteroids (ICS) remain foundational. Small randomized and pragmatic studies suggest that *curcumin* or *Boswellia serrata* added to standard care can improve symptom scores and selected inflammatory markers, with some reporting reduced rescue medication use [46]. *Ginger* has shown acute bronchodilatory synergy with β_2-agonists in preclinical and pilot human work, plausibly enhancing smooth-muscle relaxation [47]. *Licorice (glycyrrhizin)* may support cough control, though careful dosing is essential to avoid pseudoaldosteronism [48]. These data support adjunctive use not replacement especially in

patients who experience steroid side effects yet require control.

COPD & Chronic Bronchitis: Mucolytics Meet Botanicals: COPD management hinges on LAMA/LABA ± ICS; however, chronic sputum, viscous secretions, and recurrent infections remain everyday challenges. *Ivy leafandPelargonium sidoides* (EPs 7630) have repeatedly demonstrated improvements in cough scores and symptom duration in acute bronchitis and URTI settings; as adjuncts to N-acetylcysteine/erdosteine, they may further facilitate mucus clearance and shorten illness course [49]. Preliminary work combining NAC with antioxidant-rich botanicals (e.g., turmeric) suggests additive effects on oxidative stress readouts and health status, though larger trials are needed [50].

Recurrent URTI'S: Reducing Antibiotic Pressure: Antibiotic stewardship is a priority. Trials of *Pelargonium* show reduced symptom severity and lower downstream antibiotic use in acute bronchitis when used early and appropriately [51]. *Echinacea* prophylaxis may modestly reduce cold frequency/duration; as part of a supportive bundle (saline irrigation, antipyretics, delayed antibiotic strategy), it can align with stewardship goals [52]. The key is clear diagnostic criteria**,** time-limited courses, and patient education to prevent misuse.

Allergic Rhinitis: Antihistamines with Plant Allies: For patients bothered by antihistamine sedation or dryness, some studies report *Butterbur (petasins)* offering antihistamine-like benefit without sedation, allowing its adjunctive use in seasonal peaks [53].

Nigella sativa has shown histamine-release inhibition and nasal symptom improvement in early trials, supporting a role as an add-on during high-allergen periods [54].

Practical integration: Who, When, How:

Who Benefits?: Patients with mucus-dominant phenotypes (chronic bronchitis), frequent URTIs, or steroid-sensitive asthma profiles may be most likely to notice additive gains [55].

When to Start?: Stable patients on optimized inhaler technique and guideline-based therapy who still have residual symptoms; or during early URTI windows to reduce severity/duration [56].

How to Dose?: Use standardized extracts (e.g., EPs 7630 for Pelargonium; quantified saponins in ivy), time-limited courses for acute conditions, and documented, consistent brands to ensure batch-to-batch reliability [57].

Safety Checks: Screen for interactions (e.g., curcumin/ginger with anticoagulants), comorbidities (hypertension/CKD with licorice), and pregnancy/lactation status. Monitor BP, potassium if licorice is used; counsel on warning signs [58].

Shared Decision-making: Align choices with patient values, costs, cultural preferences, and access. Provide written plans specifying when to stop botanicals (e.g., new wheeze, fever escalation) and when to seek care [59].

Documentation & Audit: Chart the specific product, dose, start/stop dates, and outcomes; review at follow-up to continue only what shows clear, patient-relevant benefit [60].

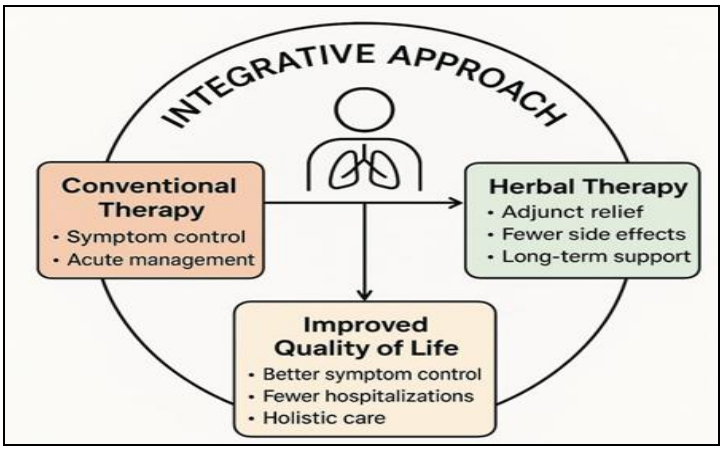

FIG. 3: INTEGRATED TREATMENT APPROACH IN RESPIRATORY DISEASES

The above figure shows how herbal therapies can complement conventional pharmacological treatments to improve outcomes in asthma, COPD, and bronchitis. The figure highlights synergistic roles (e.g., symptom relief, reduced side effects, and improved quality of life).

DISCUSSION: The comparative evaluation of herbal medicines and conventional drugs in respiratory diseases underscores a critical tension in modern healthcare: balancing rapid, evidence-based relief with long-term safety and accessibility. Conventional therapies such as corticosteroids, bronchodilators, and mucolytics remain the cornerstone of treatment, backed by robust clinical trials and international guidelines. Their ability to provide fast symptom control is unmatched, yet their chronic use is often associated with adverse effects including immunosuppression, metabolic disturbances, and dependence.

Herbal medicines, conversely, offer promising pharmacological properties anti-inflammatory, antioxidant, bronchodilatory, and immunomodulatory effects derived from agents like ginseng, licorice, and curcumin. These therapies are culturally accepted, often more affordable, and may improve patient adherence. However, their limitations lie in lack of large-scale randomized trials, variability in preparation, and inconsistent dosing standards.

Importantly, the discussion suggests that an integrative model of care where herbal therapies complement, rather than replace, conventional drugs may bridge these gaps. This would require rigorous quality control, standardized formulations, and stronger clinical evidence. By embracing both scientific rigor and traditional knowledge, respiratory medicine could evolve toward safer, patient-centered treatment paradigms.

CONCLUSION: The management of respiratory diseases continues to depend heavily on conventional drugs for their well-documented efficacy and rapid onset of action. Nevertheless, concerns over long-term safety, side effects, and patient affordability highlight the need for alternative or complementary options. Herbal medicines present a viable adjunct due to their broad spectrum of biological activities and favourable safety profiles when used appropriately. While promising, the current limitations of herbal therapies such as insufficient clinical validation and lack of regulatory oversight must be addressed before they can be integrated widely into clinical guidelines. Encouragingly, emerging research demonstrates that combining herbal therapies with conventional treatments may not only enhance outcomes but also reduce adverse effects.

Ultimately, neither approach alone is sufficient to address the global burden of respiratory diseases. The future of respiratory care lies in a balanced, evidence-based integration of both systems, offering patients safer, more effective, and accessible therapeutic strategies. This shift requires collaboration among clinicians, researchers, and policymakers to ensure that herbal and conventional medicines together create a more holistic standard of respiratory care.

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