Publisher
Maharshi Charaka Ayurveda
www.maharshicharaka.in

E-ISSN:2456-3110

Journal of Ayurveda and Integrated Medical Sciences

2025 Volume 10 Number 7 JULY

Editorial
Herbal Drugs

Check for updates

Adulteration and Substitution of Herbal Drugs: A Critical Review of Challenges and Implications for Integrative Medicine

Baragi UC[1*], Ganer JM[2]

DOI:10.21760/jaims.10.7.1

[1*] Umapati C Baragi, Associate Professor and HOD, Dept of Samhita Siddhanta and Sanskrit, Faculty of Ayurved, Main Campus, Uttarakhand Ayurved University, Dehradun, Uttarakhand, India.

[2] Jyoti M Ganer, Professor and HOD, Department of Agadtantra Evum Vidhi Vaidyak, Uttaranchal Ayurvedic College, Dehradun, Uttarakhand, India.

The authenticity and purity of herbal drugs form the cornerstone of their therapeutic efficacy. However, increasing global demand has paved the way for unethical practices such as adulteration and substitution, posing serious risks to clinical outcomes and public health. Adulteration i.e., intentional incorporation of inferior or synthetic materials and substitution of genuine herbs with unrelated species have emerged as widespread challenges within herbal medicine supply chains. These practices undermine therapeutic efficacy, compromise pharmacological reliability, and pose significant risks to patient safety, particularly in the context of integrative care where precision and synergy are supreme. This review explores the multifactorial drivers behind adulteration and substitution, including economic pressures, species misidentification, and regulatory gaps. Diagnostic methodologies, ranging from classical Ayurvedic organoleptic assessments to modern techniques such as DNA barcoding and HPTLC, are evaluated for their role in quality assurance. Ensuring the purity of herbal medicines is not merely a technical requirement but it is an ethical imperative for advancing safe, reliable, and evidence-based integrative healthcare.

Keywords: Adulteration, Substitution, Herbal Drugs, Ayurveda, Pharmacognosy, Integrative Medicine, Quality Assurance, DNA Barcoding, Herbal Authenticity

Corresponding Author

Umapati C Baragi, Associate Professor and HOD, Dept of Samhita Siddhanta and Sanskrit, Faculty of Ayurved, Main Campus, Uttarakhand Ayurved University, Dehradun, Uttarakhand, India.
Email: umapati.baragi@gmail.com

How to Cite this Article

Baragi UC, Ganer JM, Adulteration and Substitution of Herbal Drugs: A Critical Review of Challenges and Implications for Integrative Medicine. J Ayu Int Med Sci. 2025;10(7):1-4.
Available From
https://jaims.in/jaims/article/view/4890/

To Browse

Manuscript Received	Review Round 1	Review Round 2	Review Round 3	Accepted
2025-05-17	2025-05-26	2025-06-06	2025-06-16	2025-06-26

Conflict of Interest	Funding	Ethical Approval	Plagiarism X-checker	Note
None	Nil	Not required	10.35	

Introduction

Herbal medicine has long been valued for its holistic approach to healing, drawing from centuries of traditional knowledge across cultures. In contemporary integrative care, herbal formulations play a pivotal role in complementing conventional therapies, particularly in chronic and lifestyle-related conditions. However, the integrity of herbal drugs is increasingly compromised by adulteration and substitution - practices that not only undermine therapeutic efficacy but also pose significant risks to patient safety and clinical outcomes.

Adulteration refers to the deliberate or accidental inclusion of inferior, unrelated, or synthetic substances in herbal products, while substitution involves replacing authentic herbs with morphologically similar but pharmacologically different species. These practices are driven by factors such as scarcity of genuine raw materials, economic incentives, and lack of stringent regulatory oversight.

The implications for integrative medicine are profound. Therapeutic protocols that rely on synergistic interactions between herbal and allopathic interventions may falter due to compromised phytochemical profiles. Moreover, misidentified or contaminated herbs can interact unpredictably with conventional drugs, exacerbating adverse effects or nullifying intended benefits.

Modern analytical techniques such as DNA barcoding, HPTLC, and spectroscopic fingerprinting have emerged as vital tools for authentication and quality control. Yet, the integration of these technologies into routine practice remains inconsistent, especially in decentralized supply chains and traditional medicine sectors.

This review critically examines the prevalence, causes, and consequences of adulteration and substitution in herbal medicine, with a focus on their impact on integrative care frameworks. It also explores diagnostic methodologies and regulatory strategies aimed at safeguarding therapeutic authenticity.

Types of Adulteration and Substitution

1. Intentional Adulteration

- Mixing inferior or unrelated plant materials to increase volume or mimic expensive herbs.
- Use of exhausted crude drugs (post-extraction residues).
- Coloring or coating with synthetic chemicals to enhance appearance.

2. Substitution

- Replacing original herbs with morphologically similar but pharmacologically different species.
- Substitution due to regional unavailability or cost constraints.

3. Unintentional Adulteration

- Occurs due to errors in identification, harvesting during improper seasons, or contamination during storage.

Case Examples

Original Drug	Substitute	Impact
Sarpagandha (Rauwolfia serpentina)	Sida cordifolia	Loss of hypotensive activity
Ashoka (Saraca asoca)	Polyalthia longifolia	Poor efficacy in gynecological conditions
Tagara (Valeriana wallichii)	Nardostachys jatamansi	Altered CNS activity

Diagnostic & Analytical Approaches

Modern Techniques:

- TLC, HPTLC, and DNA barcoding for species authentication.
- Spectroscopic fingerprinting for phytochemical profiling.
- Pharmacognostical microscopy to identify adulterants.

Classical Ayurveda Tests:

- *Panchabhautika* parameters and organoleptic examination.
- Reference to *Nighantu* and *Dravyaguna* texts for morphological standards.

Regulatory and Ethical Considerations

Despite the presence of quality standards under WHO and AYUSH guidelines, enforcement remains inconsistent. Small-scale suppliers may bypass compliance due to lack of awareness or infrastructural support. Bridging traditional wisdom with standardized quality control is crucial to protect end-users and preserve the efficacy of integrative protocols. The impact of herbal drug adulteration and substitution on clinical treatment and patient safety is both profound and multifaceted.

Here's how it can compromise healthcare outcomes:

Impact on Clinical Treatment

- **Reduced Therapeutic Efficacy:** Substituted herbs may lack the active phytoconstituents necessary for treatment. For example, replacing *Saraca asoca* with *Polyalthia longifolia* can render a gynecological formulation ineffective.
- **Inconsistent Pharmacological Response:** Variability in bioactive content leads to unpredictable results, disrupting dosage uniformity and making outcome-based protocols unreliable.
- **Herb–Drug Interactions:** In adulterated samples, unidentified or synthetic additives may interact adversely with allopathic medications, risking side effects or contraindications.
- **Delayed Effectiveness and Management:** Ineffective herbal treatment may mask symptoms, delay definitive care, or lead to disease progression due to misplaced therapeutic trust.

Impact on Patient Safety

- **Toxicity Risks:** Adulterants like heavy metals, steroids, or harmful preservatives have been detected in herbal preparations, potentially causing hepatotoxicity, nephrotoxicity, or endocrine disruption.
- **Allergic Reactions:** Substituted plant species may elicit allergic or immunological responses not associated with the intended herb.
- **Loss of Trust:** Repeated therapeutic failures or adverse events can erode patient confidence not just in the herbal drug, but in integrative medicine itself.
- **Mislabelling and Vulnerability:** Vulnerable populations (children, elderly, immunocompromised) are at higher risk due to reliance on mislabelled or unverified herbal remedies.

Discussion

The increasing prevalence of adulteration and substitution in herbal drugs reflects a critical fissure in the continuum between traditional wisdom and modern pharmaceutical governance. While integrative medicine depends on the synergistic use of herbal and conventional therapies, any compromise in herbal drug integrity threatens both therapeutic efficacy and safety.

From an Ayurvedic standpoint, use of impure or misidentified *Dravya* violates foundational principle of *Vishuddhatva*, directly impacting *Guna*, *Karma*, and *Prabhava* of formulation. Classical texts such as *Charaka Samhita* and *Bhavaprakasha* emphasize need for meticulous identification, seasonal collection (*Kaala*), and proper preservation (*Sammelana*) of medicinal herbs. Modern pharmacognosy reiterates this through standards for botanical authentication, phytochemical profiling, and rigorous quality control.

Despite these frameworks, challenges persist:

- **Economic Drivers:** The high cost and low availability of certain botanicals incentivize substitution with cheaper alternatives, especially in informal markets.
- **Identification Gaps:** Field collectors and traders often lack taxonomical training, leading to misidentification and mixing of morphologically similar species.
- **Technological Divide:** Advanced methods such as DNA barcoding or HPTLC remain inaccessible in rural sourcing chains, creating blind spots in authentication.
- **Regulatory Vacuum:** While AYUSH and WHO advocate quality control, enforcement is uneven. There's limited surveillance of local markets and unlicensed formulations.
- **Ayurvedic Pharmacovigilance:** Though underdeveloped, this emerging field can help track adverse events and identify adulterants through retrospective analysis.

The ramifications extend to therapeutic failure, unanticipated drug interactions, and loss of trust in integrative healthcare systems.

For example, substitution of *Saraca asoca* with *Polyalthia longifolia* not only alters the pharmacodynamics of gynecological formulations but may also interfere with concurrent allopathic interventions targeting uterine tone.

To combat this, a two-pronged strategy is proposed:

1. Strengthening Detection

By promoting decentralised laboratories, training field collectors, and integrating classical identification methods with modern analytics, supply chain scrutiny can be enhanced.

2. Ethical and Regulatory Realignment

Encouraging ethical sourcing, community participation in herb cultivation, and digital transparency (such as QR-based tracing) will create a sustainable framework for quality assurance.

This discussion highlights the urgency of bridging systemic gaps between Ayurvedic purity standards and modern authentication protocols, ensuring that integrative medicine remains safe, evidence-driven, and culturally respectful.

Conclusion

The integrity of herbal medicine lies at the heart of successful integrative care. Adulteration and substitution not only compromise therapeutic efficacy but also cast doubt on the reliability of herbal interventions in clinical settings. As this review has underscored, the causes are multifactorial - ranging from economic pressures to gaps in identification and enforcement. Yet, the consequences are singular: loss of trust, reduced patient safety, and a dilution of the synergistic potential between traditional and modern healing systems.

To preserve the authenticity and promise of integrative medicine, stakeholders must act collectively. Traditional Ayurvedic standards must be fortified with modern analytical tools, and regulatory frameworks must evolve to monitor every stage of the supply chain. Cultivating awareness, investing in training, and implementing traceable sourcing methods will be essential in ensuring that herbal drugs retain their purity, potency, and purpose.

Adulteration and substitution are not just quality control issues—they are ethical and clinical imperatives. Addressing them diligently can restore confidence in botanical therapeutics and sustain the advancement of integrative healthcare.

References

1. Alyas AA, Aldewachi H, Aladul MI. Adulteration of herbal medicine and its detection methods. Pharmacogn J. 2024;16(1):248–254. *[Crossref] [PubMed][Google Scholar]*

2. Posadzki P, Watson L, Ernst E. Contamination and adulteration of herbal medicinal products (HMPs): an overview of systematic reviews. Eur J Clin Pharmacol. 2013;69(3):295–307. *[Crossref] [PubMed][Google Scholar]*

3. Diwakar D. Adulteration and deterioration: substitution of herbal drugs, causes and measures. Ashokrao Mane College of Pharmacy. 2023. *[Crossref][PubMed][Google Scholar]*

4. Calahan J, Howard D, Almalki AJ, Gupta MP, Calderón AI. Chemical adulterants in herbal medicinal products: a review. Planta Med. 2016;82(6):505–515. *[Crossref][PubMed][Google Scholar]*

5. Pratiwi R, Dipadharma RHF, Prayugo IJ, Layandro OA. Recent analytical method for detection of chemical adulterants in herbal medicine. Molecules. 2021;26(21):6606. *[Crossref][PubMed][Google Scholar]*