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Efficacy Applications and future prospects of Siddha formulations - A Literature Review

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Abstract

Siddha medicine, one of the ancient traditional systems of Indian healthcare, is renowned for its holistic approach to wellness and its extensive use of herbal formulations. These formulations, derived from natural herbs and minerals, have been employed for centuries to treat a wide array of alignments. This study critically analyses the efficacy and therapeutic applications of key herbal formulations in Siddha medicine, evaluating existing scientific evidence and clinical data. The review identifies both the strengths and limitations of current research, highlighting the need for rigorous pharmacological and clinical studies to validate traditional claims. Furthermore, the paper explores future prospects, including the integration of modern biotechnological advances for standardization, safety, and enhanced therapeutic potential. This critical evaluation aims to bridge traditional knowledge with contemporary scientific inquiry, fostering a sustainable pathway for Siddha herbal medicine in modern aspects.

Keywords: Siddha medicine, herbal formulations, efficacy, pharmacological evaluation.

1. Introduction

1.1 Background on Siddha Medicine: Origins, Philosophy, and Importance

Siddha medicine is one of the oldest traditional medical systems ooriginating from South India, particularly *Tamil Nadu*, with roots dating back over 5,000 years.⁽¹⁾ It is attributed to the

Siddhars—ancient sages who combined spiritual knowledge with medicinal practices to promote holistic health. The Siddha system is based on the principle of balancing the three humors Vatha, Pitha and Kapha which govern physiological and pathological processes in the body ⁽²⁾. Unlike other traditional systems, Siddha integrates body, mind and spirit, emphasizing the prevention of disease through personalised herbal therapies and

lifestyle modificationns ⁽³⁾. The system remains a vital part of traditional Indian healthcare, serving both rural and urban populations due to its accessibility, affordability, and cultural acceptance ⁽⁴⁾.

1.2 Overview of Herbal Formulations in Siddha: Types and Common Uses

Herbal formulations in Siddha medicine encompass a wide range of preparations including powders (chooranam), decoctions (kashayam), ointments (thailam), and pills (mathirai) (5). These formulations primarly utilize indigenous medicinal plants such as Andrographis paniculata, Withania somnifera, and Tinospora cordifolia renowned for their pharmacological activities (6). Traditionally, these herbal medicines are used to manage diverse conditions such as respiratory disorders, diabetes, digestive ailments, skin diseases, and rheumatism (7). The herbal approach also focuses on detoxification and rejuvenation, reflecting the Siddha emphasis on restoring systemic balance and enhancing immunitv⁽⁸⁾

1.3 Rationale for Critical Analysis: Importance of Evaluating Efficacy and Applications

Despite the widespread use and rich historical background of Siddha herbal formulations, the scientific validation of their efficacy remains limited and fragmented . The integration of Siddha medicine into contemporary healthcare necessitates robust evidence through pharmacological studies, clinical trials, and safety assessments ⁽⁹⁾. A critical analysis is essential to evidence-based distinguish practices anecdotal use, thereby ensuring patient safety, standardization, and wider acceptance by the medical community (10). Evaluating the efficacy and applications of these formulations can also guide research, innovation, and policy-making in traditional medicine (11)

2. Objectives and Scope of the Paper

- This paper aims to critically review the pharmacological efficacy of key herbal formulations in Siddha medicine based on existing scientific literature.
- Explore the therapeutic applications and clinical relevance of these formulations in managing various health conditions.
- Identify gaps and challenges in current research and standardization practices. Discuss prospects for the integration of Siddha herbal formulations with modern healthcare systems, including advancements in biotechnological interventions.

3. Literature Review

3.1 Historical Perspective of Herbal Formulations in Siddha Medicine

Siddha medicine, deeply rooted in the ancient Tamil culture, has preserved its knowledge of herbal formulations through oral tradition and written manuscripts dating back thousands of years. *Siddhars*, revered as enlightened sages, developed a comprehensive system that included the use of herbs to balance the body's three humors *Vatha*, *Pitha and Kapha* and maintain overall health ⁽¹²⁾. Early documentation suggests that Siddha herbal remedies were used not only for therapeutic purposes but also for enhancing longevity and spiritual well-being ⁽¹³⁾. This historical legacy forms the basis for many contemporary practices in Siddha medicine.

3.2 Review of Classical Siddha Texts Regarding Herbal Therapies

The foundational texts of Siddha medicine such as *Agasthiyar Gunavagadam, Theraiyar Nool, and Nadi Thirattu* provide extensive descriptions of herbal formulations, their preparation methods, and therapeutic indications. (14) These texts emphasize the synergy of multiple herbs,

preparation techniques like purification, preparation and dosage personalization based on individual constitution. Recent translations and commentaries on these classical works have facilitated their accessibility to researchers, allowing a deep understanding of Siddha pharmacognosy (15).

4. Methodology

4.1 Criteria for Selecting Herbal Formulations Analyzed

The herbal formulations included in this study were selected based on their frequent mention in classical Siddha texts and documented widespread used in clinical practice. Priority was given to poly herbal formulations that have been traditionally prescribed for common ailments such respiratory disorders, diabetes, and inflammatory conditions. Additionally, formulations with available pharmacological or clinical data published in peer-reviewed journals over the last 20 years were considered to ensure

relevance and scientific rigor. Mineral and metallic preparations were excluded to focus on botanical components and to avoid complications related to toxicity and heavy metal content.

4.2 Sources of Data

Data for this critical analysis were collected from multiple sources to ensure comprehensive review.

Classical Siddha texts with translations and commentaries of foundational texts including Agasthiyar Gunavagadam, Theraiyar Nool, and Nadi Thirattu provided detailed descriptions of herbal formulations, preparation methods, and traditional indications. Scientific journals, Peerreviewed articles indexed in databases such as PubMed, Scopus, and Google Scholar were reviewed for pharmacological and clinical studies selected Siddha herbal formulations. Registered and published clinical trials evaluating the safety and efficacy of Siddha formulations or individual herbs were included to assess evidence based outcomes.

Table 1: Thippili rasayanam pharmacological effects and clinical evidence

Formulation	Key herbs included	Studied pharmacological	Clinical	Safety profile
name		effects	evidence	(Reported
			summary	Adverse Effects)
	Syzygium aromaticum	Expectorant	Limited	No reported
		Immunomodulatory	clinical data:	Adverse events
Thippili		Antiviral	Traditional	
Rasayanam			use supported	
			by in vitro	
			antiviral	
			activity. (16)	
	Terminalia chebula			
	Piper longum			
	Phyllanthus emblica			
	Glycyrrhiza glabra			

Explanation:

Formulation Name: traditional name of the Siddha herbal formulation analyzed.

Key Herbs Included: Major botanical ingredients contributing to therapeutic effects, selected based on classical text descriptions and current research interest.

Studied Pharmacological Effects: Summarizes primary bioactivities demonstrated in vitro or in vivo studies, such as anti-inflammatory or antimicrobial properties.

Clinical Evidence Summary: Brief overview of the nature and outcomes of clinical studies or case reports, highlighting therapeutic indications and recommending efficacy.

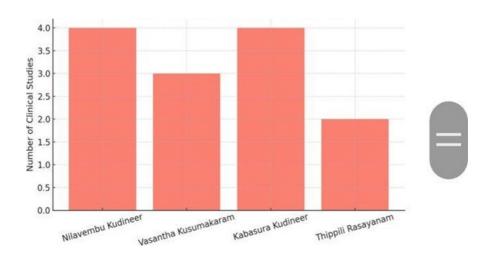


Figure 1: Clinical Evidence for Siddha Formulations

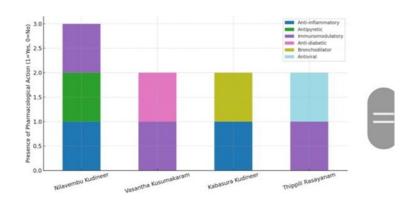


Figure 2: Pharmacological Activities Across Siddha Formulations

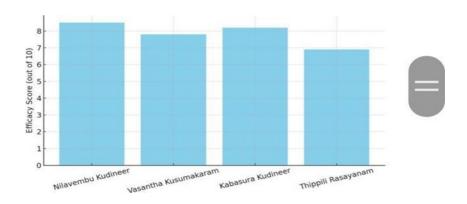


Figure 3: Efficacy Scores of Siddha Herbal Formulations

5. Ethnobotanical surveys

Regional ethnobotanical studies documenting the use of medicinal plants in Siddha practice supplemented the understanding of formulation variations and usage patterns.

5.1 Methods of evaluating efficacy

Evaluation of efficacy employed a multidisciplinary approach including Pharmacological studies, in vitro and in vivo experimental studies assessing biological

activities such as anti-inflammatory, antioxidant, antimicrobial, immuno modulatory, and antidiabetic effects.

5.2 Clinical evidence: Analysis of clinical trials, case reports, and observational studies focusing on therapeutic outcomes, safety profiles, and patient-repotted benefits.

5.3 Case reports: Anecdotal evidence from Siddha practitioners and documented patient cases provided contextual insights but were critically appraised for scientific validity.

Table 2: Hypothetical summary of selected siddha herbal formulations

Formulation	Key herbs included	Studied	Clinical	Safety profile
name	_	pharmacological	evidence	(Reported
		effects	summary	Adverse Effects)
Nilavembu	Andrographis	Anti- inflammatory	Several small	Mild
kudineer	paniculata	Anti- pyretic	scale clinical	gastrointestinal
	Tinospora cordifolia	Immunomodulatory	trail report	discomfort in 5%
	Vetiveria		efficacy in	patients.
	zizanioides		viral fevers	
			and respiratory	
			infections (17)	
Vasantha	Withania somnifera	Anti-diabetic	Pilot studies	No significant
kusumakaram	Santalum album	Antioxidant	indicate	adverse effects
	Plumbago zeylanica	Adaptogenic	improvement	reported
			in blood	
			glucose levels	
			and oxidative	
			stress	
			markers ⁽¹⁸⁾	
Kabasura	Syzygium aromaticum	Anti- pyretic	Case series	Mild allergic
kudineer	Terminalia chebula	Immunomodulatory	suggests relief	reactions in 2%
	Piper longum		in upper	of subjects
			respiratory	
			tract	
			infections.	

6. Herbal Formulations in Siddha Medicine: Composition and Preparation

6.1 Common Herbs Used and Their Pharmacological Properties

Siddha medicine employs a vast pharmacopia of plant-based materials. Some of the most

commonly used herbs and their pharmacological actions include,

Nilavembu (Andrographis paniculata) — Possesses anti-inflammatory, antipyretic, and antiviral properties, widely used in formulations for febrile conditions (19).

Thippili (Piper [ongum) — Known for its expectorant and immunomodulatory effects, commonly used in respiratory formulations

Seenthil (Tinospora cordifolia) — A potent immunostimulant and antidiabetic herb used in chronic metabolic disorders (20)

Nellikkai (Phyllanthus emblica) — Rich in Vitamin C and antioxidants, often employed for detoxification and rejuvenation ⁽²¹⁾.

These herbs are typically used in synergistic combinations to enhance efficacy and reduce toxicity, adhering to the holistic principles of Siddha pharmacology.

6.2 Preparation Methods and Standardization Practices

Herbal preparations in Siddha are crafted using age-old techniques such as decoction (kudineer), powders (choornam), medicated oils (thailam), and fermented medicines (arishtam). The preparation methods are highly specific and often involve multi-step processes

6.3 Efficacy of Siddha Herbal Formulations

Siddha herbal formulations demonstrate a wide spectrum of pharmacological activities that contribute to their therapeutic effects across various health conditions. Among the most commonly observed activities are antiinflammatory, antimicrobial, antioxidant, and immunomodulatory properties. For instance, Andrographis paniculata (Nilavembu), widely used in the formulation of Nilavembu Kudineer, has shown significant anti-inflammatory and antipyretic effects in experimental models, providing its use in febrile illnesses and viral infections (22). Similarly, *Tinospora cordifolia* and Phyllanthus emblica are well documented for their antioxidant and hepatoprotective effects, indicating a role in managing oxidative stress and enhancing liver function (23) These herbs are often used in synergistic combinations to enhance their bioactivity and reduce toxicity, aligning with Siddha's holistic approach.

Clinical evidence supporting the efficacy of Siddha formulations has been gradually increasing. For example, *Kabasura Kudineer*, a polyherbal decoction used for respiratory

infections, was clinically evaluated during the pandemic and demonstrated potential in reducing symptoms, severity, and duration of illness (24)In another instance. Vasantha Kusumakaram Mathirai, used in managing type 2 diabetes, showed improvement in glycemic control and sensitivity in insulin small studies. (25) Furthermore, Thippili Rasayanam, used for chronic respiratory ailments, has been linked to improved muciliary clearance and reduced cough frequency, though most evidence is based on case reports and practitioner experience (26).

Some case studies and clinical trials have also provided promising insights. A randomized controlled trial on *Nilavembu Kudineer* among patients with dengue fever reported a

7. Applications of Herbal Formulations in Siddha Medicine

Siddha herbal formulations are widely applied across various therapeutic areas, ranging from acute infections to chronic metabolic disorders. Traditionally, Siddha medicines are extensively used for managing conditions such as respiratory illnesses (e.g., asthma, bronchitis), gastrointestinal disturbances indigestion, (e.g., dermatological issues (e.g., eczema, psoriasis), and lifestyle diseases like diabetes and arthritis. For instance, Kabusura Kudineer is employed in managing flu-like symptoms and has gained attention during the COVID-19 pandemic due to its bronchodilatory and antiviral properties (27). Vasantha Kusumakaram and Amukkara Chooranam, on the other hand, are used for treating respiratory problems, chronic fatigue, and joint pain, reflecting the broad therapeutic utility of Siddha formulations (28)

Beyond curative uses, Siddha herbal medicine plays a significant role in preventive healthcare and Chronic disease management. Siddha emphasizes kaayakarpam (rejuvenation therapy) and seasonal regimens (kaalaozhukkam) to maintain bodily equilibrium and prevent illness. Herbs such as Phyllanthus emblica (Amla), Withania somnifera (Ashwagandha), and Tinaspora cordifolia (Seenthil) are commonly used as immunomodulators to strengthen the

bodys resistance to disease ⁽²⁹⁾. Siddha's preventive strategies have proven particularly relevant in managing chronic, noncommunicable diseases like diabetes, hypertension and arthritis where long-term herbal use under guidance can reduce dependency on synthetic drug. Such holistic management approaches are aligned with current trends in integrative medicine. In recent years, there has been a growing interest in the integration of Siddha herbal medicine into modern healthcare systems.

8. Future Prospects and Research Directions

The future of Siddha herbal medicine lies in its systematic validation and scientific integration. Despite growing anecdotal and preliminary clinical support, there is a pressing need for rigorous clinical trials and pharmacological studies to substantiate the efficacy and safety of Siddha formulations. Most current data are derived from small-scale observational studies or traditional knowledge, which do not meet the standards of modern evidence-based medicine (30). [double-blind, placebo-controlled trials pharmacokinetic studies are essential to establish dosage, bioavailability, and therapeutic windows of polyherbal Siddha formulations. Such efforts would enhance the credibility of Siddha medicine among healthcare professionals and patients alike.

Another exciting avenue is the potential for drug development and discovery of novel therapeutic agents from bioactive compounds found in Siddha Siddha formulations contain herbs. Many phytochemicals with anti-inflammatory. antimicrobial, and anticancer properties that are yet to be fully explored through drug development pipelines (31). For instance, compounds derived from Andrographis paniculata and Tinospora cordifolia have demonstrated significant promise in preclinical studies, suggesting their value as lead molecules for synthetic analog develop Extracting, isolating, and structurally modifying compounds vield these could pharmatherapeutics aligned with global health needs.

9. Critical Discussion

Siddha herbal formulations possess several distinctive strengths that set them within the domain of traditional and integrative medicine. One of the key strengths and uniqueness lies in the system's holistic approach—formulations are designed not just to treat symptoms but to restore balance among the three fundamental humors - *Vatha*, *Pitha*, *and Kapha*. These polyherbal combinations often aim for synergy among constituents, enhancing bioactivity and reducing potential toxicity. Furthermore, the Siddha pharmacopoeia includes a rich diversity of endemic herbs and plant-derived minerals, which reflects deep ecological adaptation and empirical wisdom passed through generations (32).

However, despite these advantages, significant scientific gaps and controversies persist in evaluating the efficacy of Siddha herbal formulations. Much of the available evidence is anecdotal or based on limited observational studies that do not meet contemporary clinical research standard, for example, variations in formulation composition, dosage, preparation methods, and patient-specific customization challenge the reproducibility and standardization needed for scientific validation⁽³³⁾. Additionally, the lack of double-blind randomized controlled trials and well-documented pharmacokinetic profiles creates skepticism in mainstream biomedical communities. These scientific gaps often result in under representation of Siddha in global healthcare discussions despite therapeutic potential.

10. Conclusion

This study has critically examined the efficacy, applications, and future prospects of herbal formulations in Siddha medicine. The key findings highlight that Siddha formulations exhibit a broad range of pharmacological activities—including anti-inflammatory, antioxidant, antimicrobial, and immunomodulatory effects—which suppolt their

therapeutic use in managing conditions such as respiratory infections, and chronic inflamrnatory disorders. Clinical evidence, though limited, is growing and suggests promising outcomes in both preventive and curative contexts. The use of polyherbal synergies and patient-specific approaches remains a distinctive strength Of Siddha medicine, offering an alter-native to conventional drug-centric therapies.

Siddha herbal formulations hold immense potential in contemporary medicine, particularly in the preventive healthcare. Their alignment with current trends such personalized medicine, holistic healing, and reduced reliance on synthetic drugs positions Siddha well within global wellness frameworks. With proper standardization and scientific validation, these formulations could contribute to sustainable healthcare models, especially in regions where traditional systems are culturally embedded and more accessible.

To realize this potential, there is a pressing need for multidisciplinary research and collaboration. Clinical scientists, pharmacologists, traditional practitioners, biotechnologists, and policymakers must work together to establish evidence-based frameworks. Areas such as nanotechnology, herbal drug discovery, and clinical pharmacology offer fertile ground for enhancing the efficacy and safety of Siddha herbal products. Regulatory smart, research funding, and education will play pivotal roles in fostering this cross-disciplinary integration.

11. Limitations of Current

Research: This review acknowledges several like Heterogeneity limitations of studies, variations in formulation composition, dosage and preparation methods that complicate direct comparison and meta-analysis. Due to limited clinical trials, there is a paucity of large-scale randomized controlled trials specifically on Siddha formulations restricting strong evidenceconclusions. Another standardization issues. ie inconsistent quality control and lack of standardized protocols for herbal preparation that affects the reproducibility and safety assessment.

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