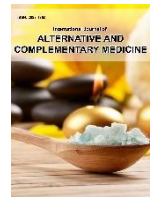




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A CRITICAL STUDY AND A REVIEW PERSPECTIVE OF AYUSH

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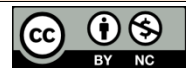
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Abstract

AYUSH, encompassing Ayurveda, Yoga, Naturopathy, Unani, Siddha, and Homeopathy, represents a holistic healthcare paradigm rooted in India's rich cultural and medical heritage. This review critically examines the evolution, philosophical foundations, and modern institutionalization of AYUSH systems, tracing their journey from Vedic origins to contemporary national and global recognition. Key areas explored include comparative diagnostics, therapeutic approaches, integrative healthcare models, and personalized medicine strategies, highlighting the convergence of traditional wisdom with evidence-based practice. The article also evaluates research and development initiatives, policy frameworks such as the National AYUSH Mission, and the integration of AYUSH services into primary healthcare. Challenges such as limited clinical validation, quality control, and global standardization are analyzed alongside opportunities in wellness promotion, preventive health, and international collaborations. By synthesizing historical, philosophical, clinical, and policy perspectives, this review underscores the potential of AYUSH to contribute meaningfully to preventive, personalized, and integrative healthcare. The study emphasizes that the future advancement of AYUSH depends on strategic research, rigorous validation, and informed policy support, positioning it as a vital bridge between ancient medical wisdom and modern scientific innovation.

Keywords: Ayush, Ayurveda, Yoga, Siddha, Unani, Homeopathy, Integrative Medicine, Holistic Health, Traditional Medicine, Evidence-Based Practice, Personalized Medicine, National Ayush Mission.

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Introduction

The term AYUSH represents an acronym for Ayurveda, Yoga & Naturopathy, Unani, Siddha, and Homeopathy, symbolizing the collective traditional systems of medicine officially recognized by the Government of India. These systems share a fundamental philosophy that emphasizes holistic well-being, focusing not merely on the absence of disease but on the harmonious balance of body, mind, and spirit. Unlike conventional biomedicine, which primarily targets symptomatic relief, AYUSH systems aim to restore equilibrium through preventive, promotive, and curative means that integrate physical, psychological, spiritual, and environmental dimensions of health [1].

The holistic healthcare approach of AYUSH stems from its deep-rooted understanding of human constitution, natural elements, and lifestyle harmony. Ayurveda, for instance, bases its therapeutic rationale on the *Tridosha* concept, which interprets health as a dynamic equilibrium among *Vata*, *Pitta*, and *Kapha* energies. Similarly, Siddha and Unani systems interpret disease as a disturbance in humoral or elemental balance, while Yoga and Naturopathy emphasize mental discipline, diet, and natural living as central pillars of health preservation [2]. This comprehensive approach promotes individualized treatment, recognizing that every person possesses a unique physiological and psychological constitution. Consequently, AYUSH embodies a preventive and personalized paradigm of medicine, aligning closely with the emerging global shift toward integrative and person-centered care [3].

Despite its ancient wisdom and widespread acceptance in India, the AYUSH sector faces challenges concerning scientific validation, standardization, and global

integration. The rapid evolution of evidence-based medicine necessitates critical evaluation of AYUSH through modern research methodologies. Lack of robust clinical trials, pharmacovigilance data, and standardized formulations continues to limit its universal recognition [4]. However, recent policy reforms-such as the establishment of the Ministry of AYUSH (2014) and national missions aimed at quality control, education, and research-reflect the government’s commitment to promoting traditional medicine on scientific grounds [5]. Globally, AYUSH systems are gaining traction as part of the complementary and integrative medicine (CIM) movement. Organizations like the World Health Organization (WHO) have acknowledged traditional medicine as a vital contributor to universal health coverage, encouraging member states to integrate validated traditional practices into mainstream healthcare [6]. Countries across Asia, Europe, and North America have begun recognizing Ayurveda, Yoga, and Homeopathy as alternative or adjunct healthcare modalities. Yet, for AYUSH to achieve sustainable global recognition, it requires a balanced synthesis of traditional knowledge and empirical validation, ensuring safety, efficacy, and consistency in its applications [7]. Thus, a critical review of AYUSH is essential to understand its philosophical foundations, therapeutic potential, research progress, and integration challenges. Such an analysis enables policymakers, healthcare professionals, and researchers to identify gaps, strengthen evidence-based frameworks, and bridge the divide between ancient wisdom and modern science-thereby advancing AYUSH as a credible pillar of global healthcare [8].

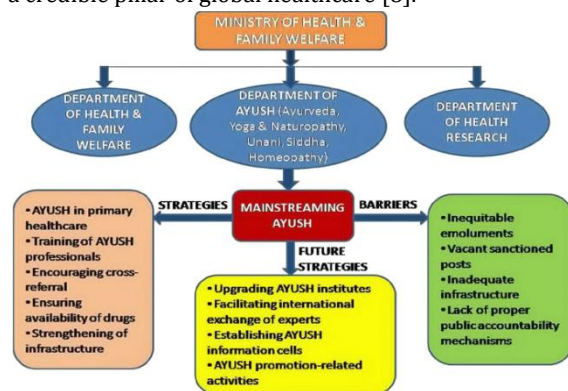


Figure 01: Conceptual overview of AYUSH systems under the Ministry of AYUSH, illustrating the integration of Ayurveda, Yoga & Naturopathy, Unani, Siddha, and Homeopathy

Historical Evolution and Institutionalization of AYUSH

The origins of AYUSH can be traced back to the Vedic period (1500–600 BCE), during which the earliest references to health, healing, and medicinal plants appear in the *Rigveda* and *Atharvaveda*-texts that emphasize disease prevention, spiritual purification, and the maintenance of bodily equilibrium [9]. The Ayurvedic

system, considered the oldest component of AYUSH, gradually developed through classical treatises such as *Charaka Samhita* and *Sushruta Samhita*, which established comprehensive doctrines of anatomy, physiology, pharmacology, and surgery [10]. These scriptures formed the foundational corpus of Indian medical philosophy, linking health to moral, spiritual, and environmental harmony.

The Siddha system, primarily flourishing in southern India, evolved parallel to Ayurveda and was deeply influenced by Dravidian culture and Tamil alchemical traditions. It emphasized the balance of *Mukkatram-Vatham, Pitham*, and *Kapham*-similar to the Ayurvedic *Tridosha*, but with distinct regional pharmacognosy and mineral-based therapeutics [11]. The Unani system, on the other hand, arrived in India around the 10th century CE through the Greco-Arab tradition, merging Hippocratic-Galenic principles with local Indian practices under the Delhi Sultanate and Mughal patronage. Its focus on *four humors* (blood, phlegm, yellow bile, black bile) and temperamental diagnosis became integrated into India’s pluralistic medical culture [12].

The Homeopathic system entered India in the early 19th century through European physicians and quickly gained acceptance due to its cost-effectiveness and minimal-dose approach. It resonated with Indian philosophical notions of subtle healing and soon became institutionalized through state and educational support during the colonial and post-colonial eras [13]. Yoga and Naturopathy, derived from ancient spiritual and ascetic disciplines, evolved simultaneously as lifestyle-based, non-pharmacological systems promoting self-discipline, diet regulation, and harmony with nature [14].

During the British colonial period, traditional systems were marginalized as Western biomedicine became the official model of public health. However, indigenous practitioners continued their traditions through local patronage and community-based practice. Following independence in 1947, India’s health policy recognized the cultural and therapeutic importance of indigenous medicine. The Bhore Committee (1946), Chopra Committee (1948), and Mudaliar Committee (1962) all advocated for a pluralistic healthcare framework integrating Indian medical systems with modern healthcare delivery [15].

The post-independence era witnessed systematic institutionalization of AYUSH through educational reforms and research initiatives. In 1995, the Government of India formally established the Department of Indian Systems of Medicine and Homeopathy (ISM&H) under the Ministry of Health and Family Welfare to coordinate traditional medicine development [16]. This department was later renamed the Department of AYUSH in 2003, reflecting a more unified and comprehensive administrative structure. The major policy transformation occurred in 2014, when the Ministry of AYUSH was created as a separate, full-fledged ministry, underscoring national commitment to

integrate traditional medicine into mainstream health policy [17].

Several policy-level milestones have since shaped the evolution of AYUSH. These include the National AYUSH Mission (2014) for infrastructure strengthening and service integration, the Pharmacopoeial Commission for Indian Medicine & Homoeopathy (PCIM&H) for quality standardization, and the AYUSH Grid (2019) for digital health data integration [18]. The Government of India also introduced specialized programs such as the Centre for Integrative Medicine and Research (CIMR) at premier institutes, collaborations with WHO for benchmarking of traditional medicine education, and the launch of AYUSH-based clinical research during the COVID-19 pandemic¹⁹. Thus, the evolution of AYUSH reflects the continuum of India's sociocultural resilience, transitioning from ancient spiritual healing traditions to modern institutionalized healthcare. This journey demonstrates how indigenous wisdom, when combined with evidence-based approaches and policy support, can contribute significantly to national and global health systems²⁰.

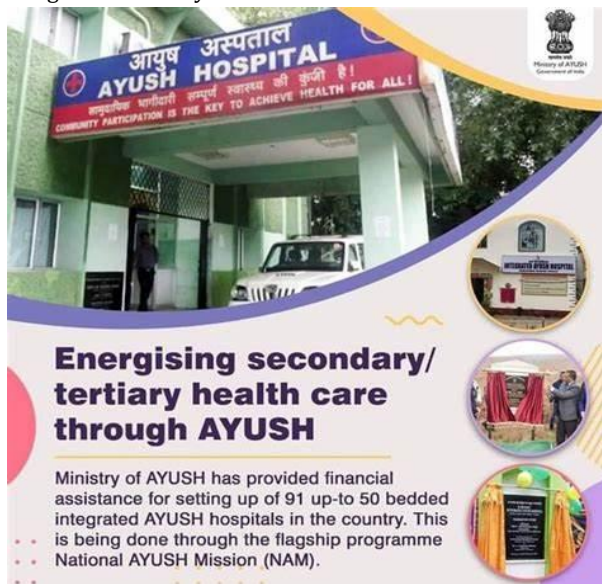


Figure 02: Infrastructure development under the National AYUSH Mission-promoting integration of traditional medicine systems through establishment of AYUSH hospitals and wellness centres across India.

Philosophical and Theoretical Foundations

The philosophical essence of the AYUSH systems is rooted in the ancient Indian worldview that perceives health as a state of **dynamic equilibrium** among bodily, mental, and spiritual dimensions. All constituent systems of AYUSH, though differing in terminology and methodology, share the **core doctrine of balance and prevention** as the key to maintaining health and longevity [21]. This integrative perspective is derived from the holistic cosmology that links the individual (*microcosm*) with the universe (*macrocosm*), suggesting that human beings are reflections of the universal elements and energies that govern nature [22].

In **Ayurveda**, the fundamental theoretical framework is built upon the **Panchamahabhuta** (five great elements)-*Prithvi* (earth), *Ap* (water), *Tejas* (fire), *Vayu* (air), and *Akasha* (ether). These elements constitute both the cosmos and the human body, and their proportional harmony determines health [23]. The physiological processes are governed by the **Tridosha theory**, comprising *Vata*, *Pitta*, and *Kapha*, which represent motion, transformation, and stability, respectively. Disease arises when there is disequilibrium among these doshas, whereas restoration of balance through diet, herbs, and lifestyle ensures well-being [24]. The Ayurvedic model thus integrates metaphysical principles with empirical clinical practice, emphasizing prevention through lifestyle modification and seasonal adaptation.

The **Siddha system**, which evolved in South India, parallels Ayurveda in its elemental philosophy but interprets health through the concept of **Mukkutram**-the triad of *Vatham*, *Pitham*, and *Kapham*. These three humors are manifestations of the five elements, and their imbalance disrupts physiological harmony [25]. The Siddha texts also incorporate alchemical and spiritual doctrines, asserting that purification of the body through diet and minerals leads to purification of the soul. This demonstrates the system's unique emphasis on **physical rejuvenation and spiritual liberation** as inseparable health goals.

The **Unani system** adopts the **Four Humors theory**, originally propounded by Hippocrates and Galen and later expanded within the Greco-Arabic tradition. According to this theory, the body's health depends on the equilibrium of *Dam* (blood), *Balgham* (phlegm), *Safra* (yellow bile), and *Sauda* (black bile). The Unani philosophy further integrates environmental and temperamental (Mizaj) factors, asserting that climatic conditions, diet, and emotions influence humoral balance [26]. The approach to therapy, known as *Ilaj bil-Tadbeer* (regimenal therapy), emphasizes moderation, purification, and lifestyle correction as preventive tools rather than mere curative interventions.

The **Homeopathic system** is based on the doctrine of the **Vital Force**, an immaterial energy responsible for maintaining life and harmony. According to Samuel Hahnemann's principle of "*Similia Similibus Curentur*" (like cures like), diseases result from disturbances in this vital force, and potentized remedies stimulate the body's innate healing potential [27]. The system, though European in origin, resonates with Indian philosophical thought by emphasizing subtle energetic interactions and the self-regulatory capacity of the organism.

Yoga and Naturopathy, integral components of AYUSH, emphasize **mind-body unity** and natural living. Yoga, rooted in Patanjali's *Yoga Sutras*, advocates ethical discipline (*Yama-Niyama*), postures (*Asanas*), breath control (*Pranayama*), and meditation (*Dhyana*) as means of harmonizing the body and consciousness. Naturopathy, meanwhile, relies on the body's inherent capacity to heal

through the five natural elements-earth, water, fire, air, and ether-aligning closely with Ayurvedic principles [28]. Together, these systems promote preventive health through balance, moderation, and alignment with nature. Despite their diverse historical trajectories, all AYUSH systems converge upon the **principle of balance (homeostasis)** and **prevention** as the ultimate goals of healthcare. They collectively reject the mechanistic view of disease and instead propose that illness is a manifestation of internal or environmental disharmony. Thus, AYUSH embodies a **philosophical synthesis of science and spirituality**, positioning health as a continuous process of equilibrium between human consciousness, biological systems, and the cosmos [29].

Comparative Analysis of AYUSH Systems

Although the AYUSH systems-Ayurveda, Yoga & Naturopathy, Unani, Siddha, and Homeopathy-emerged from distinct philosophical and cultural traditions, they share a common objective: the maintenance of health through preventive and curative measures that aim to restore balance within the body and between the individual and the environment [30]. Each system applies its own diagnostic logic, therapeutic principles, and treatment modalities, yet their integration offers a broader and more inclusive vision of healthcare.

In Ayurveda, diagnosis is based on the Tridosha theory, pulse examination (*Nadi Pariksha*), and observation of physical, mental, and emotional attributes (*Prakriti* assessment). Treatment involves a combination of herbal formulations, diet regulation, *Panchakarma* detoxification, and lifestyle correction [31]. The Siddha system, while conceptually parallel, uses techniques such as *EnvagaiThervu* (eightfold examination) and emphasizes metallic or mineral preparations (*Parpam, Chendooram*) alongside herbal and spiritual therapies [32].

The Unani system employs *Mizaj* (temperament) assessment, pulse diagnosis (*Nabz*), urine and stool examination, and symptom analysis to determine humoral imbalance. Treatments are categorized into *Ilaj bilGhiza* (dietotherapy), *Ilaj bil Dawa* (pharmacotherapy), *Ilaj bilTadbeer* (regimenal therapy), and *Ilaj bil Yad* (surgery or manipulation), highlighting its multidimensional therapeutic approach [33].

In Homeopathy, diagnosis is individualized, focusing on mental, physical, and emotional symptoms to identify a constitutional remedy. Based on the principle of “like cures like,” medicines are administered in highly diluted forms to stimulate the body’s self-healing mechanism. The emphasis on the vital force aligns conceptually with other AYUSH systems that view disease as an imbalance in life energy rather than a purely biochemical disorder [34].

Yoga and Naturopathy diverge from pharmacological dependence and focus instead on self-regulation through asanas, pranayama, hydrotherapy, fasting, and other natural interventions. Yoga promotes internal purification (*Shatkarma*), mental stability, and emotional control,

while Naturopathy emphasizes natural diet, sun exposure, and water-based cleansing to harmonize the body with its environment [35].

Despite their methodological diversity, all AYUSH systems converge on several key principles:

1. Prevention over cure – emphasis on lifestyle and diet.
2. Individualization – therapies tailored to the person’s constitution or temperament.
3. Holistic integration – uniting physical, mental, and spiritual well-being.
4. Natural and minimal intervention – avoidance of invasive or synthetic substances.

Each system’s unique strength enhances the collective scope of AYUSH. Ayurveda and Siddha offer comprehensive herbal pharmacopeias; Unani contributes an advanced regimenal and dietary framework; Yoga and Naturopathy emphasize preventive mental and lifestyle health; and Homeopathy provides a subtle, energy-based therapeutic model. Together, these traditions form a pluralistic healthcare continuum, offering solutions for chronic, psychosomatic, and lifestyle disorders that are often insufficiently addressed by modern biomedicine.

Table 01: Comparative Overview of AYUSH Systems

System	Diagnostic Basis	Therapeutic Philosophy	Treatment Modalities	Unique Strength
Ayurveda	Tridosha balance, Prakriti analysis, Nadi Pariksha	Equilibrium of doshas and dhatus	Herbal formulations, Panchakarma, Rasayana therapy	Personalized lifestyle-based preventive care
Siddha	EnvagaiThervu (eightfold exam), Mukkutram theory	Purification and rejuvenation of body and soul	Herbal-mineral drugs, yoga, dietary and alchemical therapy	Integration of mineral medicine and spiritual healing
Unani	Mizaj (temperament), Nabz (pulse), humoral analysis	Balance of four humors	Dietotherapy, regimenal therapy, pharmacotherapy	Focus on lifestyle and environmental adaptation
Homeopathy	Symptom similarity, mental-physical constitution	Stimulation of vital force	Potentiated remedies (similia principle)	Highly individualized, minimal-dose treatment

	on			
Yoga & Naturopathy	Observation of lifestyle, stress, and habits	Mind-body harmony and natural healing	Asanas, pranayama, hydrotherapy, fasting, diet correction	Non-pharmacological, preventive health model

AYUSH in the Modern Healthcare Paradigm

The evolving landscape of global healthcare has witnessed a paradigm shift toward holistic, preventive, and integrative medical systems, in which AYUSH (Ayurveda, Yoga & Naturopathy, Unani, Siddha, and Homeopathy) plays a significant role. In India, AYUSH has transitioned from being a parallel system to an essential component of the national health framework, complementing conventional biomedicine in areas such as chronic disease management, mental health, and immunity enhancement [36].

1. Contribution to Chronic Disease Management, Mental Health, and Immunity

Chronic diseases such as diabetes, hypertension, arthritis, and asthma—often resulting from lifestyle imbalances—are addressed effectively through AYUSH’s individualized and preventive therapeutic models. Ayurveda employs dietary and lifestyle interventions along with *Rasayana* (rejuvenative) therapy to manage metabolic and degenerative disorders [37]. Similarly, Yoga and Naturopathy have shown measurable benefits in the management of cardiovascular diseases, obesity, and musculoskeletal disorders through techniques that modulate the autonomic nervous system, reduce oxidative stress, and improve metabolic efficiency [38].

The mental health benefits of AYUSH practices—particularly Yoga, meditation, and certain Unani and Siddha formulations—are well documented. Regular Yoga practice has been associated with reductions in anxiety, depression, and stress biomarkers, leading to improved cognitive and emotional balance [39]. Naturopathy and Homeopathy emphasize the restoration of the body’s natural equilibrium, addressing psychosomatic conditions without chemical dependence.

Furthermore, AYUSH systems have gained prominence for their immunomodulatory and preventive potential, particularly during and after the COVID-19 pandemic. The Ministry of AYUSH introduced several immunity-boosting initiatives and formulations (e.g., *Ayush Kwath*, *Chyawanprash*, *Guduchi*, *Ashwagandha*), supported by clinical and pharmacological studies indicating their role in enhancing innate and adaptive immunity [40].

2. Integration in National Health Programs

The Indian government’s commitment to mainstreaming traditional medicine is evident through institutional and policy-level frameworks such as the National AYUSH Mission (NAM), launched in 2014. The mission aims to

strengthen AYUSH infrastructure, ensure quality control of drugs, promote research, and integrate traditional systems into public health delivery [41].

Under the Ayushman Bharat initiative, AYUSH Wellness Centres (AWCs) have been established across the country to provide preventive, promotive, and curative healthcare using AYUSH modalities. These centers operate alongside primary health centers, ensuring accessibility to traditional therapies at the grassroots level [42].

Collaborative projects between the Ministry of AYUSH and the Indian Council of Medical Research (ICMR) or Council of Scientific and Industrial Research (CSIR) have focused on standardizing herbal formulations, clinical validation, and digital documentation of AYUSH practices, further bridging the gap between tradition and evidence-based medicine.

Table 02: Integration of AYUSH in National Health Programs

Program/Initiative	Year Launched	Focus Area	AYUSH Component/Outcome
National AYUSH Mission (NAM)	2014	Infrastructure, education, and quality assurance	Strengthening AYUSH institutions and research
Ayushman Bharat – AYUSH Wellness Centres	2018	Preventive & promotive healthcare	Integration of AYUSH at primary health level
National Health Policy	2017	Universal health coverage	Recognition of traditional systems in mainstream healthcare
COVID-19 AYUSH Protocol	2020	Immunity and preventive health	Use of AYUSH formulations for immune resilience

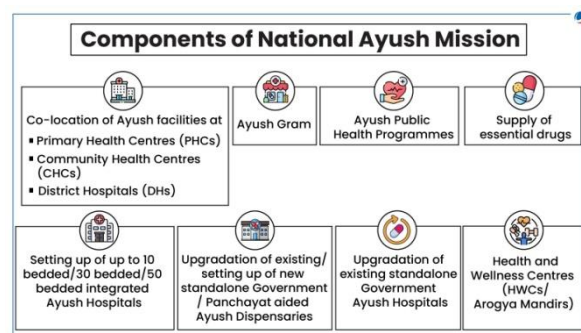


Figure 03: Components of National Ayush Mission

3. Global Recognition and WHO Collaboration

AYUSH’s global stature has expanded through collaborations with international organizations and the

World Health Organization (WHO). WHO's *Traditional Medicine Strategy (2014–2023)* emphasized integrating safe and effective traditional practices into national health systems [43]. India, being a WHO Collaborating Centre for Traditional Medicine, has played a pivotal role in setting benchmarks for herbal pharmacopoeias, quality standards, and research protocols [44].

In 2022, WHO inaugurated the Global Centre for Traditional Medicine (GCTM) in Jamnagar, Gujarat, in partnership with the Government of India, marking a historic milestone in globalizing AYUSH-based research and evidence frameworks [45]. This collaboration underscores international recognition of India's traditional medical heritage as a scientific and sustainable healthcare resource.

Research and Development: Progress and Pitfalls

Research and development (R&D) within the AYUSH framework have grown substantially over the past few decades, establishing a structured approach toward validating traditional knowledge through modern scientific methodologies. The establishment of dedicated **research councils** under the Ministry of AYUSH—namely, the Central Council for Research in Ayurvedic Sciences (CCRAS), Central Council for Research in Homoeopathy (CCRH), Central Council for Research in Unani Medicine (CCRUM), Central Council for Research in Siddha (CCRS), and Central Council for Research in Yoga and Naturopathy (CCRYN)—has significantly strengthened the institutional foundation for scientific inquiry into traditional systems [46].

1. Contributions of AYUSH Research Councils

Each of these councils has been instrumental in developing standardized formulations, conducting clinical trials, and documenting evidence-based practices. The CCRAS has played a pivotal role in developing plant-based formulations, clinical validation of Ayurvedic drugs, and digitalization of traditional manuscripts. Notably, AYUSH-64, a polyherbal formulation developed by CCRAS, was repurposed during the COVID-19 pandemic and demonstrated efficacy as an adjunct therapy in mild-to-moderate cases, marking a milestone in the modernization of Ayurveda [47].

Similarly, the Central Council for Research in Siddha (CCRS) advanced research on traditional Siddha formulations such as *Kabasura Kudineer*, which exhibited antiviral and immunomodulatory properties during the COVID-19 crisis. Its inclusion in national treatment advisories reflects the growing recognition of Siddha pharmacology within public health frameworks [48].

The Central Council for Research in Unani Medicine (CCRUM) has contributed to evidence-based Unani formulations for chronic respiratory, metabolic, and musculoskeletal disorders, while promoting standardization of classical Unani drugs and regimens [49]. The Central Council for Research in Homoeopathy (CCRH) has conducted multi-centric clinical studies on

allergic rhinitis, rheumatoid arthritis, and mental health disorders, emphasizing individualized therapy validation through large-scale observational research. In parallel, the Central Council for Research in Yoga and Naturopathy (CCRYN) has undertaken extensive trials demonstrating the role of Yoga in non-communicable disease (NCD) management, school health promotion, and mental well-being [50].

Table 02: Key AYUSH Research Councils and Their Focus Areas (Brief Version)

Council	System	Key Focus	Major Outcomes
CCRAS	Ayurveda	Drug development, clinical validation, medicinal plant research	Developed <i>AYUSH-64</i> ; digitized Ayurvedic manuscripts
CCRH	Homeopathy	Clinical trials, drug standardization, public health studies	Validated remedies for allergies and depression
CCRUM	Unani	Standardization, pharmacovigilance, disease-specific research	Developed Unani pharmacopoeia; trials on metabolic disorders
CCRS	Siddha	Formulation research, safety evaluation	Validated <i>KabasuraKudineer</i> for viral infections
CCRYN	Yoga & Naturopathy	Clinical and community studies on NCDs, stress management	Demonstrated Yoga's benefits for diabetes, hypertension

2. Major Achievements and Translational Outcomes

The combined efforts of these councils have produced several notable therapeutic and translational milestones. The development of AYUSH-64 and *KabasuraKudineer* demonstrated how traditional formulations can be repositioned through modern research for contemporary diseases. Other important contributions include standardization of raw materials, development of the *Ayurveda Pharmacopoeia of India (API)* and *Homoeopathic Pharmacopoeia of India (HPI)*, and establishment of repositories for medicinal plant DNA barcoding [51]. Additionally, research programs under AYUSH have emphasized reverse pharmacology, where clinical experiences from traditional medicine guide laboratory-based mechanistic studies. This model bridges traditional empirical knowledge and contemporary biomedical science, enhancing credibility and global acceptance [52].

3. Challenges and Limitations

Despite commendable progress, AYUSH research continues to face several systemic and methodological challenges. The most critical among them is the lack of large-scale randomized controlled trials (RCTs) that meet international standards. Many studies remain observational or pre-clinical, limiting global acceptance in evidence-based medical frameworks⁵³. Furthermore, quality control issues, including variation in raw materials, inadequate standardization, and limited Good Manufacturing Practice (GMP) compliance, affect reproducibility and safety assessments of traditional formulations [54].

Pharmacovigilance within AYUSH remains underdeveloped compared to allopathic medicine. While the Ministry of AYUSH initiated the *AYUSH Pharmacovigilance Programme* in 2008, challenges such as underreporting of adverse events, lack of trained staff, and insufficient analytical infrastructure persist. Strengthening pharmacovigilance, data transparency, and digital clinical repositories is essential for ensuring the credibility of AYUSH therapies in global research ecosystems [55].

Integration and Evidence-Based Validation

The concept of integrative medicine—the systematic combination of traditional and modern medical practices—has gained significant momentum within India’s healthcare system. The AYUSH framework now serves as an essential complement to conventional biomedicine, emphasizing patient-centered care, preventive health, and the use of validated natural interventions alongside standard clinical treatments [56].

1. Integrative Medicine Initiatives in India

India has been at the forefront of promoting integrative healthcare through institutional collaboration between AYUSH and allopathic systems. The Ministry of AYUSH, in collaboration with the Ministry of Health and Family Welfare, has implemented co-location policies that facilitate the establishment of AYUSH units within existing district hospitals and primary health centers [57]. These co-located facilities enable cross-referral, joint diagnosis, and complementary therapy, allowing patients to access holistic and multi-system care under one roof.

Major integrative models include the All India Institute of Ayurveda (AIIA) in New Delhi, which operates integrative clinics combining Ayurveda, Yoga, and modern diagnostics. Similar collaborative programs have been initiated at AIIMS Rishikesh, NIMHANS Bengaluru, and CCRAS-affiliated hospitals, where AYUSH interventions such as *Panchakarma*, Yoga, and Unani regimens are used adjunctively with allopathic therapies for chronic and lifestyle disorders [58].

2. Clinical and Ethical Considerations

While integration enhances therapeutic diversity, it also raises ethical, clinical, and methodological challenges. The absence of standardized protocols for cross-disciplinary practice often leads to uncertainty regarding treatment

attribution and patient safety. For instance, in integrative hospitals, delineating the therapeutic effect of an AYUSH intervention from concurrent allopathic therapy remains complex without well-structured clinical trial designs [59]. Ethically, informed consent and patient autonomy are vital when combining two systems of medicine, especially in chronic disease management where patients may be exposed to polytherapy. The lack of uniform evidence-based guidelines, regulatory oversight, and training in interdisciplinary practice presents ongoing challenges. Nevertheless, the growing body of research from integrative pilot programs—such as Yoga-based cardiac rehabilitation, Ayurvedic diet integration in diabetes management, and Siddha formulations for chronic arthritis—demonstrates measurable benefits when validated through proper clinical methodologies [60].

3. Towards Evidence-Based Integration

The future of AYUSH lies in its scientific validation and integration through evidence-based frameworks. This requires rigorous randomized controlled trials, harmonized data sharing between AYUSH and allopathic practitioners, and ethical research models that uphold both traditional knowledge and modern standards of safety and efficacy. The adoption of Good Clinical Practice (GCP) guidelines and pharmacovigilance networks within integrative setups will ensure that AYUSH therapies meet global clinical benchmarks while preserving their holistic essence [61].

Role of Pharmacists and Healthcare Professionals in AYUSH

Pharmacists and healthcare professionals play a pivotal role in the effective implementation, standardization, and safe utilization of AYUSH systems. Unlike conventional medicine, traditional therapies often involve complex polyherbal formulations, minerals, and individualized regimens, which require careful quality control, dosing, and patient education. Pharmacists ensure that these therapies are safe, effective, and evidence-based, bridging the gap between traditional knowledge and modern healthcare standards [62].

1. Contributions of Pharmacists in AYUSH

1. **Formulation Standardization:** Pharmacists are responsible for developing and validating standardized herbal and mineral formulations according to pharmacopeial guidelines. This includes ensuring correct plant identification, active ingredient quantification, and preparation consistency to maintain therapeutic efficacy [64].
2. **Safety Monitoring and Pharmacovigilance:** Pharmacists actively participate in monitoring adverse drug reactions (ADRs) associated with AYUSH medicines. They contribute to the AYUSH Pharmacovigilance Programme, ensuring timely reporting, data collection, and analysis of safety concerns, thereby enhancing public trust and clinical credibility of traditional therapies [64].

- Patient Counselling and Rational Use:** Trained pharmacists provide crucial guidance on dosage, administration, and lifestyle modifications aligned with AYUSH principles. They help patients understand the individualized nature of therapies—such as Prakriti-based Ayurveda or humoral balance in Unani—and ensure rational, informed, and compliant use of medicines [65].
- Research and Evidence-Based Practice:** Pharmacists facilitate clinical research by standardizing formulations, assisting in study design, and ensuring quality control during trials. Their expertise helps integrate traditional therapies into modern healthcare while adhering to scientific and ethical standards.

2. Importance of AYUSH-Trained Pharmacists

The increasing adoption of AYUSH in national healthcare frameworks, wellness centers, and integrative medicine programs underscores the need for professionally trained pharmacists. Their role extends beyond dispensing to include therapeutic guidance, quality assurance, and interdisciplinary collaboration with physicians and researchers. By ensuring the safety, consistency, and effectiveness of traditional medicines, pharmacists significantly contribute to public health outcomes and global acceptance of AYUSH therapies.

Personalized Medicine and Preventive Health Paradigm

AYUSH systems inherently emphasize individualized healthcare, where treatments are tailored according to a person's constitution, lifestyle, and environmental factors. In Ayurveda, the concept of Prakriti classifies individuals as Vata, Pitta, or Kapha, guiding the selection of diet, herbs, detoxification methods, and lifestyle interventions to restore balance and maintain health [66]. Similarly, Unani medicine evaluates the humoral balance—blood, phlegm, yellow bile, and black bile—to customize therapies, while Siddha considers Udal Thathukkal (body types) and metabolic characteristics to individualize treatment plans [67].

Homeopathy follows the principle of “like cures like”, prescribing remedies based on the patient's symptom profile, mental state, and overall vitality, ensuring a highly personalized approach [68]. Yoga and Naturopathy similarly provide personalized exercise regimens, breathing practices, and dietary guidance tailored to the individual's constitution and health goals.

This individualized approach in AYUSH parallels modern personalized medicine, including genomics, proteomics, and nutrigenomics, where interventions are designed based on genetic makeup, metabolic profile, and lifestyle patterns. While modern approaches rely heavily on molecular diagnostics, AYUSH achieves precision through observational assessment, lifestyle evaluation, and constitutional typing, offering preventive, non-invasive, and sustainable healthcare solutions.

Table 04: Personalized Treatment Concepts Across AYUSH Systems (Brief Version)

System	Personalization Basis	Diagnostic Parameter	Therapeutic Customization	Modern Correlate
Ayurveda	Prakriti (Vata, Pitta, Kapha)	Pulse, tongue, physical features	Herbal formulations, diet, Panchakarma	Genomics & lifestyle medicine
Siddha	Udal Thathukkal (body types)	Pulse, urine, tongue, metabolic traits	Herbs, minerals, yoga, diet	Personalized nutrition & metabolomics
Unani	Humoral balance (blood, phlegm, bile)	Pulse, temperament, urine	Regimens, diet, herbal therapy	Systems biology & nutrigenomics
Homeopathy	Individual symptom profile	Patient history, mental/emotional state	Highly diluted remedies	Personalized pharmacotherapy
Yoga & Naturopathy	Mind-body constitution	Physical posture, breathing, lifestyle assessment	Asanas, Pranayama, diet	Lifestyle medicine & preventive health

Challenges and Limitations

Despite its holistic benefits, AYUSH faces several critical challenges that limit its wider acceptance, scientific credibility, and global integration. Addressing these issues is essential to ensure safe, effective, and evidence-based use of traditional therapies.

1. Insufficient Clinical Evidence

One of the foremost limitations of AYUSH systems is the scarcity of large-scale, high-quality randomized controlled trials (RCTs). While numerous observational studies and pilot interventions exist, robust clinical evidence remains limited for many therapies. This hampers global recognition and integration into mainstream healthcare. To overcome this, increased funding for multicenter trials, adherence to Good Clinical Practice (GCP) standards, and standardized outcome measures are necessary to generate scientifically credible data [70].

2. Quality Control and Adulteration

Herbal and mineral formulations in AYUSH are vulnerable to variation in active constituents, contamination, and adulteration, leading to inconsistent therapeutic outcomes and potential safety risks. Standardization of raw

materials, implementation of stringent pharmacopeial guidelines, and continuous pharmacovigilance are essential measures to enhance product reliability. Advanced analytical techniques, such as HPLC, LC-MS, and DNA barcoding, can be employed to authenticate and quantify active component [71]¹.

3. Lack of Global Standardization

AYUSH practices, formulations, and terminologies are largely region-specific, leading to challenges in international acceptance. Differences in diagnostic methods, dosage forms, and nomenclature restrict the ability to export therapies or integrate them into global integrative medicine programs. Harmonization of standards, adoption of WHO benchmarks for traditional medicine, and international collaboration for formulation validation can improve global recognition [72].

9.4 Underfunded Research Infrastructure

Although the Government of India has established research councils like CCRAS, CCRH, CCRUM, CCRS, and CCRYN, overall funding and infrastructure remain limited relative to the potential scope of AYUSH research. Strengthening research infrastructure, fostering industry-academia partnerships, and establishing dedicated clinical research networks will facilitate systematic investigation and evidence generation [73].

Pathways to Scientific and Policy Solutions

Addressing these challenges requires a dual approach:

1. **Scientific Measures:** Implement standardized clinical trial designs, quality assurance protocols, pharmacovigilance frameworks, and evidence-based guidelines for therapies and formulations. Leveraging modern technology for omics-based studies, molecular validation, and AI-assisted analysis can bridge traditional knowledge with contemporary science.
2. **Policy Measures:** Formulate clear regulatory frameworks, incentivize industry participation, provide dedicated research grants, and promote public awareness programs emphasizing validated practices. International collaboration and adherence to global standards will further enhance credibility and adoption [74].

Public Awareness and Globalization of AYUSH

The promotion of AYUSH beyond India's borders depends on a combination of public awareness, policy initiatives, and international collaboration. The Indian government has launched several digital and outreach programs, such as AYUSH Grid and AYUSH Sanjivani, aimed at educating the public about preventive health, lifestyle practices, and evidence-based traditional therapies. These initiatives facilitate access to information on wellness, herbal formulations, and AYUSH services, enabling both domestic and international users to engage with traditional medicine effectively [75].

1. Opportunities for Globalization

AYUSH systems have significant potential in the global wellness and healthcare markets. Opportunities include:

1. **Wellness Tourism:** India's growing reputation for authentic Yoga retreats, Panchakarma therapies, and Siddha or Unani wellness programs attracts international visitors seeking holistic health experiences.
2. **Herbal Exports:** Standardized herbal products, nutraceuticals, and Ayurvedic formulations are increasingly demanded in markets across Europe, North America, and Southeast Asia.
3. **Global Partnerships:** Collaboration with universities, research centers, and international healthcare organizations enables knowledge exchange, joint clinical studies, and training programs in traditional medicine. These partnerships enhance the scientific credibility and adoption of AYUSH practices worldwide.

Barriers to Global Expansion

Despite these opportunities, several barriers limit global acceptance:

- **Standardization Challenges:** Variation in formulation, dosing, and quality of herbal medicines complicates regulatory approval in foreign markets.
- **Intellectual Property Rights (IPR):** Protecting traditional knowledge while facilitating innovation remains a complex legal and ethical challenge.
- **International Clinical Acceptance:** Limited high-quality RCTs and pharmacovigilance data restrict recognition by global health authorities and inclusion in mainstream healthcare programs.

Addressing these barriers through stringent quality standards, robust clinical research, and policy support will facilitate the sustainable globalization of AYUSH systems.

Innovation and Strategic Roadmap for AYUSH Advancement

The AYUSH sector is poised for transformation through technological integration, scientific validation, and global strategic initiatives. Rather than simply forecasting trends, a structured roadmap enables systematic innovation, ensuring that traditional knowledge aligns with contemporary healthcare and research standards [77].

1. Emerging Trends in AYUSH Innovation

1. **Digital Integration:** Platforms like AYUSH Grid and AYUSH Sanjivani have revolutionized data accessibility, patient engagement, and research collaboration. These digital repositories enable real-time monitoring of therapy outcomes, pharmacovigilance, and dissemination of evidence-based practices [77].
2. **AI-Driven Standardization:** Artificial intelligence is increasingly applied in herbal authentication, formulation optimization, and predictive safety profiling. Machine learning models can identify bioactive components, detect adulteration, and

predict therapeutic efficacy, enhancing the reproducibility and reliability of AYUSH medicines [78].

3. **Data-Driven Research:** Large-scale data repositories allow for population-level analysis of Prakriti patterns, treatment responses, and adverse events. Integration with electronic health records (EHRs) and genomic databases facilitates precision medicine applications and personalized therapy recommendations [79].

2. Strategic Policy and Global Certification

To achieve global recognition, AYUSH requires integrative policies and standardized certification:

- Harmonized global standards for herbal medicines and formulations.
- Certification frameworks aligned with WHO benchmarks and ISO guidelines.
- Incorporation of genomic and metabolomic correlations to strengthen evidence-based personalized medicine.

These initiatives will support both domestic credibility and international acceptance, enabling cross-border collaborations in healthcare, research, and wellness tourism [78, 79].

3. Future Research Models

The roadmap emphasizes interdisciplinary and multicentric research:

- **Multicentric Clinical Trials:** Large-scale trials across diverse demographics to validate efficacy and safety.
- **Interdisciplinary Studies:** Collaboration between AYUSH practitioners, biomedical scientists, data analysts, and bioinformaticians.
- **Digital-Integrated Research:** AI-assisted data analytics, digital monitoring of outcomes, and predictive modeling to streamline drug discovery and therapeutic optimization.

By aligning traditional knowledge with modern science and technology, AYUSH can achieve scientific robustness, global scalability, and personalized healthcare impact [77, 79].

Conclusion

The AYUSH systems-comprising Ayurveda, Yoga & Naturopathy, Unani, Siddha, and Homeopathy-represent a holistic healthcare paradigm that has evolved over millennia. These traditional practices integrate physical, mental, and spiritual well-being, offering a comprehensive framework for preventive, curative, and wellness-oriented medicine. Modern research efforts, digital initiatives, and evidence-based validation have begun bridging the gap between ancient wisdom and contemporary scientific scrutiny, highlighting AYUSH as a dynamic and scientifically evolving model of integrative healthcare.

One of the key strengths of AYUSH lies in its personalized medicine approach. From Prakriti-based classification in Ayurveda, humoral assessment in Unani, to individualized

remedies in Homeopathy, each system emphasizes treatment tailored to an individual's constitution, lifestyle, and environmental context. This focus on personalization aligns closely with modern precision medicine and nutrigenomics, demonstrating that traditional knowledge can complement and enrich current healthcare practices.

Furthermore, AYUSH has demonstrated notable contributions in chronic disease management, mental health promotion, immunity enhancement, and stress reduction. Initiatives such as the National AYUSH Mission, AYUSH Wellness Centres, and digital platforms like AYUSH Grid and AYUSH Sanjivani have expanded accessibility, awareness, and research collaboration. The integration of AYUSH with allopathic medicine through hospital co-location, interdisciplinary research, and global partnerships reflects its growing potential to provide patient-centered, cost-effective, and sustainable healthcare solutions.

Despite challenges-including limited clinical evidence, standardization issues, quality control, and underfunded research infrastructure-strategic innovation, AI-assisted herbal standardization, digital repositories, and global certification pathways offer clear solutions. By combining scientific validation, policy support, and technological advancement, AYUSH is poised to maintain its cultural heritage while meeting the rigorous standards of modern healthcare.

In conclusion, AYUSH serves as a bridge between ancient wisdom and modern science, integrating time-tested healing traditions with contemporary research methodologies. Its emphasis on holistic care, preventive health, individualized therapy, and wellness promotion positions it not only as a national healthcare asset but also as a global resource for integrative medicine, providing a roadmap for future innovations and international adoption.

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