Exploring the nexus of tradition and scientific thought: The Convergence of Ayurveda and phytopharmaceuticals

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Abstract

Herbal medicines are widely regarded as a significant alternative to modern allopathic treatments, with a long history of use in addressing diverse healthcare needs. Majority of population in developing nations relies on herbal remedies for treating various ailments. Despite the popularity of India as largest producers of medicinal plants, only a limited number of medicinal herbs have undergone scientific evaluation for their therapeutic potential, highlighting an unmet need for the discovery and development of Phytopharmaceutical drugs. Thus, Phytopharmaceuticals is the Bridge of Ancient wisdom with modern medicine. This modern approach highlights the value of evidence- based medicine and the potential for creating potent medication with precise pharmacological effects.

Keywords: Ayurveda, Phytopharmaceuticals, Case studies

1. Introduction

Ayurveda is an ancient system of medicine rooted in India that seeks to promote balance in body, spirit and mind. Ayurvedic principles include balancing of Body's three doshas i.e Vata, Pitta and Kapha- each of which represents elements and energies within the body. Central to Ayurveda, is the use of Plant- based medicines, which include herbs, minerals and also animal products. These medicinal plants are often referred to as "Phytopharmaceuticals" when used in scientific research and regulatory standards showing potential of isolation of specific bioactive compounds from plants for treatment of diseases.

2. Ayurveda: India's timeless knowledge system

Ayurveda is the science of life that helps in health maintenance from ancient time (1). Remarkably, Ayurveda tends to cure various chronic conditions like allergic reactions, skin diseases, arthritis, cancer, neuromuscular diseases asthma and obesity that are untreatable by other medical systems (2). Originating over 5,000 years ago, Ayurveda combines natural remedies, lifestyle practices, and a deep understanding of human physiology to prevent illness. Ayurveda remains a powerful system that continues to gain renewed global interest that focuses on wellness and preventive care.

3. Phytopharmaceuticals: A modern approach to plant based medicine

Phytopharmaceutical drug is defined as purified and standardized fraction with defined minimum four

bioactive or phytochemical compounds of an extract of a medicinal plant or its part, for internal or external use of human beings or animals for diagnosis, treatment, mitigation or prevention of any disease or disorder but does not include administration by parenteral route (3). Phytopharmaceuticals integrate traditional herbal knowledge with pharmaceutical practices and modern scientific research. It focuses on the identification, isolation and standardization of active moieties obtained from specific plants.

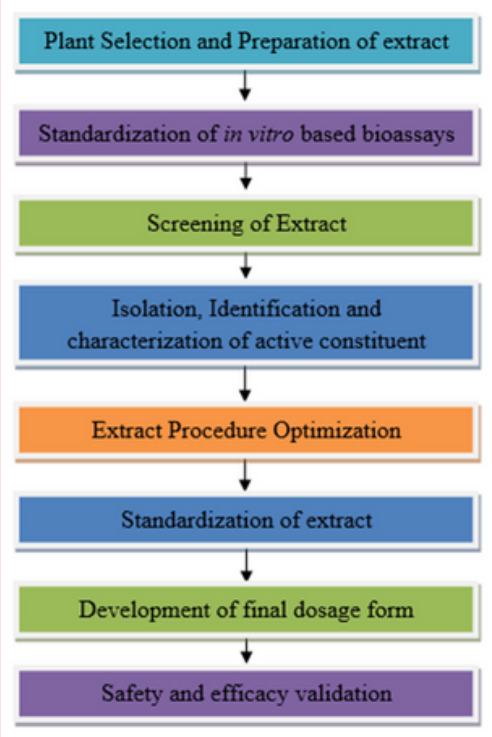

Figure 1. Phytopharmaceutical development process

4. Commutuality: Ayurvedic principles and phytopharmaceutical research

A traditional medicine serves to be a wealth of knowledge and ancient wisdom. Traditional medicinal system integrated with modern healthcare needs a strong scientific validation to ensure safety and efficacy of herbal drugs (4).

5. Scientific validation of herbal remedies: The role of phytopharmaceuticals

World Health Organization (WHO) has developed Good Manufacturing Practices (GMP) guidelines series for traditional medicines that aim to produce basic criteria for evaluating the quality, efficacy and safety of herbal remedies that aid to the national regulatory authorities, scientific departments and manufacturers of product development. The guidelines established by the U.S, FDA, the European Medicines Agency and Indian regulatory authorities are fundamentally aligned, as they are all shaped by principles set forth in the WHO guidelines (5). The use of ASU (Ayurveda, Siddha and Unani) drugs was approved by the Department of AYUSH and other regulatory authorities as per the requirements in India. And the Phytopharmaceuticals are under the purview of the Central Drugs Standard control Organization (CDSCO), Ministry of Health and Family Welfare, Govt. of India, 2015 marked as per Phytopharma guidelines. This gazette notification states that for Phytopharmaceuticals there is scientific research data submission requirement that describes the safety, quality and efficacy of an herbal preparation for evaluation.

6.Case studies: Ayurvedic remedies transformed into phytopharmaceuticals

Phytopharmaceuticals are refined plant- based products, which are standardized to get active components, ensuring their consistent therapeutic effects. Ayurvedic remedies have undergone significant transformation through scientific research, resulting in Phytopharmaceuticals. Some important phytopharmaceuticals and their therapeutic uses are listed in Table 1.

Table 1. List of some important phytopharmaceuticals

S.No.	List of Phytopharmaceuticals	Common name/ Biological name	Therapeutic Uses	Ref
1.	Curcumin	Turmeric/ *Curcuma longa*	Anti-inflammatory and antioxidant properties	(6)
2.	Withanolides	Ashwagandha/ *Withania somnifera*	Managing stress, anxiety and cognitive impairment	(7)
3.	Monoterpenes, Diterpenes, triterpenic acids	Boswellia/ *Boswellia serrata*	Anti inflammatory and analgesic properties	(8)
4.	Guggulipid	Guggul/ *Commiphora mukul*	Lipid lowering agent	(9)
5.	Artemisinin	*Artemisia annua*	Antimalarial	(10)
6.	Ginsenosides	Korean ginseng/ *Panax ginseng*	Anti-inflammatory,antioxidant and immunomodulator	(11)
7.	Digoxin	Woolly foxglove/ *Digitalis lanata*	Cardiotonic	(12)
8.	Morphine	Opium/ *Papaver somniferum*	Analgesic	(13)
9.	Quinine	Loxa bark/*Cinchona ledgeriana*	Antimalarial	(14)
10.	Reserpine & Serpentine	Indian snake root/ *Rauwolfia serpentine*	Antihypertensive and antipsychotic	(15)
11.	Azadirachtin	Neem/ *Azadirachta indica*	Anti-inflammatory, antimicrobial, insecticidal	(16)

These case studies illustrates how plant based medicines have been validated through scientific research, leads to development of safe and effective phytopharmaceuticals.

7. Challenges in convergence: Bridging knowledge system

Integrating Ayurveda with modern Phytopharmaceutical research presents several challenges. The scientific and methodological divergence creates obstacles in bridging the gap between traditional Ayurvedic system and modern phytopharmaceuticals. Ayurveda follows holistic principles while modern processing involves

extraction and purification to yield consistent active compound level by targeting specific biochemical pathways. Secondly, differences in Standardization and validation as Phytopharmaceuticals often comprises the identification and isolation of specific bioactive compounds from plants by ensuring standardized dosing and formulation while Ayurvedic remedies often utilizes whole plant matrices and enfolds a range of plant components causing synergistic interactions. Safety Assessment also creates obstacles. Rigorous pre clinical and clinical trials, detection of potential adverse effects and drug interactions are included in modern scientific research while Ayurvedic medicines might not always perform the same safety testing procedure. Some of the factors like plant sourcing, seasons also lead to variations in active compounds concentrations. A Regulatory and Intellectual Property right further obstructs the convergence. Majority of Ayurvedic medicines are based on traditional knowledge and ancient texts, posing challenges for patenting and IPR's while Phytopharmaceuticals meet the safety and efficacy standards by undergoing extensive clinical testing (17-18). Hence, efforts are required for creating effective Phytopharmaceuticals that are scientifically validated and based on Ayurvedic principles.

8. Regulatory framework: Navigating traditional and modern medicine

Taking an idea of global trends and opportunities in plant based medicines, Government of India has amended the Drugs and Cosmetics Act, 1940 and Rules 1945 to add newer category of Phytopharmaceutical drugs. This gazette notification outlines the regulatory framework for phytopharmaceuticals. It specifies the requirements for submitting scientific data to serve the quality, safety and efficacy of herbal drugs or similar chemical compounds, supporting their evaluation and approval for marketing. These regulations allow the development of new drugs using advanced techniques of solvent extraction, fractionation and modern methods of formulations. The regulatory standards for these drugs categories are aligned with those of China, USA and other such countries regulations involved in scientific evaluation (17).

In India, Healthcare policy decisions are primarily driven by opinions and often overlook regional variations in socioeconomic conditions, culture, literacy levels, population characteristics and other such relevant factors.

9. Future prospects: Unlocking the potential of Ayurvedic phytopharmaceuticals

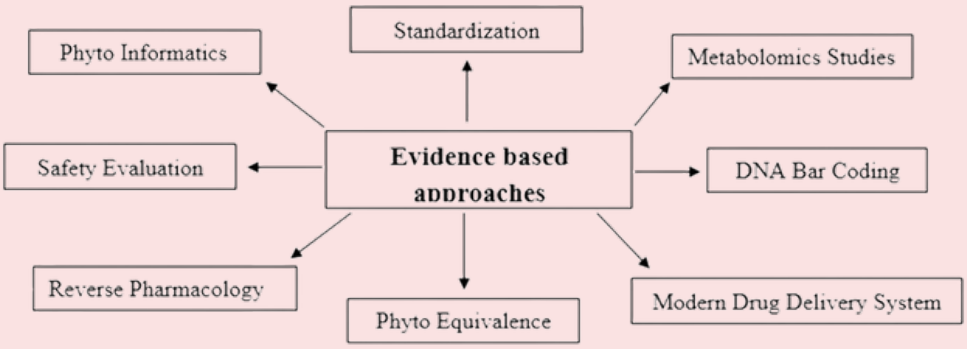

Figure 2. Techniques inspired by Traditional medicinal knowledge

The future of Ayurveda and Phytopharmaceuticals holds vast potential within the contemporary healthcare as modern science continues to explore and validate traditional remedies. By integrating Ayurvedic knowledge with rigorous clinical research, there is great promise for novel therapies that offer natural, holistic solutions to health challenges, contributing to both preventive and therapeutic care on global scale (19).

10. Conclusion: Towards a harmonious integration of tradition and science

Traditional medicines encompass the collective Ethnomedicinal knowledge, indigenous practices and skills of various cultures. So, an urgent requirement has arisen to secure the quality, safety and efficacy effectiveness of traditional medicines to phytopharmaceuticals or products obtained by drug development research. In today's world, most of the countries complementarily use modern as well as traditional system of medicine. Efforts have been undertaken to streamline the evaluation

and quality control processes for botanical preparations in drug discovery. To achieve precise identification and authentication of herbs, it is essential to prevent any admixtures or adulteration in the botanical preparations. For quality assurance, proper identification of plant is crucial for verification, which ultimately guarantees both safety and effectiveness. In summary, by further exploring the synergy between tradition and science, we open up a wider range of healing possibilities that benefit individuals and societies globally.

References

1. Arun AV, Namrata PB, Vikas JB, Dipak ND. Artificial Intelligence and Challenges in Ayurveda Pharmaceutics: A Review. Research Journal of Science and Technology. 2024; 16 (3): 237-4.
2. Teichroew and Jean Kaplan. Chronic disease: An Encyclopedia of causes, effects and treatments Bloomsbury Publishing USA; 2016.
3. Arun Bhatt. Phytopharmaceuticals: A new drug class regulated in India. Perspect Clin Res**.** 2016; 7(2):59–61.
4. Balkrishna A, Sharma N, Srivastava D, Kukreti A, Srivastava S and Arya V. Exploring the Safety, Efficacy, and Bioactivity of Herbal Medicines: Bridging Traditional Wisdom and Modern Science in Healthcare. Future Integrative Medicine. 2024; 3 (1): 35-49.
5. Mahika Punater. A Comparative Overview Of Plant Based Medicine: Phytopharmaceuticals Versus Ayurveda. IOSR Journal Of Pharmacy And Biological Sciences. 2024; 19 (2): 01-15.
6. Naresh C and Amit K. Neutraceuticals: Efficacy, Safety and Toxicity, 2nd Edition Standardized turmeric and Curcumin, 2021.pp 555-569.
7. Reddy DKN, Srilakshmi A, Prathvi S, Shreya U, Shankara P, Sudhanva MS and Shobith R. Assessing the efficacy and biological benefits of Withanolides- rich *Withania somnifera* root extract. Annual research & review in biology. 2024; 39 (5): 54-64.
8. Siddiqui MZ. *Boswellia serrata*, A Potential anti-inflammatory agent: An overview. Indian Journal of Pharmaceutical Sciences, 2011; 73 (3). 255-261.
9. Ahmad MA, Mujeeb M, Akhtar M, Khushtar M, Arif M, Haque MR. Guggulipid: A Promising Multi- Purpose Herbal Medicinal Agent. Drug Res (Stuttg). 2020; 70 (4): 123-130.
10. Ho WE, Peh HY, Chan TK, Wong WS. Artemisinins: Pharmacological actions beyond anti- malarial. Pharmacol Ther. 2014; 142 (1): 126-139.
11. Wee JJ, Mee Park K, Chung AS. Biological Activities of Ginseng and its Application to Human Health. In: Benzie IFF, Wachtel- Galor S, editors. Herbal Medicine: Bimolecular and Clinical Aspects. 2nd edition. Boca Raton (FL): CRC Press/ Taylor & Francis; 2011.
12. Priyanka Dashrath Deshmane. Digitalis Review: A Complete Pharmacognostic & pharmacological overview. International Journal of Creative Research Thoughts. 2022; 10 (5): e507-e511.
13. Purnima B, Manish S and Amarendra KS. Role of Ahiphena (Papaver somniferum) in modern and ancient treatment. Journal of Ayurveda and Integrated Medical Sciences. 2023; 8 (10): 164- 166.
14. Fauzi AA, Satrio AP, Sulisetijono S, Sitoresmi P, Hanumi OR. Screening of Secondary metabolites Quinine alkaloid by Endophytic bacteria from Cinchona plants (*Cinchona ledgeriana* Moens.) root. International conference on Life sciences and technology. AIP Conference Proceedings 2353. 2021; 030104-1- 030104—6.
15. Mehmet B, Murat B, Esra EO, Hasan S. Chemical and biological perspectives of Monoterpene indole alkaloids from Rauwolfia species. Studies in Natural Products Chemistry. 2019; 61: 251-299.
16. Soni P and Gupta P. Neem the source of versatile chemicals, Azadirachtin in modern pest management: a review. Journal of Non Timber Forest Products. 2001; 8 (1/2): 34-44.
17. Sattigeri and Viswajanani J. Council of Scientific and Industrial Research-AYUSH initiatives towards creating benchmarks. International Journal of Ayurveda Research. 2022; 3(1): 48-54.
18. Vivek VB, Dibyendu BV and V. Bhosale. Scientific Validation of Herbal Medicine Saikat Sen and Raja Chakraborty Editors. Herbal Medicine in India Indigenous Knowledge, Practice, Innovation and its Value. 2020; Springer Nature Singapore Pvt Ltd.
19. Pulok K. Mukherjee, Subhadip Banerjee, Amit Kar, and Joydeb Chanda P. K, Mukherjee. S. Banerjee. A. Kar J. Chanda. Drugs from Our Ancestors: Tradition to Innovation Department of Pharmaceutical Technology, School of Natural Product Studies, Jadavpur University, Kolkata, West Bengal, India