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Uses and Relevance of Artificial Intelligence (A.I) In Ayurveda

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ABSTRACT

Introduction: Artificial intelligence (AI) plays a vital role in modern healthcare and is crucial to achieving global objectives such as the Sustainable Development Goals (SDGs) and the World Health Organization's (WHO) Triple Billion Targets. The growing adoption of AI in healthcare has revolutionized diagnostics, personalized treatments, and clinical decision-making. In traditional medicine systems like Ayurveda, AI offers significant opportunities, but its integration remains underexplored. **Methods:** A comprehensive literature review was conducted using research papers, books, peer-reviewed journals, and online sources. The study focuses on the integration of AI in Ayurveda, particularly in Prakriti (constitution) assessment, Dosha (bodily humor) evaluation, and Rasashastra (Ayurvedic alchemy). AI tools such as data mining, pattern recognition, and predictive analytics were analyzed for their potential to improve diagnostic procedures, therapeutic outcomes, and knowledge of Ayurvedic formulations. **Results:** AI shows promise in improving diagnostic precision and personalized care in Ayurveda through tools like Prakriti and Dosha evaluation. AI's data mining capabilities enable deeper insights into disease mechanisms, symptoms, and treatment protocols. **Discussion:** While AI enhances data management, analysis, and research efficiency in Ayurveda, its limitations must be recognized. Traditional Ayurvedic practices, especially in patient care and diagnosis, cannot be entirely substituted by AI technologies. AI should complement rather than replace the expertise of practitioners. **Conclusion:** AI holds significant potential to advance Ayurvedic knowledge, diagnosis, and treatment, particularly in *Rasashastra*. However, the role of expert *Vaidyas* remains irreplaceable, and AI should be viewed as a supportive tool in integrating traditional practices with modern healthcare.

Key words: Artificial Intelligence (AI), Ayurveda, Prakriti assessment, Rasashastra, Traditional Medicine

INTRODUCTION

The importance of digital infrastructure, technology, and innovation in achieving the 17 Sustainable Development Goals (SDGs) is critical and important in making progress toward them. The strategic and critical use of digital and information and communications

technologies is an essential factor for ensuring the Triple Billion Targets, i.e., 1 billion more people benefit from universal health coverage, that 1 billion more people are better protected from health emergencies, and that 1 billion more people enjoy better health and well-being. Digital technologies in health care such as virtual care, remote monitoring, Artificial Intelligence (AI), big data analytics, blockchain, smart wearables, platforms, tools enabling data exchange and storage, remote data capture, and the exchange of data and sharing of relevant information across the health ecosystem have enhanced the health outcomes by improving medical diagnosis, data-based treatment decisions, digital therapeutics, clinical trials, self-management of care, and person-centered care as well as creating more evidence-based knowledge, skills, and competence for professionals to support health care.^[1]

The world health organization's "Global Strategy in digital health 2020 -2025" underscores the utilization

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of artificial intelligence (AI) to fortify health systems across a broad spectrum of applications. This strategy particularly addresses the requirements of consumers, healthcare professionals, healthcare providers, and the health industry, with the aim of empowering patients and realizing the vision of universal health coverage.^[1] Although the concept of AI began long back in 1950s, but in recent time specially after COVID-19 pandemic, it has shown a sudden rise in its potential for delivering health care worldwide showing its impact in various fields like drug discovery, genomics, radiography, pathology, prevention, detecting outbreaks of various epidemics and health research and biostatistics.

The Council on AI of the Organization for Economic Cooperation and Development (OECD) defines an artificial intelligence (AI) system as "a machine-based system that can, for a specified set of human-defined objectives, generate predictions, recommendations, or decisions that impact real or virtual environments." These AI systems are engineered to function with differing degrees of autonomy.^[2]

REVIEW OF LITERATURE

The emergence of artificial intelligence (AI) and its increasing influence across various sectors necessitate a thorough assessment of its effects on achieving the Sustainable Development Goals (SDGs). Through a consensus-based expert elicitation process, it has been identified that AI has the potential to facilitate the accomplishment of 134 targets across all SDGs. However, AI may also pose challenges, inhibiting progress towards 59 targets (Vinuesa et al., 2020).^[3]

Current research tends to overlook critical aspects of AI's impact on sustainable development. Floridi et al. (2018) emphasize that the rapid advancement of AI technologies must be accompanied by robust regulatory frameworks to ensure these technologies support sustainable development. Failure to implement appropriate regulatory measures could lead to significant issues in transparency, safety, and ethical standards, potentially undermining the contributions of AI to sustainable development (Mittelstadt et al., 2016; Binns, 2018).

Various *Prakriti* assessment tools, personalized holistic health care approach, data analysis, data interpretation, data presentations, thus can be done by using various AI tools in Ayurveda effectively and time consumption also be saved by this technology.

MATERIAL AND METHODS

Books, various research papers, peer reviewed journals, internet are the helping hands.

DISCUSSION

AI integration is rapidly advancing within the mainstream medical industry, and efforts are underway to incorporate AI into traditional medicine (TM). AI provides novel opportunities for analyzing ancient TM literature, enabling the screening of herbs and components in traditional formulations to elucidate their mechanisms of action. This approach facilitates the discovery of alternative, effective, and safer lead compounds and plant-based treatments. Consequently, AI has the potential to significantly expand the knowledge base within the Traditional medicine sector.^[4]

Uses and relevance of AI in Ayurveda

1. As and when the classical and textual knowledge is concerned the classical knowledge starting from *Dinacharya*, *Ratricharya*, *Ritucharya*, *Dosha*, *Dhatus*, *Mala*, concept of *Panchmahabhota*, concept of *Shareer*, concept of *Ojas*, *Vyadhikshamatava*, *Roga Rogi Pariksha* etc., they are well explained in *Ayurvedic* text and can be easily understood by core *Ayurveda* principles. AI technologies with an extra ordinary advanced vision to focus on scope in global competitive markets can be used in limited aspect when concerned to *Ayurveda*.
2. There is a wide range of AI tools now available like *Prakriti* assessment tools, dosha evaluation can be used by *Ayurvedic* physician to some extent but not completely dependent on such tools because when the patient examination, diagnosis, and management is concerned in relation to *Ayurveda*, it need a *Vaidya* or *Bhishaka*, the one who is having

a complete knowledge regarding *Roga* and *Rogi Pariksha*, and one who know complete dimension of treating a patients as well explained in *Ayurvedic* Classical texts.

3. Data mining technique by the use of Artificial Intelligence can show some promising results in the field of Ayurveda. AI can allow the particular knowledge and its availability in today's era, related to information regarding disease, causative factors, symptoms, treatment protocols, therapeutic intervention, etc.^[5]
4. AI in *Rasashastra* and *Bhaishajya Kalpana*: *Rasaushadhis* have been a focal point of safety concerns in *Ayurvedic* medicine. A substantial number of peer-reviewed articles on *Rasaushadhis*, including *Bhasmas*, are available in indexed journals. These studies encompass a broad spectrum of topics such as characterization, toxicity assessments, clinical trials, physicochemical evaluations, the development of standard operating procedures for validation, free radical scavenging activities, antioxidant properties, disease-specific pharmacological effects, and comparative analyses with modern pharmaceuticals.

It is crucial to underscore that the *Rasashastra Bhasmikaran* process transforms solid visible forms into solid nano-sized particles. In contrast, contemporary chemical techniques employ metals in ionic forms to synthesize metal nanoparticles. Bioavailability research involving approximately 50 inorganic materials was included in a World Health Organization (WHO) study published in 2000, which has facilitated the advancement of recent studies in bio-inorganics.^[5]

Summary

AI is increasingly being integrated into traditional medicine (TM), including *Ayurveda*, offering new opportunities for analyzing ancient texts and formulating effective treatments. AI tools can assist in *Prakriti* assessment and *Dosha* evaluation, but *Ayurvedic* practice still requires the expertise of a knowledgeable *Vaidya* for diagnosis and management.

AI's data mining capabilities can provide valuable insights into disease, causative factors, symptoms, and treatment protocols. In *Rasashastra* and *Bhaishajya Kalpana*, AI can enhance the safety and efficacy of *Rasaushadhis* by aiding in their characterization, toxicity assessments, and clinical evaluations. The *Rasashastra Bhasmikaran* process, which converts substances into nano-sized particles, contrasts with modern methods that use metals in ionic form to create nanoparticles. AI's application in these areas underscores its potential to advance *Ayurvedic* knowledge and practice.

CONCLUSION

AI integration into traditional medicine, particularly *Ayurveda*, is unlocking new possibilities for enhancing diagnostic accuracy, personalized treatments, and drug discovery. AI tools facilitate *Prakriti* and *Dosha* assessments, although expert *Vaidyas* remain essential for comprehensive care. Data mining through AI provides valuable insights into disease mechanisms and treatment protocols. In *Rasashastra* and *Bhaishajya Kalpana*, AI aids in characterizing, assessing toxicity, and clinically evaluating *Rasaushadhis*. The *Bhasmikaran* process in *Ayurveda* differs from modern nanoparticle synthesis, yet AI can bridge these methods to enhance bioavailability and efficacy. Overall, AI holds substantial promise for advancing *Ayurvedic* practices and integrating them with modern healthcare.

Take Home Message

1. Use and relevance of AI when related to *Ayurveda* can't be fully dependent as and when *Ayurveda* core principles are concerned, Patient care can be relied to some extent on AI based tools but it can't replace the *Vaidya*. The core *Ayurveda* principle can only be understood by its literature availability and classical texts.
2. Technology can be used as effectively in time management, data analysis, data interpretation. And data presentation, related to all aspect of patient care, but can't be fully reliable when specially patient care is concerned in related to *Ayurveda*.

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