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Research Article

## Artificial Intelligence in Prasuti Tantra and Stree Roga: Emerging Applications in Ayurvedic Women's Healthcare and Clinical Research

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### Abstract

Artificial Intelligence (AI) is increasingly transforming healthcare through predictive analytics, machine learning, clinical decision support systems, and digital health technologies. Women's healthcare, particularly in obstetrics and gynaecology, has witnessed substantial advancements through AI-assisted diagnosis, pregnancy monitoring, fertility management and disease prediction. Simultaneously, Ayurveda provides a holistic and personalized approach to women's health through the principles of Prasuti Tantra and Stree Roga. The integration of AI with Ayurvedic healthcare offers opportunities to strengthen individualized treatment, improve clinical research methodologies, and generate evidence-based healthcare solutions. AI-based technologies can facilitate Prakriti assessment, pregnancy risk prediction, patient stratification, treatment outcome analysis, and real-world evidence generation. In clinical research, AI has the potential to improve participant recruitment, data management, predictive modelling and healthcare analytics. Despite these opportunities, challenges remain regarding standardization, data quality, ethical considerations, algorithmic bias, and integration of traditional medical knowledge with modern computational approaches. This review examines the role of artificial intelligence in Prasuti Tantra and Stree Roga, explores its applications in clinical research, discusses opportunities and limitations, and highlights future directions for integrating Ayurveda and AI in women's healthcare. The convergence of these disciplines may contribute significantly to precision medicine and evidence-based Ayurvedic practice.

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## INTRODUCTION

Women's health is a fundamental component of public health and encompasses reproductive, gynaecological, obstetric, endocrine, and psychosocial wellbeing throughout the lifespan. Disorders such as polycystic ovary syndrome (PCOS), infertility, menstrual abnormalities, endometriosis, menopausal syndrome, gestational diabetes mellitus, hypertensive disorders of pregnancy, and postpartum complications continue to affect millions of women worldwide.<sup>1-4</sup> These conditions often require long-term management and significantly influence quality of life, productivity, emotional wellbeing, and healthcare expenditure.

Rapid technological advancements are transforming healthcare delivery and research. Among these innovations, Artificial Intelligence (AI) has emerged as one of the most promising tools for improving diagnosis, disease prediction, treatment planning, and clinical decision-making. AI refers to computer systems capable of performing tasks that traditionally require human intelligence, including learning, reasoning, pattern recognition, and predictive analysis.<sup>5-8</sup> Machine learning and deep learning technologies have already demonstrated significant utility in radiology, oncology, cardiology, reproductive medicine, and population health management.

Ayurveda, the traditional system of medicine originating in India, offers a holistic approach to health and disease. Unlike conventional medicine, which frequently focuses on disease-specific pathology, Ayurveda emphasizes individualized treatment based on constitutional characteristics, Dosha balance, Agni, Dhatu status, lifestyle, and environmental influences.<sup>9-12</sup> The branch of Ayurveda dealing with women's health, Prasuti Tantra and Stree Roga, contains detailed descriptions of menstruation, fertility, pregnancy care, postpartum recovery, and menopausal health.

Interestingly, the Ayurvedic principle of individualized treatment closely resembles the modern concept of precision medicine. AI technologies are designed to analyse complex datasets and identify patterns that can facilitate personalized healthcare delivery. This conceptual overlap creates an opportunity for integrating traditional Ayurvedic knowledge with contemporary digital technologies. Such integration may strengthen patient care while simultaneously improving the scientific evidence base for Ayurvedic interventions.

The present review explores the emerging role of artificial intelligence in Prasuti Tantra and Stree Roga, highlights applications in women's healthcare and clinical research, and discusses future opportunities for integrating Ayurveda with modern technological innovations.

### Ayurveda and Women's Health

Women's health occupies a central position in Ayurvedic literature. Classical texts including Charaka Samhita, Sushruta Samhita, Ashtanga Hridaya, and Kashyapa Samhita provide detailed descriptions of female physiology, reproductive health, fertility, pregnancy, childbirth, postpartum care, and menopause.<sup>9-12</sup>

Ayurveda considers health as a dynamic equilibrium among Doshas (Vata, Pitta, Kapha), Dhatus, Agni, Mala, and mental wellbeing. Disease is viewed as a manifestation of imbalance within these systems. Female reproductive health is closely associated with the proper functioning of Artava, Garbhashaya, and Apana Vata. Disturbances in these factors may contribute to infertility, menstrual disorders, pregnancy complications and gynaecological diseases.<sup>9-12</sup>

The concept of **Prakriti** represents one of the most distinctive features of Ayurveda. Prakriti refers to an individual's constitutional makeup and influences disease susceptibility, treatment response, metabolism, and psychological characteristics. Personalized healthcare recommendations are based on constitutional assessment rather than solely on disease diagnosis.<sup>13</sup>

### Garbhini Paricharya

Garbhini Paricharya refers to comprehensive antenatal care described in Ayurvedic texts. It includes dietary recommendations, lifestyle modifications, psychological wellbeing, and month-wise management strategies intended to promote healthy maternal and fetal outcomes.<sup>12</sup>

Modern research increasingly recognizes the importance of individualized antenatal care, risk stratification, and preventive healthcare. AI-assisted pregnancy monitoring systems may complement traditional Garbhini Paricharya principles by providing continuous health surveillance and early detection of complications.

### Sutika Paricharya

Postpartum care, known as Sutika Paricharya, is another important component of Prasuti Tantra. Classical Ayurvedic texts emphasize maternal recovery, nutritional support, lactation promotion, and restoration of physiological balance following childbirth.<sup>11</sup>

Digital health technologies and AI-assisted monitoring may facilitate postpartum follow-up, symptom tracking, and personalized healthcare recommendations, thereby enhancing maternal wellbeing during the postnatal period.

### Ayurveda and Personalized Medicine

The modern healthcare landscape is increasingly moving toward personalized medicine. AI technologies facilitate precision healthcare by analyzing patient-specific data and generating individualized recommendations. Ayurveda has advocated such personalized approaches for centuries through Prakriti-based treatment planning and patient-centred care.<sup>13</sup> The convergence of Ayurveda and AI therefore offers unique opportunities for advancing personalized women's healthcare while preserving traditional therapeutic principles.

### Artificial Intelligence in Women's Healthcare

AI applications in women's healthcare have expanded rapidly over the past decade. Advances in machine learning, predictive analytics, and wearable technologies have enabled healthcare

providers to improve disease detection, risk prediction, and patient monitoring.<sup>5-8</sup>

### AI in Reproductive Medicine

Infertility affects approximately one in six couples globally and remains a major healthcare challenge.<sup>3</sup> AI-assisted systems are increasingly used in fertility assessment, ovulation prediction, embryo grading, and assisted reproductive technology (ART) programs. Machine learning algorithms can analyze hormonal profiles, ovarian reserve markers, menstrual patterns, and ultrasound findings to predict treatment outcomes and improve clinical decision-making.<sup>14</sup>

AI-based embryo selection systems have demonstrated improved consistency and accuracy compared with traditional visual assessment methods. These technologies may increase success rates while reducing subjectivity in reproductive medicine.

### AI in Pregnancy Monitoring

Pregnancy generates large volumes of physiological and clinical data. AI technologies can analyze maternal characteristics, laboratory parameters, imaging findings, and wearable device outputs to identify women at increased risk of complications.<sup>15-17</sup>

Predictive models have demonstrated utility in forecasting preeclampsia, gestational diabetes mellitus, preterm birth, and fetal growth restriction. Early identification of high-risk pregnancies enables timely interventions and improved maternal-fetal outcomes.

Wearable devices integrated with AI algorithms can continuously monitor blood pressure, physical activity, heart rate, glucose levels, and sleep quality. Such technologies may support personalized antenatal care and remote patient monitoring.

### AI in Gynaecological Disorders

AI has also shown promise in the diagnosis and management of gynaecological disorders including PCOS, endometriosis, cervical cancer, ovarian cancer, and abnormal uterine bleeding.<sup>18</sup>

Machine learning algorithms can analyze clinical, biochemical, and imaging data to facilitate earlier diagnosis and treatment planning. These applications may improve healthcare efficiency while reducing diagnostic delays.

### Artificial Intelligence in Ayurvedic Clinical Research

The integration of artificial intelligence into clinical research has the potential to address several longstanding challenges associated with Ayurvedic evidence generation. Clinical research involving Ayurvedic interventions often encounters difficulties related to patient heterogeneity, individualized treatment protocols, outcome assessment, and large-scale data management. AI technologies may provide innovative solutions for overcoming these limitations.<sup>19-21</sup>

### AI-Assisted Prakriti Assessment

Prakriti assessment forms the foundation of Ayurvedic diagnosis and treatment planning. However, traditional assessment methods frequently rely on subjective clinical interpretation and practitioner expertise. Standardization remains a challenge in both clinical practice and research settings.

Machine learning algorithms can analyze structured questionnaires, phenotypic characteristics, physiological markers, and genomic data to facilitate objective Prakriti classification. Several studies have explored computational approaches for identifying Vata, Pitta, and Kapha constitutional profiles using data-driven models.<sup>13,22</sup>

Standardized AI-assisted Prakriti assessment may improve reproducibility in clinical trials and facilitate participant stratification, thereby strengthening research quality.

### Clinical Trial Recruitment and Patient Stratification

Participant recruitment is one of the most resource-intensive phases of clinical research. AI systems can analyze electronic health records and identify eligible participants according to predefined inclusion and exclusion criteria.<sup>23</sup>

In Ayurvedic clinical trials, AI may also assist in identifying patient subgroups most likely to benefit from specific interventions. For example, women with PCOS could be stratified according to constitutional characteristics, metabolic profiles, and symptom patterns, enabling more personalized research designs.

Such approaches may improve recruitment efficiency, reduce study costs, and enhance trial feasibility.

### Data Management and Predictive Analytics

Modern clinical research generates large datasets that can be difficult to analyze using conventional statistical methods alone. Machine learning techniques can identify hidden relationships among variables and develop predictive models that support clinical decision-making.<sup>5-8</sup>

In women's health research, AI may help predict treatment response, disease progression, pregnancy outcomes, and adverse events. Predictive analytics can facilitate personalized healthcare and improve understanding of treatment effectiveness across diverse patient populations.

### Real-World Evidence Generation

Real-world evidence (RWE) has become increasingly important in healthcare research. Unlike randomized controlled trials, which are conducted under controlled conditions, RWE reflects outcomes observed in routine clinical practice.<sup>24-26</sup>

AI can analyze large-scale datasets derived from electronic health records, patient registries, hospital databases, and mobile health applications. These analyses may provide valuable information regarding the long-term effectiveness and safety of Ayurvedic interventions.

Because Ayurveda emphasizes individualized treatment, real-world evidence may be particularly valuable for understanding clinical outcomes in routine practice settings.

### Natural Language Processing and Classical Ayurvedic Literature

Natural Language Processing (NLP) is a branch of AI that enables computers to understand and interpret human language. NLP applications may assist researchers in extracting information from classical Ayurvedic texts, research publications, patient records, and clinical documentation.<sup>27</sup>

Such technologies may facilitate systematic literature reviews, knowledge mapping, and integration of traditional Ayurvedic concepts with contemporary scientific evidence.

### Opportunities and Benefits

The integration of AI into Prasuti Tantra and Stree Roga presents several important opportunities for advancing women's healthcare and research.

### Strengthening Personalized Medicine

Personalized medicine aims to tailor healthcare interventions according to individual characteristics. Ayurveda has long embraced this concept through Prakriti-based treatment approaches. AI technologies can support this paradigm by analyzing large volumes of patient-specific data and generating individualized recommendations.<sup>13</sup>

Combining Ayurvedic principles with AI-driven analytics may facilitate more precise treatment planning and improved patient outcomes.

### Improving Maternal and Reproductive Healthcare

AI-assisted monitoring systems may enhance maternal healthcare through early identification of high-risk pregnancies, prediction of adverse outcomes, and personalized antenatal care strategies.<sup>15-17</sup> Integration of AI with Garbhini Paricharya may strengthen preventive healthcare and support maternal-fetal wellbeing throughout pregnancy.

### Enhancing Research Efficiency

AI technologies can improve multiple aspects of clinical research, including recruitment, data collection, quality control, statistical analysis, and reporting.<sup>21,23</sup> These innovations may accelerate evidence generation and improve the scientific rigor of Ayurvedic research.

### Expanding Digital Health

Mobile health applications, wearable devices, telemedicine platforms, and remote monitoring systems are increasingly utilized in healthcare delivery. AI-driven digital health tools may improve patient engagement, treatment adherence, and long-term follow-up. Such technologies are particularly valuable for women's health conditions that require continuous monitoring and lifestyle management.

### Challenges and Limitations

Despite its potential benefits, implementation of AI in Ayurvedic healthcare faces several challenges.

### Lack of Standardized Data

AI systems require large, high-quality datasets for training and validation. However, standardized Ayurvedic datasets remain limited. Variations in clinical documentation, diagnostic approaches, and treatment protocols may affect data quality and algorithm performance.<sup>19</sup>

### Validation of Ayurvedic Concepts

Many Ayurvedic concepts are qualitative and multidimensional in nature. Translating constructs such as Prakriti, Dosha imbalance, and Agni into computational models requires rigorous scientific validation.<sup>13,22</sup> Further interdisciplinary research is necessary to ensure accurate representation of traditional knowledge systems.

### Ethical and Privacy Concerns

AI applications involve extensive collection and analysis of personal health information. Ensuring data privacy, confidentiality, informed consent, and cybersecurity is essential.<sup>28,29</sup> Healthcare organizations must implement robust governance frameworks to protect patient rights and maintain public trust.

### Algorithmic Bias

AI systems may inherit biases present within training datasets. If datasets are incomplete or unrepresentative, predictive models may generate inaccurate results and contribute to healthcare disparities.<sup>30</sup> Continuous monitoring and validation are therefore required to ensure fairness and reliability.

### Regulatory and Ethical Considerations for AI in Ayurvedic Women's Healthcare

The increasing use of artificial intelligence in healthcare has created new regulatory and ethical challenges. AI-based healthcare systems must ensure patient safety, transparency, accountability, and protection of personal health information. In women's healthcare, these concerns become particularly important because reproductive and pregnancy-related data are highly sensitive.<sup>28-30</sup>

The World Health Organization has emphasized the need for ethical governance of AI systems in healthcare, highlighting principles such as transparency, fairness, inclusiveness, privacy protection, and human oversight.<sup>30</sup> AI tools should support clinical decision-making rather than replace healthcare professionals. Clinical judgment remains essential, particularly when managing complex obstetric and gynaecological conditions.

In Ayurvedic healthcare, ethical considerations extend beyond data privacy and algorithmic performance. Researchers must ensure that traditional knowledge systems are represented accurately and respectfully within digital platforms. Simplification of complex Ayurvedic concepts into computational models should not compromise their scientific or philosophical integrity.<sup>13</sup>

Clinical validation is another critical requirement. Before AI-assisted diagnostic or predictive tools are implemented in

routine healthcare, they should undergo rigorous validation studies to demonstrate accuracy, reliability, and clinical usefulness. Regulatory authorities increasingly require evidence that AI systems improve patient outcomes while maintaining safety standards.<sup>28</sup>

Good Clinical Practice (GCP) principles remain relevant in AI-supported clinical research. Data integrity, participant confidentiality, informed consent, and continuous monitoring are essential regardless of the technologies employed. Healthcare institutions should establish governance frameworks to oversee AI implementation and ensure compliance with national and international regulations.<sup>29</sup>

As AI technologies continue to evolve, collaboration among Ayurvedic physicians, clinicians, data scientists, ethicists, and regulatory agencies will be necessary to develop responsible and patient-centred applications.

**Table 1.** Potential Applications of Artificial Intelligence in Prasuti Tantra and Stree Roga

Area	AI Application	Potential Benefit
Fertility	Ovulation prediction, embryo assessment	Improved reproductive outcomes
PCOS	Risk prediction and patient stratification	Early diagnosis and personalized care
Pregnancy	Prediction of preeclampsia and GDM	Better maternal-fetal outcomes
Menstrual Health	Cycle tracking and symptom analysis	Early detection of abnormalities
Clinical Research	Participant recruitment	Improved trial efficiency
Data Management	Automated data validation	Enhanced data quality
Real-World Evidence	Analysis of healthcare databases	Long-term effectiveness assessment
Telemedicine	Remote monitoring and follow-up	Improved healthcare accessibility

**Table 2.** Opportunities and Challenges of AI Integration in Ayurveda

Opportunities	Challenges
Personalized medicine	Lack of standardised datasets
Improved diagnosis	Validation of Ayurvedic concepts
Better pregnancy monitoring	Data privacy concerns
Enhanced clinical research	Algorithmic bias
Real-world evidence generation	Regulatory uncertainties
Digital healthcare expansion	Limited interdisciplinary expertise

**CONCLUSION**

Artificial Intelligence is transforming healthcare through predictive analytics, personalized medicine, and advanced data management. In Prasuti Tantra and Stree Roga, AI offers significant opportunities for improving reproductive healthcare, pregnancy monitoring, disease prediction, and clinical research. The principles of individualized healthcare that underpin Ayurveda align closely with emerging trends in precision medicine. AI-assisted technologies may facilitate objective assessment of constitutional characteristics, support personalized treatment planning, and strengthen evidence generation through clinical research.

Although challenges related to standardization, validation, ethics, and data quality remain, continued interdisciplinary collaboration can help overcome these barriers. The integration of Ayurveda, artificial intelligence, and clinical research has the potential to create innovative, patient-centered approaches to women's healthcare while strengthening the scientific foundation of Ayurvedic practice.

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**Conflict of Interest**

The author declares no conflict of interest.

**Ethical Approval**

Not applicable. This review is based on published literature and does not involve human or animal subjects.

**Author Contributions**

The author solely conceptualized, prepared, and approved the manuscript.

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