

Prakriti and Personalized Medicine: An Ayurgenomics Perspective

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ABSTRACT

Background: Advances in genomics, molecular biology, and systems medicine have driven the emergence of personalized medicine, transforming modern healthcare. Ayurveda has long recognized individual variability through Prakriti, a constitutional classification based on the dominance of the three Doshas (Vata, Pitta, and Kapha). The emerging field of Ayurgenomics explores correlations between Prakriti and molecular, genetic, and biological markers.

Objective: To analyze the Ayurvedic concept of Prakriti and evaluate its relevance to modern personalized medicine.

Methods: A narrative literature review was conducted using classical Ayurvedic texts and contemporary scientific literature. Databases including PubMed, Scopus, Google Scholar, and the AYUSH Research Portal were searched using keywords such as "Prakriti," "Ayurgenomics," "personalized medicine," and "gut microbiome." Peer-reviewed articles, reviews, and classical Ayurveda references published in English were included.

Results: The Prakriti describes a constitutional constitution where not just the physiology but also the metabolism, psychology, susceptibility to illness, and response to treatments are predetermined. Evidence shows a link between Prakriti and genomic variants, gene expression, biochemical characteristics, immune mechanisms, and gut microbiota composition, highlighting the biological relevance and genesis of Ayurgenomics. Personalized dietary plans, lifestyle recommendations, pharmacogenomics, stratification for disease risk, and prevention are potential application areas of Prakriti in the clinical setting. However, the lack of proper validation and standard methods for Prakriti assessment, small study groups, and the inadequacy of clinical trials on a large scale hinder its application.

Conclusion: Prakriti could serve as a constitutionally relevant holistic model for personalized therapy. A combination of Ayurvedic paradigms with genomics and systems biology could complement the approach toward precision medicine; however, it needs to be supported by a standardized approach and large-scale, multi-centered studies for biological validation and clinical application.

Keywords: Prakriti, Ayurgenomics, Genomics, Precision medicine, Gut microbiome, System biology.

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INTRODUCTION

Modern medicine is currently experiencing a paradigm shift in which the personalized or precision medicine model has replaced the conventional paradigm because of advancements in genomics, molecular biology, and systems medicine that enable the discovery of biomarkers for disease conditions and treatments. [1] However, despite significant progress, current precision medicine approaches often face limitations such as high inter-individual variability, incomplete understanding of complex disease networks, and an overreliance on

genotype-based classifications that may not fully capture phenotypic diversity and environmental influences. Individualized medicine, however, is not a novel concept because its roots are embedded in ancient medical practices such as Ayurveda. [2]

Ayurveda inherently practices personalized medicine through the concept of Prakriti, or individual constitution. [3] Prakriti is determined at the time of fertilization according to the dominance of three regulatory factors: Vata, Pitta, and Kapha, which remain

unaltered throughout an individual's lifetime. [4] This constitutional framework significantly influences metabolic patterns, disease susceptibility, physiological responses, and reactions to environmental triggers. [5] Unlike current biomedical models that primarily emphasize disease classification and targeted treatment, Ayurveda offers a systems-based and holistic framework that integrates physical, psychological, environmental, and lifestyle factors into healthcare. [6] In this context, phenotype-based classification through Prakriti assumes considerable importance because it enables stratification of individuals according to observable physiological and metabolic traits, thereby supporting predictive, preventive, and personalized healthcare strategies.

Through contemporary scientific investigations, Ayurgenomics has emerged as an interdisciplinary field attempting to correlate Prakriti with genetics, gene expression, and metabolic processes. [7] Current research also indicates associations among genetic variations, biochemical profiles, and gastrointestinal microbiota, further supporting the relevance of Prakriti-based classification in integrative and precision medicine. [8, 9]

AIM & OBJECTIVES

Aim

To analyze the notion of Prakriti within the framework of Ayurveda and assess its applicability in the light of modern-day personalized medicine.

Objective

- To describe the classical concept and classification of Prakriti
- To analyze Prakriti as a phenotypic and functional framework
- To examine current scientific evidence, including ayurgenomics, biochemical variations, and gut microbiome associations
- To assess its role in predictive, preventive, and personalized healthcare.

METHODOLOGY

The present study is a narrative literature review based on classical Ayurvedic texts and contemporary scientific literature published between 2000 and 2025. Data for the review were collected from electronic databases, including PubMed, Scopus, Google Scholar, and the AYUSH Research Portal. The literature search was performed using keywords such as "Prakriti," "Ayurgenomics," "personalized medicine," "precision medicine," and "gut microbiome," either individually or in combination.

The data sources included in this literature review were restricted to original peer-reviewed articles and the classical Ayurveda texts published in English. The literature was limited to the English language for ease of understanding scientific evidence and avoiding inconsistent interpretation across scientific databases. Original research studies, unclear methodology, non-relevant articles, double entries, conference papers, and

non-peer-reviewed articles were omitted from the literature review. Before the screening of titles and abstracts began, duplicate articles were removed from the various databases and were omitted. The selection of the appropriate articles required a thorough screening of titles and abstracts to determine relevance to the goals of this literature review, followed by a review of full articles. Only articles fulfilling the inclusion criteria were ultimately analyzed qualitatively. The literature of this article focuses on how Prakriti is related to genomics, metabolomics, the microbiome, and personalized medicine approaches in Ayurveda and modern health systems.

RESULT

Concept of Prakriti in Ayurveda

Prakriti represents an individual's unique inherent nature and constitution that will never change over an individual's lifetime. [4] This unique constitution of an individual depends upon the dominant status of Vata, Pitta, and Kapha Doshas, which control various bodily activities. [10] Prakriti is formed from Shukra (sperm), Shonita (ovum), the intrauterine environment, and the behavior of the mother, as well as conditions during that season. [4, 11] Seven types of Prakriti are generally listed, which include single, dual, and Sama constitutions. [5] These Prakritis can be identified through differences in physical structure, metabolism, digestion, and character, which is determined by Sattvic, Rajasic, or Tamasic qualities. [6, 12]

Prakriti as a Phenotypic and Functional Classification

Within Ayurvedic science, Prakriti can be seen as an early conceptualization of inter-individual differences in phenotypes and functions. Phenotypically, this classification encompasses morphology, the physical characteristics of the body (e.g., complexion, body type, features of the skin), metabolism, appetite, and temperament. It is often suggested that Pitta dominants have a higher metabolism compared to Kapha dominants (e.g., described as anabolic and stable). [13] With regard to functions, Vata is described as governing the movement and nervous functions; Pitta regulates the metabolism and enzyme function, while Kapha provides structure and stability. [10] Moreover, scientific studies confirm the biological basis of Prakriti by describing differences between phenotypes with regard to metabolism, immunology, biochemistry, and gene expression. [8, 14]

Scientific Evidence Supporting Prakriti Ayurgenomics

A new scientific discipline known as ayurgenomics aims at combining Ayurveda with genomics, thereby facilitating the comprehension of how differences among individuals in their physiological conditions are governed. The application of genomics to Ayurveda involves linking Prakriti with genotype and transcriptome. Research indicates that people within each group of Prakriti manifest certain patterns of gene expression and genetic variations, [7] especially regarding the metabolic, immune, and stress response systems. For example, there are genetic

differences between people with different groups of Prakriti with respect to genes such as EGLN1, which are involved in adaptation to hypoxia. [15]

Moreover, genome-wide studies have provided evidence that Prakriti classification corresponds to biological differences between individuals, thereby validating the usefulness of the classification scheme based on the Ayurvedic notion of Prakriti. [8]

Gut Microbiome and Prakriti

Gut microbiota is vital for metabolism, immunity, and overall health. Modern research shows a strong connection between the microbiome and the constitution of an individual, referred to as Prakriti. Gut microbiota varies depending on the type of Prakriti, which means that host characteristics, as indicated by Ayurveda, can affect the microbiome. [9] People characterized by Kapha usually have microbial populations that support effective metabolism of nutrients and lipids. On the other hand, Pitta's constitution correlates with microorganisms that promote higher metabolic rates. Finally, the microbial populations in Vata subjects are less stable and diverse.

Such distinctions may underlie the formation of different metabolic profiles and predispositions to diseases among people with varying constitutions. [16]

Biochemical and Physiological Variations in Prakriti

Variations in the biochemistry and physiology of people from varying constitutions of Prakriti are vital in providing concrete support for the biological concept of Prakriti. Research studies have shown that individuals from specific constitutional types exhibit unique biochemistry and metabolic traits. [14] Individuals who belong to the Kapha constitution possess high blood lipids as well as a predominance of anabolic metabolic processes, making them susceptible to obesity and dyslipidemia. On the other hand, individuals with a Pitta constitution have higher enzymatic activity, elevated metabolic rates, and, consequently, higher thermal responses. Vata individuals also show inconsistencies with their physiological measurements, especially digestion and energy production. [17]

Differences have also been noted in hematological measurements, immune system functioning, and hormonal balance among Prakriti groups, indicating their biological uniqueness. [8]

Role of Prakriti in Predictive and Preventive Medicine

The Prakriti theory is critical to the development of predictive and preventive medicine, whereby it allows early detection of the likelihood of diseases depending on the body's nature or constitution. According to Ayurveda, differences in Dosh levels predispose patients to certain diseases. For example, patients with a high level of Vata are more likely to suffer from neurodegenerative diseases, while those with higher levels of Pitta suffer from inflammation and metabolism-related disorders, and the same applies to people with high levels of Kapha. [18]

The use of this method makes it easier for the practitioner to adopt a strategy towards achieving balance in the doshas through personalized diets, or Ahara, as well as other preventive measures such as Ritucharya, or seasonally guided lifestyles, among others. [4] This technique is closely associated with the modern concept of predicting, preventing, personalizing, and participating in preventive care, also referred to as P4 medicine. [1]

Clinical Applications of Prakriti in Personalized Medicine

The Prakriti principle is clinically relevant in Ayurvedic medicine and the basis for a personalized approach to diagnostics, disease prevention, and treatment. The identification of the patient's constitutional type enables practitioners to provide the most effective treatment with minimal side effects.

1. Individualized Nutrition and Lifestyle

Among the clinical applications of Prakriti is individualized nutrition and lifestyle therapy. According to Ayurveda, the right Ahara (nutrition) and Vihara (lifestyle) must correspond to the predominant dosha in an individual. Hence, Vata patients will need warm, nutritious, and oily food to compensate for their lack of lubrication, while Pitta patients require cooling and less pungent diets to neutralize the heat. Kapha patients have to consume a light, stimulating diet and increase physical activities to prevent excessive stagnation. [4]

2. Pharmacogenomics and Drug Efficacy

Another application of Prakriti in Ayurvedic medicine involves pharmacogenomic principles of selecting specific herbs and therapies. There are variations in drug metabolism and its effectiveness among patients, which can be attributed to the differences in Prakriti type, analogous to the current pharmacogenomics practice. [18]

3. Management of Diseases

For the management of diseases, Prakriti assessment proves especially helpful in chronic or lifestyle-related conditions like diabetes mellitus, obesity, high blood pressure, and autoimmune diseases. For example, Kapha-type people who are more likely to suffer from metabolic diseases need therapies that help improve metabolism and prevent excess deposition of substances, while Vata-type people may need treatments that help stabilize their physiological processes. [3]

4. Risk Assessment and Prognosis

Besides, Prakriti assessment is beneficial for risk assessment and prognosis because it helps health professionals predict the course of diseases and develop an individual approach to the management of patients. Moreover, it can be applied for preventive care by helping determine who needs special attention and implementing preventive actions in the early stages. [19] In general, it may be said that Prakriti assessment in a medical setting is a holistic and person-centered concept that combines preventive, promotive, and curative care.

DISCUSSION

The concept of Prakriti explains inter-individual variability and closely aligns with the principles of modern personalized and precision medicine. Unlike current precision medicine, which mainly depends on genomics and molecular biomarkers, Prakriti-based classification focuses on phenotypic characteristics, physiological functions, psychological traits, and Dosha predominance. This systems-based approach makes Ayurveda distinct from conventional biomedicine, which is often disease-oriented and mechanistic. Instead, Prakriti promotes a holistic, preventive, and patient-centered healthcare model integrating lifestyle, metabolism, environment, and constitutional individuality. Recent studies in genetics, metabolomics, biochemistry, and gut microbiome research support the biological relevance of Prakriti by demonstrating distinct molecular and physiological profiles associated with different constitutions. [8, 9] However, limitations such as a lack of standardized assessment methods, insufficient reproducibility, and limited large-scale validation still remain.

Despite growing interest, several challenges hinder the integration of Prakriti into mainstream healthcare. There is no universally accepted method for Prakriti assessment, leading to inter-observer variability and reduced clinical reliability. Many studies are based on small sample sizes and lack rigorous clinical validation. Furthermore, differences in the philosophical and methodological foundations of Ayurveda and modern biomedicine complicate their integration. Environmental influences, dietary habits, and epigenetic factors may also alter phenotypic expression and affect classification accuracy. Ethical concerns, including genomic data privacy, informed consent, and equitable access to personalized healthcare technologies, must also be considered.

Future research should focus on standardized and objective Prakriti assessment using digital phenotyping, wearable devices, artificial intelligence, and machine learning. Integration of multi-omics technologies such as genomics, proteomics, metabolomics, and microbiomics may strengthen the scientific basis of Ayurgenomics. Large multicentric clinical studies and interdisciplinary collaborations will be essential to validate Prakriti-based approaches in disease prediction, preventive healthcare, and personalized therapeutics.

CONCLUSION

The idea of Prakriti can be considered a basic and extensive concept in Ayurveda that is highly congruent with the notion of personalized medicine in the contemporary world. The classification of individuals according to their constitution and its regulation by Vata, Pitta, and Kapha creates an essential tool for comprehending differences among people regarding their well-being and pathologies. Some current findings related to the genome, microbiome, and biochemistry demonstrate

the biological significance of Prakriti and its potential as a functional classification system.

The integration of Prakriti and modern methods and approaches can provide some additional information about disease susceptibility and prevention mechanisms. In addition, the implementation of Prakriti into healthcare practice may offer many benefits, from personalized nutrition and lifestyle modification to customized therapy options. Nevertheless, there are still many problems, including a lack of standardization and the scarcity of large-scale validation trials that should be resolved for broad application. Future interdisciplinary investigations and advances in technology can help integrate the Prakriti concept into medicine.

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