



Personalized Nutrition through Ayurnutrigenomics A Holistic Approach Balancing Genes and Doshas for Optimal Health and Wellness

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Abstract

Background: Nutrition exerts a profound influence on human health, disease susceptibility, and longevity. Yet, inter-individual variability in dietary response remains a challenge in clinical nutrition and public health. This variability arises from genetic polymorphisms, metabolic profiles, and environmental interactions. The emerging science of nutrigenomics explores how nutrients affect gene expression and how genetic differences influence dietary needs. Parallel to this, the ancient science of Ayurveda offers a highly evolved system of personalized dietetics through the concept of Prakṛti (constitutional type) and Doṣa balance (Vāta, Pitta, Kapha). Integrating these two paradigms has given rise to Ayurnutrigenomics, a novel interdisciplinary approach combining molecular genetics with Ayurvedic principles to achieve individualized nutritional optimization. Objectives: This review aims to (1) explore correlations between Ayurvedic Prakṛti types and modern genomic traits, (2) analyze the interaction between diet, gene expression, and Doṣic balance, (3) highlight the potential of Ayurnutrigenomics in disease prevention and wellness promotion, and (4) propose an integrative model for personalized nutrition uniting Ayurveda and genomics. Methods: A comprehensive literature review was conducted using Ayurvedic classical texts (Charaka Saṃhitā, Suśruta Saṃhitā, Aṣṭāṅga Hṛdaya) and biomedical databases such as PubMed, Scopus, and Google Scholar. Keywords included Ayurnutrigenomics, Ayurgenomics, Prakṛti-genomics, personalized diet, nutrigenomics, Ayurveda, and precision nutrition. Peer-reviewed studies (2005–2025) examining genomic correlates of Prakṛti and nutrient-gene interactions were analyzed. Conceptual parallels were drawn between Ahāra Vidhi Vidhan (Ayurvedic dietary principles) and molecular nutrition findings. Results: Modern genomic studies reveal that Ayurvedic Prakṛti classifications correspond to distinct gene expression patterns and metabolic pathways. Pitta Prakṛti individuals exhibit higher expression of oxidative metabolism genes; Kapha Prakṛti types show upregulation of lipid synthesis and storage genes; Vāta Prakṛti types display gene profiles linked to neural and stress

regulatory mechanisms. These genomic signatures validate Ayurveda's constitution-based physiological framework. Nutrigenomic research supports the concept that diet can epigenetically modulate gene expression—an idea consistent with Ayurvedic principles of Ahāra influencing Agni, Dhātu, and Ojas. Integrating Prakṛti-based assessment with genetic biomarkers provides a robust foundation for individualized dietary recommendations, offering preventive strategies against metabolic, inflammatory, and degenerative diseases. Conclusion: Ayurnutrigenomics bridges the ancient wisdom of Ayurveda and modern molecular nutrition, creating a comprehensive framework for personalized, preventive, and sustainable healthcare. By aligning genetic individuality with Doṣic balance, it emphasizes health preservation rather than disease management. This holistic model enables practitioners to develop diet and lifestyle plans tailored to both genotype and Prakṛti, enhancing therapeutic efficacy and wellness outcomes. Future directions include Prakṛti-genome mapping, nutrigenomic profiling of Ayurvedic diets, and AI-assisted predictive tools for integrative nutrition. Ayurnutrigenomics thus stands as a pioneering approach to harmonizing genes, nutrition, and consciousness for optimal health and well-being.

Keywords: Ayurnutrigenomics, Prakṛti, Nutrigenomics, Ayurveda, Personalized nutrition, Gene–diet interaction, Doṣa balance, Integrative medicine, Epigenetics, Preventive health.

Introduction

Nutrition is one of the most fundamental determinants of health, longevity, and disease prevention. However, individuals respond differently to the same dietary intake—what nourishes one person may cause imbalance or disease in another. This inter-individual variability is shaped by a complex interplay of genetic makeup, gut microbiota, metabolic profile, and environmental influences. In recent years, the emerging science of nutrigenomics has provided insight into how nutrients modulate gene expression, metabolic pathways, and epigenetic mechanisms that influence health outcomes. 1

The concept of personalized nutrition—customizing dietary recommendations according to an individual's genetic and metabolic background—has evolved as a critical pillar of modern preventive and precision medicine. Nutrigenomics recognizes that specific genetic polymorphisms, such as MTHFR, FTO, APOE, and PPAR γ , determine how individuals absorb, metabolize, and respond to nutrients. By understanding these variations, it becomes possible to design dietary patterns that optimize health and reduce disease susceptibility.2

Interestingly, the foundational principles of personalized nutrition were articulated more than 5000 years ago in Ayurveda, the ancient Indian system of medicine. Ayurveda emphasizes biological individuality through the concept of Prakṛti—the unique psychophysiological constitution of a person formed at conception through the interaction of the Tridoṣas: Vāta (air and ether), Pitta (fire and water), and Kapha (earth and water). Each Prakṛti type is characterized by distinct anatomical, physiological, and psychological traits that determine a person's dietary requirements, disease susceptibility, and response to environmental stimuli. The Ayurvedic dictum “Ahāraḥ pradhānaṃ aushadham” (food itself is the foremost medicine) underscores the importance of diet as a tool for both prevention and therapy. 3

Whereas modern nutrition primarily relies on quantitative parameters—caloric intake, macronutrient ratios, and biochemical indices—Ayurveda evaluates food through qualitative aspects such as Rasa (taste), Guna (qualities), Virya (potency), Vipaka (post-digestive effect), and Prabhava (specific action). The ultimate goal is to maintain equilibrium of Doṣas and support Agni (digestive fire), thereby sustaining optimal health or Swasthya. These principles parallel the objectives of nutrigenomics, which also seeks to restore molecular homeostasis by aligning diet with individual physiology. 4

Recent advances in molecular biology and bioinformatics have revealed fascinating parallels between Ayurvedic Prakṛti types and genomic patterns. Studies have demonstrated that Pitta Prakṛti individuals exhibit enhanced expression of genes involved in energy metabolism and mitochondrial activity, Kapha Prakṛti individuals show upregulation of genes related to lipid synthesis and storage, and Vāta Prakṛti individuals exhibit elevated activity of genes associated with neuro-muscular signaling and stress regulation. These findings validate the ancient Ayurvedic understanding of individualized physiology through a molecular lens, giving rise to a new interdisciplinary field termed Ayurnutrigenomics. 5

Ayurnutrigenomics integrates Ayurvedic wisdom with genomic science, aiming to understand how Ahāra (diet), Prakṛti, and gene expression interact to shape health outcomes. It bridges the gap between the Doṣic balance described in classical texts and the gene-diet interactions revealed by modern research. This approach acknowledges that health is not merely the absence of disease but a dynamic equilibrium between internal constitution and external environment—a principle shared by both Ayurveda and systems biology. 6

As chronic lifestyle diseases such as obesity, diabetes, cardiovascular disorders, and autoimmune conditions continue to rise globally, there is an urgent need for integrative models that address both genetic predisposition and holistic balance. Ayurnutrigenomics offers a comprehensive framework for preventive and precision healthcare, combining ancient dietetics with modern genomic tools. It enables clinicians to develop individualized dietary plans based on both Doṣa-Prakṛti analysis and genetic testing, ensuring that nutrition is tailored to the body's innate tendencies rather than imposed by generic guidelines. 7

Thus, the integration of Ayurveda and nutrigenomics not only revitalizes ancient knowledge but also enriches modern nutritional science with personalized, sustainable, and holistic dimensions. This review explores the scientific foundation, conceptual framework, and clinical potential of Ayurnutrigenomics, emphasizing its role in balancing genes and Doṣas for optimal health and wellness.

Aims and Objectives

- To explore the scientific correlation between Ayurvedic Prakṛti and modern genomic traits.
- To analyze how genetic polymorphisms and Doṣic imbalances influence metabolic responses to diet.
- To review the concept of Ayurnutrigenomics and its role in personalized nutrition and preventive healthcare.
- To propose an integrated model combining Ayurvedic and molecular biomarkers for optimizing health and disease prevention.

Materials and Methods

This review is based on an extensive search of Ayurvedic classical texts (Bṛhat Trayī, Laghu Trayī) and modern biomedical literature indexed in PubMed, Scopus, and Google Scholar. Keywords such as Ayurnutrigenomics, Prakriti genomics, nutrigenomics, personalized diet, and Ayurgenomics were used. Studies on Prakriti-genotype correlations, nutrient-gene interactions, and Ayurvedic dietary interventions were critically analyzed. Classical Ayurvedic dietetic principles were cross-referenced with modern molecular nutrition data.

Ayurvedic Conceptual Framework

Ayurveda classifies human constitution into seven Prakṛti types based on the predominance of Doṣas—Vāta, Pitta, and Kapha. Each type exhibits unique physiological, psychological, and metabolic tendencies. 8

Prakṛti Type	Dominant Doṣa	Metabolic Traits	Dietary Considerations
Vāta	Air & Ether	Irregular metabolism, low endurance	Warm, oily, grounding foods
Pitta	Fire & Water	High metabolism, sharp appetite	Cooling, bitter, sweet foods
Kapha	Earth & Water	Slow metabolism, fluid retention	Light, dry, spicy foods

Ayurvedic nutrition (Ahāra Vidhi Vidhan) prescribes food choices and combinations according to Prakṛti, Agni (digestive fire), Ritu (season), and Deśa (geographical factors). These parameters parallel the genomic and epigenomic influences observed in nutrigenomic studies, demonstrating Ayurveda's advanced understanding of biological individuality. 9

Nutrigenomics and Gene-Diet Interactions

Nutrigenomics, a rapidly advancing branch of molecular nutrition, investigates how dietary components interact with the human genome to influence gene expression, metabolic regulation, and disease outcomes. It embodies the idea that food is more than a source of energy—it acts as a biological signal capable of modulating molecular pathways. Through nutrigenomics, researchers aim to decipher how specific nutrients, bioactive compounds, and dietary patterns influence transcription factors, signaling cascades, and epigenetic modifications that collectively determine health status. 10

At its core, nutrigenomics studies three interrelated dimensions:

- Nutrigenetics – the influence of genetic variations (e.g., SNPs) on nutrient metabolism and dietary response.
- Nutrigenomics (strict sense) – how nutrients regulate gene expression and cellular function.
- Nutritional epigenomics – how dietary factors induce reversible changes in gene activity via DNA methylation, histone modification, and non-coding RNAs, without altering the DNA sequence.

Together, these disciplines provide a mechanistic basis for personalized nutrition, where dietary advice can be tailored to an individual’s genetic profile.

1. Molecular Mechanisms of Nutrient–Gene Interaction

Nutrients and phytochemicals act as ligands for nuclear receptors such as PPARs (Peroxisome Proliferator-Activated Receptors), LXR (Liver X Receptor), and FXR (Farnesoid X Receptor), thereby modulating transcription of metabolic genes. 11

For instance:

- Omega-3 fatty acids activate PPAR- α , enhancing fatty acid oxidation and lowering triglycerides.
- Polyphenols like curcumin and resveratrol modulate NF- κ B and Nrf2 pathways, reducing oxidative stress and inflammation.
- Dietary methyl donors such as folate, choline, and betaine regulate DNA methylation, influencing the expression of genes like MTHFR and DNMT1, which are crucial for genomic stability.

These molecular events highlight that nutrients are epigenetic modulators, capable of turning genes “on” or “off” in response to the internal and external milieu—a principle remarkably parallel to the Ayurvedic concept of Ahāra influencing Agni (digestive fire) and Dhātu (tissue metabolism). 12

2. Genetic Polymorphisms Influencing Nutrient Metabolism 13,14,15

Several well-studied gene–diet interactions exemplify how genetic variations determine nutritional outcomes:

Gene/Pathway	Key Function	Genetic Variant/Polymorphism	Dietary Interaction & Health Implication
FTO (Fat mass and obesity-associated gene)	Regulates energy balance and appetite	rs9939609 (A/T)	High-fat diets increase obesity risk in risk allele carriers; improved outcomes with low-fat, high-fiber diet.
MTHFR (Methylenetetrahydrofolate reductase)	Folate metabolism and methylation	C677T mutation	Reduced enzyme activity; requires higher folate, B12, and choline intake.
APOE (Apolipoprotein E)	Lipid transport and metabolism	ϵ 2, ϵ 3, ϵ 4 variants	APOE4 carriers respond better to low-saturated-fat

			diets for CVD prevention.
PPARγ (Peroxisome proliferator-activated receptor gamma)	Adipocyte differentiation, insulin sensitivity	Pro12Ala variant	Modulates response to dietary fat; higher MUFA intake improves insulin sensitivity.
TCF7L2	Glucose homeostasis	rs7903146	Increases diabetes risk; low glycemic index diets mitigate risk.
SOD2	Antioxidant defense	Val16Ala polymorphism	High-antioxidant diets offset oxidative stress in variant carriers.

Such findings emphasize that dietary recommendations cannot be universally applied, as genetic differences dictate how nutrients are utilized and how metabolic balance is maintained or disrupted.

3. Epigenetic Regulation by Diet

Epigenetics bridges the gap between genotype and phenotype by explaining how environmental and nutritional factors influence gene expression without altering the DNA sequence. Nutrients such as folate, selenium, curcumin, and sulforaphane act as epigenetic modulators influencing histone acetylation, DNA methylation, and microRNA expression. 16

For example:

- Curcumin downregulates histone deacetylases (HDACs), thereby enhancing tumor suppressor gene expression.
- Resveratrol activates SIRT1, a longevity-associated gene that regulates mitochondrial biogenesis and insulin sensitivity.
- Green tea catechins (EGCG) inhibit DNA methyltransferases (DNMTs), preventing aberrant methylation linked to cancer.

These effects demonstrate that dietary molecules have gene-level intelligence, capable of restoring or disturbing homeostasis—similar to how Ayurveda interprets Ahāra as a factor that either harmonizes or disturbs Doṣic balance depending on compatibility (Satmya–Asatmya).

4. Gut Microbiome as a Mediator of Gene–Diet Interaction

The gut microbiome acts as a critical intermediary between diet and gene expression. Microbial metabolites such as short-chain fatty acids (SCFAs) influence host gene regulation, epigenetic programming, and immune signaling. Dysbiosis contributes to inflammation and metabolic disorders. Ayurvedic dietary and lifestyle principles—regular eating habits, use of Ahāra Dravyas with probiotic potential (e.g., buttermilk, fermented foods), and avoidance of incompatible foods—preserve gut health, aligning with modern findings that the microbiome is a key determinant of nutrigenomic responses. 17

5. Ayurvedic Correlation: Parallels between Nutrigenomics and Doṣa-based Nutrition 18

The Ayurvedic framework of Tridoṣa offers a physiological and energetic classification analogous to the genetic and metabolic individuality identified in nutrigenomics:

- Vāta Prakṛti individuals, characterized by irregular digestion and variable metabolism, parallel those with genes associated with stress metabolism and neuronal excitability.
- Pitta Prakṛti individuals exhibit efficient metabolism akin to higher expression of oxidative and mitochondrial genes, requiring diets that prevent inflammatory overactivity.
- Kapha Prakṛti types correspond to individuals with polymorphisms predisposing to slower metabolism, lipid accumulation, and insulin resistance, necessitating Laghu (light) and Rukṣa (dry) diets to balance anabolism.

Hence, Ayurveda intuitively recognized the gene–diet–phenotype continuum millennia ago, long before the development of molecular biology. Nutrigenomics now provides the scientific validation of these ancient principles by revealing the biochemical pathways underlying Doṣic imbalances and dietary effects.

Nutrigenomics elucidates the molecular basis of individual dietary response, while Ayurveda provides the phenotypic and energetic context through Prakṛti and Doṣa analysis. Together, they form the foundation of Ayurnutrigenomics—a comprehensive science that acknowledges diet as both a molecular modulator and a holistic healer. By understanding how genes and Doṣas interact with food, we can design precise nutritional regimens that sustain balance, prevent disease, and promote lifelong wellness. 19

Clinical and Preventive Implications 20,21

Obesity and Metabolic Syndrome:

Kapha-dominant individuals with FTO polymorphisms benefit from low-fat, high-fiber, and thermogenic diets (e.g., barley, ginger, black pepper).

Diabetes Mellitus:

Pitta-Kapha imbalance with insulin resistance corresponds to altered PPAR- γ expression; managed with Tikta (bitter) and Kashāya (astringent) foods like fenugreek and turmeric.

Cardiovascular Diseases:

Kapha-Pitta dominance linked to dyslipidemia; corrected through Ruksha, Laghu diet and Virechana therapy.

Mental Health and Neurodegeneration:

Vāta-dominant individuals are prone to anxiety and neuroinflammation; diets rich in omega-3 fatty acids and Snigdha (unctuous) foods can stabilize mood and cognition.

Discussion

The integration of Ayurveda and modern molecular nutrition marks a transformative step toward a truly personalized healthcare paradigm. While nutrigenomics focuses on identifying the molecular basis of nutrient-gene interactions, Ayurveda provides an already-established, phenotype-based framework to understand human diversity through Prakṛti analysis. Ayurnutrigenomics, therefore, represents a synthesis of ancient holistic philosophy and contemporary systems biology, translating genomic individuality into actionable diet and lifestyle recommendations. 22

Recent research in Ayurgenomics has established strong correlations between Prakṛti and specific gene expression profiles. For instance, Pitta Prakṛti individuals have been shown to express higher levels of genes related to oxidative phosphorylation and mitochondrial activity (CYP2C19, COX5A), correlating with their higher metabolic rate and thermogenic tendency. Kapha Prakṛti individuals display upregulated lipid synthesis genes (LPL, SREBF1), aligning with their predisposition to obesity and metabolic disorders. Conversely, Vāta Prakṛti individuals express genes involved in neurotransmission and stress regulation (DRD4, COMT), reflecting their quick mental reactivity but variable energy metabolism. 23

These findings suggest that Ayurvedic phenotyping reflects underlying genomic variations, confirming Ayurveda's advanced understanding of human biological individuality long before the era of molecular genetics. From a clinical perspective, Ayurnutrigenomics facilitates precise diet-based interventions that restore Doṣic equilibrium while correcting molecular imbalances. For example: 24,25

- In Kapha-dominant individuals with FTO or PPAR γ polymorphisms, thermogenic and Laghu (light) diets rich in fiber and spices like ginger and black pepper can reduce adiposity and improve insulin sensitivity.
- In Pitta types with oxidative stress tendencies, diets rich in cooling and antioxidant foods like amla, cucumber, and leafy greens can modulate inflammatory gene expression and reduce mitochondrial ROS generation.
- Vāta types, prone to anxiety and irregular digestion, benefit from unctuous and warming foods that stabilize neurotransmitter activity and improve gut-brain axis function.

Such personalized strategies mirror nutrigenomic interventions in precision nutrition but with the added advantage of Ayurvedic multidimensional assessment—considering not only genes but also Agni (digestive fire), Manas (mind), Ritu (season), and Desha (geography). 26

Ayurnutrigenomics also holds immense potential for preventive and predictive healthcare. Prakṛti-based screening could serve as an inexpensive, non-invasive biomarker to identify populations at risk of metabolic syndrome, cardiovascular disease, or inflammatory disorders. This could be integrated into public health programs where Ayurvedic constitution typing, combined with genetic profiling, guides dietary recommendations to prevent disease onset rather than merely treat symptoms. 27

Furthermore, the emerging field of Ayur-epigenomics provides mechanistic explanations for how Ayurvedic diet and lifestyle interventions influence gene expression. Nutrients and phytochemicals from Ayurvedic diets—such as curcumin, resveratrol, ashwagandha, and guduchi—act as epigenetic modulators, regulating DNA methylation, histone acetylation, and miRNA expression. For example, curcumin can downregulate pro-inflammatory genes (NF-κB) and upregulate antioxidant genes (Nrf2), providing molecular evidence for its Pitta-shāmaka and Kapha-shāmaka actions described in classical texts. 28

The integration of omics sciences (genomics, proteomics, metabolomics, and microbiomics) with Ayurvedic dietary and Panchakarma principles can advance the field of integrative personalized medicine (IPM). Studies using metabolomic profiling of individuals undergoing Ayurvedic detoxification therapies (such as Virechana and Basti) have shown favorable modulation in lipid and glucose metabolism biomarkers, suggesting that traditional interventions can exert measurable molecular effects. 29

However, challenges remain. The standardization of Prakṛti assessment tools across practitioners is essential to maintain reproducibility and scientific credibility. The subjective nature of constitution assessment requires development of validated digital platforms and genomic databases linking Prakṛti phenotypes with molecular markers. Ethical concerns also arise regarding genetic data privacy and equitable access to personalized healthcare. Collaborative frameworks between Ayurvedic institutions and genomic research centers are needed to ensure robust cross-validation and translational applicability. 30

In summary, the discussion around Ayurnutrigenomics demonstrates that the integration of Prakṛti-based insights and nutrigenomic science provides a multilayered understanding of human physiology—from molecular signaling to systemic homeostasis. It not only validates Ayurveda in contemporary biomedical terms but also extends nutrigenomics beyond reductionist biochemistry into holistic living systems science.

Conclusion

Ayurnutrigenomics represents a groundbreaking synthesis of two paradigms: the ancient wisdom of Ayurveda and the modern precision of genomic science. It recognizes that optimal health arises from harmony between genetic potential and Doṣic balance—between the biological and the energetic aspects of human existence. By aligning diet, genes, and constitution, Ayurnutrigenomics provides an innovative model for personalized, preventive, and sustainable healthcare. Unlike conventional medicine, which often focuses on disease management, this approach emphasizes health preservation (Swasthasya Swasthya Rakshanam) and early correction of imbalance (Aturasya Vikara Prashamanam) through individualized nutrition and lifestyle guidance. The convergence of Ayurveda and genomics transforms the understanding of nutrition from a

generalized prescription into a dynamic, individual-centric process. Every food item acts as an epigenetic signal, capable of influencing gene expression and metabolic balance. When these signals are aligned with one's Prakṛti and Agni, they maintain physiological equilibrium; when misaligned, they initiate pathogenesis—a principle Ayurveda identified thousands of years ago under the doctrine of Ahāra Asatmya (incompatible food combinations).

References

1. Prasher B, Negi S, Aggarwal S, et al. Whole genome expression and biochemical correlates of extreme constitutional types defined in Ayurveda. *J Transl Med*. 2008;6:48.
2. Rotti H, et al. Determinants of Prakriti, the human constitution types: Implications for personalized medicine. *J Ayurveda Integr Med*. 2014;5(3):167–175.
3. Mukherjee P, et al. Ayurveda and personalized medicine: An integrative approach. *Curr Sci*. 2017;113(6):1137–1146.
4. Makhija R, et al. Ayurnutrigenomics: A new approach in personalized nutrition. *J Ayurveda Integr Med*. 2022;13(2):100–110.
5. Das R, et al. Nutrigenomics and Ayurveda: A synergistic approach. *AYU*. 2020;41(1):15–22.
6. Bhushan P, et al. HLA gene polymorphism and the concept of Prakriti. *J Altern Complement Med*. 2005;11(3):349–353.
7. Bhasme S, et al. Nutrigenomic insights into Ayurvedic dietetics. *Int J Ayur Pharm Chem*. 2021;15(2):45–53.
8. Mathur R, et al. Ayurveda and the personalized approach in preventive cardiology. *Front Cardiovasc Med*. 2019;6:14.
9. Chopra A, et al. Genomic correlation of Prakriti with gene expression patterns. *BMC Genomics*. 2019;20:891.
10. Misra A, et al. Role of nutrigenomics in metabolic health. *Nutr Rev*. 2019;77(3):184–194.
11. Joshi KS, et al. Genetics and Ayurveda: Correlations of Prakriti with SNPs. *Ind J Med Res*. 2016;143:556–567.
12. Sethi A, et al. Nutrigenomics in Ayurveda: The future of personalized dietetics. *J Ethnopharmacol*. 2021;275:114124.
13. Patwardhan B, et al. Integrative Ayurveda genomics for personalized health. *Genome Med*. 2015;7:88.
14. Sharma R, et al. Ayurvedic Prakriti and metabolic individuality. *Clin Epigenetics*. 2019;11:23.
15. Tripathi R, et al. Ayurgenomics: Correlating genomics and Prakriti for precision medicine. *Mol Genet Genomics*. 2017;292:1–11.
16. Sharma A, et al. Nutrigenomic modulation through Ayurvedic herbs. *Phytother Res*. 2018;32(9):1734–1742.
17. Dey S, et al. Ayurgenomics: A way forward for personalized health care. *Pers Med*. 2015;12(2):107–118.
18. Shilpa S, Murthy CGV. Ayurvedic constitution and its genetic basis. *J Ayurveda Integr Med*. 2011;2(2):120–128.

19. Mishra S, et al. Gene–diet interactions and Ayurvedic correlations. *Front Nutr.* 2020;7:112.
20. Gupta R, et al. Dietary phytochemicals and gene regulation. *Nutrients.* 2018;10(9):1140.
21. Sharma M, et al. Ayurveda-inspired nutrigenomic strategies for obesity. *Evid Based Complement Altern Med.* 2021;2021:6677812.
22. Bhardwaj R, et al. Ayurveda and epigenetics: A convergence. *J Integr Biol.* 2018;22(4):215–223.
23. Udupa KN, et al. Ayurvedic Prakriti and biological variability. *Anc Sci Life.* 2006;26(1):1–10.
24. Pandey B, et al. Nutrigenomics: The science of gene-diet interaction. *Mol Biol Rep.* 2020;47(2):1251–1261.
25. Patil S, et al. Ayurveda-based biomarkers in personalized medicine. *J Ethnopharmacol.* 2019;243:112109.
26. Singh RH. Exploring Ayurvedic anthropology and genomic links. *Indian J Hist Sci.* 2010;45(3):367–378.
27. Tiwari M, et al. Ayurvedic dietetics and nutrigenomics: The link. *AYU.* 2018;39(3):150–157.
28. Pal R, et al. Ayurgenomics in India: Trends and challenges. *Curr Pharm Des.* 2019;25(16):1848–1857.
29. Chaturvedi S, et al. Epigenetic regulation through traditional diets. *Nutrients.* 2022;14(4):782.
30. Sharma S, et al. Personalized nutrition and Ayurveda interface. *Nutr Metab Insights.* 2020;13:1178638820944378.