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AYURNUTRIGENOMICS: FUTURE OF HEALTH THROUGH FOOD

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ABSTRACT

Ayurnutrigenomics is an emerging field of *Ayurveda* in which after assessment of the constitution type or *Prakriti*, a personalized approach in the predictive, preventive, and curative aspects is formulated by designing a suitable dietary, lifestyle and therapeutic regime as it determines the state of health and diseased conditions in an individual. With the advancement in genomics, human genome sequencing, cataloguing of human genetic variations and SNP mapping of human genome is possible and the investigators are now able to pinpoint the specific polymorphism linked to sensitivity to diet or an altered risk of disease. Certain diet regulated genes are likely to play a role in the onset, incidence, progression, and severity of chronic diseases. A nutrient in a diet can either interact directly by acting as a transcription factor and leading to expression of the respective gene or can interact epigenetically by changing gene expression by changing the epigenome/DNA structure or by inducing genetic variation in the building block of a genome itself. Similarly, in *Ayurveda*, condition of Doshas, Agni Bal, factors like geography,

individual's ability to digest foods, vary person to person. In Samhitas, detailed description of eatables that are contrary to Deh Dhatus and behave antagonist to them in terms of properties, combination, processing, dose etc. or in natural composition aggravates Doshas but do not expel them out of the body, eventually, causing a varied range of diseases. This clearly verifies the need of personalization of diet and individualization of lifestyle prescription for improving health and preventing disease.

KEYWORDS: Ayurnutrigenomics, Nutrient, Health, DNA, Prakriti, Genome.

INTRODUCTION

Nutrigenomics is the study of relationship between nutrients and its effect on health by acting directly or indirectly on gene expression.

Ayurnutrigenomics is an emerging field of *Ayurveda* in which after an assessment of the constitution type of a one's *Prakriti*, a personalized approach in the predictive, preventive, and curative aspects is formulated by designing a suitable dietary, lifestyle and therapeutic regime.

This is because according to *Ayurveda* the *Aahar* determines the state of health and diseased conditions in an individual. *Ayurveda* advises merging food with natural drugs to balance the three known *Doshas*—namely, *Vata*, *Pitta*, and *Kapha*—to maintain a healthy life. Based on the study of one’s genetic makeup, nutritional requirement of the individual can be determined, as knowledge about polymorphism sites (SNPs) and the interaction between the genes and the diet, can interpret why and how a person responds differently to the same nutrient. This gives rise to already existing concept in “*Ayurveda*: Personalised Nutrition” keeping in mind one’s genetic makeup or *Prakriti*. While the concept of 'Personalised Nutrition' in *Ayurveda* parallels modern nutrigenomics, there remain scientific challenges and ongoing debates regarding direct integration of these frameworks.

The Foundational Concepts of Ayurnutrigenomics

According to *Ayurveda, Prakriti* of an individual is made up of *Vata*, *Pitta* and/or *Kapha* and is fixed during gestational period and it depends on a variety of factors such as *Shukra-Shonita, Mahabhuta Vikar, Matraj Aahar-Vihar, Kaal Garbhashaya, Jati, Desh, Kaal etc.* Any type of *Aahar-Vihar* that causes disturbance in physiology of these *Doshas* leads to a condition called *Vikruti* or disease. Prakriti relates to the dosha balance at conception,

whereas Vikruti alludes to the dosha balance in the present, and hence identifies the kind of imbalance or sickness. Prakriti and Vikruti are both made up of several "Doshas" in different quantities.[1] The three main therapeutic components of *Ayurveda* namely, food (*Aahar*), daily activities (*Vihar*) and medicine (*Aushad*) are said to balance these *Doshas* to treat an individual. Amongst these three, the food whether ingested by mother during pregnancy that creates one's *Prakruti* or the food ingested daily causing imbalance creating *Vikruti* is usually the most forgotten component. The relationship between gene expression and nutrients is still under investigation, but a nutrient in a diet can either interact directly by acting as a transcription factor and leading to expression of the respective gene or can interact epigenetically by changing gene expression by changing the epigenome/DNA structure or by inducing genetic variation in the building block of a genome itself. This alteration in genetic expression can have both positive and negative impact. Food plays an important role in maintaining *Ayu* of *Ayurveda.* Thus, it is important to know what to eat and what not to eat? Also, this takes us to the concept of "Personalised Approach" towards an individual's health, which already exist in *Ayurveda* through *Dashavidh Pareeksha, Prakruti Pareekshana, Trividha Pareeksha, etc.* Scientists at CSIR-Institute of Genomics and Integrative Biology (CSIR-IGIB) in New Delhi, The Ministry of Science and Technology, hypothesize an opportunity to analyse if the *Prakriti*-based characterization of individuals has a genetic basis.[2] For the first time, assimilation of *Ayurvedic Prakriti*, classification methods with modern genomics resulted in the discovery of the molecular and genomic basis of the theory of *Dosha Prakriti*. Hence, modernizing the concept of "*Purusham purusham vikshaya"* with the integration of knowledge of genetics, for creating the molecular basis for personalised approach can revolutionize the field of healthcare. These discoveries are preliminary, and larger studies are needed to validate the molecular and genomic basis for *Prakriti* classification.

Ayurgenomics: The Genetic Basis of Prakriti

A genome is a complete set of DNA that includes all the organism's genes along with its hierarchical, three-dimensional structural configuration. The human genome is made up of 23 chromosomal pairs (diploid), each with 3 billion base pairs of DNA inherited from either parent. There are several variants in the human genome sequence known as single nucleotide polymorphisms (SNP). Some of these differences are frequent and seen in a significant number of individuals, whereas others are uncommon. If the differences occur in fewer than 1% of the population, they are most likely categorized as mutations. Many uncommon

disorders are monogenic, meaning they are caused by mutations in a single gene, for example, haemophilia and beta-thalassemia. However, diabetes, asthma, and cardiovascular disease are multigenic complicated disorders, i.e., including many genes.[3]

Genomics is a branch of biology that focuses on the evolution, function, structure, editing, or mapping of genomes.[4] Basically, genomics is a predictive personalized interpretation of what DNA tells about the respective individual based on genetic makeup and *Ayurveda* is an ancient personalized medicinal system, where the appropriate drug and dietary regime are chosen based on a clinical examination of the patient's disease endophenotype, basic constitution, and health status at the time of administration.[5]

Healthy people of different *Prakriti* types, as recognized by *Ayurveda*, display significant differences in biochemical and haematological parameters. Genomic studies showed that the main *Prakriti* types differed significantly in gene expression levels, particularly those involved in immunity, cell division, blood coagulation, etc.[6]

Epigenetics is believed to be a key component of *Ayurveda*, as it amalgamates the genotypic and phenotypic variations. *Ayurveda* describes the factors (behaviour, lifestyle, stress, diet, and digestion, as well as the environment) influencing the *Deha* (body) *Prakriti* (psychological and physiological composition), which relates to the phenotype, along with *Janma* (birth) *Prakriti*, which relates to the genotype. Understanding this will result in improved interaction and comprehension with the existing healthcare system, and greater connectivity of both fields of science in the operations of good health (Sharma and Keith Wallace, 2020).[7]

Both *Prakriti*-oriented medicine and customized medicine emphasize the significance of health enhancement and illness management.[8] The domain of epigenomics examines the impact of proteins, metabolic processes, genetic and non-genetic variables on human physiology, as well as differences in mechanisms that play a crucial part in an individual's health risk. *Ayurgenomics* can help explain how the present medications can be utilized more successfully if they are targeted at people with certain Prakriti.[9]

Nutritional Integration: Ayurnutrigenomics

According to *Ayurveda*, food plays an important role in self-preservation and disease management in an individual. It is not seen just an energy source but also as a medicine.

Acharya Kashyapa called food as *Mahabheshajya*. It is eaten up in greater quantities than any other drug and also, holds the power to disturb the "physiome" of an individual – one's biomolecular basis. Due to this reason, it is important to examine its effect and interaction with the DNA for proper understanding of diseases and their treatments.

Ayurnutrigenomics is an emerging field of interest pervading *Ayurveda* systems biology, where the selection of a suitable dietary, therapeutic, and style of living is made based on clinical assessment of an individual maintaining one's *Prakriti*. This *Ayurveda*-inspired concept of personalized nutrition is a novel concept of nutrigenomic research for developing personalized functional foods and nutraceuticals suitable for one's genetic makeup with the help of *Ayurveda*.[9]

As we develop toward the "omics" age of science, we find notable parallelism with the thoughts of our ancient scientific lineage, including *Ayurveda*. At that time, they also felt the necessity of correlating nutrition with differences in biological phenotypes, which is the expression of individual genome or variome. We find the concept of Ayurgenomics and then Ayurnutrigenomics back at the time of *Ayurveda* quite novel and contemporary even today.

The National Institute of Health defines genomics as the study of all the genes of a person and their functions, including the interactions of those genes with each other and with a person's environment.[10] The concept of nutrigenomics also includes the influence of genetic variations on pharmacokinetics and Nutrikinetics i.e. all kinds of metabolism effects of nutrients on human body like absorption, elimination, metabolism etc. This optimizes nutrition according to individual's genotype and *Ayurvedic* concept of nutrition can be translated in the same way. However, molecular nutrition research is broader than nutrigenomics because it includes the effect of nutrients and food/food components on whole-body physiology and health status at the systems biological level.

Nutrigenomics also includes precise determination of molecular mechanisms essential to human health and disease, advocating an enormous prospective for promoting health, and lowering mortality and morbidity. Sophisticated molecular techniques based on the different omics (genomics, epigenomics, transcriptomics, proteomics, and metabolomics)[11,12] may help us in this regard to develop a better understanding toward Ayurvedic principles on nutrition and genomics. Despite technological advances in omics, there is a lack of large-scale, controlled clinical studies specifically evaluating the impact of Ayurnutrigenomic

approaches on health outcomes. A nutritional epidemiology approach, where we study the role of nutrition in the causes and prevention of disease to guarantee precision of health recommendations, is currently needed to develop evidence-based quantification.

Aahar: Food, Guna, and Gene Expression

Ahara (food) is one of the three main pillars of life according to *Ayurveda*; the other two being *Swapna* (sleep) and *Brahamcharya* (regulated sex life). Another interesting taxonomy of foods is based on their effect on psychological dispositions of individuals. According to *Ayurveda*, there is a subtle link between disease manifestation and the six psychological expressions, such as lust, anger, greed, desire, attachment, and ego. These psychological states are closely linked to foods. This connection is further discussed in terms of three states of being including *Sattva*, *Rajas*, and *Tamas*. *Sattva* is the contented state, *Rajas* an excited state whereas *Tamas* relates to a lethargic disposition, i.e., foods can induce these states of mind.[13,14] There here are different effects of different component of food on gene expression. Such as[15]

- Carbohydrates → High protein diet → Obesity → Decrease in mRNA levels for the oxygenic neuropeptides AgRP (Agouti Related Peptide).
- Fats → Metabolism, growth, and cell differentiation → Oxidized fatty acid regulate the intracellular calcium levels which affect cell signalling cascades targeting the nucleus.
- Protein → Feeding low protein → Decrease insulin level or Decrease movement of intracellular calcium.
- Amino Acid → Regulate protein translation → Through modulation of elF2B activity, 4E-BP phosphorylation and protein S6 phosphorylation.
- Minerals → Zinc → Regulation of small intestine, thymus, and hepatocytes gene expression.
- Vitamins → Vitamin A → Involved in gene expression of IGF 9 insulin like growth factor.
- Vitamins → Vitamin C → Involved in hepatic gene expression.

The Role of *Agni* and *Vipaka* in Metabolism

The energy that drives metabolic processes in the body is called *Agni*, which also has an important effect on health. There are three stages in the digestive cycle starting from the gross form in the gastrointestinal tract followed by tissue-specific metabolism and elemental level metabolism. In this sequence of events, *Vipaka* has a specific impact on the body. Generally, the predominant taste of the food material remains in the post digestive effect; but for

materials with multiple tastes, the taste changes post metabolism: an important indicator of its impact on the system. For example, Indian gooseberry (*Amla*) is predominantly sour in taste, but post-digestive effect is sweet. Even though sour taste can increase *Pitta* in the body, gooseberry nullifies *Pitta* due to the sweet post digestive function.[16] Further according to *Ayurveda*, the action caused by a material (*Dravya*) varies depending on the substratum (*Dhatu*) and the contextual factors like place, time, and so on.[17]

Molecular nutrition research is broader than nutrigenomics because it includes the effect of nutrients and food/food components on whole-body physiology and health status at the systems biological level. In *Ayurveda*, food has been classified based on morphological features and their corresponding physiological actions. For example, grains, pulses, processed foods, meat and products, leafy vegetables, fruits, salts, supplements, various forms of water, milk and milk products, oils, and alcoholic drinks have been elaborated based on their effect on the body. This is further elaborated in terms of place of origin and seasonal variation.[18] Food processing is a topic that is dealt with in detail. Properties of raw, dried, smoked, grilled, pickled, steamed foods, various additives and adjuvants find mention based on the *Pancamahabhuta* theory. The pharmacological properties of a substance get altered depending on the processing. For example, puffed rice is light on the system as compared to flaked or cooked rice that is heavy to digest.[19] Curd, which is unwholesome in most situations, becomes a healthy drink when churned and the butter is removed. This sweet tasting buttermilk kept in an earthen vessel for two days develops astringent taste and becomes a wholesome food for the gastrointestinal system especially in conditions such as hyperacidity, irritable bowel syndrome, fissures, haemorrhoids, and certain types of diarrhoea and dysentery.[19]

CONCLUSION

Ayurnutrigenomics is introduced as a novel, hybrid concept bridging *Ayurveda* and modern genomics. This field is rooted in the idea that nutrients from food interact directly with an individual's genome, thus affecting gene expression at the systems biology level. This concept modernizes the foundational Ayurvedic principle of individualization, or *"Purusham purusham vikshaya"*.

The core mechanism involves assessing the fixed constitutional type (*Prakriti*), which relates to the genotype, and integrating this assessment with an understanding of current imbalances

(*Vikruti*). This personalized assessment then guides the selection of a suitable dietary, lifestyle, and therapeutic regime.

The article establishes a preliminary molecular and genomic basis for the theory of *Dosha Prakriti* classification. Healthy individuals of different *Prakriti* types show significant differences in biochemical and haematological parameters. Genomic studies further indicate that the main *Prakriti* types vary significantly in the expression levels of genes involved in immunity, cell division, and blood coagulation.

This emerging domain leverages several sophisticated "omics" technological platforms (genomics, epigenomics, transcriptomics, proteomics, and metabolomics) to develop a deeper understanding of Ayurvedic principles related to food and nutrition. The relationship between gene expression and nutrients—where nutrients act as transcription factors or interact epigenetically—is crucial to this integration.

Ultimately, Ayurnutrigenomics is positioned to revolutionize healthcare by facilitating the development of personalized functional foods and nutraceuticals tailored to an individual's unique genetic makeup. This research area aims to create a molecular foundation for Ayurvedic concepts, leading to smart, safe, and cost-effective therapeutics.

Despite these promising discoveries, the field requires validation through large-scale, controlled clinical studies. Adopting a nutritional epidemiology approach is necessary to provide the evidence-based quantification needed for precision health recommendations.

Ayurnutrigenomics is an *Ayurveda*-genomics mixed novel concept in the realms of healthcare system for development of personalized functional foods and nutraceuticals according to one's genetic makeup. This works on the concept that the nutrients of food interact with genome of an individual and affect the expression of genes at the systems biology level.

Technological platforms based on the different omics (genomics, epigenomics, transcriptomics, proteomics, and metabolomics) may help in this regard to develop a better understanding toward Ayurgenomics and Ayurnutrigenomics (Ayurvedic principles on food and nutrition). This review introduces and presents this new emerging concept of Ayurnutrigenomics as a new area of research for creating molecular basis of ayurvedic concepts of food and nutrition which can revolutionize the field of healthcare by unfolding futuristic techniques toward smart, safe and cost-effective therapeutics.

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