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Ayurvedic Perspective of Transgenerational Epigenetic Inheritance – A Scientific Elucidation

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Abstract

Ayurveda, a time-honored Indian medical system that has been recorded and practiced since 1500 B.C., follows a methodical approach that shares significant similarities with modern personalized genomic medicine approaches in understanding and treating health and disease. The trisutra consists of three interconnected components: causes, features, and treatment methods. These aspects are unified by a single organizing principle known as 'tridosha'. Tridosha encompasses three distinct physiological entities: vata (related to movement), pitta (related to metabolism), and kapha (related to potential). These entities are present throughout the body's systems, interact with each other, respond to the external environment, and ensure the body's internal balance. Every person is born with a unique combination of tridosha, which is determined by both genetics and the environment during fetal development. Collectively, they refer to an individual's fundamental nature, which is commonly referred to as 'prakriti'. In Ayurveda, Janma Prakriti, also known as birth Prakriti, is considered to be constant and forms the basis for the psychophysiological elements, or Deha Prakriti (body Prakriti), which can vary and is considered to be dynamic. The genotype can be likened to the Ayurvedic notion of birth Prakriti, whereas the phenotypic aligns with the Ayurvedic concept of Deha Prakriti. In Ayurveda, Vikriti is used to describe the disruption in the Deha Prakriti, which is equivalent to illnesses and medical conditions in contemporary medicine. Epigenetics is the alteration of DNA that occurs outside of the genes, leading to the activation or deactivation of specific genes. This modification affects the expression of genes without modifying the genome itself. This gene expression demonstrates transgenerational effects. The main factors that contribute to epigenetic changes are lifestyle and behavior, nutrition and digestion, stress, and environmental variables. Ayurveda categorizes these factors, which subsequently impact the Deha (body) Prakriti (psychophysiological constitution) that aligns with the physical characteristics, and indirectly the Janma (birth) Prakriti, which comprises the genetic makeup. This confirms that epigenetics plays a crucial role in Ayurveda’

Keywords: Epigenetics, Transgenerational , *Tridosh*, *Prakriti*, *Ayurveda*

Introduction:

Ayurveda, a traditional Indian medical system that dates back to 1500 B.C., employs a systematic approach that is closely related to contemporary personalized genomic medicine. It focuses on the comprehension and treatment of health and disease. The trisutra, consisting of causes, traits, and therapeutic associations, is rooted in the principle of 'tridosha'. The concept of Tridosha involves three distinct physiological entities: vata (related to movement), pitta (related to metabolism), and kapha (related to potential). These entities are present throughout the body's systems, function together, respond to the external environment, and maintain equilibrium. Every person is born with a unique combination of tridosha, which is determined by genetics and can also be influenced by the environment during fetal development. Collectively, these terms refer to an individual's fundamental nature, known as 'prakriti'. According to Ayurvedic texts, the psychophysiological elements, or Deha Prakriti (body Prakriti), which is dynamic and subject to change, are based on the constant Janma Prakriti, also known as birth Prakriti. The Ayurvedic notion of birth Prakriti is aligned with genetics, whereas the concept of deha Prakriti is

aligned with phenotype. Vikriti, the Ayurvedic term for disruption in the Deha Prakriti, is equivalent to modern medical conditions and disorders. The term "epigenetics" describes the outside-in modification of DNA that regulates gene activation and deactivation, affecting gene expression without changing the genome. There are impacts of this gene expression over generations. The main causes of epigenetic changes are stress, nutrition and digestion, lifestyle and behavior, and environmental factors. According to Ayurveda, these factors have an indirect impact on the genotype-related Janma (birth) Prakriti and an influence on the Deha (body) Prakriti, or psychophysiological constitution, which correlates to the phenotypic. This proves that one of the main principles of Ayurveda is epigenetics.

Sexual reproduction involves the transfer of genetic information from two parents to their children through gametes, leading to the development of a complex multicellular organism from a single-celled zygote[1].Somatic cells and germ cells are the two main cell types found in multicellular eukaryotic organisms. Although somatic cells comprise the bulk of the organism, they are not involved in heredity. On the other hand, germ cells are specialized cells that mature into adult gametes, which pass on all genetic information from one generation to the following. A diploid zygote is created during fertilization when the haploid gametes from each parent mix and rearrange their genetic makeup. After then, this zygote matures into a unique person carrying its parents' genetic makeup. It is commonly acknowledged that information is passed from parents to children through the genetic material found in gametes.

However, it is now evident that the DNA sequence alone is unlikely to carry all of the inherited information[2]. On the contrary, there is evidence that epigenetic information, which is found in molecular components that control genome function without relying on the DNA sequence, can potentially contribute to the transmission of information between generations[3]. Similarly, Ancient Ayurvedic thinkers such as Charaka and Sushruta made significant progress in comprehending the concepts of inheritance and the nature of traits or characteristics. They possess extensive knowledge of the fundamental principles of Genetics[4]. They have elucidated six components that are accountable for the creation of embryos and organogenesis. Unfavorable conditions during conception and the antenatal period not only lead to childhood disorders but also raise the risk of diseases in adulthood, indicating the possibility of transgenerational epigenetic inheritance. Ayurvedic scholars have proposed many principles, such as Punsavana samskara, Masanumasika Paricharya, and avoidance of Garbhaupghatkarabhava[5], to ensure the birth of healthy offspring. They emphasize that any negative exposure of the mother can have detrimental effects on future generations. The determination of a child's sex and the identification of genetic defects related to childhood frailness. Acharya Charaka elucidated the complete concept of genetics by categorizing it into three genetic components known as Beej, Beejbhaag, and Beejbhagavaya. Alterations in the DNA sequence of individual genes or small groups of genes are known to cause specific biological traits that are passed on to future generations. Typically, a gene mutation is responsible for the transmission of certain disease-related traits.Nevertheless, there have been documented instances in which individuals with identified disease-causing genetic mutations fail to exhibit most or all of the symptoms associated with the corresponding genetic illness. Similarly, the environmental influences that both parents and kids are directly exposed to during their lifespan do not consistently cause changes in the genetic code. Therefore, they are unable to adequately explain the inheritance of altered phenotypes. However, there has been an increase in the number of inherited disease phenotypes that are caused by environmental exposures. These phenotypes cannot be solely explained by genetic mutations, as there is no evidence linking the disease's cause to changes in the gene sequence or other genetic abnormalities. These observations motivate the investigation of the molecular mechanisms by which epigenetic information is passed down from one generation to another, and the significance of this information for the development of offspring.

Materials & Methods:

The Brihat-trayee, together with their comments, especially those from Sushruta Samhita Sharirsthana, are said to contain hidden notions of Genetics. In addition to examining supportive texts from contemporary science, this study also evaluated references from the internet and academic periodicals.The Brihat-trayee, together with their comments, especially those from Sushruta Samhita Sharirsthana, are said to contain hidden notions of Genetics.

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Result And Discussion:

Ayurvedic Understanding Of Transgenerational Epigenetic Inheritance;

Scientists like Randy Jirty, Phd scholar of Duke University Medical Centre apprehends that epigenetics may ultimately touted to have major role in disease than genetics. According to Ayurveda union of *Shukra* and *Shonita* into *garbhashaya* along with *aatma* is called *Garbha*. Other factors like *ritu, kshetra,ambu* and *beeja* are responsible for formation of *garbha* and abnormality in any of these factors can cause Congenital abnormalities. Other factors like diet, exercise,alcohol,stress,exertionetc can alter effect both mother and fetus.*Garbha* is considered to be formed by Six procreative factors such as *Matruja,Pitruja, Rsaja, Satvaja*, *Satmyaja* and *Aatmaj*.These are basically combined attributes of genetic ,psychological, and nutritional factors.Most of these factors contributes for the causation of congenital anomalies such as vitiated *beeja* contributes to fetal defects. Other diseases such as *Prameha,Kushta* are also touted to be caused by *beeja dushti* which later can be seen in adult life.Abnormality in genes and chromosome causes many diseases and birth defects.Epigenetics is defined as science which deals with cellular and physiological traits that are inherited by daughter cells and not because of the changes in the sequence of DNA.In study carried out by Marcus Pembrey and colleagues it was observed that parental grandsons of Swedish men who was said to exposed to famine at his preadolescence were less likely to die because of Cardiovascular disease suggesting Transgenerational epigenetic inheritance due to increased mortality of diabetes in grand children as food was not sufficient. This study supports the fact that microenvironment at initial stages of development of embryo is considered important for the establishment of epigenetic changes in Adulthood thus Substantiating the Concept of Transgenerational epigenetic inheritance. Ayurvedic scholars felt that not only the Maternal factors are responsible for epigenetic changes to offspring .It is becoming much more evident that factors like Exercise, Diet, Nicotine, Alcohol, Chemicals in the living or workplace and plenty of medications can cause epigenetic changes which ultimately leads to diseases that can be considered Transgenerational. Ayurvedic learners considered the aforesaid as *hetu* and also the exposure of these *hetu* during pregnancy will cause congenital anomalies[6]. Also the age of Parents (*kala*), Ethnicity*(jati*), familial characteristics (*Satmya*),place of origin *(Desha)* are said to influence the Transgenerational epigenetic inheritance.Also the vitiation of Dosha because of impaired Garbhotpattikar bhava (ritu, kshetra,beej, ambu) leads to various disorders related to shape, colour, sensory as well as motor organs of offspring .According to *Acharaya Sushruta* , the description of seven types of diseases as *Trividha* dukha are mentioned. Among these *Adibala pravritta vyadhi* are described as congenital in origin that are genetically determined like *Dushta arsha, Prameha* etc that are said to occur by disbalance of *Shukra* and *Shonita* of father and mother respectively thus establishing the concept of Transgenerational epigenetic inheritance[7].

Ayurvedic Perspective Of Factors Responsible For Change Of Phenotype;

According to Ayurveda, matter consists of five Mahabhutas, which are the fundamental components possessing the qualities of space (Akasha), air (Vayu), fire (Tejas), water (Jala), and earth (Prithivi). The three Doshas, Vata, Pitta, and Kapha, are psychophysiological principles that control the different combinations of the human body. Vata is derived from the less dense components that possess characteristics of space and air. On the other hand, Pitta is created by the combination of substances that possess the attributes of fire and water. Kapha is derived from the denser elements and possesses the characteristics of water and earth. Vata is responsible for various physiological processes such as blood circulation, cardiac contraction, respiration, digestion, and nerve impulse transmission. Pitta regulates the processes of digestion, metabolism, and transformation, which encompass energy exchange, hunger, and endocrine activities. Kapha is responsible for the organization and unity of the body, encompassing attributes such as physical strength, stability, maintenance of bodily fluids, and body weight. Each person has a distinct combination of Vata, Pitta, and Kapha, which is referred to as their psychophysiological constitution and is related to their physical characteristics[8]. Ayurveda provides a comprehensive account of maintaining good health by adhering to the correct rules in relation to four aspects that significantly impact phenotype. These factors can be categorized as follows:

Lifestyle And Behaviour;

Ayurveda encompasses the entirety of an individual's existence, encompassing prenatal, postnatal, childhood, and lifelong social experiences. The regimen includes schedules for daily and seasonal routines, encompassing bedtime, waking up, meals, exercise, studying, meditation, and other activities. Additionally, it includes recognition for appropriate conduct and interactions with peers, individuals of younger and older age groups, in various general and specific situations. As an illustration, the behaviors and attitudes that should be enhanced encompass love, compassion, and communication aimed at elevating individuals. Undesirable behaviors and attitudes that should be avoided are wrath, aggression, and the use of harsh or cruel language. It is imperative to provide counsel and direction to both younger individuals and to educators and older individuals. These behaviors impact physical health by releasing neuropeptides that strain and harm the organs, whereas happy emotions aid in the release of health-promoting chemicals[9].

Digestion ;

Ayurveda emphasizes the crucial role of food digestion in maintaining optimal health. The fundamental principle of Agni, or the element of "fire," is essential for the efficient digestion and absorption of food by the body's tissues. Agni's weakness leads to the accumulation of a material called Ama[10,11,12], which is formed when food is not fully digested. Ama can appear as harmful byproducts resulting from inadequate digestion that accumulate in the extracellular spaces, or as abnormalities in homeostatic processes. As Ama accumulates in the tissues and the channels responsible for energy flow, both at the macro and micro level, it has the potential to stimulate the immune system and cause localized inflammation. The remnants of Ama can lead to the formation of atheroma in arteries, hypercholesterolemia, painful or swollen joints, as well as microscopic obstacles to the absorption of nutrients. Ayurveda provides advice for optimal digestion of food in order to reduce the accumulation of Ama, or toxins.

Ayurveda provides specific guidelines for diet and nutrition that are tailored to an individual's Ayurvedic constitutional type and other relevant considerations[13,14.15]. The primary determinants of the diet are as follows:

The factors that can influence the taste of food include the qualities of the meal itself, the time of the day, the season of the year, the age of the individual, the state of the individual's physiology, and the geographic location.

The flavors and characteristics of foods have strong effects on the Doshas (Vata, Pitta, and Kapha), which in turn influence the psychophysiological constitution in either a beneficial or detrimental manner. The Doshas categorize the time of day, season of the year, and age of an individual, influencing their psychophysiological constitution and their preference for good or unhealthy foods in that specific setting. The consideration of geographic location is also included in.

STRESS;

Aside from significant sources of stress, minor arguments and disputes that arise in daily life can have detrimental effects on health and hinder personal growth and development. Ayurveda promotes stress management through many methods such as adopting a healthy lifestyle, acquiring knowledge about life, practicing Yoga, engaging in breathing exercises, meditating, receiving whole-body massages, undergoing Ayurvedic psychotherapy, and using herbal remedies.

ENVIRONMENT;

Ayurveda elucidated the impacts of proximate and distant surroundings. The phrase "near environment" refers to the immediate surroundings of one's dwelling and the impact it has on the physical structure of the house and office. There are guidelines prescribed for the choice of residential locations, the design of houses, the impact of our living environment, the avoidance of harmful substances, and strategies to enhance positive impacts. Environment which is considered refers to the cosmic bodies – the planets, moon, and stars. Admonitions address their influence and how they affect the physiology[16].

Conclusion:

Ayurveda revitalizes the native cognitive abilities of the body and promotes revival. Homeostatic forces are inherent in the genetic code of living organisms. Manipulating the rules of nature which result in deviations from the prime state of well-being. Ayurvedic medicines have a significant impact on both genetic as well as phenotypic manifestation of life. Research endeavors focused on Ayurvedic techniques and herbal preparations should emphasize the recognition that epigenetic pathways are reformed in certain tissues or immune cells. Potential novel mechanisms comprising cellular and molecular functioning could be uncovered during the evaluation of methodologies of Ayurveda. Ayurveda can be understood and touted by studying the science of epigenetics, which explores how the expression of life is influenced and how individuals can maintain and enhance their health. Epigenetic variables have a significant impact on the phenotype, either positively or negatively, by indirectly influencing genetic expression. This influence can be passed on to future generations, supporting the concept of Transgenerational epigenetic inheritance. Ayurveda evaluates both genetic and phenotypic components of life and is a comprehensive, holistic, and customized healthcare system. \

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