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Epigenetics and Ayurveda – an insight

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Abstract:

Ayurvedic wisdom emphasizes the importance of preparing parents-to-be for childbirth through a holistic approach that encompasses physical, mental, and spiritual well-being. The science of epigenetics reveals that environmental factors, nutrition, and lifestyle choices significantly influence fetal development.

This article aims to discover ancient Ayurvedic practices, such as *Garbha Sanskara* and *Sadvritta*, offer valuable insights into promoting healthy progeny and preventing diseases. This article delves into the fascinating connection between Ayurveda and epigenetics, highlighting the crucial role of prenatal care, diet, and lifestyle in shaping the health of future generations. Furthermore, it explores the relevance of Ayurvedic concepts in modern healthcare, bridging the gap between traditional wisdom and contemporary science.

Keywords: Epigenetics, *swasthavritta*, *ayurveda*, *roga*, *garbha samskara*

Introduction:

The timeless principles of Ayurveda, including the concept of prakriti (individual constitution) and the emphasis on diet, lifestyle, and stress management, resonate profoundly with the modern science of epigenetics.

Ayurvedic practices, such as: Meditation, Yoga, adaptogenic herbs have been shown to positively influence epigenetic markers, promoting overall health and well-being.

As we explore the intersection of Ayurveda and epigenetics, we may discover innovative approaches to

disease prevention and treatment, and gain a deeper understanding of the complex interplay between our genes, environment, and health. This convergence of ancient wisdom and modern science has the potential to revolutionize our understanding of human health and wellness.

Materials and Methods:

Distinctive books of Ayurveda including Classical literatures like *Charaka Samhita*, *Susruta Samhita*, to understand the importance of *garbhini paricharya* . and effects of external factors on genes, scholarly articles, google searches, and textbooks on epigenetics were also used to collect the data.

Results:

The integration of Ayurvedic wisdom with epigenetics underscores the profound impact of prenatal care, lifestyle, and nutrition on future generations. Ancient practices like *Garbha Sanskara* and *Sadvritta* offer invaluable insights into fostering holistic well-being, aligning seamlessly with modern scientific discoveries. By embracing Ayurveda's preventive approach, parents can optimize foetal development and promote lifelong health. This synergy between traditional knowledge and contemporary research highlights the need for a balanced, evidence-based approach to prenatal care. As modern healthcare evolves, incorporating Ayurveda's timeless principles can pave the way for healthier generations, bridging ancient wisdom with scientific advancements for a more conscious future.

Discussion :

Environmental factors during crucial developmental stages, such as gametogenesis and early embryogenesis, significantly impact offspring health and disease susceptibility. Exposure to environmental factors during critical periods of development, such as gametogenesis and early embryogenesis, can have far-reaching consequences on disease susceptibility in offspring. These factors include: Nutrition, Climate, Stress, pathogens, toxins, social behavior. Research reveals that early-life epigenetic modifications play a crucial role in linking prenatal exposure to phenotypic changes later in life. The expression of genetic information stored in the genome is influenced by these modifications. [1]

The alarming reality is that environmental pollutants, including:

Atmospheric pollution, endocrine-disrupting chemicals, heavy metals have already taken a significant toll on human health. Moreover, growing evidence suggests that these pollutants are causing relevant modifications in the epigenome, perpetuating a cycle of disease and health disparities. [2]

A research reveals that environmental pollutants, including: atmospheric pollution, endocrine-disrupting chemicals, heavy metals have already inflicted significant harm on human health. Furthermore, compelling evidence now links these pollutants to lasting modifications in the epigenome, potentially perpetuating a cycle of disease and health disparities across generations. [3] Histone modifications are a complex array of post-translational modifications that occur on the tail

domains of histone proteins. These modifications include:

acetylation, phosphorylation, methylation, ubiquitination, sumoylation, adenosine diphosphate (ADP)-ribosylation

The epigenome encompasses the complete description of all these potentially heritable changes across the genome. Two crucial epigenetic regulations that have been extensively studied are:

DNA Methylation: A key mechanism for regulating gene expression.

Covalent Modifications of Histones: Essential for chromatin remodeling and gene regulation. Understanding these epigenetic modifications is crucial for uncovering the intricate relationships between gene expression, environment, and disease.

The Tridosha Theory: Understanding the Fundamental Forces of the Human Body

In Ayurveda, the human body is composed of three primary *doshas*, or psychophysiological principles, that govern various bodily functions:

Vata (Space + Air): Governs movement and communication. Regulates blood flow, heart contractions, breathing, digestion, and nerve impulses

Pitta (Fire + Water): Regulates digestion, metabolism, and transformation processes, oversees energy exchange and endocrine functions

Kapha (Water + Earth): Oversees the body's structure, strength, stability, fluid balance, and weight

Each individual possesses a unique combination of these doshas, known as their psychophysiological constitution, which correlates with their phenotype. This distinctive balance of *Vata*, *Pitta*, and *Kapha* influences a person's physical characteristics, personality traits, and overall well-being.

The ancient Ayurvedic practice of *garbha samskara* offers a unique opportunity for epigenetic programming, enabling parents-to-be to influence the health and well-being of their offspring. By harnessing the power of epigenetics, individuals can shape the phenotype of their child, setting the stage for a lifetime of optimal health.

These intentional epigenetic changes can have a lasting impact, manifesting at various stages throughout a person's life. Moreover, research suggests that these epigenetic modifications can be transmitted to future generations, creating a lasting legacy of health and wellness.

There is a lot of scope in research translating the concept of *Swasthavritta* in the light of epigenetics into clinical research outcomes.

***DINACHARYA* – THE EFFECT OF CIRCADIAN RHYTHM ON GENES**

Nutrition's Impact on Epigenetics:

A Key to Unlocking Gene Expression

Research has shown that nutrition plays a crucial role in modifying epigenetic mechanisms, which regulate gene expression. A diet rich in polyunsaturated fatty acids, for example, can generate free radicals and oxidative stress, leading to epigenetic alterations.

Dietary Nutrients as Epigenetic Regulators

Dietary nutrients and bioactive food components have been found to modify gene expression by regulating DNA methylation, histone modifications, chromatin remodelling, and mRNA expression. Foods rich in B vitamins, such as folate, vitamin B12, and vitamin B6, can influence DNA methylation.

One-Carbon Metabolism: A Key Mechanism

One-carbon metabolism is a cellular process that provides methyl groups for biological methylation of DNA, protein, or phospholipids. Nutrients like folate, vitamin B12, vitamin B6, betaine, choline, and methionine play a significant role in this process. [4]

Ayurvedic Foods that Support Epigenetic Health

Classical Ayurvedic texts like Charaka Samhita recommend foods like *Shastika shali* (rich in calcium, phosphorus, and vitamins), *Mudga* (rich in vitamins and minerals), *Amla* (rich in vitamin C), and *Sarpi*/ghee (rich in vitamins D, E, and K). These foods support one-carbon metabolism, influencing the genetic makeup of the body. [5]

Unveiling the Connection: *Nidra*'s Influence on Epigenetics:

Environmental Influences on Epigenetics and Circadian Rhythms: Environmental factors, such as light-dark cycles, meal timing, and social cues, can impact both circadian rhythms and epigenetic modifications. [6] For example, exposure to light at night can disrupt circadian rhythms and also induce changes in DNA methylation patterns. This validates the " *Bhrama muhurthe uthishte* " for maintaining the circadian rhythm.

Health Implications: Dysregulation of both epigenetics and circadian rhythms has been linked to various health conditions, including metabolic disorders, cardiovascular diseases, and cancer. Epigenetic modifications can influence the expression of clock genes, leading to disruptions in circadian rhythms, which in turn can contribute to disease development and progression. [7]

***Garbhini Paricharya*: Impact on genetic make up**

The Intersection of Epigenetics and Ayurveda

Epigenetics explores the complex interplay between genetic expression and various influences throughout an individual's lifespan, includes:

Prenatal and postnatal experiences, Childhood and lifetime social interactions, diet, nutrition, and exposure to toxins, lifestyle, behavior, stress, and environment

These factors can significantly impact gene expression, shaping the phenotype.

Ayurveda's Proactive Approach to Parenthood

Thousands of years ago, Ayurveda recognized the importance of preparing parents-to-be for the life-changing event of childbirth. This ancient wisdom emphasized the need for physical, mental, and spiritual preparation, acknowledging the profound impact that parents' well-being can have on their offspring's health and development.

By combining epigenetic principles with Ayurvedic wisdom, we can better

understand the critical role that lifestyle choices and environmental factors play in shaping our genes and influencing our overall well-being. [8]

Befitting drift in epigenetic modifications is essential for embryogenesis, early foetal development, and early postnatal growth.

Every *aahara* given to mother during the ante natal period influences the growing fetus in ways possible. The regimens have been designed to meet the needs at appropriate stages like 1st trimester when, the mother gets dehydrated of nausea and vomiting is compensated by giving *payasa*, *kshira*, *krusara* medicated with *madhura aushadi*. During 2nd trimester, when the muscular growth of fetus is intensified, protein supplement is met by meat, milk, cheese. This provides nourishment and stability to fetus. The 3rd trimester is marked by the end of pregnancy and preparing the body for parturition. Hence involves providing *balya* and *brimhana ahara* to mother and fetus. The regimen when followed appropriately leads to mother delivering healthy child whose genetics level have been influenced with the quality input. [9]

Ethical Guidelines for Influencing Genetic Makeup – The *Sadvritta*

Ayurveda provides a comprehensive framework for wellness, spanning the entire lifespan, from prenatal care and preparation for parenthood, to postnatal support for mother and child, childhood development and growth, and lifetime social experiences and relationships. This ancient wisdom also offers guidance on daily and seasonal routines, including optimal sleep schedules, personalized diet and nutrition recommendations, tailored exercise and physical activity advice, and stress management and relaxation techniques, empowering individuals to cultivate a deeper understanding of their unique needs and rhythms, leading to a more balanced, harmonious, and fulfilling life.

It also has recommendations for proper behavior, and how to deal with peers, individuals who are younger, and those who are older, in general and in different circumstances. For example, behaviors and attitudes to be maximized include love, compassion and speech that uplifts people. Behaviors and attitudes to be avoided include anger, violence, and harsh or hurtful speech. Advice and guidance should be given to those who are younger, and respect should be given to teachers and elders. These behaviors affect health on the physical level through the release of neuropeptides. The behavioral qualities hold good in the principles of *Sadvritta* mentioned in *Swasthavritta*.

"*NIDANA PARIVARJANA EVA CHIKITSAM* "- THE PROPHYLACTIC MEASURE

The prevalence is on the rise for chronic disease states such as Diabetes and Obesity. Understanding the relationship between epigenetics, diet, lifestyle and chronic stress could help in the identification of key factors to prevent or lower the risk for diseases such as obesity, and diabetes. Also, lot of the recent studies have suggested that consuming certain foods, herbs and spices may be able to modify our genes expression and influencing our health. Ayurvedic nutrition concepts hold the key to a personalized approach to health

and wellness. Ayurvedic approach through the use of Ayurvedic Therapies could be used as a tool for stress management.

Ayurvedic Therapies such as *Shirodhara* and *Abhyanga* and its use as a stress management tool. [10]

TRIVIDHA ROGA KARANA VS EPIGENETICS

Ayurveda describes causes of diseases in 3 broad spectrums namely, misuse of intellect (*pragyapradha*), misuse of senses (*Asatmendriyarthasamyoga*), seasonal variations (*parinama* or *kala*).

(i) The misuse of senses (*Asatmendriyarthasamyoga*) can be well correlated with the current "digital eye strain era" which has affected the majority of population seemlessly spending time on screen with advent of modernization and artificial intelligence. This is accompanied with the improper contact of senses resulting in over stimulation or deficiency of sensory activities. This also has brought forth the new wave of eye appendages carried over generations that has affected the eye sight of young generations as well in off springs in days to come.

(ii) With the rise of industrialization and prolonged use of bluetooth headsets in every other occasion is now the fashion fit of the current day generation which can induce changes in DNA methylation in the brain, which may be associated with adverse effects upon metabolic health through modulation of response to stress-related hormones. DNA methylation and gene expression changes were also investigated in relation to the more frequently self-reported symptoms, particularly tinnitus. [11] Following short term noise exposure, only the DNA methylation of the catechol-O-methyltransferase (*Comt*) gene was significantly increased in medulla oblongata. After long-term exposure, *Comt* methylation was significantly increased in the inferior colliculus, while the melanocortin 2 receptor (Mc2r) gene demonstrated a significantly decreased methylation in hippocampus. [12]

Parinama **(**seasonal variations)

The external environment can trigger disease by deranging the body through unnatural or extreme variations in temperature, rainfall or wind. [13]

This necessitates the importance of following *rtucharya* in accordance with the changing seasons to prevent the possibilities of accumulating doshas thereby disease.

When the body fails to adapt to stressors due to changes in seasonal traits, it can lead to *Dosha* imbalance (*Dosha Vaishamya*), making it vulnerable to various disorders

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