Review Article

Changing the Phenotypes – Epigenetics in Ayurveda

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Abstract

Objective: The primary objective is to elaborate the various concepts concerning genetics and epigenetics in *Ayurveda*. **Data Source:** The classical *Ayurveda* texts, along with the commentaries and peer-reviewed articles, were referred. The classical information was further analyzed and concluded. **Review Method:** Systematic review after studying changes in phenotypes with a view-through epigenetics will be a scientific contribution to generate interest among medical fraternity for better public health contribution. **Results:** The four major factors influencing the phenotypes are lifestyle and behavior, diet and digestion, stress and the environment we live in. It is not only genes that are the cause of numerous disorders our children are facing but, also the surrounding (both living and nonliving) that lays an impact, thus changing the "gene expression," thus changing a whole lot of traits. **Conclusions:** Genes are affected by several factors and processes including development in utero and childhood, environmental chemicals, drugs, and pharmaceuticals, aging, and diet thus inducing epigenetic changes through developmental plasticity which may land up into diseases with transgenerational inheritance. This comprehension will lead to better integration with the current medical system in managing optimal health of the public sector.

Keywords: *Gene expression, gene, phenotype, prakriti*

Introduction

The study of genes and their contrast in living organisms is known as "Genetics" or "genesis." The word genetics originated from the Greek word "genetikos," referring to "genitive" or "origin" and it is firmly linked with the study of information systems. The variations in phenotype of an individual or gene expression, that is caused by various mechanisms in the surroundings without any change in the underlying DNA sequence is named "Epigenetics". Both the medical worlds Modern and *Ayurveda* have their bits of knowledge to contribute regarding embryology. However, what demarcates both of their views is the area captured by teratogenicity. *Ayurveda* kept its conviction stern on the effect of the environment over anatomical and psychological aspects of developing embryo. Recently, Modern science too has come and accepted that there are factors that affect not only the genotypes but the phenotypes of offspring as well. *Shristi utpatti*, *Prakriti*, the inheritance of character as *Shadgarbhakara bhava*, genomics principles, a constituent of *Beeja* responsible for the inheritance, gene transformation, genetically determined disease, etc., are notably snippets of information concerning genetics in embryology.

Materials and Methods

As source materials, the classical Ayurveda texts along with the commentaries are referred. Other than this, various peer-reviewed articles were also studied. All the relevant matter regarding this topic is further compiled and analyzed for the conclusion as per the author's view.

Results and Discussion

Prakriti

The concept of *Prakriti* in Ayurveda can be considered from the genomic viewpoint. *Prakriti* has a genetic association that allows the classification of the human population based on phenotype characteristics. *Prakriti* is the unchangeable qualitative and quantitative *doshika* predominance of the human body.[1] Dominant *Dosha*; (humor) in the course of the union of *Shukra* (sperm) and *Shonita* (ovum) determines the *Prakriti* of an individual.[2] *Prakriti* of an individual not only depends on *Shukra* and *Shonita* but feigned by the *Kala* (duration),

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Ahara (dietetic regimen), the behavior of the mother, nature of *garbhashaya* (uterus) and on *Panchmahabhuta*.[3] In *Ayurveda*, *Prakriti* constitutes the bodily constitution, mental status and elemental form that is distinct for an individual. *Prakriti* assessment evaluates the dominance of each *Dosha* and plays a prime role in diagnosis, prognosis, and therapeutics. The concept of individualized medicine concerning *Prakriti* has been acknowledged in the current scenario.

A recent study exhibited a correlation between CYP2C19 genotypes and *Prakriti*, with fast and slow metabolism being one of the significant distinguishing and differentiating characteristics and suggested a significant impact on phenotype-genotype correlation, drug discovery, pharmacogenomics, and personalized medicine.[4] According to the study, individuals from the three most contrasting constitutional types show striking differences for biochemical and haematological parameters and at genome-wide expression levels.[5] Another study manifests the relationship between human leukocyte antigens alleles and *Prakriti* typing.[6]

Shadgarbhakara bhava

Shad Garbhakara Bhava (six procreative factors) are propounded in the *Ayurveda* classics which are mentioned as *Matrija, Pitrija, Atmaja, Rasaja, Satmyaja,* and *Sattvaja.* These procreative factors, when amassed, are a must for a healthy progeny.[7,8] In *Ayurveda*, each *bhava* is assigned with a particular organogenesis/functional/psychological phenomenon to be developed in *garbha*.[9] A straggle on any of the *bhava* may lead to physical, functional, or psychological abnormality, which can be contributed by the respective *bhava*. The *Matrija, Pitrija,* and *Atmaja Bhava* are inherited from the parents, and *Poorvajanma Samskara (code of conduct),* respectively, and hence cannot be changed. Nevertheless, *Satmyaja, Rasaja,* and *Sattvaja Bhava,* when adopted properly can actually modify the intrauterine environment and also psychosomatic health of the mother, thus generating a healthy impact on the fetus. It is a known fact now that the genome is influenced by the environmental factors.[10] Whatever diet and regimen a pregnant woman adopts, the child will develop the same qualities. The fetus grows from the essence of the diet that the mother takes through the processes of *Upsweda* and *Upsneha*.[11] Therefore, the intrauterine environment is dependent upon maternal nutrition status. Hence, it determines not only the risk of disease occurrence but also the time and intensity of the disease and its pathological process. Contemporary science too agrees that exposure to toxin and alcohol, during the antenatal period may appear as teratogens for developing embryo.[12]

Epigenetics links early environmental exposures during pregnancy with programmed changes in gene expression that alters the growth and development of the offspring. Modern genetics believe that maternal and paternal chromosomes are not solely responsible for the phenotype but epigenetic factors are also involved.[13] Environment triggers change to epigenetic tags on our genome, thereby shaping gene expression. These tags can be carried along cell to cell as damaged body tissues are replaced. These changes inside ovum or sperm cell can further pass to the next generation. When an unfavorable environment interacts with a genetic predisposition, the health of the growing fetus is at risk. These genetic/chromosomal abnormalities required certain other conditions to be dominant or recessive. All of these may be acting at different time during gestation and contributing to the development of disorders in adulthood such as insulin resistance, glucose intolerance, hypertension, obesity, and carcinoma.[13]

The fetal origins of adult diseases hypothesis states that the events during the intrauterine period have a massive impact on the developing fetus, which may be evident during that period or in adult life. Low birth weight is linked to coronary artery disease, hypertension, obesity, carcinoma, and insulin resistance.[14] Clues originally arose from the large 20th century European birth registries.[13]

Epigenetic determining disease in Ayurveda

The vivid description of neonatal anomalies is also traced in *Ayurveda*. The permanent change in the DNA sequence is known as mutation. Sometimes, mutations in DNA can change the cell behavior, which could be inherited. Germ-line mutation is the DNA mutation that existed in the parent gene and is further passed to the next generation. Mutations can occur because of damage to DNA from environmental factors or when error occurs during cell replication before cell division. Mutations can occur in every cell of the body; when they occur in somatic cells, there is a risk of cancer development; when, they occur in the germ line, there is a risk of the offspring inheriting a structural or functional disability.[12]

Apart from mutations, epigenetics is also responsible for congenital and genetic anomalies. These changes caused by the epigenetics may remain through cell divisions for the remainder of the cell's life and even for multiple generations. However, there is no change in the underlying DNA sequence of the organism; but the nongenetic factors cause that organism's genes to "express themselves" differently. Epigenetic operations are influenced by numerous factors and actions including development in utero and childhood, environmental challenges, drugs and pharmaceuticals, age, and diet consumed. DNA methylation occurs when methyl groups can tag DNA and in turn "activate" or "repress" gene.[15] Because of the abnormalities of bija (ovum and sperms), Atmakarma (deeds of previous life), ashaya (uterus), kala (time factor or abnormality of ritukala) *Ahara*, (diet) and the mode of life of the mother, the vitiated doshas causes abnormalities in the fetus influencing its appearance, complexion, and indriya (senses).[16] These significant factors develop an

environment for mutation and epigenetic changes in the Shonita (ovum), leading to abnormalities in the fetus. *Acharya Charak*, while describing fetal anomaly, mentions that during fertilization, the part of *beeja* (sperm or ovum) affected by its genetic source gets abnormality otherwise not.[17] Advanced paternal age increases the risk of a new mutation, thereby causing autosomal dominant diseases.[12] It is viewed that exposures to drugs may increase the risk of adverse fetal outcome.[18] Furthermore, environmental exposures of mercury, lead, solvents, pesticides, etc., to males are associated with early pregnancy loss.[19] In 1999, Trasler and Doerksen discovered that male germ cell when exposed to certain drugs or environmental agents may alter genomic imprinting or varies gene expression.[20]

The cause effect concept for the manifestation of anomalies in the fetus is also explained. Unrighteous acts performed by parents may result in fetus of shape such as snake, scorpion, and pumpkin.[21] On the contrary, *Kubja* (humped), *Kuni* (deformed hand), *Pangu* (lame), *Mook* (dumb), and *Minmin* (muffled voice) neonates are formed either by vitiated *Vata* or ignoring desires of *dauhridya*.[22] *Ayurveda Acharya* has clarified that the suppression of desires of the *Dauhridini* (pregnant woman) may impact the psyche of both the mother and fetus.[23] *Acharya Sushrut* states, what-so-ever diet and regimen the pregnant woman adopts, the child will develop similar attributes.[24] This is well supported by the recent research, which suggests that antenatal stress and anxiety (around the second trimester of pregnancy) possess a programming effect on the developing fetus, which lasts at least until middle childhood and may result in behavioral disorders such as dyslexia, hyperactivity, and attention deficit disorder.[25]

These above mentioned are a few descriptions in the *Ayurveda* classics that impart well verse explanation that it is not only the genes that are the cause of numerous disorders our children facing but also the surrounding (both living and nonliving) that lays an impact; thus changing the "gene expression" thus changing a whole lot of traits.

Conclusion

Vikriti is the nature of imbalance of our natural physical or mental state. The status of health of an individual begins during intra-embryonic life. Therefore, it is necessary to provide harmony at physical, mental, social and spiritual level, accompanied with practice of a wholesome Ayurvedic regimen of the mother during pregnancy. Negligence toward any of these factors becomes a cause for unhealthy and defective childbirth. As per the *Ayurveda* principles, proper preparation of parents is an essential precondition for a healthy product of conception. Preconception care includes both the prevention and management of ailments and intensifying good health that requires poignant action before conception for maximal impact.

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Conflicts of interest

There are no conflicts of interest.

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सारांश

उद्देश्य: इसका मुख्य उद्देश्य आयुर्वेद में आनुवंशिकी और एपिजेनेटिक्स से संबंधित विभिन्न अवधारणाओं को विस्तृत करना है। **डाटा स्रोत:** शास्त्रीय आयुर्वेद ग्रंथों, साथ ही टिप्पणियों और सहकर्मी की समीक्षा लेखों का उल्लेख किया गया तथा शास्त्रीय सूचनाओं का विश्लेषण कर, निष्कर्ष प्राप्त किया गया। **समीक्षा विधि:** एपीजेनेटिक्स तथा फेनोटाइप में परिवर्तन का अध्ययन करने के पश्चात् सार्वजनिक स्वास्थ्य योगदान के लिए चिकित्सा संगठन के बीच रुचि प्रतिबद्ध करने के लिए यह शोध एक वैज्ञानिक योगदान होगा । **परिणाम:** फेनोटाइप को प्रभावित करने वाले चार प्रमुख कारक हैं: जीवनशैली, आहार - पाचन, तनाव तथा जिस वातावरण में रहते हैं। हमारी पीढ़ी न केवल जीन सम्बंधित विकार से पीड़ित है अपितु वातावरण भी मुख्य हेतु है जिसके कारण जीन अभिव्यक्ति में परिवर्तन देखा जाता है। **निष्कर्ष:** जीन गर्भाशय गत विकास, पर्यावरणीय रसायनों, दवाओं, जरा अवस्था एवं आहार सहित विभिन्न कारकों और प्रक्रियाओं से प्रभावित होते हैं । इस प्रकार विकासात्मक प्लास्टिसिटी के माध्यम से एपिजेनेटिक परिवर्तनों को उत्प्रेण करते हैं, जो ट्रांसजेनरेशनल विरासत कर असंख्य रोगों के हेतु हैं। इस शोध से सार्वजनिक क्षेत्र के इष्टतम स्वास्थ्य प्रबंधन में वर्तमान चिकित्सा प्रणाली का एक बेहतर एकीकरण होगा।