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GENETICS IN AYURVEDA W.S.R. TO DEVELOPMENTAL ANATOMICAL DEFORMITIES AND THEIR PREVENTION -A REVIEW

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ABSTRACT

Medical science hasn't been able to reduce the prevalence of congenital malformations despite improvements in diagnostic methods and therapeutic approaches. This is something that the traditional Indian medical system of *Ayurveda* has placed a lot of emphasis on and has proposed a number of countermeasures. In *Ayurveda, Sahaja Roga, Kulaja Roga, Adibala Pravritta Roga*, and *Janmabala Pravritta Roga* all go into great detail about the idea of congenital diseases. It has been made clear what the prenatal causes, safeguards, and disease categories are. In *Ayurvedic* texts, the significance of the Shad-Garbhakara *Bhavas* (six pro-creative factors), including *Matrija* (maternal), *Pitrija* (paternal), *Atmaja* (soul), *Rasaja* (nutritional), *Satmyaja* (wholesomeness), and *Sattvaja* (psyche/mind), is discussed. It is thought that for healthy progeny, these pro-creative factors must come together. In order to raise healthy children, it is important to consider one's own physical, mental, social, and spiritual well-being as well as the mother's diet during pregnancy and one's own adherence to a wholesome routine.

Keywords: *Sahaja Roga, Kulaja Roga, Adibala Pravritta Roga, Janmabala Pravritta Roga Atmaja, Matrija, Pitrija, procreative factors, Rasaja, Sattmyaja, Sattvaja, shad-garbhakarbhavas*

INTRODUCTION

The occurrence of malformed foetuses has been well documented since the *Vedic* era. Due to flaws in *Beeja* (sperm, ovum), various genetic disorders were described by *Ayurveda*. When explaining the morbidity of sperm and ovum, *Beeja* (chromosome), *Beejabhaga* (genes), and *Beejabhagavayava* (DNA) were described[1]. Six procreative factors, including *Matrija* (maternal), *Pitrija* (paternal), *Atmaja* (Soul), *Rasaja* (Nutritional), *Satmyaja* (Wholesomeness), and *Sattvaja* (Psych/Mind), are necessary to achieve the goal of a healthy progeny. Healthy offspring require the conglomarance of these procreative factors[2]. Each procreative factor is given a specific organogenesis, functional, or psychological phenomenon to develop during the foetus' intrauterine life.[3] Physical, functional, or psychological defects may result from a delay in any of these procreative factors, and each one may be responsible for some of these defects. *Ayurvedic* principles state that appropriate *Ritu*, *Kshetra*, *Ambu*, and *Beeja*, as well as proper parental preparation, are essential requirements for a healthy offspring. The vitiated *Doshas* cause abnormalities in the foetus that have an impact on its appearance, complexion, and Indriyas because of abnormalities in *Beeja* (ovum and sperm), *Kshetra* (uterus), *Ritukala* (time factor or abnormality of menstruation), *Ambu* (dietetics/nourishment including all the hormones), and the mother's lifestyle. These elements foster the environment necessary for ovum mutation and epigenetic changes, which result in abnormalities in the developing foetus.[4] Congenital anomalies, also known as birth defects, congenital disorders, or congenital malformations, are defined as structural or functional anomalies (such as metabolic disorders) that develop during intrauterine life and can be detected prenatally, at birth, or later in life. According to a study on genetic disorders, Around the world, 6% of newborns are thought to have a congenital disorder and 20%-30% of all infant deaths are brought on by genetic disorders.[5] A specific cause cannot be determined for about 50% of congenital disorders. Nevertheless, there are a number of recognized causes, such as single-gene defects, chromosomal issues, multifactorial inheritance, environmental teratogens, and micronutrient deficiencies. Genes that are inherited or mutated can be linked to genetic causes. When parents are consanguineous, there is a higher chance of congenital abnormalities, as well as a nearly doubled chance of neonatal and early childhood death, intellectual disability, and other health issues. Additionally, chromosomal abnormalities like Down syndrome are more likely in mothers who are older. There is evidence that certain illnesses, such as the Zika virus, syphilis, and rubella, increase the prevalence of congenital disorders.[6]

Aims and Objectives: Examine the relationship between *Shad Garbhakar Bhavas* and inherited and congenital diseases.

Material and Methods

This study is based on a review of previous research that includes commentary on pertinent original *Ayurvedic* texts, necessary and reliable interpretations, and scholarly analysis. To locate the pertinent studies and reviews published , electronic databases like "PubMed" and "Google Scholar" were searched. Both *Ayurveda* and terms associated with modern medicine had been used as pertinent search terms. Only English-language abstracts and full-text, open-access articles were taken into account.

***Garbha Vikriti*-**

Various abnormalities in the shape, complexion, and sense organs of the fetus during its life inside the uterus are caused by defects in the genes, the self, past actions, the uterus, time, and the mother's diet and behavior.[7]According to *Charakas* view, congenital abnormalities are caused by particular morbid conditions of *Beeja* (sperm and ovum), *Atmakarma* (past deeds), *Ashaya* (uterus), *Kala* (time factors), and *Matuaharvihar* (mom's diet and routine). *Beeja* has been further developed into *Beeja Bhaga* and *Beeja Bhagabayava*. Their combined abnormalities point to chromosome, gene, and DNA material abnormalities that cause morbidity in various ways.[8]

This category includes *Atmakarma*, which shows a person's vulnerability to environmental factors and their unknown chance of susceptibility to them.

Shusruta claims that *Janmabala* and *Adibala* are to blame for birth defects. The causes of *Adibala* are *Matrija* (maternal) and *Pitrija* (paternal), while the causes of *Janmabala* are *Rasakrita* (dietary indiscretion) and *Dauhrid aBimanan*. *Sahaja* and *Garbhaja* were mentioned by *Vargbhata* in this context.[9]While *Janmabala* and *Garbhaja* exhibit genetic abnormalities brought on by morbid diet and mother's prenatal regiments, the *Adibalaand Sahaja* exhibit genetic abnormalities brought on by autosomal dominant, autosomal recessive, and sex link dominant. Congenital malformations, which result from abnormalities brought on by the mother's excessively unrighteous behaviour, are characterized by characters in the fetus such as *Sarpa* (a snake), *Vrischika* (a scorpion), *Kushmanda* (a field of pumpkin), etc., which denote monsters and are present in conjoined twins (more specifically, parasite twins) and monozygotic monochorionic monoamniotic twins. This category can also be used to understand associating parasite limbs. Other disorders like *Kubja, Kudi, Pangu, Muka*, and *Minmin* are brought on by *Dauhrida Bimanan*.[10]

According to *Acharya Bhavamishra, Dohsa Vishistha Ahara* caused fetal abnormalities[11].

SN	Pregnant women consuming *Doshas* vitiating diet	**Effect on Progeny**
1	*Vata Dosha*	Number of body parts, lameness, dwarfism, hoarse or nasal voice
2	*Pitta Dosha*	Baldness, early graying of hairs, lack of facial hair, and tawny skin, hair, and nails.
3	*Kapha Dosha*	*Kushta* (leprosy), *Kilas* (type of skin condition), and congenital tooth presence

Factors that Cause Epigenetic Change

The significance of the factors that alter DNA expression in an epigenetic way is being supported by more and more evidence [12]. Epigenetic patterns may be altered by factors such as diet, obesity, physical activity, tobacco use, alcohol use, environmental toxins, psychological stress, and working the night shift [13]. For example, long interspersed nucleotide element-1 (LINE-1) elements, a class of repeated sequences that are heavily repeated in the human genome, have been linked to increased methylation in peripheral blood lymphocytes. Chromosome instability and inflammatory responses are linked to low methylation in these elements [13]. An occupational study looked at how workers at an electric-furnace steel plant's miRNA expression was affected by exposure to air pollution, specifically particulate matter and metal components. The levels of lead exposure and oxidative DNA damage were found to be positively correlated with the overexpression of two miRNAs associated with oxidative stress and inflammation [13]. In respiratory epithelial cells, cigarette smoke condensate reduces nuclear levels of specific histone modifications, and these alterations are comparable to those in the histone modifications found in lung cancer tissues. A population-based case-control study on alcohol consumption revealed that current alcohol drinkers had a stronger association between LINE-1 hypomethylation in blood leukocyte DNA and gastric cancer than non-drinkers. The glucocorticoid receptor gene is hypermethylated in suicide victims with a history of childhood abuse, but not in controls or suicide victims without a history of abuse, according to research on psychological stress. Working the night shift can have a negative impact on a worker's health and wellbeing, according to a number of epidemiological studies. Blood DNA methylation was found to have changed in a population of night shift workers, including alterations in the methylation of inflammatory genes at the gene-specific level [13]. The four main causes of epigenetic changes are further explored in the research that follows.

1. **Nutrition and Digestion**- Bioactive food ingredients and dietary nutrients are epigenetic regulators that change how genes are expressed. By controlling DNA methylation, histone modifications, chromatin remodeling, and changes in miRNA expression, diet can alter epigenetic mechanisms [14].

Epigenetic mechanisms have been found in herbs [15]. According to a study on herbs, 36% of them interact-

ed with enzymes that modify histones, and 56% of these enzymes promoted chromatin condensation [16]. Breast cancer cells' DNA methyltransferases and histone deacetylase have been shown to be downregulated by withaferin A, a component of Withania somnifera (L.) Dunal (*Ashwagandha*), which also causes these cells to undergo apoptosis [17].

2. **Lifestyle and Conduct-** Numerous human disorders and diseases, such as cancer and cardiovascular, neurodegenerative, and autoimmune diseases, may be impacted by epigenetic dysregulations in terms of their onset, development, and pathogenesis [18]. According to a study on patients with coronary artery disease, stress reduction, aerobic exercise, and a vegetarian diet successfully and sustainably modulated gene expression to reduce cardiovascular risk [19]. Increasing physical activity and eating more fruits and vegetables had a positive effect on DNA methylation patterns in gene regions linked to immune cell metabolism, tumor suppression, and general aging, according to a study [20].

3. **Environmental Factors**

Epigenetic mechanisms allow environmental factors to change the way genes are expressed [21]. According to studies, certain tumor suppressor genes can be silenced by environmental toxins such as inorganic arsenate, cigarette smoke, and diesel exhaust particles, which leads to the development of cancer [22]. Skin epigenetics change as a result of repeated sun exposure. Epidermis samples from older people that had been exposed to the sun exhibited hypomethylation [23]. It has been demonstrated that gestational exposure to air pollution affects the mother, her embryo, and the embryo's developing germ line, influencing the phenotype of the third generation [24].

4. **Stress-**

The epigenetic marks, or tags, that regulate gene expression can change as a result of stressor exposure [25]. Depression has been linked to stress-related changes in the epigenome [26]. The DNA shortens and tightens as a result of anger, stress, frustration, and fear. It also turns off many codes. The DNA, on the other hand, becomes relaxed and the strands unwind and start to express when we feel gratitude, love, and appreciation [27]. An increase in telomerase gene expression was observed in hypertensive patients in a pilot study on telomerase gene expression, which demonstrated the benefits of stress reduction techniques like meditation and lifestyle changes [28]. These studies show that managing stress is a vital component of good health and wellbeing. *Ayurveda* has long emphasized a thorough comprehension of meditation as a remedy for this.

Measures to avoid genetic disorders-

A. ***Garbhadan Samskar* for Prenatal Management Planning(for Good Progeny Before Conception)**

- *Vayu* (vata dosha), a sound mental state, a healthy and properly functioning female reproductive system, a well-prepared uterus, healthy *shukra dhatu* (sperm), and a healthy ovum are all necessary conditions for conception to occur.
- As part of nature, humans must follow the same rules as plants in order to produce good crops: we need the right season, the right nutrition, fertile soil, high-quality seed, and the right nutrition. When it comes to conception, four factors are given top priority.
- *Ritu*, *Kshetra*, *Ambu*, and *Beeja* are among the characters[29]-

➢ ***Ritu*** explains the typical female menstrual cycle and indicates when it is best to conceive. It is significant because it facilitates both fertilization and ovum release. *Ritukala* is thought to be the most favourable period for conception.

➢ The term "***Ambu***" describes the nutrition that the *Garbha* receives from the ovum and sperm. The redeemed nutrition has an impact on placenta formation, implantation, fertilization, and fetal organogenesis.

➢ The word "***Beeja***" is used to describe genetic components like chromosomes, DNA, and genes. It has the capacity to create new generations. They play a crucial role in *Garbha's* conception and subsequent growth. Any *Beeja* abnormality leads to infertility.

- ***Kshetra*** stands in for *Garbhashaya*, which alludes to the uterus and other reproductive organs of the mother. It is a place where the *Garbha* live. Additionally, the area of *Garbha's* development
- Purification of *Shukra* (sperm) and *Shonita* (ovum): According to *Ayurveda*, the s*hukra* and *shonita* should be free of all vitiated d*oshas* for proper conception and to produce offspring with the best possible traits. *Dosha* imbalance in the *shukra* (sperm) and *shonita* (ovum) may result in offspring that are abnormal in both appearance and behavior. As a result, the text describes various methods for purifying *shukra* and *shonita.*[30]
- It includes *panchkarma* procedures after *Snehan* (oleation) and *Swedana* (sudation).
- The *Putreshti Yajna* merely serves to mentally prepare the couple for conception. The couple should prepare themselves before becoming pregnant, according to *Ayurveda*. The *putreshti yagya* is a type of mental preparation for the parents. When mentally prepared, the couple will adhere to all prenatal guidelines to produce a healthier offspring. An event's mental impact is improved when it is connected to a religious or auspicious act[31]. The most crucial factor in conception is the couple's happiness or normal psychological functioning[32].
- Diet prior to conception: *Madhur Varga* medicated milk with *Ghrita* consumption by male and oil and *Masha* consumption by female before having intercourse[33]
- A *Rupavanta* (beautiful), *Satavanta*-full of *Sattvik* quality (virtuous, possessed of analytical knowledge, mercy, satisfaction, clarity of mind, and senses), and *Chirayu* (long-lived) progeny are produced by an appropriate conception with all the elements in balance.[34]

B. Garbhni Paricharya

- Three sections of the *Garbhini Paricharya* can be studied-

1. *Masanumasika Pathya* (Monthly Dietary Regimen).
2. *Garbhopaghatakara bhavas* (Activities and things that are bad for the fetus)
3. *Garbhasthapaka dravyas* (Substances helpful for maintaining pregnancy)

1. ***Masanumasika Pathya:*** (Month Wise Dietary Regimen):

The placenta begins supplying the fetus with nutrition during pregnancy. The monthly consistent and appropriate growth of the embryo requires adequate nutrition. The nutritional needs of a fetus vary month-by-month (*Masanumasika vrudhi*) in accordance with their developmental stage. The extra nutrient needs are imposed by pregnancy. As a result, the mother's nutritional needs vary from month to month. The pregnant woman maintains her health by adhering to the dietetic regimens recommended, and she gives birth to a healthy baby with a good complexion, voice, and energy.

The infant would also be physically fit. Due to the significance of this, the month-by-month dietary regimen for women from the first to the ninth month of pregnancy is described in detail in *Ayurvedic samhitas* under the name *masanumasika paricharya* (monthly regimen). The monthly routine is essential for maintaining the health and flexibility of the pelvis, waist, sides of the chest, and back as well as the downward movement of *vata* (*vataanulomana),* which is required for a normal delivery.

Normalization of the stools and urine, and elimination of these with ease, Promotion of strength and complexion.

Month wise regimen as per the *Samhita*

Months	***Sushruta Samhita***[35]	***Charak Samhita***[36]	***Astanga Sangraha***[37]	***Harita Samhita***[38]
1st Month	*Madhur, Sheet,* Liquid Diet	*Anupsanskrit kshira* (nonmedicated milk)	Medicated milk	*Madhuyashti, madhuka puspa* with butter, honey, and sweetened milk
2nd Month	Same as first month	*Madhur gana siddha*	Same as *Charaka* Milk	*Kakoli madhur payayet*

		kshira (milk medicated with sweet drugs)	medicated with *madhura* rasa (sweet taste) drugs	(sweetened milk treated with *kakoli)*
3rd Month	Same as first month	*Kshira madhu* and *Ghrita* (milk with honey and ghee)	*Astanga Sangraha*-Milk with honey and *ghrita*	*Krisara*
4th Month	Cooked *Shasthi* rice with curd, dainty and pleasant food mixed with milk & butter and *Jangal mansa*	*Kshir Navneet* (milk with butter)	Milk with one *tola* (12gm) of butter	*Kritodan* (medicated cooked rice)
5th Month	Cooked *shastika* rice with milk, *jangal mansa* along with dainty food mixed with milk and *ghrita*	*Kshira sarpi* (ghee with milk)	*Ghrita* prepared with butter extracted from milk	*Payasa* (porridge)
6th Month	*Ghrita* or rice gruel medicated with *gokshura*	*madhura gana aushadhi siddha kshira ghrita* (milk medicated with sweet drugs and ghee)	*Ghrita* prepared from milk medicated with *madhura* (sweet) drugs	Sweetened curd
7th Month	*Ghrita* medicated with *prithakaparnyadi* group of drugs	Similar as sixth month	Similar as sixth month	*Ghritakhanda* (a type of sweet dish)
8th Month	*Asthapana basti* with *kwatha* (decoction) of *badari, bala, atibala satapuspa, patala,* etc., *madhu* (honey) and *ghrita* superseded by *Anuvasana basti* of oil medicate with milk *madhura* drugs (different medicated enemas)	*Kshira Yawagu* mixed with *ghrita*	*Kshirayawagu* mixed with *ghrita, asthapanabasti* with decoction of *badar anuvasana basti* with oil medicated with *Madura* drugs	*Ghritapuraka*
9th Month	Unctuous gruels and meat-soup of wild animals up to the period of delivery	*Anuvasana basti* with *Madhura gana aushadhi* medicated oil and *Pichudharan* (enema and vaginal tampon of medicated oil)	Same as *Charaka*	*Vividha anna* (different varieties of cereals)

2. *Garbhopaghathakara Bhavas* (Activities and Substances Harmful to the Fetus)

Garbhini ought to abstain from using *teekshna, rooksha,* and *ushna dravyas.* Should avoid eating *vistambhi(*hard to digest) and *vidahi* food, which are harmful to the fetus, and should avoid giving up offensive-smelling items. She should stay away from strenuous activities, coitus, rough or violent activities, riding over vehicles[39], excessive satiation, excessive emaciation, sleeping during the day and waking up at night, sitting in uneven places, fasting, grief, anger, visiting lonely places, visiting cremation grounds[40], staying for an extended period of time

close to fire or the sun, etc. A soft cushion or mattress [41] should be placed over her sleeping and sitting areas. All of these mental and physical strains, such as lifting heavy objects or riding in a car, can hasten an abortion by suddenly raising intraabdominal pressure. Asthapana basti with decoction of badari mixed with bala, atibala, Sathapushpa, pestled sesamum seeds, milk, curd, mastu, oil, salt, Madanaphala, honey, and ghrita was recommended by Susruta in the eighth month of pregnancy. Anuvasana basti of oil medicated with milk and decoction of the madhura group of drugs was then suggested to clear the retained feces and Vayu's anulomana. Because Vayu is moving in the proper direction, the woman gives birth easily and keeps complications at bay.

In contrast, charaka and vagbhata[42] recommended anuvasana basti with oil treated with the Madhura group of medications and vaginal tampons with the same oil used for sthana and garbha mārga (vaginal canal and perineum) in the ninth month. Aindri, Brahmi, Satavirya, Sahastravirya, or Durva, Amogha, Avyatha, Siva, arista, Vatyapuspi, and Viswaksena were recommended by Charaka and Vagbata for oral use with milk or ghritha made with these medications. These substances can also be used as amulets to be tied to the head or kept in close contact with the body.

3. Garbhasthapaka dravyas (Substances beneficial for maintenance of pregnancy):

Assisting in the proper upkeep of the garbha, garbhasthapaka dravyas mitigate the effects of garbhopaghatakara bhavas. They can also be applied to the seven methods of abortion treatment and prevention. As they are advantageous for the upkeep of proper health, growth, and development of the mother and fetus, they should be used routinely. Some of the garbhasthapakaaushadhis are Aindri (Bacopamonnieri), braahmi (Centellaasiatica), Satavirya (Asparagus racemosus), Sahashravirya (Cynodondactylon), Amogha (Stereospermumsuaveolens), Avyatha (Tinosporacardifolia), Shiva (Terminaliachebula), Arista (Picrorhizakurroa), Vatyapushpi (Sidacardifolia), Vishwasenkanta (Callicarpamacrophylla) etc. These should be consumed orally as milk and ghee preparations. During Pushya Nakshatra, one should take a cold decoction bath with these medications.

C. **Developmental Plasticity-**

The ability of a developing body to respond to outside cues is known as developmental plasticity. The ability of genes to coordinate a range of physiological or morphological states in response to environmental factors during fetal development is where it gets its name. Throughout the development of organisms, various cells and tissues experience various gene expression programs. Sequences of carefully measured and organized epigenetic changes are essential for the appropriate development of multicellular organisms like humans.[43] Early growth patterns in humans have an impact on a variety of diseases that manifest in adulthood. Early-life nutrition and environmental factors have a significant impact on the development of specific human diseases as well as their likelihood. A potential link between behaviour during a crucial developmental stage, nutrition, lifestyle, and changes in gene expression that could result in disease phenotypes is provided by epigenetic alteration.

CONCLUSION

The entire world is turning to *Ayurveda* for a better way of life and a method to prevent congenital disorders and hereditary diseases. *Ayurveda* recommends a variety of measures, including a dietary plan related to *Garbhini Paricharya*, avoiding Garbhopghatkar Bhava, and *tridoshavitiating*, to reduce the prevalence of congenital or genetic disorders. Better pregnancy preparation, such as *Garbha Sanskar*, can also stop it. Following *Ayurvedic* guidelines can also help you produce healthy offspring. By using the proper *Ausadha* (medications/interventions), *Aahar* (diet), and *Vihara* (daily routine), various fetal anomalies that develop at different stages can be avoided or managed easily at the beginning. *Ayurveda* provided a wealth of information on *Sharir Rachana* and anatomical abnormalities that affect the human body and are primarily brought on by genetic and congenital factors. The maternal or paternal defects connected to progeny are where the *Garbhajanya Vikriti* arises. Such diseases' pathogenesis is triggered by defects in

Beeja& Beejabhag. Pitrija, Rasaja, Satmyaja, Sattvaja, and Aatmaja factors, according to *Ayurveda Matrija*, are important for the development of healthy offspring. Any abnormalities or vitiations in these factors may result in *Garbhajanya Vikriti.* It is crucial to understand development and how to stop it in order to determine the proper timing.The correct understanding of genetics in Ayurveda (*Beeja& Beejabhag* etc.) and *Shad Garbha Bhava* (*Matrija, Pitrija, Rasaja, Satmyaja, Sattvaja, and Aatmaja*) thereby prevents an anatomically *Garbhaja Vikrtis.*

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