iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** I **Month of publication:** January 2026

DOI: https://doi.org/10.22214/ijraset.2026.76898

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue I Jan 2026- Available at www.ijraset.com

Concept of Heredity in Ayurveda: A Comparative Study of Matruja and Pitruja Bhava with Modern X- and Y-Linked Genetic Disorders ("An Integrative Ayurvedic-Genetic Perspective")

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Abstract: ***Ayurveda presents a sophisticated understanding of heredity through the concepts of Matruja and Pitruja Bhava, describing maternal and paternal contributions to the formation of the offspring. This comparative study explores these classical Ayurvedic principles alongside modern genetic concepts, particularly X- and Y-linked inheritance. By correlating Matruja Bhava with X-linked traits and Pitruja Bhava with Y-linked transmission, the study highlights conceptual parallels between ancient Ayurvedic thought and contemporary genetics. This integrative analysis aims to provide a holistic perspective on hereditary disorders, emphasizing the relevance of Ayurvedic insights in understanding genetic diseases within a modern biomedical framework.***

Keywords: Ayurveda, Heredity, Matruja Bhava, Pitruja Bhava, X-linked disorders, Y-linked inheritance, Genetic diseases, Organogenesis, Beeja and Beejabhaga, Integrative medicine.

I. INTRODUCTION

The study of Matrija Bhava, as explored in Ayurveda, emphasizes the essential role of a mother's contributions to embryonic development. According to Ayurveda, achieving the Ayurvedic goals of life—Dharma, Artha, Kaama, and Moksha—requires a healthy body (Swastha Sharira). The development of the human body is not merely coincidental but a well-orchestrated process involving various factors. Among these, Matrija Bhava is particularly significant due to its influence on the formation of soft organs, facilitating the understanding of organogenesis both from an Ayurvedic and a modern scientific perspective.

A. The Concept of Shada Bhava

Shada Bhava, essential for the development of the embryo, consists of six components: Matrija, Pitrija, Aatmaja, Satymyaja, Satvaja, and Rasaja. In Ayurveda, these elements are crucial for forming different organs, particularly emphasizing the role of Matrija Bhava in developing soft organs. According to prominent Ayurvedic texts like Charaka Samhita, Sushruta Samhita, and Kashyapa Samhita,

Matrija Bhava influences various organs such as Twacha (skin), Hridaya (heart), and Yakrita (liver). This perspective parallels modern scientific understanding of organogenesis, highlighting the interrelation between Ayurvedic concepts and contemporary embryological studies.

B. Modern Perspectives on Organogenesis

Modern science recognizes organogenesis as a critical process culminating in the anatomical formation of organs through histological differentiation. In the context of Ayurveda, the formation of an embryo is attributed to the fusion of genetic material from the male (Shukra) and female (Shonita) gametes.

This fusion marks the beginning of a new life, which aligns with modern notions of genetic contribution, wherein nuclear and mitochondrial DNA from the mother play pivotal roles. The discussion extends to how maternal contributions shape soft organs, linking maternal health and nutrition to the wellbeing of the developing fetus.

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C. The Role of Matrija Bhava

Matrija Bhava encompasses two fundamental contributions from the mother—Shonita (the seed) and Kshetra (the uterus). Together, these aspects play a crucial role in the formation and nurturing of the embryo. The nurturing provides the necessary nutrients and genetic background for the developing fetus. Acharyas have emphasized the significance of Matrija Bhava, explaining how most soft organs arise from maternal elements and are nourished throughout gestation. The attributes of Matrija Bhava based on Ayurvedic texts echo findings in modern science, reinforcing the theoretical framework established by Ayurveda regarding embryonic growth.

1) Key Concepts of Matruja Bhava

- Origin & Contribution: *Matruja* (from mother) *Bhava* (factors) contribute specific anatomical parts and attributes to the fetus, including blood, muscle, fat, skin, heart, pancreas, and most soft organs.
- Soft vs. Hard Organs: Ayurveda distinguishes *Matruja* (soft) organs from *Pitraja* (paternal/hard) elements like bones, hair, and nails, showing a nuanced view of genetic inheritance.
- Intrauterine Environment (IUE): The mother's diet, emotions (stress, anxiety), lifestyle, and overall health during pregnancy significantly impact the *Matruja* factors, affecting fetal development and predisposition to diseases.

2) Modern Correlations & Scientific Validation

- Genetics & Epigenetics: Maternal mitochondrial DNA and nuclear DNA directly contribute to the fetus, aligning with *Matruja* principles. Epigenetic changes influenced by the maternal environment (diet, stress) can alter gene expression, affecting offspring health, a concept echoed in Ayurvedic texts.
- Fetal Programming/Development: Research shows maternal nutrition and stress can "program" fetal development, impacting long-term health (e.g., metabolic disorders, immune function), which is the essence of *Matruja* influence.

D. SHADBHAV

1) Matrija (Maternal Factors):
  - Ayurvedic View: Responsible for "soft" or "mridu" organs like the heart, liver, spleen, kidneys, stomach, and intestines.
  - Modern Correlation: Corresponds to mitochondrial DNA (exclusively maternal) and endodermal/mesodermal derivatives.

2) Pitrija (Paternal Factors):
  - Ayurvedic View: Responsible for "hard" or "sthir" structures like bones, teeth, nails, hair, ligaments, and tendons.
  - Modern Correlation: Corresponds to nuclear DNA and ectodermal/mesodermal derivatives.

3) Atmaja (Soul-derived Factors):
  - Ayurvedic View: Governs life span, self-realization, mind, and sensory perception.
  - Modern Correlation: Linked to genetic predisposition, cognitive potential, and the "consciousness" that emerges during neural development.

4) Rasaja (Nutritional Factors):
  - Ayurvedic View: Derived from the mother's nourishment (Ahar Rasa), responsible for physical growth, vitality, and health.
  - Modern Correlation: Parallels placental nutrition and maternal metabolism essential for tissue growth and cellular differentiation.

5) Satmyaja (Wholesomeness/Habituation):
  - Ayurvedic View: Influences the fetus's ability to adapt, its overall vigor, and freedom from disease.
  - Modern Correlation: Correlates with epigenetics, where maternal lifestyle and environmental factors influence gene expression without altering the DNA sequence.

6) Sattvaja (Psychic/Mind Factors):
  - Ayurvedic View: Determines temperament, memory, and psychological traits based on previous impressions.
  - Modern Correlation: Linked to the development of the Central Nervous System (CNS) and neuro-behavioral predispositions.

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II. MATERIAL AND METHOD

Matrija Bhava leads to the formation of four *Dhatu* and major organs of the body. The *Dhatu* forming these organs are the ones that are enumerated in *Matrija Bhava*. Hence, there is a need to promote a healthy environment to build strong bhava that are to be "pass ed on" to the progeny so that healthy genes are transmitted and the occurrence of disorders can be prevented. The present knowledg e on embryology including its entire aspects, gross as well as at the electron microscopic level, deserves a great sense of appraisal an d it is a result of deep devotions of the scientists, in the field. The treasure of knowledge of embryology, present in the ancient literat ure, though retaining behind the roots of its all the branches, could not have the attraction of the deserved workers and was left negle cted so far. It is high time when the hidden truths in these classics may get explored and proved with the advance and highly sophisti cated technology of the present era

Acharya has explained the theory of inheritance elaborately in the concept of *Shad Bhava Samudaya* in which each physical and ana tomical structure in human body is said to be derived from paternal as well as maternal genes. As per *Ayurveda* three genetics units have been mentioned by *Acharya Charaka; 1. Beeja 2. Beejabhaaga 3. Beejabhaagaavayava* The anatomical anomalies develop in t hose parts of the body whose part of the chromosome or gene is defective. The Genes are located on chromosomes and it is the chro mosomes that segregate and independently assorted. Alleles are various forms of genes. Therefore, dominant and recessive factors a re alleles of gene. A pair of alleles exist for each trait in kalal (zygote) of a fertilized ovum and in every cell of the body there after. According to Chakrapani; The smallest unit found in *Shukra* (sperm) and *Shonita* (ovum) which can be considered as *Beeja* of male and female respectively. The *Beejabhaaga* is the component lying inside the *Beeja* and holding responsibility of development of diff erent body organs. The beejabhaaga avayava is the more subtle stage of *Beeja Bhaaga* carrying hereditary characters.While consider ing about miscarriage or *Garbhanaasha,* sperm anomalies can also lead to *Garbhanaasha. Shukra,* as it is considered as itself derive d from the *Pitruj Bhaava*, the *Shukra* and *Shonit* are responsible for carrying the hereditary factors of the father and mother to the u pcoming fetus through fertilization. Various research works has shown that there are various paternal reasons for miscarriage, such a s, the sperm transcript dysregulation and oxidative DNA damage can be "carried over" after implantation thus effecting embryogene sis and health of the future progeny. Around half of the spontaneous miscarriages occurring in the first trimester are likely to be due to chromosomal abnormality. The chromosomal abnormality in the zygote may result from errors during gametogenesis, during ferti lization or during first cellular division. Thus, any such abnormality in the sperm could be a cause of spontaneous miscarriage. The male factors other than advanced paternal age, such as excessive stress, competitive sports, infection, alcohol, smoking, nicotine and drug abuse may result in production of reactive oxygen species and in sperm DNA fragmentation. Here, we can see that advanced p aternal age, as per *Ashtanga Hridaya*, the latent period of age that is in *Vridhaavastha* the body will be of *Vata Dosha* predominant constitution (*Vayo Aho Ratri Bhuktaanam te Antah Madhyaadika Kramat*). Excessive stress is one among the *Manasika Nidana* fo r *Vata Kopa*. The competitive sports can be compared with *Ativyayama* that leads *to Vataprakopa.*

III. RESULT

All the Aspects of X linked /Maternal And Y linked/Paternal bhava of Garbha mention in ayurvedic samhitas has been taken in to consideration .

Matruja Bhava : Maternal / X linked

Bhava	Organ	Disease	Gene Involved (X linked)
Twak	Skin	Ichythyosis,Gotz Syndrome	FDH
Lohit	Blood	Haemophilia A Haemophilia B SCA	F8 F9 Betaglobin gene
Mansa	Muscle Tissue	DMD Cystic Fibrosis	Dystrophine gene
Meda	Adipose Tissue	Obesity	CYP27A1, TFAP2B, PARK2, IFNGR1, UCP 2 & 3
Hruday	Heart	Congenital Heart Disease	TBX2

Mastishka	Brain	Retts Syndrome OptizKaveggia Syndrome	MED12
Yakrut	Liver	Congenital Hepatic Fibrosis	Alfa1antitrypsin
Pleeha	Spleen	Spherocytosis	ANK1,EPB42,SLC4A1 SPTA1,SPTB
Vrukka	Kidney	Alports Syndrome	XLAS
Basti	Baldder	CA Bladder	PIK3CA,KDM6A,TP53
Amashay	Stomach	Chrons Disease	NOD2,ATG16L1,IL23R IRGM
Pakvashay(Uttargud and Adhargud)	Anal Part	Hereditery Hemorrhoids	FOXC2
Kshudrantra	Small Intestine	CA	APC,STK11,SMAD4
Sthulantra	Large Intestine	HIRSH-Sproongz	RET,EDNRB,EDN3

Pitruja Bhava : Paternal / Y linked

Bhava	Organ	Disease	Gene Involved (Y linked)
Kesha,Loma,shmashru	Body Hairs	Hypertrichosis	MAP2K6- CH17
Nakha	Nails	Congenital nail disorders Anonychia,Pincer nail deformity	FZD6
Danta	Teeth	Hypo/Oligodontia,Anodontia	EDA,EDARADD
Asthi	Bones	Chondrodysplasia ,Craniosynostosis	FGFR1-3
Sira	Veins	Atherosclerosis	GATA4
Snayu	Ligaments	Collagen disorders	COL1A1
Dhamanya	Arteries	PAD	CH 19
Shukra	Semen	Infertility	CFTR

Acharya Charak also mentioned 8 body types (Ashtouninditiya)[6]which are hereditary in origin. These eight undesired body types, mentioned in Ayurveda also categorized under X linked And Y Linked According to Matruja And Pitruja bhava .

Pitruja Bhava : Y linked

AtiDeergha	Long stature	Acromegaly	FBN1
AtiHrasva	Short stature	Achondroplasia	FGF3
Ati Loma	Hairy	Hereditary Hypertrichosis	MAP2K6
A Loma	Without Hair	Hereditary Hypotrichosis	LIPH, LPAR6, or DSG4 gene.

Matruja bhava : X linked

AtiKrushna	Black	Hereditary Hypermelanosis	TYR
AtiGaura	White	Hereditary Albinism	OCA1 to OCA8
AtiSthula	Obese	Hereditary obesity	MC4R, CYP27A1, TFAP2B, PARK2, IFNGR1, UCP 2 & 3
AtiKrusha	Lean	Hereditary leanness	ALK, FTO, IRS1 and SPRY2

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Matruja factors are nothing but Matruja bhava i .e
X linked Characters**.**
Pitruja factors are nothing but Pitruja bhava i.e Y linked Characters.
maternal factors.

IV. DISCUSSION

The use of alcohols in excess leads to *Vata* aggravation in the body and *Dhatu Shosha* as the properties of *Madya* is opposite to that of Ojas. 28 Smoking or *Dhoomapana* if it is not practiced according to *Dhoompana Vidhi* mentioned by *Acharyas* or excessive *Dho omapana* can also lead to *Vata Kopa.* As it is proved that all these factors lead to sperm anomalies, we can correlate that the aggrava ted *Vata* with its impaired function can lead to DNA fragmentation and difference in length of telomere that can lead to defective cle avage, that is the first stage of cell division. The process of cell division itself is the property of vata i.e. *Vibhajana* is affected and al l these ultimately can result in miscarriage or *Garbhanaasha.* Here comes the importance of *Beejashudheekarana Samskaras* explai ned by *Acharya.* Proper preconceptual care for both the parents should be given before preparation for a *Shreyasi Praja,* for improvi ng the qualities of *Beeja, Beejabhaaga* and *Beejabhaaga Avayava. Acharyas* had explained various methods to be followed as preco nceptual care starting from proper *Sneha Sweda,* then undergoing *Shodana Karma* as *Vamana and Virechana* to eliminate the vitiate d doshas present in our body and after that to undergo *Asthapana* and *Anuvasana Vasthi* to normalize the remaining vitiated *Vata* in the body. 29 After these *Shodhana Karma* both the male and the female partners should undergo specific diet to make the body healt hy and to improve the quality of *Beeja* in both the parents. For a disease free and healthy infant endowed with excellence in the cont ributing factors mentioned in *Shadbhava Samudaya* i.e. the factors derived from each *Bhaava* should be of good quality and thus ea ch factor in *Garbhakara Bhaava* has equal importance for the formation of *Supraja.30*

V. CONCLUSION

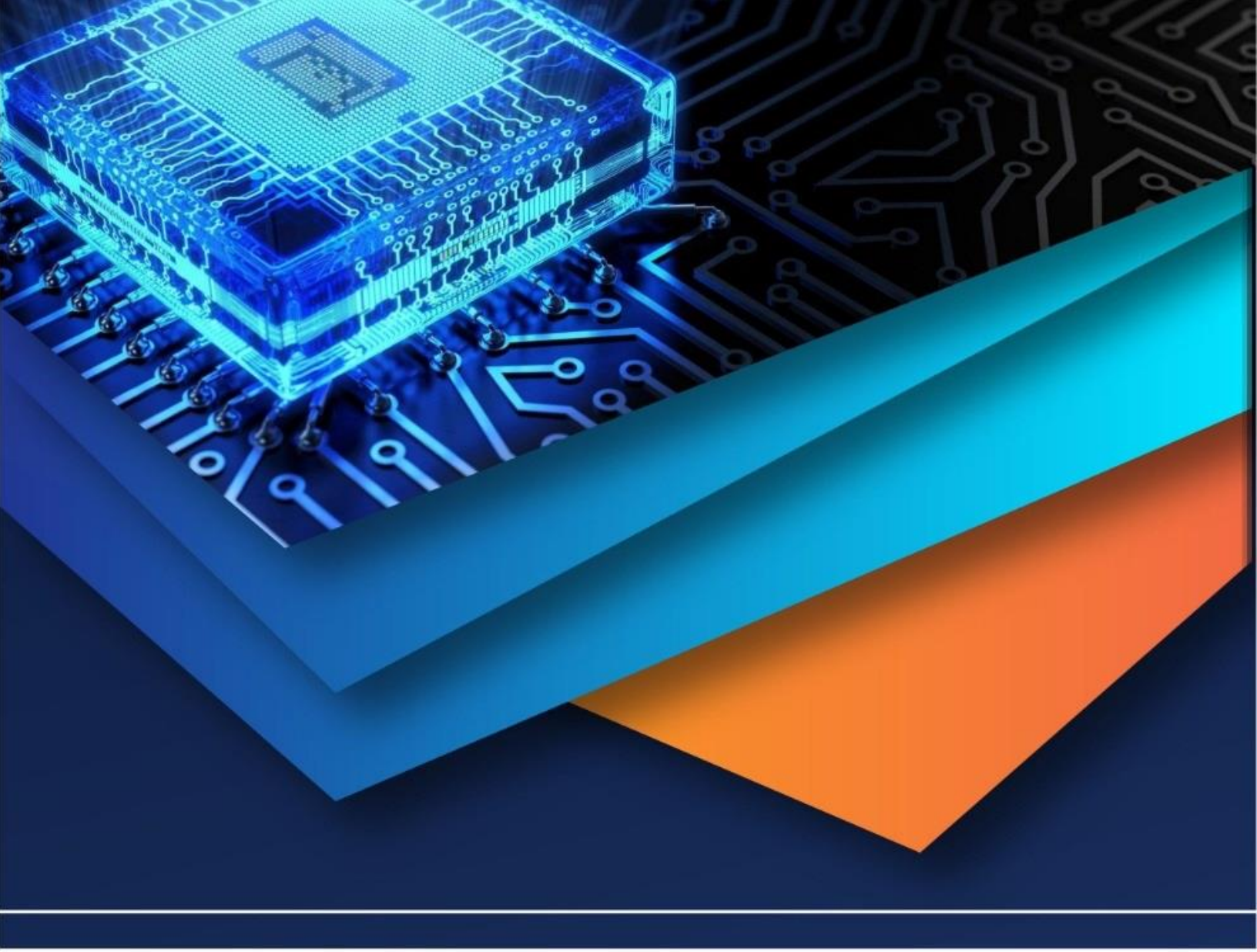
In spite of advance in technologies, we can see that there are some unknown causes responsible for defective development of fetus o r that causes abortion. Ayurveda suggests various approaches like considering Shad Garbhakara Bhaavas which plays a vital role to wards the development of normal fetus. A lag on any part of these procreative factors may lead to structural and psychological defec ts to the body. Just like maternal care, pre conceptional care for the male part is also necessary as unhealthy Shukra and Shonit also l eads to miscarriage. Proper management should be taken care to normalize the Doshas in the body especially Vata Dosha as Vata in fluence other Doshas to get vitiated among the Tridoshas. As well as we can see each Panchabhootha has its own influence in the fo rmation of Garbha and we should maintain a wholesome atmosphere for the action of these factors without disturbance, in the forma tion of Garbha. In short being Swastha, that is with equilibrium in Dosha, Agni, Dhatu, Mala etc is necessary to maintain good healt h28 . As each anatomical structure and even psychological status of the fetus has been derived from each Shadbhaava, utmost impor tance should be given to each factor for a healthy progeny. We can see that the basic principles established by Acharyas ancient year s ago in the field of Rachana Sharir about the formation of an embryo stand true in the light of modern science also.

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