



**CONCEPT OF HUMAN EMBRYOLOGY, FOETAL GROWTH AND DEVELOPMENT: AN AYURVEDIC PERSPECTIVE**

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**ABSTRACT :**

Embryology is the study of development of an individual before birth. In ancient times though, the microbiology, molecular biology and genetics were not developed, different concepts regarding it are found in *vedic* scriptures, *puranas* and *samhita* granthas for which they have mentioned terms '*Garbhavakranti*'. In present study literature review about references regarding it are collected to get concepts of embryology, foetal growth and development. The various references prove improvements of these branches at that times including concepts of fertilization, cell division, foetal nourishment and organogenesis with monthly foetal development. Some of this can be correlated with modern researches and are found correct.

**Keywords :** Human Embryology, foetal growth and development, *Garbhavakranti*.

**INTRODUCTION:** Embryology is a branch of biology that studies the prenatal development of gametes (sex cells), fertilization and development of embryo and foetus. As recently as the 18<sup>th</sup> century in western, human embryology was preformation. The idea that 'semen contains an embryo'- a preformed, miniature infant that simply becomes larger during development. As microscopy improved in 19<sup>th</sup> century, biologist could see that embryo took shape in series of progressive steps, epigenesis displaced preformation as the favoured explanation amongst embryologist. After 1950, the field of molecular biology and genetics developed which attempts to correlate the genes with morphological change and so tries to determine which genes are responsible for each morphological change that takes place in an embryo.

**Concept of fertilization:** Ancient aacharyas used the term *Raja* or *Streebija* for ovum and *Retas* or *Shukra* for sperm. The term '*Garbha*' is mentioned for embryo or foetus. The union of *shukra* (sperm) and *aartava* (ovum) takes place inside the *Garbhashaya* (uterus), after that *Atma* or *jiva* (spirit of supreme soul) enters in this and formation of *Garbha* (embryo) takes place.<sup>[1,2]</sup> Addition to *atma*, the association of *prakriti* (nature) and *vikaras* (emotions) are essential.

There is some difference in the event described by various authors. As mentioned in the *Charakasamhitagrantas* – when man copulates with a *Rutumati* woman (woman having ovulatory period of menstrual cycle) due to excitement or pleasure the *shukra* is excreted. This excreted *shukra*, coming out of male body enters the uterus through proper passage (vagina) and gets mixed with *aartava* (*streebija*). At this time due to

association of *satva*(mind), *jivatma* (spirit) comes there in the *garbha*(zygote). Due to congenial diet by pregnant woman, this *garbha*(fetus) grows normally and gets delivered at appropriate time with all *indriyas* and complete body parts along with *matrija*(maternal), *pitrija*(from father), *atmaja* (self), *satmyaja* (conducive of any substance or process to an individual i.e. habituation), *satvaja* (one of the three mental quality according to Indian *vedic* philosophy which means purity, harmony and balance) and *rasaja* (food) *bhavas* (physical and psychological components – genes).<sup>[3]</sup>

**Concept of cell division to form an embryo and foetus:** The multiplication of cells takes place by division of pre-existing cells in zygote to form an embryo and then foetus. As per ayurvedic *granthas*, responsible factors for cell division are ‘*Panchamahabhutas*’- *Vayu*, *Teja*, *Jala*, *Prithvi* and *Aakasha*.

In alive *garbha*, *vibhajana*(division) is done by *vayu*, *Paachana* process (metabolism) is done by *Teja*, *Kledana* (moistening) is by *Jala*, *Samhana*(solidification) is by *Prithvi* and *vivarana* (increase in size) is by *Aakasha mahabhuta*.<sup>3</sup> Dalhan further clarifies the verse saying that – ‘Only *chetana* (spirit), *garbha* (foetus) remains alive up to time of delivery, in absence it gets putrified or degenerated. The division of major and minor body parts is done by *Vayu*. The *Teja* by metabolism changes the shape and provide general appearance like human structure. The dryness or absorption caused by division and metabolism by *Vayu* and *Tejas* is normalised moistening

action by *Jala*. *Aakash* by providing vacuum to the *srotasa*( channels), increase the size.<sup>[4]</sup>

**Concept of foetal nourishment:** In *charakasamhitagrantha* – it is mentioned that embryo gets its nourishment from *Rasa* (supplied by mother) by process of *Upasnehana* (attracting moisture) and *Upaswedana* (osmosis). Through the passage of umbilical cord and placenta which they have called *Garbhanabhi-nadi* the foetus gets its nourishment.<sup>[5-7]</sup>

**Concept of Organogenesis and other features formation:**<sup>[8-12]</sup> It is now proved that, from embryonic disc, germ layer formation occurs, from which different organs gets formed and developed at different periods of foetal growth.

In ancient *granthas*, it is mentioned that organ formation is from six factors which termed as *bhavas* –*matrija*(maternal factors), *pitraja*(from father), *Atmaja*(from soul), *Satvaja*(mental faculty), *Rasaja*(food) and *Satmyaja* (habituation) and from *Panchamahabhutaj*.

- 1) Body parts formed from *Matrijabhava* – Skin, blood, muscles, fat, umbilicus, heart, spleen, kidney, urinary bladder, bone marrow and organs of digestive system.
- 2) Body parts formed from *pitrajabhava* – Hairs, teeth, bones, veins, arteries, tendons, nails and semen.
- 3) Components derived from *Atmajabhava* – Knowledge about oneself, happiness, sadness, emotions, birth in specific species and appearance.
- 4) Components derived from *Satmyaja bhavas* –Life, natural immunity, refined intelligence and function, absence of idleness, strength and energy.

5) Components derived from *Satvajabhas* –Consciousness, determination, pride, endeavour, memory, knowledge and longevity.

#### **Monthly foetal development :**

1) 1<sup>st</sup> month : Embryo takes shape of *Kalala*( random or irregular form). <sup>[13-15]</sup> Harita elaborated in detail development in 1<sup>st</sup> month.<sup>[16]</sup> On 1<sup>st</sup> day – It becomes *Kalala*. as per modern science morula formation.

Upto 10<sup>th</sup> day - It becomes *Budbuda*. (this indicates blastocyst formation which begins about on 5<sup>th</sup> day)

Upto 15<sup>th</sup> day - It becomes *Ghana* (solid).

Upto 20<sup>th</sup> day - It becomes mass of flesh (*mamsapinda* ).

Upto 25<sup>th</sup> day - It becomes *Panchamahabhatatmaka*. (we can explain it as already present from fertilization, gets activated for organogenesis)

2) 2<sup>nd</sup> month: Sex of child can be predicted at this stage. If solid mass has oval shape (*pinda*), then born child would be male, if elongated (*peshi* ) the female and if round shape (*arbudakara*) mass the hermaphrodite. Shushruta have elaborated that, accumulated mahabhutas gets processed by combined *shleshma*, *pitta* and *vayu* (*tridosha*) and becomes solid.<sup>[17-20]</sup>

-Harita mentioned upto 50<sup>th</sup> day budlike structure of future body parts are formed (*Garbhankura* ).<sup>[21]</sup>

3) 3<sup>rd</sup> month: In the third month, all body parts and *indriyas* becomes apparent. Five buds – one for head, 4 for upper and lower extremities developed.<sup>[22-25]</sup>

-Kashyapa mentioned, movement of embryo starts (*praspandana*), develops consciousness and can feel

pain.<sup>[26]</sup> Development of body hairs is mentioned by Chakrapani in this month.<sup>[27]</sup> According to modern science, organs arms and legs are developed up to end of 2<sup>nd</sup> month and on 3<sup>rd</sup> month. Spontaneous movements are possible by foetus, although they are usually faint to be felt mother.<sup>[28]</sup> May be this apparent movement is mentioned by Kashyapa.

4) 4<sup>th</sup> month: The formation of various body parts completed till 4<sup>th</sup> month and stability to foetus comes. Heart beating and consciousness associated with heart is mentioned by Shushruta and Bhavamishra. Character and behaviour of child can be determined by the presence of taste and food the mother asks for.<sup>[29-32]</sup>

-Harita mentioned lanugo appears on 4<sup>th</sup> month.<sup>[33]</sup>

As per modern science, heart beating starts at 2<sup>nd</sup> month but are audible through Doppler on 3<sup>rd</sup> month and by stethoscope in 4<sup>th</sup> month. In ayurvedicgranthas, heartbeats apparent is mentioned directly on 4<sup>th</sup> month and lanugo formation is mentioned in 4<sup>th</sup> by modern and by Harita also.

5) 5<sup>th</sup> month: Mind is developed and hence increase in the mental consciousness.<sup>[34-37]</sup>

-Harita mentioned the foetus becomes more '*Sujiva*' (viable)<sup>[38]</sup>.

As per modern, by 5<sup>th</sup> month, auditory and peripheral sensory reflexes develop to certain extent according to modern researches hence authors have mentioned the enlightenment of '*mana*'.

6) 6<sup>th</sup> month: Aacharyas have mentioned enlightenment of '*buddhi*' in 6<sup>th</sup> month.<sup>[39-40]</sup>

-Development of hairs, nails, bone, tendons and accumulation of energy and skin complexion is mentioned in this month.<sup>[41-42]</sup>

-Harita mentioned *Prasphurana* – spontaneous foetal movements.<sup>[43]</sup>

Up to 24 to 25<sup>th</sup> week sensory and motor neurone system attains some maturity and gets developed....so description about enlightenment of ‘*buddhi*’ can be explained. Till 6<sup>th</sup> month hair forms extending to include eyebrows and eyelashes and hairs on scalp. Lanugo covers entire body.<sup>[44]</sup>

7) 7<sup>th</sup> month: In 7<sup>th</sup> month all the features, all body parts and organs gets properly developed.<sup>[45-48]</sup>

According to modern, foetal viability is mentioned by 28<sup>th</sup> wk , if birth occurs at 7<sup>th</sup> month newborn can survive as lungs gets matured.<sup>[49]</sup>

8) 8<sup>th</sup> month: Instability of ‘*oja*’ is mentioned in this month by all *aacharyas* in this month.<sup>[50-53]</sup>

[*Oja* concept – it is essence of all seven *dhatus* which give strength to the body,

improves immunity power and takes care of well being.]

It moves from mother to foetus and foetus to mother in this month. At the time of delivery if *oja* remains in mother’s body instead of foetus, foetus will die.<sup>[50-53]</sup>

This concept of ‘*ojatranformation*’ is difficult to explain yet by modern science, but it is noted that babies delivered in 8<sup>th</sup> month have more chances of still birth than in 7<sup>th</sup> and 9<sup>th</sup> month the cause of it cannot be explain as per modern.

-Harita mentioned *Pachakagni*(digestive system) starts functioning in 8<sup>th</sup> month.<sup>[54]</sup>

#### **First body part develops in foetus:**<sup>[55-56]</sup>

There is controversy found in *granthas* regarding it. Different opinions are mentioned below which comes from debates.

<b>Sr . no</b>	<b>First formed body part in foetus</b>	<b><i>Samhitas</i> mentioning the debates</b>		
		Charakasamhita	Sushrutasamhita&Bhavamishra	Bhela
1.	Head	KaumarashiraBharadwaja	Shaunak	Bharadwaja
2.	Heart	Kankayana	Krutavirya	Parashara
3.	Umbilicus	Bhadrakapya	-	Khandakapya
4	Duodenum & anus	Bhadrashaunaka	-	Shaunak
5.	Extremities	Badish	Markandeya	Badish
6.	<i>Indriyas</i> (sense organs)	VaidehaJanaka	-	-
7.	Trunk	-	Gautam	-
8.	Eyes	-	-	Kashyapa
9.	All body parts together	Dhanwantari&AatreyaPunarvasu	Dhanwantari	AatreyaPunarvasu

As organogenesis starts from different stages of embryonic life up to 9<sup>th</sup> month opinion of Dhanwantari&AatreyaPunarvasu that all body part development starts simultaneously is more correct.

**Constituents of different body parts :**<sup>[57-58]</sup>

Organs	Origin from
Spleen and liver	<i>Raktadhatu</i>
Caecum	Waste product of <i>Raktadhatu</i>
Lung	Foam of <i>raktadhatu</i>
Intestine, anus and urinary bladder	<i>Sara</i> (essence) of <i>shleshma</i> and <i>rakta</i> by <i>pitta</i> and <i>vatadosha</i>
Tongue	<i>Rakta, kapha</i> and <i>mamsa</i>
Muscles	From <i>mamsadhatu</i> and <i>vayu</i> and <i>pitta</i>
Tendons and vessels	From unctuous portion of <i>medadhatu</i> : by <i>mrudupaka</i> – vessel by <i>kharapaka</i> - tendons
Testicles	<i>Rakta, meda, kapha</i> and <i>mamsa</i>
Kidneys	<i>Raktaandmeda</i>
Heart	Essence of <i>Rakta</i> and <i>kapha</i>

From this review we can conclude that at ancient times thought and technology was not developed, but there was detailed study about embryology including concepts of fertilization, cell division, foetal nourishment and organogenesis with monthly foetal development. Some concepts are as same as modern researches.

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