



## A CRITICAL ANALYSIS OF *GARBHAVRIDHI* (GROWTH OF EMBRYO/FETUS) IN THE THREE TRIMESTERS

Thomas Anju<sup>1\*</sup>, G M Kanthi<sup>2</sup>

<sup>1</sup>Associate Professor, Dept of Rachana Shareera, Sri Dharmasthala Manjunatheswara College of Ayurveda, Hassan, Karnataka, India.

<sup>2</sup>Professor & HOD (Rtd), Dept of Samhita & Siddhanta, Sri Dharmasthala Manjunatheswara College of Ayurveda, Udupi, Karnataka, India.

**KEYWORDS:** *Garbha* (embryo/fetus), Trimester, *Garbhavidhi* (growth and development of embryo/fetus), Pregnancy, Gestation

### ABSTRACT

The union of *Sukra* (sperm) and *Sonita* (ovum) along with *Atma* (soul) in *Garbhashaya* (uterus) is termed as *Garbha* (embryo/fetus). It is formed as a result of combination of *Panchamahabhutas* (five elements) and *Chetana* (soul). Further these *Panchamahabhutas* (five elements) play an important role in *Garbhavidhi* (growth of embryo/fetus). Almost all *Acharyas* (scholars) of Ayurveda has similar opinion regarding the formation of *Garbha* (embryo/fetus). Four *Garbhotpadakabhavas* (factors responsible for the formation of embryo/fetus) and six *Garbhavidhikarabhavas* (factors responsible for the development of embryo/fetus) aid in the formation and growth of *Garbha* (embryo/fetus). The developmental stages of *Garbha* (embryo/fetus) have been vividly narrated in Ayurveda as well as modern science. Almost all ancient scholars have described the month wise development of *Garbha* (embryo/fetus) but Harita has keenly observed the changes happening in weeks or a couple of days at a few instances. The concept of *Garbhavidhi* (growth of embryo/fetus) was of great interest to the Ayurvedic scholars; the developmental changes happening in the embryo during pregnancy is given much importance in modern parlance too. As per modern view the whole period of pregnancy can be divided into three trimesters each of which comprises of three months. Each trimester has its own milestones in the developmental aspect of embryo/fetus. The knowledge regarding the developmental events help in preventing various fetal anomalies thus aids in the formation of healthy individuals and thereby a healthy society. The basic facts pertaining to the growth, differentiation, specialization and development of an individual starting from fertilization till birth forms the core concept of this review. A keen study of both Ayurvedic and modern aspects of the developmental events during the gestational period has been attempted for a better understanding.

### \*Address for correspondence

**Dr Thomas Anju**

Associate Professor,  
Dept of Rachana Shareera,  
Sri Dharmasthala  
Manjunatheswara College of  
Ayurveda, Hassan, Karnataka,  
India  
Ph: 9483544894  
Email:  
[dr\\_anju\\_thomas@yahoo.com](mailto:dr_anju_thomas@yahoo.com)

### INTRODUCTION

*Garbha* (embryo/fetus) is defined as the union of *Sukra* (sperm) & *Sonita* (ovum) in *Garbhashaya* (uterus) along with *Atma* (soul). The word *Garbha* (embryo/fetus) is formed from the root '*Ghru*' which means to eat, to devour etc. *Garbha* is formed when the *Veerya* (sperm) is placed in the *Yoni* (vagina) as per *Sabdakalpadruma*<sup>1</sup>. Charaka has described that *Garbha* (embryo/fetus) is the *Samyoga* (combination) of *Sukra* (sperm), *Sonita* (ovum) and *Jiva* (soul) in the *Kukshi* (abdomen)<sup>2</sup>. Sushruta explains the formation of *Garbha* (embryo/fetus) as the combination of *Sukra* (sperm), *Sonita* (ovum), *Atma* (soul), *Ashtaprakritis* (8 *prakritis*) and *Shodashavikaras* (16 *Vikaras*) in *Garbhashaya* (uterus)<sup>3</sup>. Ashtanga Hrudaya opines that the *Atma* (soul) impelled by the afflictions of its own past actions enters the union of *Sukra* (sperm) and *Sonita* (ovum) giving rise to the formation of *Garbha* (embryo/fetus) in a predetermined

manner just like fire from two pieces of wood rubbed against each other<sup>4</sup>. Ashtanga Sangraha too has a similar concept<sup>5</sup>. Kashyapa has a different view that *Prana* (air) divides *Bijadhata* (fertilized gamete) according to *Asthisankhya* (number of bones). The *Bija* (sperm) immediately after its entry is enveloped by the *Rakta* (ovum)<sup>6</sup>. Bhavamisra's view is that when with great love copulation occurs, *Garbha* (embryo/fetus) gets formed by the union of *Sudhasukra* (pure male gamete) and *Shonita* (female gamete) in the body of the woman; after birth it is called *Bala* (child)<sup>7</sup>. Harita gives an account of *Garbha* (embryo/fetus) as the combination of *Beeja* (sperm) and *Retas* (ovum) produces *Garbha* (embryo/fetus)<sup>8</sup>. Sharngadhara's view is similar to that of Bhavamisra<sup>9</sup>.

## Factors Responsible for Formation and Development of *Garbha*

*Garbha* (embryo/fetus) being the *Adhishtana* (abode) of *Chetana* (soul) is the product of *Akasha* (ether), *Vayu* (air), *Tejas* (fire), *Ap* (water) and *Prithwi* (earth). Thus *Garbha* (embryo/fetus) is an aggregate of *Panchamahabhutas* (five elements) and *Chetana* (soul), the latter being considered as the sixth constituent of *Garbha* (embryo/fetus). *Garbha* (embryo/fetus) formation takes place only by the suitable combination of four factors termed as *Garbhotpadakabhavas* (factors responsible for the formation of embryo/fetus) such as *Rtu* (period), *Kshetra* (place of conception), *Ambu* (nutrition) and *Bija* (gametes). Six factors are responsible for the proper development of embryo called as *Garbha vridhikarabhavas* (factors responsible for the development of embryo/fetus) which are *Matruja*, *Pitruja*, *Atmaja*, *Satmyaja*, *Rasaja* and *Satwaja* (factors derived from mother, father, soul, wholesomeness, nutrition, psyche). Development of *Garbha* (embryo/fetus) takes place by *Rasa* (nutrition) and *Adhmana* (inflation) of *Vayu* (air). The *Jyotisthana* (place of fire) is said to be inside the *Nabhi* (umbilicus). *Vayu* (air) blows it by which the *Deha* (body) of *Garbha* (embryo/fetus) grows and attains development. *Vayu* (air) along with *Agni* (fire) demarcates and dilates channels in all directions *Urdhva* (upright), *Adha* (downwards) and *Tiryak* (transverse).

*Panchamahabhutas* (five elements) play an important role in the formation and development of *Garbha* (embryo/fetus). Susruta has mentioned specific function for each *Bhutha* (element) and further Dalhana has given elaborate description for each. *Prithvi* (earth) does *Samhanana* (compactness), *Jala* (water) *Kledana* (moistens), *Teja* (fire) *Pachana* (digests); by its specific function provides general shape, *Vayu* (air) does *Vibhajana* (division) of body parts and *Akasha* (ether) *Vivardhana* (increases); it also provides space to *Srotases* (channels).

### Modern and Ayurvedic View

*Garbha* (embryo/fetus) is defined as the union of *Sukra* (sperm) and *Sonita* (ovum) in *Garbhashaya* (uterus) as per the Ayurvedic classics. The same view is contributed by the modern scientists that sperm and ovum gets fused to form the zygote. Kashyapa further states that *Bija* (sperm) immediately after its entry is enveloped by the *Rakta* (ovum). This can be correlated to the entry of sperm into the ovum. The acrosome penetrates the zona pellucida by the release of acrosomal enzymes followed by the entry of tail which results in complete fusion of the sperm and the oocyte.

An embryo is an early stage of development of a multicellular diploid eukaryotic organism. In organisms that reproduce sexually, an embryo develops from a zygote resulting from the fertilization of the female egg cell by the male sperm cell. The zygote possesses half the DNA of each of its two parents. The development of the zygote into an embryo proceeds through specific recognizable stages of blastula, gastrula, organogenesis etc. In humans, pregnancy is generally considered to be

in the embryonic stage of development between the fifth and the eleventh weeks after fertilization and is expressed as a fetus at a more advanced stage of development i.e. from ninth - twelfth week until birth.

### Trimesters

The whole period of development of embryo / fetus can be divided into three trimesters. Each trimester comprises of almost 3 months or 12 weeks which is marked by specific fetal developments<sup>10</sup>. Thus there is an almost equal division of the events of human pregnancy into three intervals<sup>11</sup>. The development in each trimester has been explained hereafter.

**I Trimester** – consists of first, second and third months of pregnancy.

#### First Month

Susruta and Ashtanga Hrudaya opine that during the first month, *Garbha* (embryo) is in the form of *Kalala* (semisolid) and is *Avyakta* (unmanifest)<sup>12,13</sup>. Dalhana further clarifies that *Kalala* (semisolid) is like *Singhanaka* (nasal discharge). As per Charaka, *Garbha* (embryo) is like *Kheta* (phlegm) because of all *Kalushitadhatus* (mixed up dhatus) and even though *Avyakta* (unmanifest) all *Angavayavas* (body parts and organs) are both *Sat* (clear) and *Asat* (hidden)<sup>14</sup>. Bhavamisra states that *Garbha* (embryo) is in *Dravavastha* (liquid form)<sup>15</sup>. Harita has explained in detail *Garbhavidhikrama* (sequence of development of embryo) in days. In the *Prathamaahani* (first week) *Garbha* (embryo) is in *Kalalavastha* (semisolid) and attains *Budbudakara* (bubble like) and *Shonitaswaroopa* (resemblance of blood) by ten days. It gets solidified and becomes *Ghana* (compact) by fifteen to twenty days and forms *Mamsapinda* (fleshy mass); by twenty five days, it attains *Panchabhutatmasambhava* (five elemental being) and by the completion of one month the *Pinda* (mass) gets the *Panchatatwa* form<sup>16</sup>.

During embryonic development, blastomeres form a loosely arranged clump until the eight cell stage. Later it forms morula and fluid penetrates the zona pellucida into the intercellular spaces which become confluent to form blastocoele; the embryo becomes the blastocyst by the end of first week. By ninth day, vacuoles appear in the trophoblast which fuses to form large lacunae. By 11 - 12 days, syncytial lacuna becomes merged with the maternal sinusoids and maternal blood enters the lacunar system thus establishing utero-placental circulation. By about 18 - 20 days embryo has a pear shaped appearance.

*Kalalavastha* (semisolid state) may be correlated to blastomeres and blastocyst; *Budbudakara* (bubble like) to lacunar stage of trophoblast which resembles a bubble; *Sonitaswaroopa* (resemblance of blood) to the maternal blood filled lacunar spaces of trophoblast and *Mamsapinda* (fleshy mass) to the pear shaped embryo. Tiny limb buds which are not easily recognizable can be correlated to the *Angavayavas* (parts and organs) which are *Sat* (clear) and *Asat* (hidden).

## Second Month

*Garbha* (embryo) becomes *Ghana* (compact) due to *Sanghata* (consistency) of *Panchabhutas* (five elements) and undergoes *Paka* (assimilation) by *Kapha*, *Pitta* and *Anila* (three humors); if it assumes *Pindakara* (mass) it develops as a *Pum* (male) or else if *Peshi* (elongated), *Stri* (female) is formed and if *Arbudakara* (tumor like), *Napumsaka* (hermaphrodite) develops. Charaka, Ashtanga Hrudaya and Bhavaprakasha have the same opinion<sup>17,18</sup>. By fifty days *Ankuras* (buds) develop according to Harita<sup>19</sup>.

In the first month embryo is so small and tender. By the end of the second month of pregnancy, the embryo resembles a tiny human infant. This might have been explained by Acharyas (scholars) that the *Garbha* (embryo) becomes *Ghana* (compact). External appearance of embryo is marked by the formation of limbs. By the beginning of fifth week, forelimbs & hind limbs appear as paddle shaped buds. The *Ankuras* (buds) can be correlated to these buds.

## Third Month

Susruta narrates the formation of *Panchapidakas* (five buds) - *Hasta*, *Pada* (limb buds) and *Shiras* (bud for head) and the minute manifestation of *Angapratyangas* (parts and subparts) while Charaka has explained the simultaneous development of *Indriyas* (sense organs) and *Sarvangavayavas* (all organs). Harita has explained the further growth of hands, legs and head in the third month. Vagbhata adds an extra point that along with the development of *Shiras* (head), *Garbha* (fetus) can perceive the knowledge of *Sukha* (pleasure) and *Dukha* (pain). Kashyapa describes that the *Garbha* (fetus) quivers during this period. Manifestation of mind in the third month has been highlighted with the perception of pain and consciousness along with *Praspandana* (quivering) as per Kashyapa<sup>20</sup>. Bhavamisra too stands by the view of Susruta.

By the end of the second month, all major body organs and systems, including the lungs, stomach, brain and liver start developing. Organs assume definitive position especially the eyes and ears. Eyelids start forming and grow but remain tightly closed<sup>21</sup>. The inner ear, ankles, toes, wrists, fingers, and sexual organs begin developing. The first bone cells appear during this period. The limbs reach their relative length in comparison with the rest of the body. Genitals, abdominal loops etc. develop during this period. By the end of third month, reflex activity can be evoked which indicates muscular activity. Coordinated fetal movements occur along with various expressions like squinting, frowning etc. and initiation of sucking occurs almost towards the end of third month.

Pleasure and pain is perceived though the sense organs with the development of head as *Shiras* (head) is the seat of *Indriyas* (sense organs). Harita's view of further growth of limbs in the third month correctly matches with that of modern view. Reflex and muscular activity is responsible for the quivering of *Garbha* (embryo/fetus). Even though genitals appear in this particular period almost all *Acharyas* (scholars) have

revealed the determination of sex in the second month itself. *Praspandana* (quivering) refers to the coordinated fetal movements; the various expressions arise as a result of consciousness which occurs due to presence of mind. Hence the manifestation of *Manas* (mind) as told by Kashyapa holds true. Simultaneous development of *Indriyas* (sense organs) and *Sarvangavayavas* (all body parts and organs) can be correlated to the development of all major body organs and systems.

**II Trimester** - consists of fourth, fifth and sixth months

## Fourth Month

Susruta describes that due to clear development of heart, *Chetanadhatu* (sentience) becomes expressive of desires as heart is the seat of *Atma* (soul). Hence the fetus expresses desires and the woman is thereafter called *Douhridini* (one having two hearts)<sup>22</sup> and all *Angapratyangas* (parts and subparts) are clearly demarcated. Charaka further explains *Rasavahinis* (nutrient channels) connecting maternal and fetal heart being the cause for *Douhruda* (having two hearts)<sup>23</sup>. Ashtanga Hrudaya mentions the manifestation of all body parts in this particular month<sup>24</sup>. Appearance of *Loma* (hair) is narrated by Harita<sup>25</sup>. Kashyapa states that *Garbha* (embryo) attains *Sthiratwa* (compactness) and becomes free from abnormalities due to which *Garbhini* (pregnant lady) experiences *Gurugatrata* (heavy body).<sup>26</sup>

Fetus is covered with lanugo; eyebrows, eyelashes and head hair are also visible and fetus increases in weight. Tooth buds and sweat glands start developing and its gender is identifiable. Fingers, toes and fingerprints are well defined. Fingernails and external ears are visible and the fetus can perceive the sense of hearing; eyes can sense light. Fetal neck is long enough to lift the head from the body. The fetus develops reflexes such as sucking and swallowing, squinting, frowning and it moves, kicks, sleeps, wakes and passes urine. Kidneys start to produce urine and pancreas starts to develop and produce hormones. Liver starts to secrete bile; spleen starts to produce red blood cells<sup>27</sup>. The legs grow longer than arms and the skeleton hardens from cartilage to bone. Brown fat starts to accumulate which has an important role in heat regulation. The pregnant woman undergoes rapid weight gain<sup>28</sup>.

As per modern science too the pregnant lady expresses longings / peculiar yearnings/ cravings which have been divided into natural / healthy & unnatural / revolting /pathological. The latter one has to be treated sufficiently. As per Giles, the former one – a part of it accounts for fulfilling some psychological want in food and drink whereas the rest is considered superstitious. Non- satisfaction of longings results in the development of longing-mark or birth-mark. The article states that due to non-satisfaction of a lady's longing to consume strawberry since it was not the season of the fruit but as she was only made to see the ripening strawberry, a strawberry like growth appeared on the eyes of the baby<sup>29</sup>.

The development of *Angapratyangas* (parts and subparts) as mentioned by Ayurveda *Acharyas* (scholars) goes in par with that of modern science. Non -



satisfaction of desires expressed by the mother results in fetal anomalies is substantiated by both modern and ancient science. Since after four months, chances of abortion decline and basic organogenesis advances to a certain extent minimizing the chances of congenital anomalies. Probably keeping this fact in mind, Kashyapa says that fetus is stable without complications. The rapid weight gain of the pregnant lady can be considered as *Gurugatrata* (heavy body).

#### Fifth Month

Susrutha opines that mind is more awakened in this month<sup>30</sup> whereas Charaka states that there is *Upachaya* (increase) of *Mamsa* (flesh) and *Shonita* (blood) of fetus due to which the *Garbhini* (pregnant lady) becomes *Krishha* (lean).<sup>31</sup> According to Vagbhata there is development of *Chetana* (sentience)<sup>32</sup>; as per Harita, *Garbha* (fetus) becomes *Sujiva* (lively).<sup>33</sup>

Weight of fetus increases considerably; quickening occurs, thus the movements of fetus are felt by the mother. Hearing of fetus improves, starts recognizing voice and gets startled by loud noise. Body of the pregnant lady uses more calories during pregnancy which results in some weight loss so as to provide nutrition for the fetus. As the calories consumed by her is utilized for the fetal growth the body resorts to use fat stores to keep going thus leading to weight loss.<sup>34</sup>

*Upachaya* (increase) of *Mamsa* (flesh) and *Sonita* (blood) can be considered as the reason for weight gain. Quickening might have been mentioned as *Sujiva* (lively) by Harita. Knowledge of perception develops to a certain extent by this month; because of this reason Susruta mentions the enlightenment of *Mana* (mind) during this span and Vagbhata states the development of *Chetana* (sentience). The utilization of calories by mother to the fetus results in *Karshya* (emaciation).

#### Sixth Month

*Budhi* (intelligence) gets evolved<sup>35</sup> and there is excessive increase of *Bala* (strength) and *Varna* (complexion) of *Garbha* (fetus) due to which *Garbhini* (pregnant lady) loses her *Bala* (strength) and *Varna* (complexion)<sup>36</sup>. Kashyapa adds *Ojas* (essence) to it. Ashtanga Hrudaya states the development of *Snayu* (ligaments), *Sira* (vessels), *Roma* (hair), *Bala* (strength), *Varna* (complexion), *Nakha* (nails) and *Twacha* (skin)<sup>37</sup>. *Prasphurana* (quivering) occurs as per Harita<sup>38</sup> while Bhavaprakasha has a similar opinion as that of Susruta.

The pupils of fetus can constrict, dilate and detect light entering eyes. The fetus can respond to sound. The fetus can see and hear and has developed a startle reflex which is an unconscious defensive response to sudden or threatening stimuli. The brain continues to develop and scalp hair continues to grow. Blood forming function is almost completely taken over by the bone marrow; fetus develops almost all parts and weight increases considerably. The skin becomes pink and smooth.

*Bala* (strength) is due to increase of weight; *Varna* (complexion) is due to *Rakta* (blood); here *Varna* (complexion) may be taken for the pink skin.

Development of *Snayu* (ligaments), *Sira* (vessels), *Roma* (hair), *Bala* (strength), *Varna* (complexion), *Nakha* (nails) and *Twacha* (skin) relates to the development of all fetal parts. Hence a direct correlation can be established. The view of Ashtanga Hrudaya somewhat matches with that of modern embryology. Kashyapa's view can also be considered here as *Ojas* (essence) is *Bala* (strength). The startle reflex is an unconscious defensive response to sudden or threatening stimuli which can be correlated to *Prasphurana* (quivering) as per Harita. Development of startle reflex as well as response to light and sound can happen only by evolution of *Budhi* (intelligence).

In the second trimester, two distinct growth spurts in fetal brain.

1. During the end of first trimester and beginning of second trimester fetal neurons begin to develop dendrites which establish synaptic connections with neighboring neurons to form vast regions of interconnected neural network. Millions of synaptic connections form during this critical period of development.
2. Brain starts downloading tendencies and properties that have been experienced by previous generations.

An innate intelligence begins to form the architecture of brain which supports function of brain, mind and consciousness.

View of *Acharyas* (scholars) regarding the manifestation & development of mind with perception of consciousness and evolution of *Budhi* (intelligence) comes in par with that of modern view.

#### III Trimester

The third trimester begins in week 29 of pregnancy and lasts until the birth of baby, which may be around week 36 - 40 weeks of pregnancy. In other words, third trimester lasts from seventh month to ninth month of pregnancy

#### Seventh Month

*Sarvangapratyanga* (all parts and subparts) becomes *Vyakta* (manifest)<sup>39</sup> and there is all round development of fetus; thereafter *Garbhini* (pregnant lady) becomes *Klanta* (tired) in all aspects<sup>112</sup>. Vagbhata quoted the development of *Sarvangasampoornata* (complete body parts) and *Pushti* (well nourished)<sup>32</sup>. Kashyapa has a similar opinion that *Garbha* (fetus) attains *Sarvadhatwangasampoornata* (complete development of all *Dhatu*s) along with *Vata*, *Pitta* and *Kapha* (three humors)<sup>49</sup>.

Several organ systems are able to function by seven months. The central nervous system has matured to the stage where it can control body temperature. The fetus gains weight which smoothens out many of the wrinkles in skin. Lanugo starts disappearing from the skin which becomes less red and wrinkled. Thus the fetus obtains well rounded contours as a result of deposition of subcutaneous fat. The fetus is more round and plump. The pregnant lady feels more zapped in this trimester because of the demands pregnancy.

All round development refers to the development of various organ systems. Due to good nourishment fetus obtains rounded contours. The view of *Klantata* (tiredness) of *Garbhini* (pregnant lady) holds true in the case of modern science too. The plumpness and rounded contours of fetus can be taken for *Pushti* (nourishment).

### **Eighth Month**

Instability of *Ojas* (essence of *Dhatus*) is mentioned by *Brihatrayees* (Charaka, Susruta and Vagbhata) and as such if the fetus is delivered in this month, it does not survive being devoid of *Ojas* (essence of *Dhatus*); Bhavaprakasha too has the same opinion<sup>40</sup>. Charaka opines that both *Garbha* (fetus) and *Garbhini* (pregnant lady) experience a wavering feeling of joy and sorrow<sup>34</sup>; while Harita mentions *Agniyoga* (union of digestive fire) in this month

Overall rapid growth of fetus occurs and most body organs are well developed in the eighth month. Fetus begins absorbing vital minerals such as iron and calcium from the intestinal tract. The pregnant woman's moods and emotions can range from over joy and excitement to impatience and worry as the delivery and motherhood approaches due to the rising hormone level. Experts have found a relationship between hormone levels and the brain's neurotransmitters especially serotonin that regulates mood<sup>39</sup>.

IgG transfer from mother to fetus begins as early as 13 weeks of gestation and transport happens in a linear fashion as the pregnancy progresses with the largest amount transferred in the third trimester. Malek and colleagues demonstrated a continuous rise in IgG levels in the fetal circulation between 17 and 41 weeks of gestation. Fetal IgG concentrations were only 5%–10% of the maternal levels at weeks 17-22 but reached 50% of the maternal concentrations at weeks 28-32. The majority of IgG is acquired by the fetus during the last 4 weeks of pregnancy and fetal IgG concentrations usually exceed maternal ones by 20%-30% at full term. Understanding the mechanism for immunoglobulin transfer will help to understand how to minimize risk of exposure of the fetus to the therapeutic monoclonal antibody both in utero and after delivery to benefit the newborn as it is a predominant means of fetal immunity. The finding that mothers respond well to vaccination and are able to transfer their entire antibody repertoire to their infants is encouraging, raising the possibility of providing protection until the time when the infant is vaccinated. Overall, the employment of IVIG therapy promises to be an area of active research with applications in mothers with primary immune deficiencies to promote maternal and newborn protection against infections and in the treatment of various antibody-mediated autoimmune diseases, modulating transfer of harmful autoantibodies<sup>40</sup>.

Babies are considered premature if they are born before 37 weeks of gestation. Fetuses begin to produce surfactant between weeks 24 and 28. By about 35 weeks, most fetuses have enough naturally produced surfactant to keep the alveoli from collapsing.

Successful development and functioning of the lung requires the completion of both physical development and biochemical development of the surfactant system required for the stability of very large surface area. Lung growth proceeds throughout gestation. There is progressive branching of the airways and finally development of alveolar spaces capable of gas exchange in the last trimester. The surfactant system is composed of phospholipids that decrease surface tension within the alveoli and prevent alveolar collapse during exhalation so that spontaneous respiratory function can occur; it develops in the last trimester and reaches maturity by approximately 36 weeks. The two processes clearly are related. Incomplete development of lung structure and premature birth prior to the development of the surfactant system will lead to respiratory compromise or insufficiency in the newborn. Birth before 36 weeks may be associated with respiratory compromise and failure. The incidence and severity of the lung disease is greater in proportion to the degree of prematurity<sup>41</sup>.

*Agni* (fire) here refers to *Jataragni* (digestive fire). While explaining the development of *Garbha* (fetus), Susruta mentions *Nabhi* (umbilicus) as the *Jyotisthana* (place of digestive fire). Dalhana further explains that *Jyoti* (fire) is *Agni* (fire) which is situated inside the *Nabhi* (umbilicus). Due to this *Agni* (fire) and the *Adhmana* (inflation) of *Srotas* (channels) by *Vayu* (air), the body of *Garbha* (fetus) grows. For digestion and absorption to take place, there is need of *Agni* (fire) and this *Agni* (fire) related to *Koshta* (alimentary tract) is *Jatharagni* (digestive fire). This might have been told as *Jatharagniyoga* (union of digestive fire) by Haritha. The overall growth of fetus as per modern view fits to this occasion. The wavering feeling of joy and sorrow experienced by the pregnant lady holds true in the modern science as well. Almost all babies born in this month will live if they receive intensive care services. This suggests instability of *Ojas* (essence) as there is chance of death of fetus if intensive care services are not administered. The immunoglobulin transfer and the development of surfactant system have to be considered while explaining the instability of *Ojas* (essence of *Dhatus*) in the eighth month.

### **Ninth Month**

9<sup>th</sup> - 12<sup>th</sup> month is considered as the normal time for delivery according to Susruta<sup>42</sup>. Harita opines that *Cheshta* (activity) occurs in ninth month and in the 10<sup>th</sup> month, there develops *Garbhavasavairagya* (dislike for stay in womb) which ultimately leads to delivery<sup>43</sup>. Almost all *Acharyas* (scholars) have mentioned the delivery of *Garbha* (fetus) in this month.

Normal time for delivery during this period is quoted in modern science too. By ninth month the fetus will descend into the head down position preparing for birth. *Cheshta* (activity) here refers to the fetal kicks. Due to *Garbhavasavairagya* (dislike for stay in womb), *Garbha* (fetus) gets prepared to be delivered out of the womb as mentioned by Harita.

**CONCLUSION**

*Garbhavidhikrama* (sequence of developmental events) has been vividly explained by many *Acharyas* (scholars) of Ayurveda. Valuable information regarding the development of *Garbha* (fetus) at different stages of growth has been contributed by these ancient scholars. All of them have made their own opinions and views regarding the subject. The concept of *Garbhavidhikrama* (sequence of developmental events) included in the study of *Shareera* (study of body) demands concern taking into consideration, the importance in assessing the developmental changes during pregnancy. Events occurring in the human body which cannot be seen with the naked eye were well narrated by *Acharyas* (scholars) decades back even before the invention of ultramodern sophisticated instruments. The knowledge of nature and causation of congenital anomalies can be well understood so as to prevent and cure these anomalies to attain sound health in the coming generations.

**REFERENCES**

1. Raja Raghakantadeva Bahadur, Sabdakalpadruma Edited by Sri Varadprasad and Sri Haricharana, Nag Publishers Delhi, Reprint 1988. p. 312.
2. Agnivesha, Charaka Samhitha, revised by Charaka and Dridhabala with Sri Chakrapanidatta Ayurveda dipika Commentary in Sanskrit edited by VaidyaJadhavji Trikamji Acharya. Choukambha Sanskrit Sansthan, Varanasi, 2007. p. 316.
3. Sushruta, Sushruta Samhitha with Nibandha sangraha Commentary of Sri Dalhana Acharya (and Nyayachandrika Panjika of Gayadas Acharya on Nidhanasthana edited by Trikamji Acharya and Narayanaramacharya Kavyathirtha). Choukambha Orientalia, Varanasi. IX Edition. 2007. p. 352.
4. Vagbhata, Astangahrdayam with Commentaries of Sarvangasundara of Arunadatta and Ayurveda rasayana of Hemadri Edited by Bhishagacharya Harisastri Paradakara Vaidya, Choukambha Orientalia Varanasi Reprint Ninth Edition 2005. p. 361.
5. Vagbhata, Ashtanga Samgraha with Hindi Commentary by Kaviraj Atrideva Gupta Vol 1, Choukambha Sanskrit Sansthan Varanasi, Reprint 1993. p. 272
6. Vrুদ্ধha Jeevaka, Kasyapa Samhita or Vrুদ্ধha Jeevaka Tantra, revised by Vatsya with Sanskrit introduction by Nepal Rajaguru Pandit Hemaraja Sharma, Choukambha Sanskrit Samsthan, Varanasi, 7<sup>th</sup> edition 2000. p. 112.
7. Bhavamisra, Bhavaprakasha, Text, English Translation, Notes, Appendices and Index Vol 1 Translated by K R Srikantha Murthy, Choukambha Krishnadas Academy Varanasi reprint 2008. p. 21
8. Harita, Harita Samhita with Hari Hindi Translation, Edited by Hariharaprasad Tripathi, Choukambha Krishnadas Academy Varanasi First Edition 2005. p. 516
9. Sharngadhara, Sharngadhara Samhita with Jiwanpada Hindi Commentary by Shailaja Srivastava Choukambha Orientalia Varanasi, Fourth Edition 2005. p. 53.
10. Pregnancy The Three Trimesters | Conditions & Treatments | UCSF...[https://www.ucsfhealth.org/Conditions & Treatments > Pregnanc](https://www.ucsfhealth.org/Conditions&Treatments/Pregnanc).
11. Dating of pregnancy by trimesters: a review and reappraisal Sawin SW, Morgan MA. - NCBI <https://www.ncbi.nlm.nih.gov/pubmed/8657403>. Obstet Gynecol Surv. 1996 Apr;51 (4) :261-4.
12. Sushruta, Sushruta Samhitha with Nibandha sangraha Commentary of Sri Dalhana Acharya (and Nyayachandrika Panjika of Gayadas Acharya on Nidhanasthana edited by Trikamji Acharya and Narayanaramacharya Kavyathirtha). Choukambha Orientalia, Varanasi. IX Edition. 2007. p. 352.
13. Vagbhata, Astanga Hrdayam with Commentaries of Sarvangasundara of Arunadatta and Ayurveda rasayana of Hemadri Edited by Bhishagacharya Harisastri Paradakara Vaidya, Choukambha Orientalia Varanasi Reprint Ninth Edition 2005. p. 361.
14. Sushruta, Sushruta Samhitha with Nibandha sangraha Commentary of Sri Dalhana Acharya (and Nyayachandrika Panjika of Gayadas Acharya on Nidhanasthana edited by Trikamji Acharya and Narayanaramacharya Kavyathirtha). Choukambha Orientalia, Varanasi. IX Edition. 2007. p. 352.
15. Agnivesha, Charaka Samhitha, revised by Charaka and Dridhabala with Sri Chakrapanidatta Ayurvedadipika Commentary in Sanskrit edited by Vaidya Jadhavji Trikamji Acharya. Choukambha Sanskrit Sansthan, Varanasi, 2007. p. 316.
16. Harita, Harita Samhita with Hari Hindi Translation, Edited by Hariharaprasad Tripathi, Choukambha Krishnadas Academy Varanasi First Edition 2005. p. 516.
17. Agnivesha, Charaka Samhitha, revised by Charaka and Dridhabala with Sri Chakrapanidatta Ayurveda dipika Commentary in Sanskrit edited by VaidyaJadhavji Trikamji Acharya. Choukambha Sanskrit Sansthan, Varanasi, 2007. p. 316.
18. Vagbhata, Astangahrdayam with Commentaries of Sarvangasundara of Arunadatta and Ayurveda rasayana of Hemadri Edited by Bhishagacharya Harisastri Paradakara Vaidya, Choukambha Orientalia Varanasi Reprint Ninth Edition 2005. p. 361.
19. Harita, Harita Samhita with Hari Hindi Translation, Edited by Hariharaprasad Tripathi, Choukambha Krishnadas Academy Varanasi First Edition 2005. p. 516.
20. Vrুদ্ধha Jeevaka, Kasyapa Samhita or Vrুদ্ধha Jeevaka Tantra, revised by Vatsya with Sanskrit introduction by Nepal Rajaguru Pandit Hemaraja Sharma, Choukamba Sanskrit Samsthan, Varanasi, 7<sup>th</sup> edition 2000. p. 112.
21. Month 2 Fetal development information How your baby is developing ww. baby2see. com/development /month2. htm



22. Sushruta, Sushruta Samhitha with Nibandha sangraha Commentary of Sri Dalhana Acharya (and Nyayachandrika Panjika of Gayadas Acharya on Nidhanasthana edited by Trikamji Acharya and Narayanaramacharya Kavyathirtha). Choukambha Orientalia, Varanasi. IX Edition. 2007. p. 352.
23. Agnivesha, Charaka Samhitha, revised by Charaka and Dridhabala with Sri Chakrapanidatta Ayurveda dipika Commentary in Sanskrit edited by Vaidya Jadhavji Trikamji Acharya. Choukambha Sanskrit Sansthan, Varanasi, 2007. p. 316.
24. Vagbhata, Astanga Hridayam with Commentaries of Sarvangasundara of Arunadatta and Ayurveda rasayana of Hemadri Edited by Bhishagacharya Harisastri Paradakara Vaidya, Choukambha Orientalia Varanasi Reprint Ninth Edition 2005. p. 361.
25. Harita, Harita Samhita with Hari Hindi Translation, Edited by Hariharaprasad Tripathi, Choukambha Krishnadas Academy Varanasi First Edition 2005. p. 516.
26. Vrুদ্ধha Jeevaka, Kasyapa Samhita or Vrুদ্ধha Jeevaka Tantra, revised by Vatsya with Sanskrit introduction by Nepal Rajaguru Pandit Hemaraja Sharma, Choukamba Sanskrit Samsthan, Varanasi, 7<sup>th</sup> edition 2000. p. 112.
27. My Baby's Growth Second trimester Fourth-month-pregnancy - 4 months pregnant | Dr N Layyous. [www.layyous.com/.../pregnancy/pregnancy-month-month/fourth-month-pregnancy](http://www.layyous.com/.../pregnancy/pregnancy-month-month/fourth-month-pregnancy).
28. Fetal Development, Weeks, Months and Trimesters Guides, Month 4 Fetal development information. How your baby is developing [www.baby2see.com/development/month4.html](http://www.baby2see.com/development/month4.html).
29. Dating of pregnancy by trimesters: a review and reappraisal Sawin SW, Morgan MA. - NCBI. <https://www.ncbi.nlm.nih.gov/pubmed/8657403>. Obstet Gynecol Surv. 1996 Apr;51 (4) :261-4.
30. Sushruta, Sushruta Samhitha with Nibandha sangraha Commentary of Sri Dalhana Acharya (and Nyayachandrika Panjika of Gayadas Acharya on Nidhanasthana edited by Trikamji Acharya and Narayanaramacharya Kavyathirtha). Choukambha Orientalia, Varanasi. IX Edition. 2007. p. 352.
31. Agnivesha, Charaka Samhitha, revised by Charaka and Dridhabala with Sri Chakrapanidatta Ayurvedadipika Commentary in Sanskrit edited by Vaidya Jadhavji Trikamji Acharya. Choukambha Sanskrit Sansthan, Varanasi, 2007. p. 316.
32. Vagbhata, Ashtanga Samgraha with Hindi Commentary by Kaviraj Atrideva Gupta Vol 1, Choukambha Sanskrit Sansthan Varanasi, Reprint 1993. p. 272.
33. Harita, Harita Samhita with Hari Hindi Translation, Edited by Hariharaprasad Tripathi, Choukambha Krishnadas Academy Varanasi First Edition 2005. Pp 524 P No-516.
34. Is it normal for a plus-size woman to lose weight during pregnancy [www.babycenter.com/Pregnancy/Nutrition & Weight/Plus-Size & Pregnan](http://www.babycenter.com/Pregnancy/Nutrition & Weight/Plus-Size & Pregnan). The Baby Center Editorial Team.
35. Sushruta, Sushruta Samhitha with Nibandha sangraha Commentary of Sri Dalhana Acharya (and Nyayachandrika Panjika of Gayadas Acharya on Nidhanasthana edited by Trikamji Acharya and Narayanaramacharya Kavyathirtha). Choukambha Orientalia, Varanasi. IX Edition. 2007. p. 352.
36. Agnivesha, Charaka Samhitha, revised by Charaka and Dridhabala with Sri Chakrapanidatta Ayurveda dipika Commentary in Sanskrit edited by VaidyaJadhavji Trikamji Acharya. Choukambha Sanskrit Sansthan, Varanasi, Edition, 2008. p. 321.
37. Vagbhata, Astanga Hridayam with Commentaries of Sarvangasundara of Arunadatta and Ayurveda rasayana of Hemadri Edited by Bhishagacharya Harisastri Paradakara Vaidya, Choukambha Orientalia Varanasi Reprint Ninth Edition 2005. p. 361.
38. Harita, Harita Samhita with Hari Hindi Translation, Edited by Hariharaprasad Tripathi, Choukambha Krishnadas Academy Varanasi First Edition 2005. Pp 524 P No-516.
39. Sushruta, Sushruta Samhitha with Nibandha sangraha Commentary of Sri Dalhana Acharya (and Nyayachandrika Panjika of Gayadas Acharya on Nidhanasthana edited by Trikamji Acharya and Narayanaramacharya Kavyathirtha). Choukambha Orientalia, Varanasi. IX Edition. 2007. p. 352.
40. IgG Placental Transfer in Healthy and Pathological Pregnancies, Patricia Palmeira, Camila Quinello, Anaúcia Silveira-Lessa, Cláudia Augusta Zago, and Magda Carneiro-Sampaio.
41. Lung Development, Peter Rothstein, MD [ptr1@columbia.edu](mailto:ptr1@columbia.edu). [www.columbia.edu/itc/hs/medical/humandev/2004/Chpt12-LungDev.pdf](http://www.columbia.edu/itc/hs/medical/humandev/2004/Chpt12-LungDev.pdf).
42. Sushruta, Sushruta Samhitha with Nibandha sangraha Commentary of Sri Dalhana Acharya (and Nyayachandrika Panjika of Gayadas Acharya on Nidhanasthana edited by Trikamji Acharya and Narayanaramacharya Kavyathirtha). Choukambha Orientalia, Varanasi IX Edition. 2007. P. 352.
43. Harita, Harita Samhita with Hari Hindi Translation, Edited by Hariharaprasad Tripathi, Choukambha Krishnadas Academy Varanasi First Edition 2005. p. 517.

**Cite this article as:**

Thomas Anju, G M Kanthi. A Critical Analysis of Garbhavidhi (Growth of Embryo/Fetus) in the Three Trimesters. AYUSHDHARA, 2016;3(3):718-724.

**Source of support: Nil, Conflict of interest: None Declared**