

## AN ANALYTICAL STUDY OF ESSENTIAL FACTORS FOR EMBRYOGENESIS

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### ABSTRACT

*Ayurveda*, the ancient Indian medical system has given emphasis on various measures to facilitate fetal growth and normal delivery in due time. The procedure initiate from even before conception and application of subsequent measure for meeting the objective of proper embryogenesis Ayurveda given importance on *Garbhatpadakarobhava* i.e. essential factors *ritu*, *khetra*, *ambu*, and *beeja* to be in healthy state. These can be understood with reproductive age of parents, condition of maternal health both physical and mental, condition of nourishment of both parent and status of ovum and spermatozoa in general. It is observed that due to deficiency or abnormality of any factor will hamper in conception. The ritumati characteristics can be understood with ovulatory changes. Here different hormone specially related to limbic system come in to consideration. Endorphine helps in synthesis of NO which influences mood elevation. Status of uterus also shows significant role in impregnation. *Ambu* is the nourishment during the preconceptional period and deficiency may hamper in fertilization. On the other hand *beeja* and its defect in broader sense can be understood with chromosomal and genetic abnormality. According to *Ayurvedic* principles, proper preparation of the parents is an essential prerequisite for a healthy progeny. Pre-conception care is a set of interventions that identifies biomedical behavioural and social risks to the health of the mother and the baby. The conglomeration of these procreative factors is must for healthy embryogenesis. Any defect of these factors becomes a cause for defective pregnancy. The present work Analyses to understand embryogenesis in Ayurveda with therapeutic intervention.

**Keywords:** Embryogenesis, reproductive age, ovulation, reproductive system

### INTRODUCTION

The text enriched with description of embryogenesis. Embryo defined as *Garbha* includes from the formation of zygote upto the development of fetus with subsequent maturation. Certain factors are considered as essential factors for formation of *Garbha*. The achievements of conception depend on normal physical and psychological status of both parent, healthy and normal reproductive system, healthy sperm as well as ovum are considered mostly. However *Susrutas* mentioned 4 factors

i.e. *Ritu*, *Ksetra*, *Ambu* and *Beeja* which are more significant and specific. *Susruta* equating achievement of conception with germination of a seed says that as sprout comes out by the aggregation of Season, Soil, Water and Seed likewise proper union of *Ritu*, *Ksetra*, *Ambu* and *Beeja*, are essential for definite achievement of *garbha*. In this context the above mentioned 4 factors *Ritu*, *Ksetra*, *Ambu* and *Beeja* can be understood as ovulation period and period near the ovulation, female

reproductive system, nourishing substances of parents and sperm and ovum in specific. In this study we try to analyze the concept from classics with clinical applicability from modern Biogenetic and Cytogenetic. Involvements of micronutrient that are essential for fertilization are also stressed to clarify the whole context.

#### **AIMS:**

1. Review of essential factor for fertilization.
2. Analysis the factor of embryogenesis from applied aspect.
3. Assessment of review of Previous Research Work.

#### **MATERIAL AND METHODS:**

The present study designed to carry out the work in following ways-

1. Analysis of factor responsible for embryogenesis in different context.
2. Reproductive health of both maternal and paternal will be assess and observation of its effect of different pathological condition in fertility.
3. Influences of different factors in maternal reproductive health specially on uterus (*khetra*) will be assess.
4. Similarly *ambu* and *beeja* with their influencing factor in the morbidity will be seen in different work and micro nutrients and its influence will be interpreted.

#### **DISCUSSION**

**RITU:** The term indicate season. However in the context of embryogenesis it is emphasize with the reproductive period of female and ovulation in particular. The term is specifically highlighted for two purposes i.e. *Bijotsarga* (release of ovum) and *Garbhadhan* (fertilization). Ovulation is the key period which is necessary for above two functions. In text the duration is considered 12 days by *Susruta*, *Vagbhata*, *Indu*, while *Cakrapani*, *Harita*, *Bhavaprakash* considered it as 16 days. The differ-

ence is due to counting from onset up to 16 days while 12 days when it counted from third or fourth days of last menstrual period. The view is cleared by *Dalhana*.

Ovulation which is a period of menstrual cycle, counted from 12 to 16 days in a normal 28 days phase. *Ritukala* is mentioned as the best period of conception without any morbidity. The text enriched with characteristics of *Ritumati*. Ovulation necessary for conception occurs by a complex interplay of gland and hormone. The characteristics of *Ritumati* exhibit a glimpse of ovulation with inclusion of both primary and secondary signs. An interpretation in this regard is essential-  
**RITUMATI LAKSHANA WITH CHARACTERISTICS AND INDUCING FACTORS FOR OVULATION:**

*Pinapasannabadana* (enlightened and cheerful face): Exhalation of mind is occur due to action of endorphin specifically endorphin. It is observe that beta endorphin stimulate the activity of ovarian nitrous oxide synthesis which in term is key for cheerfulness of mind.

*Praklinnamukhatbijam* (moistening of teeth and mouth): Increased mucosal secretion due to high level of estrogen

*Narakamangpriyokotha* (anxious to hear love stories and have sexual relation): Affection toward the opposite sex. Peaking up of estrogen and testosterone level influences the sensitivity and increased sexual drive.

*Sphuratbhujakusasoninabhyuruja-ghanasfisam* (Quivering of arm, breast, and pelvis, umbilical Thigh and Hip) all these characters occur due to increased level of estrogen which in other way responsible for increased libido. Mucosal changes in external genitalia with increased circulation also may be incorporated here.

*Harshautsukaparam* (happy and excited): Due to hyperactivity of limbic system

In broader sense however *Ritu* exhibit best phase of reproductive age. It is seen that female fertility is affected by age. After puberty, female fertility increases and then decreases, with advanced maternal age causing an increased risk of female infertility. This occurs due to decline in oocyte quality such as aneuploidy rather than merely decreasing oocyte number. In humans, a woman's fertility peaks in the early and mid-20s, after which it starts to decline slowly, with a more dramatic drop at around 35<sup>1</sup>. The prevalence of infertility increased ranging 1% at 25years and enhance to 55% at 45years. At a specific period the reproductive activity totally ceased i.e Menopause, identifies with physiological cessation of fertility which is indicate with women's biological clock<sup>1</sup>.

A typical term ovarian reserve used in reproductive health emphasizes the capacity of ovary to produce potent ovum mean for conception. Increase maternal age influence 81% of ovarian reserve with influencing female infertility<sup>2</sup>. As like female the increasing male age has significant impact on reproduction. Increasing male age is associated with increased time to conception. This reflects the age-related increase in acquired medical conditions, falling androgen levels, decreased sexual activity, alterations in sperm motility and morphology, decreases in semen quality, and increasing rates of DNA fragmentation in sperm. Glucosidase, PSA, zinc, and fructose were significantly lower in men aged > 50 years compared with men aged between 21 and 30 years. In a multiple regression analysis, glucosidase and PSA showed positive association with progressive motility, whereas zinc levels showed an inverse relationship with motility. Declining testosterone with increase age may

cause decline in libido, erectile dysfunction, and difficulty achieving ejaculation.

**KSETRA:** The term *ksetra* means a field or area or a sphere of action. In text the term is highlighted for the place or human body in which the *kshtregya* (i.e. soul, *sakshi, bakta, ganta...*) reside. However in this context of fertilization the term better to understood with the status of women health in general and reproductive system of the mother, mainly the uterus in particular. The homeostasis condition of mother health, the whole hormonal control of ovarian and uterine cycle along with the normal anatomical and physiological condition of the reproductive system is essential for formation of *Garbha*.

Certain morbid conditions of reproductive system are responsible for infertility can be enlisted as bellow-

**A. Ovarian cause:** An ovulation- failure to release mature egg which may due to following reasons- Hormonal imbalance (FSH & LH), Obesity and weight gain, Prolong excessive stress, High level of serum prolactin, Cyst in ovary, various medications.

**B. Related to fallopian tube:** Obstruction in various part result-Defective ovum picks up, impaired tubal motility, Partial and complete obstruction of tubal lumen.

**C. Uterus related cause:**

1. Fibroids-when they are located close to tubal opening or in cervical region can cause infertility.
2. Adhesions- A tough band of fibrous tissue causing obliteration of the cavity of uterus in varied severity can lead to infertility.
3. Septum-presence of wall in the uterine cavity can cause recurrent pregnancy loss and infertility.
4. Congenital malformation- Maldevelopment of uterus and bicornuate uterus.

5. Related to cervix-Anatomical defect preventing the sperm to ascend into the uterine cavity and thus preventing fertilization.
6. Cervical mucus-faulty mucosal composition or amount, Presence of anti-sperm or sperm immobilizing antibodies in the mucus may be implicated as immunological factor of infertility.

D. Vaginal cause: Congenital narrowing/ Stenosis of the vagina, Presence of partial or complete wall in vagina.

The psychological status of parent also shows impact on fertility. Interrelation of stress in infertile women specifically suffered from depression is noted. Different cognitive behavioural therapies improve psychological quality which shows significantly high rate in pregnancy. *Bhaya*, *shoka* considered fatal factors for conception highlight defective mental alteration. Study involving treatment of infertility specially IVF shows that depression mood disorder affects the fertility in vitro.

Above mentioned all the causative factors are directly related with reproductive system which is hinder in the formation of *garbha*.

**AMBU:** The term *Ambu* means water in general. But in this context it emphasizes the nourishing substances of both mother and father. However in specific it can be considered as the periconceptional maternal nutrition which plays a key role in reproductive health. This affects both fertility and the early stage of gestation.

Recent evidences shows that Micronutrient deficiencies have been associated with significantly high reproductive risks, ranging from infertility to fetal structural defects and long-term diseases. Fertility, conception, implantation, fetal organogenesis and placentation are the critical stages potentially affected by nutrition during the periconceptional period. Reactive oxygen

species (ROS) and total homocysteine (tHcy) plasma levels are factors involved in the respective mechanisms. The preconceptional period is particularly important since it affects both fertility and the early stages of gestation. Micronutrients' dietary intake and maternal status affect the different phases of the onset and development of pregnancy as well as of the fetus.

#### **Role of specific dietary micronutrients in ovulation:**

- Iron supplements and non-heme iron supplements decrease the risk of ovulatory infertility (Chavarro *et al.*, 2006).
- Folate seems to be important for oocyte quality and maturation (Ebisch *et al.*, 2007).
- Zinc plays a role in ovulation and the menstrual cycle. Oocyte maturation, ovulation, luteolysis and follicle atresia are affected by ROS unbalance. OS and apoptosis are involved in folliculogenesis, follicular atresia and luteal regression. In particular, OS leads to detrimental effects on second meiotic division progression, diminished gonadotrophin, antisteroidogenic actions, DNA damage and inhibited protein ATP production (Ruder *et al.*, 2008).
- Similarly, folate, zinc, ROS and thiols affect apoptosis, which is important for regulation of follicle atresia (Hussein, 2005), degeneration of the corpus luteum and endometrial shedding.
- Deficiencies of vitamins A, C and D have been demonstrated to result in diminished fertility in rats and rainbow trout as reported by Ebisch *et al.* (2007)

Role of micronutrient in spermatogenesis: various nutrients help in spermatogenesis, among them most important are act as below:

#### **Zinc helps in:**

- involves in ribonuclease activity<sup>4</sup>
- participate in spermatozoa maturation<sup>4</sup>,

- Preserve germinative epithelium and somniferous tubule<sup>4</sup>.

**Function is various vitamins:**

- Vit B2: involves in RNA & DNA synthesis, promote healthy growth of somniferoustubule<sup>5</sup>
- Vit B9: promotes healthy sperm & somniferous tubule development<sup>5</sup>.
- Vit BA: spermatogonia differentiation spermatogonia regulation<sup>5</sup>.
- Vit E: promote healthy reproductive organ development, prevent sperm cell membrane from lipid peroxidation, defends sperm from ROS related events<sup>6</sup>
- Vit C: protect sperm from oxidative stress<sup>7</sup>.

**Function various nutrient on sperm motility-**

- Calcium-initiate sperm motility<sup>8</sup>
- Selenium-assure the accurate formation of mid piece and flagella<sup>9,10</sup>.
- Zinc-enhance sperm motility through ATP system and phospholipids regulation<sup>11</sup>.
- Vit E- Improve mitochondrial function<sup>12</sup>.
- Nickel- change CNG cation channel function<sup>13</sup>.

**BEEJA:** The term indicates seed essential for fertilization. *Beeja* possess the capacity to produce another thing by removing its covering. It is the excellent status of reproductive tissue in parents i.e. spermatozoa and ovum. However exact representation of *beeja* is the condition of genetic material i.e. chromosome, DNA with mRNA and gene play key role in conception and subsequent development. The inducing cause for infertility expressed under chromosomal and genetic factor can be enlisted as bellow-<sup>14,15</sup>

**1. Chromosomal abnormalities-**

- a. Numerical abnormalities: Anuploidy of the sexual chromosomes (1%) Fe-

male: Turner syndrome - 45,X. Male: Klinefelter syndrome - 47,XXY

- b. Structural abnormalities: Reciprocal translocations (0.6%), Robertsonian translocations (0.2%), Inversions (0.1%),Deletions (0.1%).
- c. X-linked disorders- Premature Ovarian Failure (POF Syndrome) Female carries of FMR1 permutation, increased risk of POF, subclinical ovarian dysfunction. Monosomy 45,X – 50%,Mosaicism 45,X/46,XX – 20%. sochromosome 46,X,I (Xq) – 15% 46,X,r(X), 46,X,del (Xp), etc – 15%
- d. Y chromosome micro deletions (Yq11.2): Microdeletions in Yq11 (AZFa, AZFb, AZFc) are the most frequent genetic cause of male infertility. Y chromosome Testicular histology associated to AZF deletions

**1. Gene mutation (Monogenic disorders)-<sup>16</sup>** Monogenic disease, most common

autosomal recessive disorder, CFTR mutations: (Cystic Fibrosis Transmembrane Conductance Regulator), Congenital Absence of Vas Deferens (CAVD)About 98% of males affected with CF is infertile. Mutations (>1300) in CFTR gene Clinical features related with infertility male: atrophy, fibroses or congenital absence of vas deferens female: reduced fertility, thick dehydrated mucus in the cervix. Prenatal environmental cause: The Toxin are as- Methyl mercury, Lead, Ionizing radiations, Polychlorinated biphenyls, Polycyclic aromatic compounds ,Other air contaminants, Organic solvents ,Some pesticides, Alcohol etc.<sup>16</sup> Developmental toxicants' effects: Chromosomal abnormalities Spontaneous abortion, Still-birth, Low Birth weight, Decreased head circumference, Preterm delivery, Birth defects, Visual and hearing deficits, Intellectual deficits etc.

**MECHANISMS OF ACTION:<sup>16</sup>**

1. Direct gene expression -Environment directly acts on hormone function
2. Epigenetic route -Environment augments gene expression, but does not act directly on DNA sequence
3. Genetic route -Environmental exposure causes DNA mutations in the egg, sperm, or the foetus
4. Endocrine mimicking
5. Neuroendocrine route- Effect nervous system that then acts on hormones
6. Systemic toxicity:

## CONCLUSION

Essential factors for conception mostly consider as *Garbhatpadakarobhava* emphasize thus *ritu, khetra, ambu, beeja* can be understood with reproductive age of parents, condition of maternal health both physical and mental, condition of nourishment of both parent and status of ovum and spermatozoa in general. While in particular they better to understand with best fertile period along with ovulation, condition of uterus with proper hormonal balance, nutritive substances of mother and status of genetic material in relation to *ritu, khetra, ambu, beeja* respectively.

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