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Ayurveda and Ovulation Induction: Insights from Classical and Modern Literature

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Abstract: ***The main factor responsible for female infertility is the inability to ovulate. The woman's chances of becoming pregnant are reduced even though ovulation does occur. The spectrum of ovarian dysfunction includes the inability to generate a corpus Luteum that functions normally after ovulation. Fertility problems have a plethora of causes. Anovulation is one of them. In contrast to seed germination, the creation of Garbha is attributed by Ayurveda to four crucial components: Rutu (fertile period), Kshetra (healthy reproductive organs), Ambu (appropriate nutrient fluid), and Bija (ovum / sperm).Any one of these flaws might lead to Vandhyatva, or infertility. Of these four, the ovulation is directly correlated with Bija (ovum/sperm). The vitiation of vata is a reflection of ovulatory failure, which is responsible for around 40% of female infertility in the modern era. In Ayurveda, aartavaha strotas is co-related with menstrual cycle and very important for female reproductive system. Dosh dushti mainly vata dushti causes vaginal discomfort (yonivedana), sparse menstrual blood, and delayed or absent menstruation, which is called kshina Artava. The use of hormonal treatment to induce ovulation is very expensive and carries a number of complications. Thus, it is necessary to include Ayurvedic medications for inducing ovulation. Ayurvedic practitioners recommend Nidana parivarjana as the primary therapy method. Artavajanaka Dravya (helps in ovulation induction by keeping all doshas in balance. When the Apana vayu is blocked, the Anulomana of Artava is eliminated, allowing for normal ovulation. Uttarbasti is also highly beneficial for the anovulatory cycles.***

Keywords: Rutu, Ambu, Bija, ksehtra, Kshinaartava, yonivedana, ovulation, infertility, Anulomana, Uttarbasti.

I. INTRODUCTION

A growing number of infertile cases are occurring due to changes in lifestyle, even if the world population is expanding. The ancient *Ayurvedic* scholar *Sushruta* has mentioned the four crucial elements for conception that are now as important as they ever were. The ovum is one of these vital components that make up the feminine aspect. The vitiation of vata is indicative of ovulatory failure, which is responsible for around 40% of female infertility in the modern era. *Stree* means one who keeps *garbha* or has the ability to procreate.

Factors responsible for fertility[1]-ऋतुक्षेत्राम्बुबीजानाां सामग्र्यादङ्कुरो यथा| (सु. शा. २/३३) In contrast to seed germination, *Ayurveda* identifies four vital elements—*Rutu* (fertile phase), *Kshetra* (healthy reproductive organs), *Ambu* (appropriate nutritional fluid), and *Bija* (ovum/sperm)—results in formation of *Garbha*[1].

Infertility (Vandhyatva) may arise from one of these defects. *Bija,* or seed, is the one of these four vital components that directly affects the ovulation process. In women, the lack of this *bija* is referred to as anovulation. Anovulatory cycles are mostly caused by vitiation of *vata*, which affects the menstrual and ovulatory phases and is devoid of *Bija (*ovum)[2].

Anovulatory cycles are now recognized as an issue of lifestyle changes. Unusual eating and lifestyle choices lead to dosha vitiation and malabsorption result in blockage, or *Margasyaavarana*, which in turn causes *Rasa/Rakta dosha dushti*. Reduced menstrual flow, or *ArtavaKshaya*, is one of the symptoms. This might be either *bijarupa* (invisible) or *drusyarupa* (visible). *Vata and pitta* become more severe due to *dhatu kshaya* (diminished tissue element) and *margasyaavarana* (obstruction of passageways), while *kapha* reaches *strotas* (channels), which leads to various diseases and *rasadi dhatu sosha*[3]. *Kshinaartavadushti*, or a decreased menstrual period, is brought on by *pitta and vata* together[4]. Women's *artava*, or menstrual period, is ruined as a result of blockage in the *dosha* passages[5].

The signs and symptoms of *kshinaartava* (diminished menstruation / ovulation) includes
vaginal discomfort (*yonivedana*), sparse menstrual blood, and delayed or absent

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menstruation[6]. One of the signs of polycystic ovarian disease, which prevents ovulation, is scanty bleeding[7]. Ovulatory factors are responsible for 26–44% of female infertility cases. The use of hormonal treatment to induce ovulation is very expensive and fraught with complications. Thus, it is necessary to include ayurvedic medications for inducing ovulation. There are naturally occurring herbs that are highly helpful in triggering ovulation in addition to helping the body' hormones.

II. CONCEPT OF *BEEJA*

Beeja signifies *Shukra and Shonita*. We can interpret *Shonita* as *beejarupa Artava* which is ovum (*Streebeeja*). *Artava* word denotes *Streebeeja* i.e. Ovum[8]. In females, *artava* is a component for *garbha* formation, it is understood that *shukra* is for *bala, varna, pushti*. With this, it is understood that, in females, *shukra* is not for *garbha* formation. Due to the *shukrapradurbhaava* during puberty, *romaraajee* (hair) appears at special places (pubic, axillary) in females. In *Sushruta Sharira sthana*, there is a word *Anatargataphala* which directly refers to ovary.

A. Anatomy of Ovary[9]

The two paired sex organs, known as the female gonads are responsible for-I)Steroidogenesis II) the development, storage and release of germ cells.

Each oval- shaped ovary has a pinkish- gray colour, and throughout the reproductive stage, the surface becomes scarred. It is approximately 3 cm long, 2 cm wide and 1 cm thick. Each ovary has two terminals – Tubal and uterine, two boundaries – mesovaria and free posterior and two surfaces – medial and lateral.

Ovaries reside within the peritoneum. Ovarian fossa or the lateral pelvic wall contains the ovary in a nulliparous female. The ovary is connected to the posterior layer of broad ligament by the Mesovarium, to the lateral pelvic walls by the infundibulopelvic ligament and to the uterus by the ovarian ligament.

The germinal epithelium, a single layer of cubical cells, covers the ovary. Inside the medulla and outside the cortex makes up the glands' substance.

III. CONCEPT OF OVULATION

All these references establish that the word *beeja* means 'the ovum', essential for conception. Combination of *shukra* (Sperm) and *shonita* (Ovum) is the fertilization and forms *garbha* (conceptus).

Menstruation/ovulation takes place only after the age of 12 years, but the ovum is present in the latent form in the body of the fetus from the period of pregnancy.

Woman becomes capable of conception, provided the sperm and ovum are pure with *shodhan* and gain natural qualities.

Beeja nirmana starts from the age of approximately 12 years (*Rajodarshan kaal) and* ceases at the age of 50 years (*Rajonivrutti kaal*). But the *beeja* is present since the fetal stage in *Avyakta* form. This is also proved in modern science, that oocytes are present since the fetal life, which starts to get mature at puberty. This explanation is very nicely given by Sushruta[10] by giving example of bud of a flower that as the bud of flower has its fragrance since its birth, but it is revealed only after when the flower blossoms. Similar to this, *beeja* is present since birth in *Beejagranthi* in *Apakva* (immature) form and it begins to mature at the age of puberty.

This happens because prior to the puberty, the dhatus are not *Paripurna*. At puberty, all *dhatus* attains *purna bhava and* then the *beeja* reaches its maturity. This is explained in *Kashyapa Samhita Khila sthana* i.e. formation of *beeja* begins at the age of 12 when the *dhatu* gets matured[11].

Our *Acharyas* has mentioned *utpatti* of every *dosha, dhatu, updhatu and mala*. They have mentioned that when *Ahara* is taken, then due to the action of various *agnis,* it is converted into the "*Rasa"*. From *rasa, uttarottara dhatus* and *updhatus* are being produced. The main function of *rasa is preenana* i.e. supplying nutrition to every part of the body. After consuming *ahara*, the *ahara rasa* is treated with *Jatharagni* and then *Dhatvagni* to create *Artava.*

By the action of *Rasagni, Rasa* is converted into its *Prasada bhaga and Kitta bhaga*. The *Prasada bhaga* again gets divided into two parts as *Sthoolabhaga and Sukshma bhaga*. This *sukshmabhaga travels to Beejashaya or Beejagranthi*, where by action of various *agnis* it is transformed to *Beeja* or ovum[12].

A. Physiology of Beejotsarga

The transformation that takes place during *Ritu Kala* can be used to explain the physiology of *Beejotsarga. Ritu kala* is described as a time when conception is most likely to occur. This is a precise reference to the time of ovulation, when the highest possibilities of conception are found as *Ayurveda scholar Kashyapa* has explained a *Ritu kala,* also known as the *Beeja Kala*[13].

B. Time frame of Ritu Kala

Various theories are available in this context are –

1) It is of 12 days[14]
2) It is of 16 days[15]
3) It is for the whole month[16]
4) It is present even in the absence of menses[17]

These two last opinions strongly suggest about the ovulation inside the body. The different opinion of *Ritu kala* 12, 16 may be due to that some who described 16 days they might have included 4 days of menses and those who said about 12 days they might have excluded 4 days. So, in short *Ritu kala* starts from the 5th day of menstrual cycle up to the 17th day in average. During this *kala*, different changes occur in *Beeja* (follicle). Follicle gets increase in size and rupture of follicle at the 14th day (i.e. Ovulation) in regular menstrual cycle.

When an adult graffian follicle bursts, one secondary oocyte that is ready for fertilization is released from the ovary, marking the beginning of the ovulation. In every ovarian cycle, which begins at adolescence and ends at menopause, only one secondary oocyte is expected to rupture. When it comes to the menstrual cycle, the events take place around 14 days before the next anticipated period; nevertheless, menstruation can happen even in the absence of ovulation and is halted during pregnancy and lactation.

IV. MECHANISM

Ovulation is a multifaceted process. Preovulatory modifications take place in the follicle as well as the oocyte.

A. Alterations In The Follicle

The fluid accumulation causes the graffian follicle to prior-ovulatory hypertrophy, resulting in a diameter of 20 mm. Within the antrum, the cumulus oophorus detaches itself from the remaining granulosa cells and floats freely. The inner layer of cells that surround the oocyte and are directed radially is known as the corona radiata. The follicular wall gets thinned out in the vicinity of the ovarian surface. The ovary's outer layer is penetrated by the conical protrusion known as the sigma, which then remains as a thin membrane for a duration of 1 ½ to 2 minutes. The cumulus escapes out of the follicle as a slow oozing process, taking about 1 to 2 minutes, along with varying amount of follicular fluid. The plug of the plasma quickly closes the stigma.

B. Alterations In The Oocyte

Just before ovulation, significant alterations in the oocyte take place. Changes in the quantity and location of mitochondria, as well as in the Golgi apparatus, result in an increase in the cytoplasmic volume. With the evacuation of the first polar body, which each contains a haploid number of chromosomes (23X), the first meiotic division is completed.

C. Causes

The reasons listed below might be applied separately or in combination.

1) Endocrinal – In the late follicular phase, LH Surge maintained the highest level of oestrogen for 24 – 36 hrs.
2) LH Surge from the anterior pituitary – Approximately 16-24 hrs following the LH spike, ovulation occurs. LH Peak lasts for around a whole day. The LH surge starts the granulosa cells' leutinisation process, which leads to the production of prostaglandins and progesterone, as well as the completion of the oocyte reduction division.
3) FSH rise – Progesterone's pre-ovulatory surge serves as a catalyst for oestrogen's positive feedback effect, which increases plasmin, plasminogen activator, and FSH. Plasmin facilitates the follicular wall's breakdown.

Hence, the final step of maturation, follicle rupture, and oocyte evacuation are all caused by the combined LH / FSH midcycle surge.

The intrafollicular pressure, which stays constant at around 188mmhg, is more of a passive stretching. An increase in prostaglandin release causes the micro muscles of the ovarian stroma and theca externa to contract.

D. Effect Of Ovulation

The follicle transforms into the corpus Luteum after ovulation. Once deposited in the fallopian tube, the ovum either degenerates or continues to mature, depending on whether fertilization takes place. There is no connection between ovulation and menstruation, and anovulatory menstruation is prevalent in adolescents, women going through menopause, and after childbirth.

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V. DIAGNOSIS OF OVULATION

A. Indirect

Menstrual History: it can be suggestive of symptoms of premenstrual syndrome or primary dysmenorrhea which includes irregular, abnormal menstruation loss, mid menstrual spotting or discomfort and profuse mucoid vaginal discharge between the age group of 20 to 35.

Assessment of end organ alterations -

- BBT i.e. (basal body temperature) –the ovulatory cycle exhibits a biphasic pattern of temperature change.
- Every morning before waking up and before consuming any meal, the oral temperature is measured. Ovulation schedule is upheld. It indicates a ½ F drop in temperature around ovulation. The thermogenic impact of progesterone causes the temperature to increase over ½ -1 F after ovulation.

B. Cervical Mucosal Study

Spinbarkeit test and fern test suggests that the cervical mucous gets thin and plentiful close to the ovulation. It has excellent elasticity and can endure stretching of upto 10 mm or more. Under a microscope, the mucous spread across the slide and its drying process will display a fern pattern. This is because sodium chloride is present. When ovulation takes place, the mucous loses its flexibility, fern pattern, and becomes scarce and tenacious.

C. Vaginal Cytology

A high cornification index of 25% or more is seen when the upper lateral vaginal wall is scraped during the pre-ovulatory period. With no leucocytes in the background, the squamous type cells are visible. Leucocytes are abundant in the background and are gathered together when the index drops after ovulation.

D. Hormonal Assessment

- Serum progesterone: Serum progesterone levels are assessed on day 8 and 21 of a cycle. Ovulation is suggested by a rise in volume from less than 1mg/ml to more than 6mg/ml.
- Serum LH: Serum LH measurements made daily at midcycle can identify the LH surge. About 34-36 hrs following, the start of the LH surge is when ovulation happens. It occurs around 10-12 hours following the LH peak. About 24-36 hours before the ovulation and 24 hours before the LH surge, serum estradiol reaches its highest elevation.
- Primary LH: To find the mid- cycle LH surge, LH kits are available. After a urine LH spike is detected, ovulation happens 14-26 hours later and nearly always happens 48 hours later.
- Endometrial biopsy: Premenstrual cycle is the ideal time to do this. Ovulation is indicated by the secretory endometrium.
- Sonography: By observing the morphological characteristics of graffian follicles serially between 12 and 16th day of a 28 days menstrual cycle, ultrasound has been used to track the moment of ovulation. Ovulation is indicated by the abrupt loss of the prominent follicle and the presence of free fluid in the Douglas pouch.
- Direct: The only conclusive proof of ovulation is laparoscopic sight of the recent corpus Luteum or the identification of the ovum from aspirated fluid from the Douglas pouch.

VI. MANAGEMENT

Ayurvedic practitioners recommend *Nidana parivarjana* as the primary therapy method. To overcome the disease of *Ahara and Vihara*, it is important to eliminate the underlying causes. *Jatharagni* is decreased as a result of dosha provocation. *Deepana pachana* can aid in the correction of *mandajathragni. Shodhana and Shamana* will maintain all *doshas. Vata* is a stimulant of other doshas. According to *Acharya Sushutra, Nashtartava* is best cured by *Sanshodhana and Agneya Dravya*. *Agneya Dravya activates Agni*, aiding in *Ama* digestion and normalizing *Rasa dhatu,* followed by *Upadhatu*.

Artavajanaka Dravya (helps in ovulation induction by keeping all *doshas* in balance. *Acharya Sushutra* also suggested *Artava Shuddhi Chikitsa .Acharya Vagbhata* advised *Pitta Vriddhikara* and *Raktavriddhikara chikitsa*[18]. *Acharya Charaka* recommends using *Tikshna svedana, Niruhabasti, Vaman, and Virechana*[19]*Kaphavritta Vata*. *Kashyap* claimed that *Basti* is the greatest treatment. *Basti* governs the *Apana vayu*, which controls the reproductive system. When the *Apana vayu* is blocked, the *Anulomana of Artava* is eliminated, allowing for normal ovulation. *Uttarbasti* is also highly beneficial for the anovulatory cycles.

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VII. DISCUSSION

The ovulation process is clearly explained in *Ayurvedic* texts. We may deduce that ovulation and folliculo-genesis are caused by *Vayu, Karma, Swabhava, Rasa, Rakta, and Dhatu paripurnata. Ayurvedic acharyas* are well known of the physiological changes that occur in the female body during the ovulatory phase. During the menstrual cycle, the *awastha* of *vata, pitta, and kapha* may be directly correlated with the hormonal changes that occur in the body.The *pitta and kapha doshas* are linked to the *vata dosha*, which primarily regulates ovulation. *Pitta* is linked to its capacity for conversion, such as the conversion of androgens to oestrogen in graffian follicles. *Vata* is the symbol for follicle rupture. *Kapha* functions as a structural and nutritional element (follicle maturation). As a result, each of the three *doshas* is essential for ovulation process.

VIII. CONCLUSION

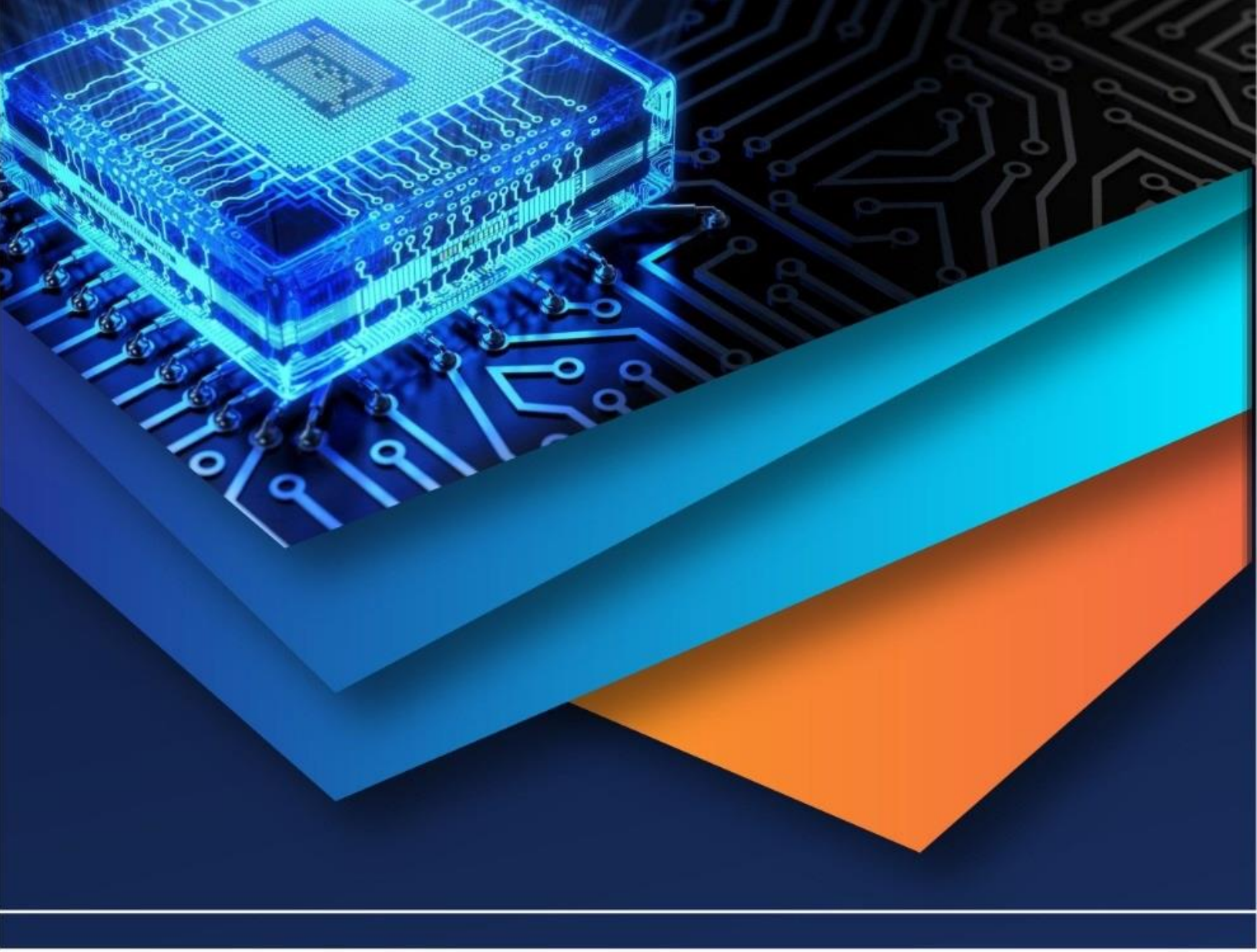
In *Ayurveda,* Ovulation process is explained very clearly. Concept of *Beeja, Beejotsarga*, and Menstrual process is explained in detail. *Ayurvedic acharyas* are well known of the physiological changes that occur in the female body during the ovulatory phase. The changes in hormones during ovulation and their doshas correlation explained in this article. *Vata* is for follicle rupture. *Pitta* is for conversion of androgens to oestrogen in graffian follicles. *Kapha* functions as a structural and nutritional element (follicle maturation). As a result, each of the three *doshas* is essential for ovulation process. For induction of ovulation, we should know about all the aspects which are explained by our *Acharyas*.

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