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REVIEW ARTICLE

DOSHIC VARIATION DURING PHASES OF MENSTRUAL CYCLE

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ABSTRACT

Though *stri* (female) and *purusha* (male) are the main contributors to the universal progeny but more importance has been given to *stri* as it is only her in which conception takes place, conceptive material develops from ovum to fetus and who gives shelter to *garbha* (fetus) for complete 9 months. *Artava pravritti* or menstruation in females is considered as an important physiological process which plays an important role in the formation of *garbha. Artava* (menstruation) is mentioned as *upadhatu* of first and foremost *dhatu, rasa*. During each menstrual cycle, level of gonadotropes varies in a specific pattern which leads to a series of events termed as Follicular phase, Ovulatory phase and Luteal phase and Menstrual phase. In the same way, *ayurveda* has also classified *artava* or *rituchakra* (menstrual cycle) as *ritukala, rituvyateetakala* and *rajakala* respectively. There is a specific pattern of *doshasanchaya* (collection of *doshas), doshakopa* (aggravation of *doshas*) and *doshashamana* (pacification of *doshas*) during these three *kalas*. Most of the diseases which are related to the menstruation or menstrual cycle are because of imbalance of *dosha* at that *kala.* In this article, an attempt has been made to explain *doshavastha* (state of *dosha*) during all the phases of menstrual cycle so that one should consider *doshic* imbalance according to symptomatology and phase of occurrence of symptoms and managed accordingly.

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INTRODUCTION

Menstruation is the visible manifestation of cyclical physiological uterine bleeding out of shedding of endometrium due to invisible interplay of hormones mainly through the coordination of Hypothalamo-pituitary-ovarian (HPO) axis. In *ayurveda,* it has been termed by various names e.g.*raja, artava, beej, shonita, lohita, pushpa. Ayurveda* has described four essential factors required for healthy conception which includes *ritu* (fertile period), *kshetra* (reproductive organ), *ambu* (adequate and healthy nutrient fluid) and *beej* (sperm or ovum)[1]. *Beejotpatti* (ovulation) in females is an important event during artavachakra (menstrual cycle). Irregularity in beejotpatti irrespective of cause is a leading cause of *bandhyatva* (infertility) across the globe. So Normal *artavachakra* (menstrual cycle) is considered as the indicator of healthy and normal reproductive cycle.

In *ayurvedic* Literature, *artava* and *artavachakra* has been explained by various *acharyas.* As classification of *samvatsara* (complete year) in *shadaritu* (six seasons) i.e. *grishma, varsha, sharad, hemant, shishira* and *vasant* is done according to the dominance of *dosha*; *rituchakra* is also classified according to *doshic* dominance in 3 *kala*. So here correlation of these 3 *kala* according to dominant *dosha* with the phases of menstrual cycle has been done in a systematic way.

Menstruation

Menstruation is the final phase induced and regulated by Hypothalamo-pituitary-ovarian-utero-endometrial axis through the hormones. Whole menstrual cycle requires precise coordination of HPO axis[2] out of which the major components include Gonadotropin releasing hormone (GnRH) pulse generator, pituitary gonadotropes, the ovaries and the uterus.

Table no. 1 Components of HPO axis and their functions

COMPONENTS OF HPO Axis	FUNCTIONS
GnRH Pulse generator	1) It is considered as the primary structure that drives the menstrual cycle. 2) It is the hypothalamic structure that releases Gonadotropin releasing hormone (GnRH). 3) GnRH releases in a pulsatile manner[3] and thus causes the release of gonadotropins from the anterior pituitary gland in a pulsatile rather than a continuous fashion.

<table>
<tr><td rowspan="3">Pituitary Unit</td><td colspan="2">1) With the stimulation of GnRH, pituitary starts releasing Leutinizing Hormone (LH) and Follicle Stimulating Hormone (FSH). The gonadotropins, LH and FSH, are synthesized within the gonadotropes in the anterior pituitary gland.
2) Both LH as well as FSH acts on the ovaries to induce morphologic changes and ovarian steroid secretion.
Functions of gonadotropins, FSH and LH are-</td></tr>
<tr><td>Follicle Stimulating Hormone</td><td>• Regulates ovarian follicle development.
• Stimulates mitosis and activates aromatase production in granulosa cells, allowing for growth and increased ovarian estradiol production.
• FSH is also the major stimulus for inhibin B secretion, which increases at the time of estrogen production[4]. This inhibin influences FSH release specifically through their own negative feedback loop.
• There is acquisition of LH receptor due to action of FSH, over the selected follicle</td></tr>
<tr><td>Leutinizing Hormone</td><td>• Mediates ovulation.
• Maintenance of corpus luteum.
• The large increase in LH inhibits androgen production as a result estradiol as well as progesterone concentration decreases from the preovulatory level[5].</td></tr>
<tr><td>Ovarian Unit</td><td colspan="2">Granulosa cells, thecal cells and luteal cells synthesize and release ovarian steroids from ovary.
The type and amount of hormone released depend on the status of the follicle and the corpus luteum[6].
Function of ovarian steroids, estrogen as well as progesterone are as follows-</td></tr>
</table>

	Estrogen	• Increased estrogen milieu modifies the genital tract[7]. The glandular endometrium proliferates, cervical mucus changes with decreased viscosity and increased pH. Simultaneously, cornification of vaginal epithelium occurs. • Rising estrogen, through negative feedback, suppresses FSH level to very low concentration. • Estrogen stimulates the release of LH as well as FSH.
	Progesterone	• At low concentration, progesterone facilitates LH release[8]. • Progesterone dominance in the luteal phase leads to significant decrease in GnRH/LH pulse frequency in this stage of the cycle[9]. • It also affects the hypothalamic thermoregulatory centre. • Progesterone makes the endometrial glands more secretory. Cervical mucus becomes thick and viscous to prevent entry of the sperm. • It also inhibits estradiol positive feedback loop due to which FSH and LH level starts diminishing.

***Ovarian Changes*[10]**

Changes in the ovaries or ovarian follicles during menstrual cycle can be classified into 3 parts-

Changes During menstrual phase (0-4th day)

During this phase, LH, estrogen and progesterone levels are very low but slight more than baseline FSH level is still maintained. Due to it, growth of follicles goes on in a slow and continuous manner even during this phase.

Changes During follicular Phase (5th-16th day)

At the start, several of these follicles begin to enlarge. In humans, usually one of the follicles in one ovary starts to grow rapidly under the effect of FSH on about 6th day and become the dominant follicle. The cells of the theca interna of the dominant follicle which, on maturation, is termed as Graafian Follicle starts releasing estrogen which causes the regression of other follicles by causing atresia. At about 14th day, the distended follicle ruptures and the ovum is

extruded into the abdominal cavity. This process is called ovulation. Just before ovulation, the first meiotic division is completed due to which secondary oocyte and 1st polar body is formed from primary oocyte. Fragmentation of Ist polar body occurs here. The secondary oocyte immediately begins the second meiotic division, but this division stops at metaphase and is completed only when the sperm penetrates oocyte. Formed IInd polar body is cast off and the fertilized ovum proceeds to form a new individual.

Changes during luteal phase (17th-28th day)

After ovulation, there remains an empty follicle filled with blood. The granulosa cells and theca cells of this follicle begin to proliferate and clotted blood is rapidly replaced with yellowish white lipid rich lutein cells, forming corpus luteum. These lutein cells secrete both progesterone and estrogen. If there is no pregnancy, corpus luteum starts degenerating and is eventually replaced by scar tissue, forming corpus albicans.

Uterine Changes

Endometrial changes within uterine cavity during menstrual cycle can also be mentioned into 3 parts-

Changes in menstrual phase (0-4th day)

Due to sharp drop in the level of estrogen and progesterone, shedding of superficial layer of endometrium takes place which is termed as menstruation. It usually lasts for 2 to 7 days[11].

Changes during proliferative phase (5th-16th day)

At the beginning of proliferative phase, the endometrium is relatively thin (1-2mm.). Stimulated by gradually increasing estrogen, uterus lining starts becoming thick. Uterine glands grow in size and form straight, narrow and tubular structure.

Changes during secretory phase (17th to 28th day)

Within 48-72 hrs. following ovulation, progesterone starts secreting which produces a shift in histologic appearance of endometrium to secretory phase. During this, uterus lining changes to prepare for potential implantation of embryo with the thickening of the cervical mucus. Straight, tubular endometrial glands become tortuous and corkscrew shaped.

Formation of *raja* or *artava*

In majority of *ayurvedic* classics, *raja* or *artava* is said to form as an *upadhatu* of *rasa dhatu*. According to *acharya Charak*, when various kind of food or *ahara* is ingested, then *jatharagni* (digestive juices) acts over that food in *amapakwashaya* (stomach and intestine) and form nutrient fluid part called as *prasada bhaga*, and excretory part, known as *mala bhaga*[12]. Just after the action of *jatharagni* as well as *bhutagni* (digestion at cellular level), *ahara* forms *ahara rasa* and that *ahara rasa*, after *rasadhatwagni kriya,* forms 2

main constituents- one is *sthula or poshya bhaga* and other is *sukshma or poshak bhaga. Poshya bhaga* is used further for the nutrition of its own *rasa dhatu* and from *poshak bhaga*, one part is left for the formation and giving nutrition to *next dhatu, rakta* and other part forms *artava as upadhatu*[13].

When compared with Modern Gynecological Endocrinology, it can be interpreted that it is plasma or blood (*rasa* or *rakta dhatu*) only which helps in circulating hormones. Among these, GnRH, FSH, LH, estrogen and progesterone are the hormones helping in the proliferation, secretory hypertrophy and regression of endometrial layer along with follicular maturation, its rupture with the release of ovum and formation of corpus luteum.

Regulation of *artavachakra*

Normal Menstruation or *artavachakra* is a result of synchronized coordination of Hypothalamo-pituitary-ovarian axis. It is HPO axis or the interaction between CNS (Hypothalamus and anterior pituitary) and the ovaries which is responsible for the cyclic and ordered events in uterus as well as ovaries during menstrual cycle. In *ayurveda*, it is mainly *vata dosha* which governs whole CNS. *Vata* is responsible for all psychological as well as physiological activities within the body. According to *ayurveda*, the coordinated events seen during menstrual cycle can be considered as the function of *prana vayu* (helps in the functioning of CNS i.e.hypothalamus and pituitary), *vyana vayu* (helps in the circulation of sex hormones along with blood to the target organ and secondarily, movement of ruptured ovum from graafian follicle to the fallopian tube) and *apana vayu* (present in uterus which helps in the progression and regression of endometrium and maturation and rupture of ovum). Any vitiation in these subtypes of *vayu* can cause change in the normal pattern of the release of related hormones, leading to abnormal menstrual cycle.

Secondarily, *agni* which comprehends various factors which participate in and direct the course of digestion and/or metabolism in a living organism[14], also play important role in the regulation of *artavachakra*. Any metabolic change at the level of HPO axis can lead to *agni vaishamya* specifically at the level of *rasa dhatvagni* which may lead to disorders related to menstrual cycle.

Ayurvedic concept of menstrual cycle or *rituchakra*

Normal menstrual cycle according to all *ayurvedic Classics*, is a discharge of blood every month (*maasaata*) which should be devoid of any sliminess or mucous debris, burning sensation or any type of pain and should remain for five days i.e.*panchratranubandhi*[15]. There will be

variation in the menstruation due to *doshic* imbalance. The ancient Indian authorities have classified menstrual cycle into 3 phases, known as *ritukala* (preovulatory phase and ovulatory phase), *rituvyateetakala* (post ovulatory phase) *and rajakala* (menstrual phase).

- *Rajakala* – remains for 3 to 5 days
- *Ritukala*- Different opinion about the duration of *ritukala* has been mentioned in Classics. It remains for approx. 12 to 16 days. *Acharya Kashyapa* has described different *ritukala* for different castes i.e. *brahmin* (12 days), *kshatriya* (11 days), *vaishya* (10 days) and *kshudra* (9 days)[16].
- *Rituvyateetakala*- Particular duration is not described in *ayurvedic* Literature. But it has been mentioned by *acharyas* that chances of conception are very meagre during this phase.

According to *ayurveda*, with every environmental change, there will be direct sequential influence on the human body in terms of *sanchaya, prakopa* and *prashamana* of specific *dosha* (natural stages of *dosha* development) in particular time.

- *Sanchaya* means slight increase or accumulation of *dosha* in their own place.
- *Prakopa* means increase and overflow of *doshas* from its own place to other body channels. The premonitory symptoms of the disease can be observed at this stage.
- Last stage is *prashamana.* It means *doshas* come in normal level and restore health.

In *ayurveda,* depending upon the *sanchaya, prakopa* and *prashamana,* samvatsara (a complete year) is classified in 6 *ritus* [17] (Table no.2).

Table no.2 *Doshavastha* in 6 *ritus*

Ritu	***Dosha***		
	Samchaya	***Prakopa***	***Prashamana***
Shishir	-	-	-
Vasant	-	*Kapha*	-
Grishma	*Vata*	-	*Kapha*
Varsha	*Pitta*	*Vata*	-
Sharad	-	*Pitta*	*Vata*
Hemant	*Kapha*	-	*Pitta*

In healthy menstrual cycle, each of these three phases is governed by a separate *dosha. Doshic* rhythm i.e. *sanchaya, prakopa* and *prashamana avastha* like in *ritus,* is also seen in *kalas* of *artavachakra* (Table no.3).

Table no.3 *Doshavastha* in *artavachakra*

Phase	***Ritukala***	***Rituvyateetakala***	***Rajahkala***
Dosha Sanchaya	*Pitta*	*Vata*	*Kapha*
Dosha Prakopa	*Kapha*	*Pitta*	*Vata*
Dosha Shamana	*Vata*	*Kapha*	*Pitta*

Ritukala

Ritukala is considered as a best fertile period in *ayurveda* during the whole cycle, So this phase can be compared with the proliferative phase of the uterine cycle or the follicular phase of the ovarian cycle along with ovulatory phase i.e. approx. 48 hrs. after ovulation, during which chances of conception are maximum.

In Modern reproductive Endocrinology, Follicular phase begins immediately after the menstruation. In this phase, with the influence of FSH, follicles start growing in the ovary. These developing follicles begin to release Estrogen which stimulates the repair of endometrium in the uterus. Vascular Endothelial growth factor (VEGF) a major angiogenic factor, is also detected in the developing follicles during this phase[18] which is a sign of active vasculogenesis[19]. During this, endometrium thickens, glands develop and blood vessels grow in the new tissue. At the end of proliferative phase of uterine cycle, exponentially raised level of Estrogen trigger LH surge and inhibit FSH. This LH surge is responsible for the rupture of one mature follicle and with this, ovum is released. This is termed as Ovulation.

In *ritukala, prakopavastha* of *kapha dosha* can be there because it is due to *bandh karma* (binding action) of *kapha dosha*[20]only that uterus is able to build new endothelial lining as well as new vasculature in endometrium after menstruation. Simultaneously, along with the aggravation of *kapha*, there is accumulation (*sanchaya*) of *pitta dosha. Pitta*, in *ayurveda,* can be considered as hormones or enzymes which help to regulate body functions. In this *ritukala*, level of all three hormones (except progesterone) FSH, estrogen and LH become at peak level. So it can be compared with *pitta sanchayavastha.*

Rituvyateetakala

Next phase is *rituvyateetakala*, which can be compared with secretory phase of uterine cycle or luteal phase of the ovarian cycle when

the chances of conception are minimal. This *kala,* according to *ayurveda i*s governed by *pitta*. That means there is dominance or *prakopa* of *pitta dosha* with the *sanchaya* of *vata*.

This stage starts immediately after ovulatory phase and ends with the beginning of menstrual phase. LH surge stimulates the development of corpus luteum to secrete progesterone along with estrogen. In the absence of pregnancy, corpus luteum starts degenerating. Progesterone causes the endometrium to thicken, filling with fluids and nutrients to nourish potential embryo. Transudation of plasma from circulating blood in the endometrial mucosa also contributes to secretory changes of uterus. It causes the cervical mucus to thicken so that sperm is less likely to get entered in the uterine cavity. It also causes body temperature to increase slightly and remain elevated until menstrual phase starts. The increase in estrogen and progesterone level causes milk ducts in the breast to dilate due to which breasts may become tender and swell.

Progesterone also stimulates the synthesis of PGF2α and PGE_2[21]. Prostaglandins are the main cause for painful menstruation as they cause spasm of uterine muscles, leading to ischemic pain[22] so beginning of prostaglandin synthesis can be compared with the *vata dosha sanchaya*. Secondarily, on 17th day of menstruation, the most reliable histologic alteration seen in luteal phase is uniformly developed subnuclear glycogen vacuoles in the gland lining cells and palisading of gland cell nuclei[23]. The process of vacuolization is the dominant feature of *akasha mahabhoota* which along with *vayu mahabhoota* is the principle of *vata dosha*. So this can be correlated with the *vatasanchaya lakshana*.

Progesterone which is a thermogenic hormone, becomes at peak level in this phase. So can be compared with *pittakopavastha*. This *ushnatva guna* (thermogenic property) of *pitta* leads to raised temperature during this *rituvyateetkala*.

Rajakala

Last phase i.e. *rajakala* begins when there will be *vata prakopavastha* and *kapha Sanchayavastha*. This stage can be related to menstrual phase of uterine cycle. According to *ayurveda*, main *dosha* behind every movement is *vata.* It controls blood flow, elimination of wastes, breathing and movements of thoughts across mind. Since *pitta* and *kapha* cannot move without *vata*, so it is considered as the Chief of *tridosha*. Among these five types of *vata*, it is *apana vayu* which is responsible for the elimination of wastes like *raja, mala*, *mutra* outside the body.

When fertilization of ovum does not take place, corpus luteum in the ovary starts degenerating. Due to which estrogen as well

as progesterone, which is released by the corpus luteum, begins to fall. This negative feedback to these hormones leads to the shedding of endometrial layer, which is termed as menstruation. On cycle days 2 and 3, the functional layer gradually becomes cleaved off from the underlying basal layer, resulting in a thin, denuded basal layer. Starting from the day 2 and for the subsequent 2 days during menstrual cycle, there is proliferation of the basal gland epithelium in the area of denudation and the surface of the endometrium starts re-epithelialized[24].

Pitta diminishes from *kopavastha* to *shamanavastha* in this stage as both there is rapid decline in estrogen as well as progesterone amount in this stage. There is *kapha dosha sanchaya* in this phase which can be compared with the beginning of regeneration of endometrium on day 2.

CONCLUSION

With this, it can be concluded that in *ayurveda, sharir* or body is composed of *tridosha, saptadhatu* and *mala. Acharya Charak* has stated that *doshas,* when remain in physiological state (*samyavastha*), maintain health and when in pathological state (*vikritavastha*), lead to a disease. In *ritucharya adhyaya* of *Charak Samhita, sutrasthana*, all 6 *ritus* has been classified according to the *doshic* state during that particular *ritu* i.e.*sanchaya, prakopa* and *shaman avastha*. Likewise, menstrual cycle or *archavachakra* is a normal physiological phenomenon with the dominance of *dosha* in each phase of *artavachakra*. Though whole menstrual cycle is governed by HPO axis which acts in a very coordinated way due to *Vata dosha,* but still specifically, in *ritukala* (which can be compared with the early proliferative phase of the uterine cycle or the early follicular phase of the ovarian cycle), there is *sanchaya* of *pitta dosha* with *kapha dosha prakopa* and *vata dosha shamanavastha*. In *rituvyateetakala* (end of proliferative phase with secretory phase of uterine cycle or late follicular with luteal phase of the ovarian cycle), *sanchaya* and *prakopa* of *vata* and *pitta Dosha* respectively can be seen with *shamana* or pacification of *kapha Dosha*. In the last *rajakala* (menstrual phase of menstrual cycle), *vata dosha prakopa* along with *sanchaya* of *kapha* and *shamana* of *pitta dosha* is manifested.

Treatment principles of disorders pertaining to *rajakala* include use of *vatanulomana* and *vatashamaka chikitsa*, as in *rajakala*, there is *vatadosha prakopa.* Another aspect is management of *kaphasanchaya* occurring during the cycle. Drugs having *usna guna* would be drug of choice as on one part they take of *prakupita vata dosha* while also eliminates *kapha* in its *sanchaya* itself. Secondarily, disorders of *rituvyateetakala* like

PMS can be treated with *pitta* as well *vata shamaka* management. So *virechana* with *Eranda taila* can be preferred and *rasayana drugs* which pacify *vata* as well as *pitta* can be administered as there is *pitta dosha kopa* and *vata dosha sanchaya* in *rituvyateetakala*. In *ritukala* related disorders i.e. anovulatory cycles, *tridoshahara chikitsa* should be done as along with *Kapha kopa* and *pitta sanchaya*, there is *vata dosha* which is responsible for release of ovum from the ovary. So accordingly, the disorders related to menstruation as well as menstrual cycle can be treated after recognizing the *sanchaya* and *prakopa* of respective *dosha* and balancing them by providing specific *ahara* and *vihara* and *aushadha* to the patient.

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