Available Online at http://www.recentscientificcom

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 15, Issue, 09, pp.4962-4968, September, 2024

International Journal of Recent Scientific Research

ISSN: 0976-3031

REVIEW ARTICLE

UNDERSTANDING MENSTRUATION: UNRAVELLING THE HORMONAL SYMPHONY, SURGICAL INSIGHTS, AND AYURVEDIC WISDOM IN MENSTRUATION

Dr Shilpa P N and Dr Shanmugaloga S*

Professor and Pg scholar

Department of Shalya Tantra, government Ayurveda Medical College, Bengaluru, Karnataka

DOI: http://dx.doi.org/10.24327/ijrsr.20241509.0936

ARTICLE INFO

Article History:

Received 15th July, 2024
Received in revised form 23rd August, 2024
Accepted 15th September, 2024
Published online 28th September, 2024

Key words:

Menstrual cycle, hormones, surgical timing, *ritukala, rajasrava kala, rituvyatita kala*

ABSTRACT

The menstrual cycle is primarily regulated by hormones, including follicle-stimulating hormone (FSH), luteinizing hormone (LH), estrogen, and progesterone. FSH promotes the development of ovarian follicles and stimulates estrogen production, while LH triggers ovulation and the formation of the corpus luteum, which secretes progesterone.

These hormones orchestrate the thickening and shedding of the uterine lining (endometrium) in preparation for potential pregnancy. Hormonal imbalances can lead to menstrual disorders such as irregular cycles, heavy bleeding, and dysmenorrhea (painful periods), impacting women's physical and mental health. In Ayurveda, the menstrual cycle is known as *Rituchakra* and is divided into three phases based on the predominance of the three *doshas* as *Vata, Pitta*, and *Kapha*. Each phase is associated with specific hormonal changes and physical and emotional characteristics. Understanding hormonal roles in menstruation is vital for reproductive health, enabling effective management of menstrual disorders and promoting overall well-being. Regular monitoring of menstrual cycles can aid in early detection of hormonal issues, guiding appropriate interventions and lifestyle adjustments.

INTRODUCTION:

Menstrual health is an integral part of overall health because between menarche and menopause. Yet for tens of millions of women around the world, menstruation regularly and often catastrophically disrupts their physical, mental, and social well-being. Enhancing our understanding of the underlying phenomena involved in menstruation, abnormal uterine bleeding, and other menstruation-related disorders will move us closer to the goal of personalized care. Furthermore, a deeper mechanistic understanding of menstruation in healthy individuals will likely yield insights into a myriad of other diseases involving regulation of vascular function locally and systemically. We also recognize that many women now delay pregnancy and that there is an increasing desire for fertility and uterine preservation [1].

Menstruation is the cyclical bleeding from the uterus through vagina that occurs for 4-7 days every 28-32 days during the reproductive life of a woman, with average loss of about 20-60ml of blood.it has been observed that in two-thirds of adult woman have the cycle lasting from 21-35 days [2].

The normal menstrual cycle is coordinated by stimulated and inhibitory effects that results in release of single mature oocyte from a pool of thousands of primordial oocytes.

A variety of factors contribute to the regulation of this process including hormones and paracrine & autocrine factors.

Table 1 Events at different parts of cycle[3],[4]

Events at different parts of cycle	
Events	**Days**
Estrogen secretion	7-14
Estrogen peak	11-14
Progesterone rise	15-26
LH surge	12-15

*Corresponding author: **Dr Shanmugaloga S**

Department of Shalya Tantra, government Ayurveda Medical College, Bengaluru, Karnataka

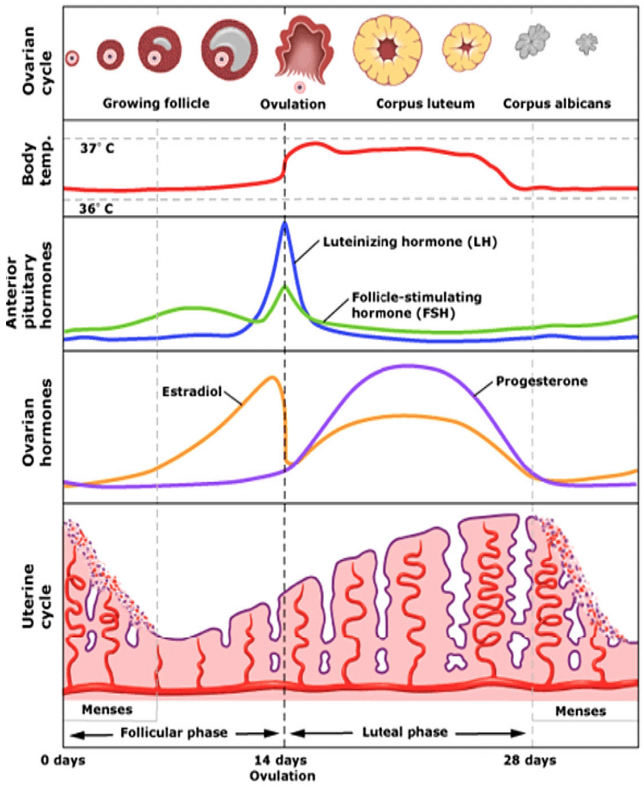

Fig 1 Phases of Menstrual cycle

Physiology of menstruation is regulated by complex neurohormonal pathways, divided into the following:

- Endocrine cycle
- Ovarian cycle
- Uterine cycle

Endocrine cycle:

Hypothalamic pituitary ovarian axis (HPO Axis) works in concert to regulate the menstrual cycle. This allows for procreation by means of cyclical production of gonadotropic and steroid hormones. HPO axis is tightly regulated to select dominant follicle for ovulation; also priming the endometrium for implantation.

So, the menstrual cycle is determined by the complex interaction of hormones.

The predominant hormones involved are

- gonadotropin releasing hormones (GnRH)
- gonadotropin hormones viz follicle stimulating hormone (FSH) and luteinizing hormone (LH).
- Estrogen
- Progesterone

Table 2 Hormones and their secretion site [5]

S no	Hormones	Secretion site
1	Gonadotropin releasing hormone	Secreted by hypothalamus in a pulsatile manner
2	Follicle stimulating hormone	Anterior lobe of pituitary gland
3	Luteinizing hormone	Anterior lobe of pituitary gland
4	Estrogen	Ovary
5	Progesterone	Ovary

GnRH

⇩

Release of FSH & LH from anterior pituitary

⇩

Release of estrogen & progesterone at the level of ovary

Ovarian cycle

Ovary plays a pivotal role in the production of steroid hormones, necessary for the follicular development and oocyte maturation.

At birth there are about 2 million primordial follicles in the ovary and by puberty it decreases to about 300,000 number due to spontaneous degeneration of follicles.

In reproductive life about 400 follicles ovulate and by menopause the ovary will have dense stromal tissue with only a few follicles left.

It takes place in three phases:

- Follicular phase
- Ovulation
- Luteal phase

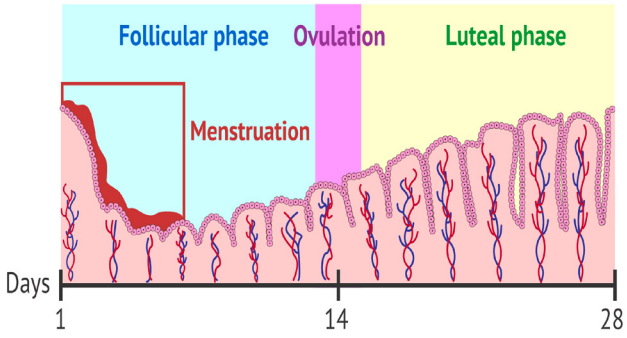

Fig. 2 Phases of menstrual cycle

Follicular phase:

This phase starts from the first day of menstruation and lasts until ovulation.

Primary goal is to develop a viable follicle to undergo ovulation.

After the onset of puberty, between 15 and 20 primordial follicles develop into primary follicles with each ovarian cycle.

Primary follicle consists of primary oocyte surrounded by a layer of cuboidal or columnar granulosa cells. Zona pellucida is a thick layer composed of glycoproteins and acid proteoglycans which is present between the oocyte and granulosa cells.

As the follicle develops from a primordial follicle into a **primary unilaminar follicle**. At this stage of development, the surrounding stromal cells become prominent. Transportation of amino acids, nucleotides and lipid precursors into the oocyte takes place through gap junctions. Gap junctions are present between the oocyte and surrounding granulosa cells. Once oocyte growth is completed, the granulosa cells proliferate to

form multiple layers giving rise to a **primary multilaminar follicle**.

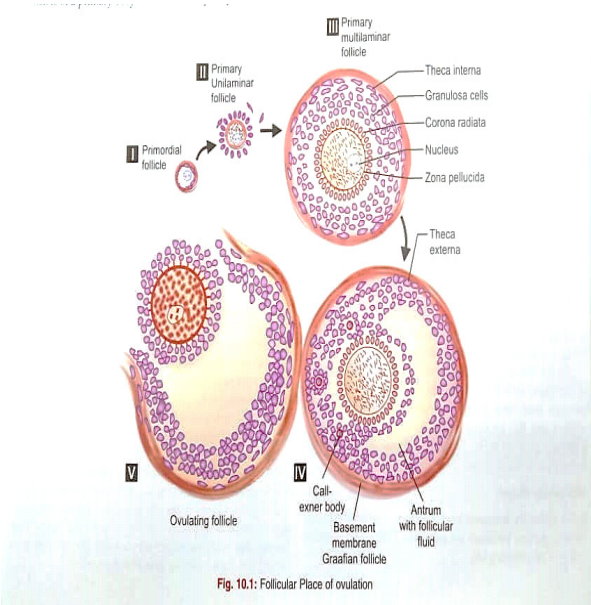

Fig. 3 Follicular phase of ovulation

Theca cells surrounding the follicle differentiate into two layers – theca interna and theca externa by the influence of LH. This theca cells induces androgen synthesis. By the influence of FSH androgen is transferred into granulosa cells and converted into estrogens by the activation of aromatase enzyme

The primary multilaminar follicle further develops into a graafian follicle. The graafian follicle is characterized by a large, fluid filled antrum (containing inhibin & activin) and eccentric oocyte.

This step of development is by the influence of FSH. Both FSH and estrogen induces the proliferation of granulosa cells and increases the number of FSH receptors on each granulosa cell, thus accentuating its own effects such as proliferative changes in endometrium.

As one follicle became dominant, atresia starts in the rest of the unsuccessful primordial follicles.

The granulosa cells divide into two groups- the zona granulosa (thin layer along the periphery of the follicle) and the corona radiata (surrounds the oocyte).

The oocyte undergoes the first meiotic division influenced by LH, giving rise to a secondary oocyte and the first polar body. Now the secondary oocyte is arrested in the metaphase of second meiotic division and remains like that until fertilization. Oocytes also undergo cytoplasmic maturation, a series of changes in protein synthesis for embryogenesis in the event of fertilization. The graafian follicle represents the final stage of follicular phase before ovulation.

Herewith LH surge, progesterone levels continue to rise and this has negative feedback on FSH. The fall in FSH level brings about reduction in the level of inhibin and arise in a peptide activin of graafian follicle

Table 3 Stages of follicular phase with eventual changes[6]

Early follicular phase	1st 7 days	By 5th day, peak FSH occurs, leads to selection of dominant follicle by 5- 7th day
Mid follicular phase	7-14	Increased level of estrogen and inhibin brings negative feedback on pituitary FSH positive feedback on pituitary LH
Late follicular phase	24-48 hours before ovulation	Gradual rise in LH along with estrogen influence granulosa cells to produce some progesterone This causes LH surge, which itself causes a drop in estrogen level Peak estrogen level is seen 48 hours before ovulation & LH peak occurs about 24-36 hours before ovulation

Ovulation

There occurs a perforation in the weak elevated follicular wall and a slow release of oocyte along with follicular fluid.

Timing of ovulation is important for successful conception.

The fertile period starts about 4-5 days before ovulation and ends about 24-48 hours after it. Maximum fertility is reached during the period 24 hours before and after ovulation (fertile window).

Determined by;

- Basal body temperature0.7-0.8^0 c due to increase in progesterone levels in luteal phase.
- Cervical mucus: rise in serum estradiol concentrations causes gradual thickening of endometrium and also the cervical mucus
- LH surge.

Luteal phase:

With release of oocyte, the follicle now known as corpus luteum (which gets collected in preovulatory stage).

This phase starts from ovulation and lasts for 14 days.

Here the progesterone level rises as the androgen production occurs in theca cells of unsuccessful follicles which are nearing atresia.

Rise in estrogen and progesterone brings secretory changes in the endometrium.

Corpus luteum remains mature from 19-26 days and then degenerates if no fertilization. That leads to fall in the level of estrogen and progesterone thereby menstruation takes place.

Fall in the above two hormones and also the level of inhibin results in positive feedback mechanism, triggering the hypothalamus to release GnRH for the follicular phase of next menstrual cycle.

Uterine cycle

Cyclical changes in the endometrium makes it ready for implantation, in case of fertilization. However, menstruation takes place in absence of it.

The endometrial thickness varies throughout the cycle. The normal endometrial thickness during the menstrual phase is 2-4mm; during the early proliferative phase increases to 5-7mm. The endometrial thickness range during the late proliferative or pre-ovulatory phase is up to 11 mm. During the secretory phase, the endometrial lining thickness is 7-16 mm.

Table 4 Endometrial thickness corresponding to phase of menstrual cycle[7]

Phase of menstrual cycle	Endometrial thickness
Menstrual phase	2-4mm
Follicular phase	5-7mm
Luteal phase	11 mm
Secretory phase	7-16mm

The endometrium is divided into two layers:

- The upper functionalis layer- undergoes changes throughout the menstrual cycle and is shed during the menstruation.
- Lower basalis layer-Remains constant during the menstrual cycle from which the functionalis layer regenerates every month.

The uterine endometrial cycle can be categorized into three phases:

- **Proliferative phase**: starts from end of menstruation until ovulation. Increasing estrogen levels induces the proliferation of functionalis layer from basalis. Also, there is a proliferation of endometrial glands and stromal connective tissue. Endometrial glands elongates with a narrow lumens and epithelial cells which contains glycogen.spiral arteries elongate and span the length of endometrium.
- **Secretory phase**: begins at ovulation and lasts until menstrual phase of next cycle. At the beginning of luteal phase, progesterone induces endometrial glands to secrete glycogen and mucus.in the absence of fertilization by 23rd day of menstrual cycle, the corpus luteum degenerates and consequently the ovarian hormones levels fall.
- **Menstrual phase**: by fall of ovarian hormones, menstrual phase begins as the spiral arteries rupture secondary to ischemia, releasing blood into the uterine cavity and the apoptosed endometrium is sloughed off. Usually lasts for 3-5 days.

Ayurvedic view on Menstrual cycle[8][9][10]:

In Ayurveda, the menstrual cycle is known as *Rituchakra* and is divided into three phases based on the predominance of the three *doshas* as *Vata, Pitta*, and *Kapha*[. Each phase is associated with specific hormonal changes and physical and emotional characteristics.The three phases are as follows:

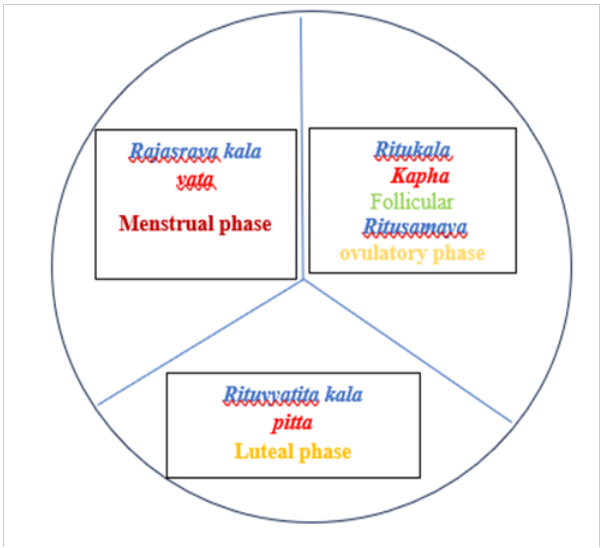

Fig. 4 Phases of menstrual cycle according to ayurveda

***Rajasravakala*:**

- *Rajasravakala* refers to the menstrual phase, which is characterized by the shedding of the uterine lining (endometrium) and is dominated by *Vata dosha.*
- *Vata* increases to its aggravating level (*Vata prakopa*), triggering the menstrual flow to begin.
- *Apana Vayu*, a sub-dosha of *Vata*, governs downward movement and elimination, enabling the free flow of menstrual blood.
- During this phase, estrogen and progesterone levels are low, and the corpus luteum (formed from the ruptured follicle after ovulation) degenerates. The decrease in progesterone levels triggers the breakdown of the endometrium, leading to menstrual bleeding.

Ritukala

Ritukala is the fertile phase of the menstrual cycle, which is further divided into two sub-phases:

a) *Ritukala*: This phase is favorable for conception and lasts for about 16 days, starting from the first day of menstruation.
b) *Ritu-samaya*: This is the ovulatory phase, which typically occurs around day 14 of the cycle. During this time, estrogen levels peak, triggering the LH surge, which in turn stimulates ovulation.

- This phase is dominated by *Kapha dosha*. Endometrium starts to thicken, and Kapha levels increase to its peak of aggravation (*Kapha prakopa*).
- *Pitta* starts to increase in the latter half, while *Vata* remains at a normal level
- Women may feel the essence of *Kapha* with glow and a sense of peace.
- During *Ritukala*, FSH levels rise, stimulating the growth and maturation of ovarian follicles. Estrogen levels also increase, promoting the proliferation of the endometrium and the production of cervical mucus, which facilitates sperm transport.
- *Ritukala* ends with ovulation.

***Rituvyatitakala*:**

- *Rituvyatitakala* refers to the luteal phase, which begins after ovulation and lasts until the start of the next menstrual period.
- During this phase, the ruptured follicle transforms into the corpus luteum, which secretes progesterone.
- There is a dominanance of *Pitta dosha* in this phase and *Pitta* increases to its peak of aggravation (*Pitta prakopa*), while *Kapha* decreases.
- Progesterone levels rise during the luteal phase, preparing the endometrium for implantation in case of fertilization. If fertilization does not occur, progesterone levels decrease, leading to the breakdown of the endometrium and the onset of menstruation
- *Pitta* acts through the *Rakta Dhatu* (blood tissue layer) within the endometrium, which becomes more enlarged with blood vessels in preparation for a fertilized egg.
- *Vata* starts to increase towards the end of this phase leads to onset of menstruation of next cycle.

Surgical importance of understanding menstrual cycle [11][12][13][14][15][16][17]

1. Timing of Surgery

The timing of surgical procedures in relation to the menstrual cycle can be critical. For example:

Endometrial ablation: Surgeries like endometrial ablation are often performed during the early proliferative phase when the endometrium is thinner, reducing the risk of complications.

- This procedure is typically performed during the early proliferative phase of the menstrual cycle (days 6-14), when the endometrium is thinner. This timing minimizes complications and enhances the effectiveness of the procedure.
- **Considerations**: Surgeons must assess the patient's menstrual cycle to ensure optimal timing, as performing the procedure during the luteal phase may lead to increased vascularity and thicker endometrial tissue, complicating the surgery.

Myomectomy: It involves the surgical removal of uterine fibroids while preserving the uterus, which is essential for women desiring future pregnancies.

- The ideal time for myomectomy is often during the luteal phase (days 15-28) when fibroids may be smaller due to hormonal influences. This can help reduce intraoperative bleeding and improve surgical visibility.
- **Considerations**: Surgeons must consider the patient's cycle to optimize outcomes and minimize complications. Additionally, understanding the menstrual cycle can help manage postoperative expectations regarding menstrual changes.

Hysterectomy: A hysterectomy is the surgical removal of the uterus, often performed for conditions such as uterine fibroids, endometriosis, or cancer.

- Hysterectomies can be performed at any time, scheduling during the follicular phase can reduce the risk of excessive bleeding due to lower vascularity in the endometrium.
- **Considerations**: Surgeons should evaluate the menstrual cycle to anticipate potential complications related to bleeding and recovery, as well as to discuss the implications of the procedure on future menstruation and fertility.

Laparoscopic Surgery for Endometriosis: Laparoscopy is a minimally invasive surgical technique used to diagnose and treat endometriosis, a condition where endometrial-like tissue grows outside the uterus.

- **Timing**: Procedures are often scheduled during the menstrual phase (days 1-5) when endometriosis lesions may be more visible and easier to excise due to hormonal changes.
- **Considerations**: Understanding the menstrual cycle helps in planning the surgery for optimal visibility and effectiveness, as well as in managing postoperative pain, which can be cyclical.

Breast Cancer Surgery

Surgical interventions for breast cancer, such as lumpectomy or mastectomy, are influenced by the menstrual cycle due to hormonal effects on tumor biology.

- Some studies suggest a potential survival benefit when surgeries are performed during the luteal phase (days 15-28). This is thought to be linked to the hormonal environment, particularly the presence of progesterone.
- **Considerations**: Surgeons may consider the timing of surgery in relation to the menstrual cycle to optimize outcomes, although research findings on this topic are mixed and still under investigation

2. Intraoperative Considerations

Understanding menstrual physiology aids in anticipating intraoperative challenges:

- **Endometrial Thickness**: The thickness of the endometrium varies throughout the cycle, impacting hysteroscopic visibility and technique.
- **Uterine Vascularity**: Increased vascularity during the luteal phase can complicate procedures, necessitating careful planning and technique adjustments.
- **Endometriosis**: Surgeons may encounter more pronounced endometriosis lesions during specific phases, impacting surgical strategy.

3. Postoperative Management

Postoperative care can also be influenced by the menstrual cycle:

- **Menstrual Patterns**: Procedures like hysterectomy or ablation can alter menstrual cycles, necessitating clear communication with patients about expected changes.
- **Pain Management**: Cyclical pain patterns may emerge post-surgery, requiring tailored pain management strategies based on the patient's cycle.
- **Bleeding Complications**: Understanding menstrual physiology helps in predicting and managing abnormal postoperative bleeding, which may be linked to residual endometrial tissue or hormonal fluctuations.

4. Implications for Fertility:

Menstrual physiology is closely tied to reproductive health, and surgical interventions can have significant implications for fertility:

- **Ovarian Reserve**: Surgeries such as cystectomies can impact ovarian function, necessitating careful timing to preserve fertility.
- **Tubal Patency**: Procedures affecting the fallopian tubes, such as salpingectomies, require consideration of the menstrual cycle to optimize outcomes.
- **Uterine Receptivity**: The timing of myomectomy or adenomyomectomy can affect the endometrial environment, influencing future implantation success.

CONCLUSION

The role of hormones in menstruation is pivotal, orchestrating the complex interplay of physiological changes throughout the menstrual cycle. Hormones such as estrogen, progesterone, FSH, and LH not only regulate the cycle but also regulates the potential health of body. Understanding these hormonal dynamics is crucial, especially in surgical contexts where interventions may be necessary for conditions like endometriosis or uterine fibroids.

- **Understanding the normal cycle**: This provides a baseline for identifying potential hormonal imbalances or menstrual irregularities that may require medical attention.
- **Fertility and pregnancy**: The menstrual cycle is directly linked to a woman's fertility. Studying the hormonal fluctuations helps determine the fertile window and supports family planning, whether trying to conceive or avoid pregnancy. It also provides insights into hormonal changes during pregnancy.
- **Diagnosing and treating disorders**: Hormones play a crucial role in regulating the menstrual cycle. Any disruption in HPO axis can lead to conditions like ovulation disorders, ovulatory dysfunction and endocrinopathies. Understanding the hormonal mechanisms involved is a key to diagnose and treat these disorders. Menstrual irregularities can sometimes be an indicator of underlying health problems, such as polycystic ovary syndrome (PCOS), thyroid disorders, or chronic stress. Analysing the hormonal patterns helps diagnose these conditions and provide appropriate treatment.
- **Surgical relevance:** Recognizing hormonal roles aids in surgical decision-making to yield targeted benefits. Also, can address reproductive health issues that disrupt normal hormonal function.
- **Developing hormonal therapies**: Knowledge of the hormonal mechanisms regulating the menstrual cycle is essential for developing effective hormonal therapies, such as birth control pills or hormone replacement therapy. It allows for targeted interventions to manage menstrual disorders or menopausal symptoms or any hormonal imbalances as well.

Conflict of interest- nil

References

1. Critchley, Hilary O.D. et al. Menstruation: science and society. American Journal of Obstetrics & Gynecology, Volume 223, Issue 5, 624 – 664.
2. Konar, H. (2014). DC Dutta's Textbook of Gynecology. Chapter 8: menstruation-Dr B N Chakravorty. Page no 82. India: Jaypee Brothers Medical Publishers Pvt. Limited.
3. Sudha salhan. (2011).Textbook Of Gynecology.Chapter 10: Physiology Of Menstruation. Pikee Saxena, B Minocha.Page No: 56. Jaypee Brothers Medical Publishers Pvt. Limited.
4. Thiyagarajan DK, Basit H, Jeanmonod R. Physiology, Menstrual Cycle. [Updated 2022 Oct 24]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK500020/
5. Berga SL, Johnston-MacAnanny EB. Physiology of the menstrual cycle. In: Bieber EJ, Sanfilippo JS, Horowitz IR, Shafi MI, eds. *Clinical Gynecology*. Cambridge University Press; 2015:972-984
6. Farage MA, Neill S, MacLean AB. Physiological changes associated with the menstrual cycle: a review. Obstet Gynecol Surv. 2009 Jan;64(1):58-72. doi: 10.1097/OGX.0b013e3181932a37. PMID: 19099613.
7. Kasera, S., Yadav, S. & Prabhu, P. Effect of hormonal changes during menstrual cycle on measures of differential sensitivity: a cross-sectional study. *Egypt J Otolaryngol* 39, 60 (2023). https://doi.org/10.1186/s43163-023-00421-3
8. Sushruta, Sushrutasamhita edited with Ayurveda-tattva-sandeepika Hindi Commentary by KavirajAmbikaduttaShastri(AMS) forewarded by Dr.Pranjivan Manekch and Mehta, Part 1,Chaukhambha Sanskrit Sansthan, Varanasi , Sharirasthana , Chapter 3,Verse 8,Page 21.
9. CharakSamhita, edited by Pt.Rajeshwar dutt Shastri, Pt.Yadunandan Upadhyay, Pt.Gangasahay Pandey, Dr. Banarasidas Gupta, Bhishagratna Pt.Brahmashankar Mishra, Chaukhambha Bharti Academy, 2003,Part 2, Sharirasthana ,Chapter 8, Verse5 ,Page919.
10. Sushruta, Sushrutasamhita edited with Ayurveda-tattva-sandeepika Hindi Commentary by Kaviraj Ambikadutta Shastri(AMS) forewarded by Dr.Pranjivan Manekch and Mehta, Part 1,Chaukhambha Sanskrit Sansthan, Varanasi , Sharirasthana , Chapter 2,Verse 19,Page12.
11. Menstruation and Menstrual Problems | NICHD - Eunice Kennedy Shriver National Institute of Child Health and Human Development.NICHD Information Resource Center. https://www.nichd.nih.gov/health/topics/factsheets/menstruation
12. Maybin JA, Critchley HO. Menstrual physiology: implications for endometrial pathology and beyond. Hum Reprod Update. 2015 Nov-Dec;21(6):748-61. doi: 10.1093/humupd/dmv038. Epub 2015 Aug 7. PMID: 26253932; PMCID: PMC4594618.
13. Sudha salhan. (2011).Textbook Of Gynecology.Chapter 10: Physiology Of Menstruation. Pikee Saxena, B Minocha.Page No: 56. Jaypee Brothers Medical Publishers Pvt. Limited.
14. Sudha salhan. (2011).Textbook Of Gynecology.Chapter 70: Hysterectomy. Sudha Salhan,Rani Jain, MD Gowsami.Page No: 559. Jaypee Brothers Medical Publishers

Pvt. Limited.

15. Sudha salhan. (2011).Textbook Of Gynecology. Chapter 71:Microsurgery in Gynecology. Rekha Bharti, Sudha Salhan. Page No: 574. Jaypee Brothers Medical Publishers Pvt. Limited.
16. Sudha salhan. (2011).Textbook Of Gynecology. Chapter 72: Myomectomy. Sudha Salhan, Shweta Rajani. Page No: 579. Jaypee Brothers Medical Publishers Pvt. Limited.
17. Sudha salhan. (2011).Textbook Of Gynecology.Chapter 78: Breast Diseases.Sunita Singal, Sudha Salhan.Page No: 603. Jaypee Brothers Medical Publishers Pvt. Limited.

How to cite this article:

Shilpa P N and Shanmugaloga S.(2024). Understanding Menstruation: Unravelling the Hormonal Symphony, Surgical Insights, and Ayurvedic Wisdom in Menstruation. *Int J Recent Sci Res*.15(09), pp.4962-4968.

****