



Review Article

NEUROENDOCRINE REGULATION OF FEMALE REPRODUCTIVE PHYSIOLOGY: AN AYURVEDIC PERSPECTIVE

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ABSTRACT

Female reproductive physiology is regulated through a complex interaction between the nervous, endocrine and reproductive system. Modern medicine explains this regulation through the co-ordination of hypothalamic-pituitary-ovarian (HPO) axis, whereas Ayurveda describes reproductive physiology through the concepts of *Artava*, *Artavaha Srotas*, *Rituchakra*, and *Tridosha* co-ordination. Although Ayurveda does not describe hormones as discrete physiological entities, its fundamental principles provide a functional framework for understanding reproductive regulation. The present conceptual review was undertaken to explore the neuroendocrine regulation of female reproductive system from an Ayurvedic perspective through a critical review of classical Ayurvedic texts, including *Charaka Samhita*, *Sushruta Samhita*, and *Ashtanga Hridaya*, along with contemporary literature on reproductive neuroendocrinology. Functional correlations were identified between neuroendocrine mechanisms and Ayurvedic principles governing female reproduction physiology. *Prana Vata*, *Sadhaka Pitta*, *Tarpak Kapha* were found to correspond with functions of higher regulatory mechanisms, *Apana Vata* with reproductive expression, *Kapha* with proliferative and nourishing functions, and *Pitta* with transformative physiological processes. Furthermore, the cyclical predominance of *Doshas* described in *Rituchakra* demonstrated functional similarities with the hormonal fluctuations and endometrial changes occurring during the menstrual cycle. This integrative understanding provides a broader perspective on female reproductive physiology, facilitates the interpretation of neuroendocrine regulation through Ayurvedic principles, and may contribute to a better understanding of *Samprapti* of reproductive disorders, rational Ayurvedic management, and future interdisciplinary research in reproductive health.

INTRODUCTION

The hypothalamus, pituitary gland, and ovaries function as an integrated neuroendocrine unit, commonly referred to as the hypothalamic-pituitary-ovarian (HPO) axis. Through the coordinated actions of Gonadotropin-releasing hormone (GnRH), Follicle-stimulating hormone (FSH), Luteinizing hormone (LH), estrogen, and progesterone, this axis regulates follicular development, ovulation, menstrual cyclicity,

and fertility.^[1] Disturbances in neuroendocrine regulation may result in menstrual irregularities, anovulation, infertility, and other reproductive disorders. In clinical practice, women presenting with menstrual and fertility-related complaints are frequently evaluated using hormonal investigations that reflect the functional status of the HPO axis. Assessment of hormones such as FSH, LH, estrogen, progesterone, prolactin, and thyroid hormones is an important component of reproductive evaluation. These investigations help identify abnormalities in neuroendocrine regulation and guide clinical management.

Ayurveda does not describe hormones as discrete physiological entities. Instead, physiological regulation is explained through broader concepts

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governing normal bodily function. As a result, a practical challenge arises while interpreting modern hormonal findings within an Ayurvedic framework. Understanding how neuroendocrine mechanisms can be viewed through Ayurvedic principles may facilitate a more comprehensive understanding of reproductive physiology and disease processes.

Ayurveda emphasizes that proper understanding of pathological states (*Vikrutavastha*) requires prior knowledge of physiological states (*Prakrutavastha*). Therefore, before attempting to interpret reproductive disorders, it is essential to understand the mechanisms responsible for maintaining normal reproductive function.

The present review aims to analyse the neuroendocrine regulation of female reproduction physiology and explore its Ayurvedic concepts. Such an integrative approach may contribute to a better

understanding of reproductive physiology, disease pathogenesis, and Ayurvedic management strategies.

MATERIALS AND METHODS

The present study is a conceptual review based on the analysis of classical Ayurvedic literature and modern scientific literature related to female reproductive physiology and neuroendocrinology. Classical Ayurvedic concepts were reviewed from *Charaka Samhita*, *Sushruta Samhita*, *Ashtanga Hridaya*, and their commentaries. Modern scientific literature concerning neuroendocrine regulation, the hypothalamic-pituitary-ovarian axis, menstrual physiology, ovulation, hormonal feedback mechanisms, and reproductive endocrinology was reviewed from standard books and scientific publications.

The collected information was critically analysed and interpreted to identify functional similarities between neuroendocrine mechanisms and Ayurvedic principles governing female reproduction.

RESULTS

Table 1: Functional Co-relation of Neuroendocrine Regulation and Tridosha

Hypothalamus	Co-ordinated regulatory functions of <i>Prana vata</i> , <i>Sadhak pitta</i> , <i>Tarpak kapha</i>
GnRH secretion	Initiating and Regulatory action of <i>Prana Vata</i>
FSH-mediated follicular growth	<i>Kapha</i> -mediated nourishment and proliferation
LH surge and ovulation	<i>Pitta</i> -mediated transformation with <i>Apana Vata</i> -mediated release
Estrogen-mediated endometrial proliferation	<i>Kapha</i> predominance
Progesterone-mediated secretory transformation	<i>Pitta</i> predominance
Menstruation	<i>Apana Vata</i> -mediated <i>Artava Nissarana</i>
Hormonal homeostasis	<i>Dosha Samya</i>

Table 2: Correlation of Rituchakra with Menstrual Cycle and Endometrial changes

Phase	Days	Dominant Dosha	Function	Endometrial Changes
Proliferative (<i>Ritukala</i>)	5-16	<i>Kapha</i>	<i>Upchaya</i>	Thick, smooth, proliferative
Secretory (<i>Rituvyatita kala</i>)	17-28	<i>Pitta</i>	<i>Apchaya</i>	Soft, spongy, receptive
Menstrual (<i>Rajahsrava kala</i>)	1-4	<i>Vata</i>	<i>Prasek</i>	Breakdown, shedding

DISCUSSION

Ayurvedic Basis of Neuroendocrine Regulation

The hypothalamus functions as the principal neuroendocrine regulatory centre, integrating neural inputs and coordinating endocrine homeostasis through the HPO axis. *Charaka* has described *Shira* as the *Uttamanga* and the seat controlling the functions of *Sarvindiya* (sensory and motor organs).^[2]

Prana Vata is described as residing in *Murdha* and governing higher physiological activities and coordination of bodily functions.^[3] *Sadhaka Pitta* is

associated with *Buddhi*, *Medha*, and higher regulatory processing^[4], while *Tarpaka Kapha*, situated in the *Shira*, nourishes and stabilizes the nervous system and sensory functions.^[5] The coordinated actions of *Prana Vata*, *Sadhaka Pitta*, and *Tarpaka Kapha* may therefore be functionally interpreted as the Ayurvedic basis of hypothalamic regulation, maintaining neuroendocrine balance and controlling female reproductive functions.

Dosha Physiology and Hormonal Functions

The physiological actions of hormones can be interpreted through the functional attributes of *Tridosha*.

FSH and Kapha

FSH plays a key role in follicular growth and maturation by stimulating granulosa cell proliferation, promoting follicular development, and enhancing estrogen synthesis.^[6] These anabolic and nourishing functions may be functionally correlated with *Kapha Dosha*, which governs *Vridhhi* (growth), *Brimhana* (nourishment), *Sthiratva* (stability), and *Upachaya* (tissue proliferation). The *Guru*, *Snigdha*, *Manda*, and *Sthira Gunas* of *Kapha*^[7] support tissue growth, nourishment, and structural integrity, resembling the physiological actions of FSH during folliculogenesis.

LH and Pitta-Apana Vata

LH triggers ovulation, a process involving follicular maturation, rupture, and release of the ovum.^[8] Follicular maturation and rupture may be functionally correlated with *Pitta Dosha*, whose *Ushna*, *Tikshna*, and *Sara Gunas*^[9] facilitate these changes. Ayurveda describes *Apana Vata* is responsible for the expulsion of *Artava*.^[10] Therefore, the release of the ovum may be functionally correlated with the *Chala guna* and *Anuloman gati* of *Apana Vata*. Thus, ovulation may be interpreted as a coordinated action of *Pitta*-mediated follicular rupture and *Apana Vata*-mediated release of *Artava* (*Beeja*).

Estrogen and Kapha

Estrogen is the principal hormone of the proliferative phase, stimulating regeneration and proliferation of the functional endometrium following menstruation.^[11] It also promotes angiogenesis, cellular proliferation, and enhances uterine receptivity. These nourishing and constructive actions may be functionally correlated with *Kapha Dosha*, which governs tissue growth and nourishment through its *Snigdha*, *Guru*, *Sthira*, and *Picchila Gunas*.^[12] Thus, the regenerative endometrial changes induced by estrogen may be interpreted as an expression of *Kapha* predominance, preparing the uterus for implantation.

Progesterone and Pitta

Following ovulation, progesterone secreted by the corpus luteum transforms the proliferative endometrium into a secretory endometrium, preparing it for implantation.^[13] This secretory transformation may be functionally correlated with *Pitta Dosha*, which governs *Paka* (transformation), maturation, and metabolic activity. The *Ushna*, *Tikshna*, *Sara*, and *Drava gunas* of *Pitta*.^[14] facilitate these physiological changes. Furthermore, progesterone exerts a thermogenic effect by increasing basal body temperature after ovulation^[15], which further supports its functional

correlation with the *Ushna guna* of *Pitta*. Thus, the physiological actions of progesterone may be interpreted as an expression of *Pitta* predominance.

Artava and Artavavaha Srotas in Reproductive Regulation

Artava occupies a central position in Ayurvedic understanding of female reproductive physiology. Acharyas have described *Artava* as an essential reproductive factor in women and have elaborated its normal characteristics (*Shudha artava lakshanas*) as indicators of reproductive health. ^[16]

The concept of *Artava* extends beyond menstrual blood. Several classical references suggest that *Artava* is also interpreted as hormonal regulation. Similarly, terms such as *Raja* and *Pushpa*, used in different contexts in the classical texts, may also represent reproductive hormones rather than solely menstrual blood.^[17]

Sushruta describes *Artavavaha Srotas* with *Garbhashaya* and *Artavavaha Dhamani* as their *Mulasthanas*, indicating the principal sites through which the physiological functions of *Artava* are carried out.^[18] While these structures may be correlated with the uterus and fallopian tubes when *Artava* is interpreted as menstrual blood or ovum, a broader interpretation of *Artava* as reproductive hormones suggests that *Artavavaha Srotas* represents the integrated reproductive and neuroendocrine network responsible for hormonal regulation and expression.

Sushruta describes two *Artavavahi Dhamanis* responsible for the formation of *Artava* and two for its transport.^[19] This functional distinction suggests that *Artava* undergoes separate processes of production and delivery. From a neuroendocrine perspective, these descriptions may be interpreted as representing the synthesis, transport, and physiological action of reproductive hormones rather than merely the movement of menstrual blood.

The integrity of these channels is essential for normal reproductive function. Injury or dysfunction of *Artavavaha Srotas* leads to conditions such as *Anartava*, *Vandhyatva*, and *Maithuna Asahishnuta*^[20] emphasizing their importance in female reproduction.

Artavavaha Srotas may therefore be understood as the system which is governed by the balanced actions of *Tridosha* which regulate *Artava* and maintain the normal sequence of *Rituchakra*, ovulation, conception, and *Garbhotpatti*.

Correlation of Rituchakra with Menstrual Cycle

The cyclical nature of female reproductive physiology described in modern endocrinology may also be appreciated through the concept of cyclic *Tridosha* predominance during *Rituchakra*. Each phase of the menstrual cycle exhibits physiological

characteristics that can be interpreted through the dominant *Dosha*.

Rajahsrava Kala corresponds to the menstrual phase (approximately days 1–4) and is predominantly governed by *Apana Vata*, which facilitates the downward movement and expulsion of *Artava*.^[21] The *Chala guna* of *Vata* governs menstrual flow, corresponding to the menstrual phase of the modern cycle, during which the functional endometrium is shed following progesterone withdrawal.

Ritukala represents the fertile period and is described as the most suitable time for conception due to the presence of *Artava (Beeja)* and a conducive reproductive environment.^[22] It corresponds to the proliferative and peri-ovulatory phases (approximately days 5–16), during which follicular growth and endometrial regeneration occur. These events may be functionally correlated with *Kapha Dosha*, whose *Snigdha*, *Guru*, and *Sthira* Gunas promote nourishment, growth (*Upachaya*), and tissue stability. The regenerated endometrium during this phase may be correlated with the concept of *Navinraja*.^[23] By 12th day pitta intervenes and puts a break to proliferation. Penetrating and exudating properties of pitta softens the bed and make it spongy and loose to make it compatible for nidation.

Rituvyatita Kala follows the fertile period and is characterized by reduced reproductive receptivity.^[24] This corresponds to the luteal or secretory phase (approximately days 17–28). This phase is characterized by secretory transformation of the endometrium and preparation for implantation under the influence of progesterone. These transformative and metabolic activities may be interpreted through the predominance of *Pitta Dosha*, whose *Ushna* and *Tikshna* properties govern physiological transformation and maturation. The mature and fully developed endometrium during this phase may be correlated with the concept of *Puranaraja*, representing transformed and mature reproductive tissue.^[25]

decline, resulting in breakdown of the functional endometrium and the onset of menstruation.^[26] Functionally, this hormonal withdrawal may be correlated with the decline of *Kapha*- and *Pitta*-dominant activities. As these stabilizing and transformative influences diminish, *Vata*, particularly *Apana Vata*, regains predominance and initiates *Artava Nissarana*, leading to the commencement of a new *Rajahsrava Kala*. Thus, the cyclical transition from *Vata* → *Kapha* → *Pitta* → *Vata* mirrors the recurring physiological rhythm of both *Rituchakra* and the modern menstrual cycle.

Thus, *Rituchakra* provides a dynamic framework for understanding cyclical reproductive physiology and demonstrates notable functional similarities with the hormonal regulation of the menstrual cycle.

Dosha Samya and Endocrine Homeostasis

A fundamental principle of modern endocrinology is the maintenance of physiological homeostasis through feedback regulation. The HPO axis functions through intricate positive and negative feedback mechanisms that ensure hormonal balance and reproductive health.^[27]

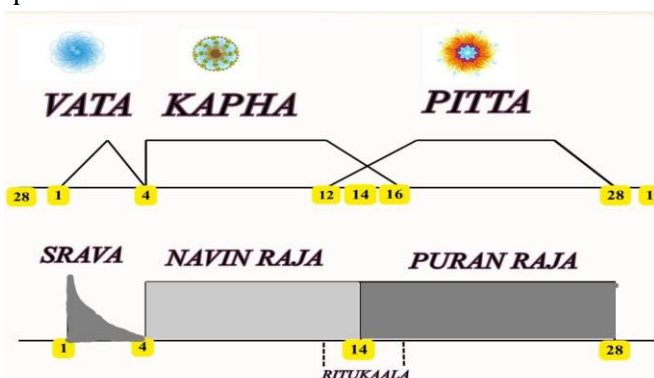
Ayurveda similarly emphasizes the importance of *Dosha Samyata* in maintaining health. *Acharya Vagbhata* states that *Vata*, *Pitta*, and *Kapha* in their balanced state sustain normal physiological functions, whereas their imbalance leads to disease.^[28]

The concept of endocrine homeostasis may therefore be interpreted through the principle of *Dosha Samya*. Physiological feedback mechanisms that regulate hormonal secretion can be viewed as processes aimed at restoring and maintaining equilibrium. Likewise, endocrine dysfunction may be interpreted as *Dosha Vaishamya* affecting reproductive physiology.

Although the mechanisms described by modern endocrinology and Ayurveda differ conceptually, both systems recognize the necessity of maintaining physiological balance for normal reproductive function.

Clinical Implications in Understanding Samprapti and Management

Dosha Siddhanta forms the cornerstone of Ayurvedic physiology and pathology. While modern medicine explains reproductive disorders through hormonal and neuroendocrine disturbances, *Ayurveda* interprets these alterations through *Dosha Vaishamya* and its effects on *Dhatu*, *Upadhatu*, and *Srotas*. Thus, *Dosha* theory provides the fundamental framework for understanding disease pathogenesis (*Samprapti*) and planning management.



At the end of *Rituvyatita Kala*, when conception does not occur, estrogen and progesterone levels

According to Ayurveda, physiological processes are carried out through *Srotas*, which serve as channels for the transport, nourishment, and regulation of various bodily constituents. *Acharya Charaka* describes *Srotas* as the pathways through which *Dosha*, *Dhatu*, *Upadhatu*, and other physiological substances circulate within the body.^[29] Consequently, the formation, nourishment, transport, and expression of *Artava* also occur through the proper functioning of *Srotas*. Following digestion and metabolism by *Agni*, *Ahara* is transformed into *Rasa Dhatu*, from which *Artava* is formed and maintained. This *Artava* is subsequently regulated and expressed through *Artavaha Srotas*, ultimately contributing to normal *Rituchakra* and *Garbhotpatti*.



Disturbances in central regulation may be interpreted through dysfunction of *Prana Vata*, *Sadhaka Pitta*, *Tarpaka Kapha* while abnormalities in ovulation, menstruation, and fertility may involve impairment of *Apana Vata* and *Artavaha Srotas*. Likewise, alterations in follicular growth, ovulation, and endometrial changes may be analysed through *Dosha* predominance and imbalance.

Such an integrative understanding may help clinicians construct *Samprapti* more systematically and may contribute to rational planning of Ayurvedic interventions according to *Doshas* including *Shodhana*, *Basti*, *Artavajanana*, and *Garbhasthapana* therapies according to the underlying physiological disturbance.

CONCLUSION

Female reproductive physiology is regulated through a complex interplay of neural, endocrine, and reproductive mechanisms. Modern medicine explains

this regulation through the neuroendocrine interactions of the hypothalamic-pituitary-ovarian axis, while Ayurveda describes reproductive physiology through the coordinated actions of *Prana Vata*, *Sadhaka Pitta*, *Apana Vata*, *Artava*, *Artavaha Srotas*, and *Rituchakra*.

Despite differences in conceptual framework, both systems seek to explain the regulation and maintenance of reproductive health. Functional interpretation of neuroendocrine mechanisms through Ayurvedic principles provides a broader understanding of female reproductive physiology and highlights the relevance of classical Ayurvedic concepts in contemporary reproductive science.

Such an integrative approach may contribute to improved understanding of *Samprapti*, facilitate rational Ayurvedic management, and provide a foundation for future interdisciplinary research in reproductive health.

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