

## Chapter 25

# Nutritional and Ayurvedic Approaches to Female Reproductive Health

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## Abstract

Female reproductive health is governed by a complex interplay of endocrine pathways, somatic integrity, and psychosocial well-being, influencing daily systemic function from menarche through senescence. Pathologies such as dysmenorrhea, premenstrual syndrome (PMS), polycystic ovary syndrome (PCOS), and endometriosis present a substantial, expanding global burden among young women. Despite biomedical advancements, a critical deficit remains for accessible, evidence-based interventions that accommodate cross-cultural preferences while simultaneously addressing physiological and psychological symptomatology.

This chapter synthesizes integrative paradigms combining modern nutritional science and Ayurvedic medicine to support female reproductive oncology and physiology, relying on evidence from randomized controlled trials, systematic reviews, and classical Ayurvedic literature.

From a nutritional perspective, this review evaluates the mechanistic roles of omega-3 polyunsaturated fatty acids, iron, calcium, zinc, and pyridoxine (Vitamin B6) in modulating endocrine biomarkers and mitigating menstrual distress. Furthermore, contemporary insights into the gastrointestinal microbiome—specifically the estrobolome—are analyzed regarding its role in regulating systemic estrogen homeostasis. Conversely, through the lens of classical Ayurveda, traditional frameworks including Stree Roga (gynecological disorders), Artava Dhatu (reproductive tissue), and Dosha homeostasis are examined alongside the clinical utility of *Rasayana* (rejuvenative) therapies and botanical agents such as *Asparagus racemosus* (Shatavari) and *Withania somnifera* (Ashwagandha).

Evidence-supported complementary strategies are outlined, focusing on functional foods (e.g., flaxseeds), traditionally fermented substrates, and targeted herbal infusions (ginger, chamomile, fennel, spearmint, and hibiscus) that demonstrate distinct hormonal and microbiome-modulating mechanisms. Finally, the chapter provides structured dietary counseling frameworks and translation-ready clinical recommendations, concluding with defined priority vectors for future empirical research at the intersection of nutritional science, Ayurvedic pharmacology, and gynecological medicine.

**Keywords:** Female Reproductive Health, Integrative Nutrition, Ayurveda, Estrobolome, Endocrine Modulation, Botanical Therapeutics, omega-3 fatty acids, Gut microbiome, Herbal tea, Flaxseed, Stree Roga, Artava Dhatu, Integrative medicine, Menstrual health.

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## Introduction

Women's reproductive health touches everything—physical health, mental well-being, and social life. It shapes a woman's entire lifespan. Right now, reproductive and gynaecological disorders are causing a massive, growing crisis worldwide. We are talking about conditions like irregular periods, infertility, PCOS, and endometriosis. The numbers back this up. The 2021 Global Burden of Disease Study showed that gynaecological diseases hit women of childbearing age hard, accounting for roughly 2.17 billion cases globally. These aren't just mild inconveniences; they cause severe daily disruptions for millions of women (Chen et al., 2025).

Infertility is also climbing fast. The World Health Organization estimated the global infertility rate reached 17.5% in 2023, a significant jump from past years (Frontiers in Public Health, 2025). It is officially a major public health emergency. Take endometriosis as another example. It hits hardest when women are in their prime—between 20 and 24 years old. On top of the physical pain, it frequently triggers anxiety, depression, and terrible sleep, destroying a person’s quality of life (Li et al., 2025). To tackle this, we need a better approach. Combining solid, evidence-based nutritional science with the traditional principles of Ayurveda offers a practical, lasting way to treat female reproductive health as a whole.

## **Bridging Modern Nutrition and Ayurvedic Science**

Modern nutritional science and traditional Ayurvedic medicine come from completely different worlds, but they land on the exact same truth: what you eat directly shapes your body and your reproductive health.

Modern science focuses on the microscopic details. It uses a molecular lens to look at macronutrients, vitamins, bioactive compounds, and the gut microbiome. Ayurveda takes a different approach. It explains nutrition through concepts like Rasa (taste), Guna (quality), Virya (potency), and Vipaka (the post-digestive effect) and how they interact with your body’s unique energies (*Doshas*) and tissues (*Dhatus*).

Blending these two frameworks isn’t just for academic debate. It works in the real world. Traditional Indian foods—like fermented dishes, seed-based chutneys, and herbal remedies—are packed with active ingredients. Today, modern labs are finally proving exactly how these traditional foods work in the body. This chapter brings together the hard evidence behind both systems to support women’s reproductive health, focusing on practical, easy, and culturally familiar ways to eat well.

## **Female Reproductive System: Structure and Function**

### **Anatomy and Physiology of the Female Reproductive System**

The female reproductive system relies on a perfectly timed partnership between the ovaries, fallopian tubes, uterus, cervix, and vagina. Together, they handle everything from growing eggs and fertilization to implantation and pregnancy. The ovaries do double duty. They act as hormone factories—churning out estrogen, progesterone, and androgens—while safely housing the egg supply a woman is born with. For periods to stay regular and for fertility to remain intact, the structure of these organs must stay healthy. When that anatomy gets disrupted by things like endometriosis, fibroids, or the physical changes caused by PCOS, reproductive health takes a massive hit. Data from the 2021 Global Burden of Disease study confirms that endometriosis creates a brutal, lifelong public health burden. Because it takes years to diagnose and causes chronic pain, it robs women worldwide of healthy, functional years of life (Li et al., 2025). To understand how nutrition and Ayurveda contribute to maintaining and restoring health, it is essential to first examine the structure and functioning of this system.

### **Hormonal Regulation of the Menstrual Cycle**

The menstrual cycle runs on a complex brain-to-body feedback loop called the HPO axis (hypothalamic-pituitary-ovarian axis). First, the hypothalamus releases GnRH. This triggers the pituitary gland to send out follicle-stimulating hormone (FSH) and luteinizing hormone (LH). These hormones tell the ovaries when to mature an egg, when to release it, and when to form the corpus luteum. As estrogen and progesterone rise and fall throughout the month, they signal the uterine lining to thicken and then shed as a period if pregnancy doesn’t happen. A glitch anywhere along this chemical highway can completely derail a woman’s cycle. Poor nutrition, chronic inflammation, and mental stress can all trigger painful periods, irregular cycles, or missed ovulation. Interestingly, we now know the gut microbiome plays a massive role in managing estrogen levels. When your gut bacteria get out of whack (dysbiosis), it directly fuels conditions like PCOS and endometriosis (Qi et al., 2021). Dietary intake and the efficient absorption of nutrients play a fundamental role in maintaining hormonal balance and regulating endocrine function.

## **Nutritional Foundations of Female Reproductive Health**

### **Key Macronutrients and Micronutrients in Reproductive Function**

Nutrition is not a passive backdrop to female reproduction. It is the fuel and the architecture. Without adequate substrates, the entire endocrine symphony collapses. At the fundamental level, macronutrients dictate whether the body registers an environment as safe for reproduction. Carbohydrates drive insulin signalling which directly gatekeeps ovarian steroidogenesis. Proteins supply the raw amino acid building blocks for gonadotropins and sex hormones. Dietary fats—especially unsaturated fatty acids—determine the fluidity of reproductive membranes and feed prostaglandin pathways.

Examination of individual micronutrients highlights their specific physiological functions. Iron is indispensable for hemoglobin synthesis and is essential in preventing anemia associated with menstrual blood loss. The global scale of this deficit is staggering: in 2021, anemia derailed the health of 657 million reproductive-age women, hitting low- and middle-income regions with disproportionate severity (GBD 2021, as cited in Wang et al., 2025). Moving from hematology to cellular development, folate acts as an indispensable driver of DNA methylation and early neural tube formation.

The psychological and physiological changes associated with the menstrual cycle are also influenced by nutritional status. During the luteal phase, adequate calcium intake is important for maintaining normal neurotransmitter function, including serotonin regulation. Reduced calcium levels during this phase have been associated with an increased severity of premenstrual syndrome (PMS) symptoms. Similarly, zinc depletion strips away a crucial antidepressant-like defense, aggravating mood and behavioral distress by depressing serotonin activity and brain-derived neurotrophic factor (BDNF) synthesis (Siminiuc & Turcanu, 2023; Abdi et al., 2024).

## Targeted Nutrients: Omega-3s, Iron, Calcium, and Folate

Among the various nutritional interventions investigated for women's reproductive health, omega-3 polyunsaturated fatty acids (PUFAs), including eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA), and alpha-linolenic acid (ALA), have been extensively studied. These essential fatty acids play important roles in regulating metabolic and endocrine functions by reducing systemic inflammation and modulating prostaglandin synthesis, thereby contributing to hormonal homeostasis.

Clinical evidence supports the beneficial effects of omega-3 fatty acids on reproductive health. The BioCycle Study, involving 259 healthy premenopausal women, demonstrated that low dietary intake of omega-3 fatty acids was associated with hormonal irregularities and an increased likelihood of sporadic anovulation (Mumford et al., 2011). Conversely, a meta-analysis by Schaefer et al. (2024) reported that women who consumed omega-3 supplements had a significantly higher probability of conception compared with non-users.

Whole-food sources of omega-3 fatty acids may provide additional physiological benefits. Flaxseed (*Linum usitatissimum*), for example, is a rich source of lignans, which influence estrogen metabolism and have been shown to alleviate perimenopausal symptoms through their phytoestrogenic activity (Porwal et al., 2024). Furthermore, nutritional interventions combining calcium and vitamin B6 have demonstrated efficacy in reducing the psychological symptoms associated with premenstrual syndrome (PMS). Randomized controlled trials have consistently shown that this combination can improve mood-related symptoms and enhance overall quality of life in affected individuals (Abdi et al., 2024).

## Dietary Patterns and Symptoms Load

Dietary patterns, rather than individual nutrients alone, play a significant role in maintaining menstrual health. Since foods contain complex combinations of macro- and micronutrients that interact synergistically, evaluating overall dietary quality provides a more comprehensive understanding of their effects on reproductive function than assessing single nutrients in isolation. Epidemiological studies have demonstrated an association between dietary quality and menstrual health outcomes. For example, in Japan, where a large proportion of women participate in the workforce, menstrual disorders such as dysmenorrhea and premenstrual syndrome (PMS) are highly prevalent. Approximately 80% of women experience menstrual pain and PMS, and these conditions have been associated with dietary patterns characterized by inadequate intake of omega-3 fatty acids, B vitamins, vitamin D, and antioxidant-rich foods (Yamamoto et al., 2023). Deficiencies in these nutrients may contribute to an enhanced inflammatory response, leading to increased synthesis of prostaglandins and leukotrienes. Elevated levels of these inflammatory mediators are associated with uterine contractions, dysmenorrhea, headache, and gastrointestinal symptoms.

Improvement in overall dietary quality has been shown to reduce the severity of menstrual symptoms. A systematic review of 31 randomized controlled trials involving 3,254 participants reported that supplementation with vitamin B6, calcium, and zinc significantly reduced the psychological symptoms of PMS, including anxiety, mood disturbances, and difficulties in concentration (Abdi et al., 2024). These findings highlight the importance of balanced nutrition in the prevention and management of menstrual disorders. Consequently, nutritional assessment and dietary counseling should be considered integral components of preventive healthcare and the comprehensive management of women's reproductive health.

## The Estrobolome: Gut Microbiome and Endocrine Control

Recent advances in reproductive endocrinology have emphasized the significant role of the gut microbiome in regulating female reproductive health. The gut microbiota and the endocrine system interact through a bidirectional relationship, commonly referred to as the gut–endocrine axis, which influences hormone metabolism, immune regulation, and reproductive function.

A key component of this interaction is the estrobolome, a group of intestinal microorganisms involved in estrogen metabolism. These microorganisms produce the enzyme  $\beta$ -glucuronidase, which deconjugates estrogen metabolites in the intestine, enabling their reabsorption into the systemic circulation through the enterohepatic circulation. This process contributes to the regulation of circulating estrogen levels. Alterations in the composition and function of the gut microbiota, known as dysbiosis, may disrupt estrogen metabolism and lead to hormonal imbalance. Such disturbances have been associated with the development of reproductive disorders, including polycystic ovary syndrome (PCOS), endometriosis, menstrual irregularities, and adverse pregnancy outcomes (Chadchan et al., 2022; Qi et al., 2021).

Recent research has provided stronger evidence supporting the role of the gut microbiome in reproductive endocrine disorders. Using Mendelian randomization analysis, Liang et al. (2023) identified potential causal relationships between specific gut microbial profiles and reproductive endocrine diseases. These findings suggest that alterations in the gut microbiota may contribute directly to the pathogenesis of endocrine disorders affecting female reproductive health.

Modulation of the gut microbiome has emerged as a promising therapeutic approach for the management of reproductive endocrine disorders. Probiotic supplementation, particularly with strains belonging to the genera *Lactobacillus* and *Bifidobacterium*, has been shown to restore microbial balance and improve both metabolic and hormonal parameters in women with polycystic ovary syndrome (PCOS) (Qi et al., 2021).

The beneficial effects of microbiome-targeted interventions extend beyond reproductive health. A comprehensive meta-analysis by Varin et al. (2025) reported that modulation of the gut microbiota significantly reduced symptoms of depression (SMD = -0.848,  $p = 0.008$ ) and anxiety (SMD = -0.997,  $p = 0.004$ ) across different stages of female reproductive life when compared with control groups. These findings suggest that maintenance of a healthy gut microbiome contributes to both endocrine regulation and psychological well-being.

Dietary strategies that support the growth of beneficial intestinal microorganisms are an important component of microbiome-based interventions. Fermented foods containing naturally occurring probiotic microorganisms can enhance microbial diversity and promote intestinal health. Traditional fermented foods, including Indian fermented pickles (achar) prepared using conventional fermentation methods, may serve as accessible dietary sources of beneficial bacteria. Regular inclusion of such foods as part of a balanced diet may support gut microbial homeostasis and contribute to improved metabolic, reproductive, and overall health.

## Ayurvedic Perspective on Female Reproductive Health

### Concept of Stree Roga in Ayurveda

Stree Roga, the Ayurvedic science of gynecology, does not isolate the female reproductive system. It maps it across a lifetime, from the onset of puberty through the reproductive years and into menopause. While classical Ashtanga Ayurveda lacks a standalone, siloed specialty for gynecology, the foundational texts of the Brihatrayi—the Charaka Samhita, Sushruta Samhita, and Vagbhata's Ashtanga Hridayam—alongside the Kashyapa and Harita Samhitas, systematically weave these principles throughout their volumes (Tiware, 2012). The system views pathology through a wider lens than modern localized medicine.

At the center of this framework lies Yoni Vyapada: twenty distinct disorders of the female genital tract and reproductive tract. Charaka categorizes these based on doshic dominance (Charaka Samhita, Chikitsa Sthana 30). When Vata subverts the system, it produces irregular, frothy, painful menstruation paired with localized numbness and stiffness (Sharma & Dash, 2010). Excess Pitta—frequently fueled by sharp, sour, or overly saline diets—drives heat, fever, and acute inflammation. Kapha dominance slows the system down, yielding pale, slimy menstrual discharge, itching, and tissue pallor (Charaka Samhita, Chikitsa Sthana 30/13–14). Sushruta expands this map to include Raktapradara (menorrhagia) and postpartum complications known as Sootika Roga (Sushruta Samhita, Uttara Tantra 38), while the Ashtanga Hridayam ties the depletion of menstrual tissue directly to Vata-Pitta vitiation, manifesting as tissue emaciation, burning sensations, and skin discoloration (Tripathi, 2015).

Ayurveda anchors women's health to a moving equilibrium of *Dosha*, Dhatu, Mala, Agni, and Manas (mind). When pathology strikes, the root usually traces back to *Rasa Dhatu*, the body's primary nutritive fluid. Because Artava (menstrual tissue) functions as an Upadhatu—a secondary tissue derived directly from Rasa—any breakdown in foundational nutrition compromises the reproductive cycle (Tiware, 2012). This is not simple organ failure. It is a systemic alarm showing nutritional, metabolic, and psychological strain.

### Doshas and Their Influence on the Menstrual Cycle

Ayurvedic physiology treats the menstrual cycle—the Rituchakra—as a dynamic 28-day rhythm orchestrated by all three *Doshas*. Each has a specific job. Vata, specifically Apana Vayu, dictates the downward momentum and physical expulsion of menstrual blood. Pitta governs the quality, metabolic transformation, and color of the discharge, while Kapha builds, nourishes, and lubricates the reproductive tissues.

When these forces drift out of balance, the rhythm breaks. Vata disturbances trigger scanty, painful, and highly erratic cycles. Pitta excess drives heavy hemorrhaging and systemic inflammation, while Kapha stagnation leaves the cycle sluggish, congested, or entirely suppressed (Tanwar, 2024; AYUSHDHARA, 2024). We can reverse these dysfunctions by target-correcting the specific *Dosha* involved. Clinical trials demonstrate that interventions like Shatapushpa-Shatavari Churna and targeted herbal decoctions successfully restore regular menstrual flow and cyclical predictability by re-establishing baseline doshic balance (AYUSHDHARA, 2024). This individual etiology forms the bedrock of personalized integrative reproductive care.

### Artava Dhatu: The Ayurvedic Understanding of Reproductive Tissue

Artava holds a unique status in Ayurvedic physiology. It is an Upadhatu—a secondary, specialized tissue born directly from the metabolic refinement of *Rasa Dhatu*. Charaka clarifies that Artava emerges as a downstream byproduct during Rasa metabolism, meaning its vitality depends entirely on the metabolic fire, or Agni, operating within that primary nutritive fluid (Charaka Samhita, Chikitsa Sthana 15/17). While Charaka and Vagbhata trace its lineage strictly to Rasa, Sushruta frames Artava as Rakta (blood) that concentrates within the Garbhashaya (uterus) and exits cyclically. Sharangadhara synthesizes both views, identifying Artava as a secondary tissue shaped by the dual metabolism of both Rasa and Rakta Dhatu (Sharangadhara Samhita, Purva Khanda 5/16–17).

Every month, this tissue pools within the Garbha Koshtha (uterus) and clears through Rajapravritti (menstruation). This clearance keeps the system clean. For successful conception and healthy embryogenesis, the Artava must remain Shuddha—perfectly pure. The classical descriptions are highly visual. Charaka compares pure Artava to the brilliant red of the *Abrus precatorius* (Gunja) seed, the red lotus, or the vivid hue of the Indragopaka insect (Charaka Samhita, Chikitsa Sthana 30/226). Sushruta adds a practical diagnostic metric: healthy menstrual fluid does not stain cloth (Sushruta Samhita, Sharira Sthana 2/17). Vagbhata refines this further, noting it should carry a characteristic honey-like scent, remain entirely non-sticky, and cause zero burning sensations during transit (Ashtanga Hridayam, Sharira Sthana 1/22–23).

Any deviation indicates Artava Dushti (tissue impurity). This structural breakdown drives downstream clinical pathologies, including severe dysmenorrhea, menorrhagia, amenorrhea, endometrial dysfunction, and structural infertility (Tiware, 2004). Modern science is catching up to these descriptions. When *Rasa Dhatu* Dushti manifests clinically as Artava Kshaya, irregular cycles, and anovulation, it mirrors modern endocrinology's breakdown of the hypothalamic-pituitary-ovarian (HPO) axis. Emerging menstrual blood proteomics provides a molecular basis for these classical insights, mapping changes in fluid color, viscosity, and odor to distinct biomarker shifts. Artava is a brilliant clinical bridge between ancient tissue physiology and modern reproductive science.

### Rasayana and Vajikarana: Therapeutic Pathways to Wellness

Ayurveda tackles long-term reproductive vitality through two specialized clinical branches: *Rasayana* and *Vajikarana*. *Rasayana* comprises rejuvenating formulations and protocols engineered to maximize longevity, boost cellular immunity, and deep-nourish every foundational tissue layer. *Vajikarana* focuses strictly on the reproductive axis, optimizing libido, tissue quality, and fertility parameters in both sexes.

Two foundational botanicals bridge these categories perfectly: Shatavari (*Asparagus racemosus*) and Ashwagandha (*Withania somnifera*). Shatavari delivers profound *Rasayana*, Balya (strength-promoting), and Stanya Janana (lactogenic) actions. Its dense concentration of steroidal saponins, or shatavarins, yields reliable phytoestrogenic and adaptogenic activity that stabilizes hormonal fluctuations, curbs menstrual disorders, and improves fertility outcomes (Dove Medical Press, 2026). Pharmacological reviews validate its capacity to smooth out erratic hormonal spikes and ease the menopausal transition. Ashwagandha complements this mechanism. Utilized as a premier

*Rasayana* for over three millennia, contemporary data highlights its role as a master adaptogen with potent neuroimmune-modulatory and stress-mitigating properties that preserve adrenal reserve and rescue reproductive function from the destructive downstream effects of chronic cortisol elevation (Jamnekar et al., 2025). These botanicals are not mere historical remedies. They represent clinical instruments capable of integrating ancient therapeutics with modern, evidence-based nutritional practice.

## Common Female Reproductive Health Conditions

### *Dysmenorrhoea, PMS, and PCOS: Nutritional and Ayurvedic Insights*

Dysmenorrhea, premenstrual syndrome (PMS), and polycystic ovary syndrome (PCOS) dominate the landscape of global female reproductive morbidity. They are not minor inconveniences. They are systemic disruptors. PMS alone tracks across a staggering checklist of over 200 identified physical and psychological symptoms. These manifestations systematically erode a woman's quality of life and fracture occupational productivity (Siminiuc & Turcanu, 2023).

The pathophysiology of dysmenorrhea is primarily attributed to excessive production of endometrial prostaglandins and leukotrienes during menstruation. Elevated concentrations of these inflammatory mediators increase uterine contractility, reduce uterine blood flow, and produce transient uterine ischemia, resulting in menstrual pain. In addition, they contribute to systemic inflammatory responses that may be associated with symptoms such as headache, nausea, vomiting, and gastrointestinal discomfort.

Nutritional interventions have been shown to modulate these inflammatory pathways and reduce the severity of menstrual symptoms. Clinical studies have demonstrated that supplementation with omega-3 polyunsaturated fatty acids, magnesium, and vitamin B6 can decrease the synthesis and activity of inflammatory mediators, thereby reducing the intensity and frequency of dysmenorrhea and premenstrual syndrome (PMS) symptoms (Siminiuc & Turcanu, 2023; Abdi et al., 2024).

PCOS presents an even more complex, multi-system crisis. Depending on which diagnostic criteria you deploy, the condition afflicts between 4% and 21% of women globally (Global Burden of Disease Study, 2025). It binds metabolic dysfunction to psychological suffering, showcasing a triad of hormonal imbalances, insulin resistance, and heavy psychiatric burdens like depression and anxiety. Ayurveda maps this exact constellation through a different, yet complementary, lens. It identifies PCOS as a predatory combination of Kapha and Vata stagnation. This dual-*Dosha* blockage causes Artava Kshaya (menstrual tissue depletion) and Beeja Dushti (impairment of the ovum). To dismantle this pathology, Ayurvedic protocols bypass localized organ treatment, focusing instead on repairing Agni (the metabolic fire) and aggressively clearing Kapha accumulation through strict dietary correction.

### Nutritional Deficiencies and Menstrual Irregularities

Menstrual irregularities, including irregular cycle length, oligomenorrhea, amenorrhea, and menorrhagia, are influenced by multiple physiological, endocrine, and nutritional factors. Nutritional deficiencies can disrupt hormonal homeostasis and normal reproductive function, thereby contributing to abnormalities in the menstrual cycle.

Iron deficiency is one of the most common nutritional disorders affecting women of reproductive age and is closely associated with menstrual health. Heavy menstrual bleeding may result in significant iron loss, increasing the risk of iron deficiency anemia. In turn, iron deficiency anemia can impair physical performance, cognitive function, and overall well-being, creating a cycle in which excessive menstrual blood loss and iron depletion reinforce one another (Wang et al., 2025). This condition also contributes to increased fatigue, reduced work capacity, and adverse long-term health outcomes.

Several micronutrients play essential roles in endocrine regulation and ovarian function. Vitamin D functions as a steroid hormone precursor and exerts its biological effects through vitamin D receptors expressed in ovarian tissue. Deficiency of vitamin D has been associated with impaired follicular development, menstrual irregularities, and the pathogenesis of polycystic ovary syndrome (PCOS). Similarly, zinc is required for normal follicular development, ovulation, and reproductive hormone synthesis, and inadequate zinc intake has been associated with ovulatory dysfunction and increased severity of dysmenorrhea. Selenium is essential for normal thyroid function, and selenium deficiency may alter thyroid hormone metabolism, thereby affecting the hypothalamic-pituitary-ovarian (HPO) axis and menstrual function.

In many developing countries, including India, nutritional deficiencies remain a significant public health concern among adolescent girls and women of reproductive age. Limited dietary diversity, a high prevalence of nutritional anemia, and inadequate consumption of omega-3 fatty acids may adversely affect reproductive health and menstrual function. Nutritional assessment, dietary counseling, and the promotion of balanced diets rich in essential macro- and micronutrients are therefore important components of preventive healthcare. Encouraging the consumption of diverse, nutrient-rich, and culturally appropriate foods can improve menstrual regularity, support reproductive function, and enhance overall health outcomes.

### Psychological Burden of the Cycle

Menstrual health encompasses not only physical symptoms but also important psychological and emotional changes. Many women experience symptoms such as anxiety, mood swings, irritability, depression, impaired concentration, and sleep disturbances during different phases of the menstrual cycle. These symptoms can substantially affect academic performance, work productivity, interpersonal relationships, and overall quality of life. Despite their high prevalence, the psychological manifestations of menstrual disorders are often under-recognized in clinical practice.

Research has demonstrated a close association between menstrual disorders and psychological well-being. A cross-sectional study conducted among Japanese female medical students found that both the severity of dysmenorrhea and the presence of premenstrual syndrome (PMS) were independently associated with increased psychological distress (Takeda et al., 2020). Furthermore, women with chronic gynecological conditions such as endometriosis and polycystic ovary syndrome (PCOS) have a higher prevalence of depression and anxiety than the general population, highlighting the complex relationship between reproductive and mental health.

The psychological symptoms associated with the menstrual cycle result from the interaction of hormonal, neurochemical, and nutritional

factors. Cyclical fluctuations in estrogen and progesterone influence the activity of neurotransmitters, including serotonin, dopamine, and gamma-aminobutyric acid (GABA), which regulate mood, cognition, and emotional well-being. Nutritional status also plays an important role in these processes. For example, reduced calcium levels during the luteal phase have been associated with alterations in serotonin regulation, which may contribute to the development and severity of premenstrual symptoms.

Recent research has also emphasized the importance of the gut–brain axis in women’s mental and reproductive health. Modulation of the gut microbiome through dietary interventions and probiotic supplementation has been shown to improve psychological well-being. A meta-analysis by Varin et al. (2025) reported that microbiome-targeted interventions significantly reduced symptoms of depression and anxiety across different stages of female reproductive life. These findings suggest that maintaining adequate nutritional status and a healthy gut microbiome may contribute to the prevention and management of menstrual-related psychological symptoms. Consequently, nutritional assessment, dietary counseling, and strategies to support gut health should be considered important components of comprehensive menstrual healthcare, particularly among adolescents, university students, and young women of reproductive age.

## Integrative Dietary Interventions

Functional foods are foods that provide health benefits beyond their basic nutritional value due to the presence of biologically active compounds. Regular consumption of these foods has been shown to promote health, reduce the risk of disease, and support the management of various physiological conditions, including disorders of the female reproductive system.

One of the most extensively studied functional foods is flaxseed (*Linum usitatissimum*). Flaxseed is a rich source of alpha-linolenic acid (ALA), a plant-derived omega-3 fatty acid, as well as lignans, particularly secoisolariciresinol digluconide (SDG). These bioactive constituents contribute to its antioxidant, anti-inflammatory, and phytoestrogenic properties. Clinical evidence suggests that flaxseed supplementation may improve reproductive and menopausal health. In a study by Porwal et al. (2024), three months of flaxseed supplementation significantly reduced the severity of perimenopausal symptoms. The study also demonstrated increased serum levels of estradiol and enterolactone, indicating effective absorption and metabolism of flaxseed lignans.

Lignans are classified as phytoestrogens because they possess structural similarities to endogenous estrogens and are capable of interacting with estrogen receptors. Depending on the hormonal environment, they may exhibit either weak estrogenic or anti-estrogenic activity, thereby helping to maintain hormonal balance. This modulatory action may be beneficial in conditions associated with estrogen deficiency, such as menopause, as well as disorders characterized by altered estrogen metabolism, including polycystic ovary syndrome (PCOS).

Fermented foods containing live probiotic microorganisms represent another important category of functional foods. By promoting a healthy intestinal microbiota, these foods contribute to improved gastrointestinal, metabolic, and immune function. Probiotic supplementation, particularly with *Lactobacillus* and *Bifidobacterium* species, has been shown to improve menstrual regularity, reduce insulin resistance, and improve metabolic and hormonal parameters in women with PCOS (Qi et al., 2021).

Traditional medicinal plants also play an important role in supporting women’s reproductive health. Herbs such as Shatavari (*Asparagus racemosus*) and Ashwagandha (*Withania somnifera*) have long been used in Ayurveda as *Rasayana* (rejuvenative) therapies to promote hormonal balance, enhance reproductive function, and improve the body’s ability to adapt to physiological stress. When combined with a balanced diet that includes functional foods, these traditional interventions complement contemporary nutritional approaches and contribute to an integrative strategy for the promotion of women’s reproductive health.

## Traditional Indian Foods with Therapeutic Potential

Traditional Indian dietary practices incorporate a wide variety of foods and spices that possess nutritional as well as therapeutic properties. Commonly used ingredients such as fenugreek (*Trigonella foenum-graecum*), sesame (*Sesamum indicum*), cumin (*Cuminum cyminum*), turmeric (*Curcuma longa*), and flaxseed (*Linum usitatissimum*) contain bioactive compounds that have been shown to exhibit antioxidant, anti-inflammatory, and hormone-modulating effects. These dietary components complement Ayurvedic principles of nutrition and are increasingly being investigated for their potential role in supporting women’s reproductive health.

Traditional fermented foods, including dahi (curd) and naturally fermented pickles (achar), contribute beneficial microorganisms that help maintain a healthy gut microbiota. A balanced intestinal microbiome supports digestive health, immune function, and the metabolism of estrogens through the gut–endocrine axis. Regular consumption of traditionally fermented foods, when prepared using appropriate fermentation methods, may therefore contribute to hormonal homeostasis and overall reproductive health. Because these foods are affordable, culturally acceptable, and widely available, they may serve as practical dietary interventions for promoting women’s health at the community level.

An emerging dietary approach known as seed cycling has also gained attention as a complementary nutritional strategy for supporting hormonal balance. This practice involves the consumption of flaxseed and pumpkin seeds during the follicular phase of the menstrual cycle, followed by sesame and sunflower seeds during the luteal phase. The proposed mechanism is based on the presence of phytoestrogens, essential fatty acids, lignans, zinc, selenium, and other micronutrients that may support normal hormonal function. Although the biological rationale for seed cycling is plausible, high-quality clinical evidence demonstrating its effectiveness remains limited. Further well-designed randomized controlled trials are required before definitive recommendations can be made. Nevertheless, the inclusion of a variety of nutrient-rich seeds as part of a balanced diet is consistent with current nutritional recommendations and may contribute to overall reproductive health.

## Flaxseeds, Fermented Foods, and Hormonal Modulation

The mechanisms through which flaxseed and fermented foods influence female reproductive health have been increasingly explored in recent years. Flaxseed is a rich source of lignans, which are metabolized by the intestinal microbiota into the enterolignans enterodiol (ED) and enterolactone (EL). These metabolites possess phytoestrogenic properties and can interact with estrogen receptors, exerting either weak estrogenic or anti-estrogenic effects depending on the endogenous hormonal milieu. This dual modulatory action may contribute to the

maintenance of hormonal homeostasis and may partly explain the beneficial effects of flaxseed observed across different stages of a woman's reproductive life.

In addition to its lignan content, flaxseed provides alpha-linolenic acid (ALA), an essential omega-3 fatty acid with anti-inflammatory properties. Increased dietary intake of omega-3 fatty acids have been associated with alterations in eicosanoid metabolism, including reduced synthesis of pro-inflammatory mediators such as prostaglandin  $E_2$  and thromboxane  $A_2$ , together with increased production of less inflammatory prostaglandins. These changes may contribute to reduced uterine inflammation and decreased severity of dysmenorrhea (Mumford et al., 2011).

Fermented foods may provide complementary benefits by promoting a healthy gut microbiota. The gut microbiome, particularly the estrobolome, plays an important role in estrogen metabolism through the production of  $\beta$ -glucuronidase, an enzyme involved in the deconjugation of estrogen metabolites and their enterohepatic recirculation. Alterations in the composition and function of the gut microbiota (dysbiosis) have been associated with disturbances in estrogen metabolism and the development of reproductive disorders, including polycystic ovary syndrome (PCOS) and endometriosis (Chadchan et al., 2022; Qi et al., 2021). Dietary intake of fermented foods containing beneficial microorganisms may help improve microbial diversity and support normal gut function, thereby contributing to endocrine homeostasis.

The combined inclusion of flaxseed and traditionally fermented foods within the diet may therefore provide complementary nutritional benefits through multiple biological pathways, including modulation of inflammatory responses, regulation of estrogen metabolism, and maintenance of gut microbial balance. Although the mechanistic evidence supporting these interactions is substantial, additional well-designed clinical studies are needed to further clarify their long-term effects on reproductive health outcomes.

### Targeted Botanical Infusions and Menstrual Comfort

Among herbal interventions evaluated for the management of primary dysmenorrhea, *Zingiber officinale* (ginger) has demonstrated considerable clinical efficacy. A meta-analysis by Nikkhah et al. (2021) reported that oral ginger supplementation significantly reduced both the intensity and duration of primary dysmenorrhea compared with placebo (MD = 2.67; 95% CI: 1.84–3.51;  $p = 0.0001$ ). Furthermore, randomized controlled trials have shown that ginger provides analgesic effects comparable to those of mefenamic acid, a commonly prescribed nonsteroidal anti-inflammatory drug (NSAID), in relieving menstrual pain (Ozgoli et al., 2009).

The therapeutic effects of ginger are primarily attributed to its bioactive constituents, including gingerols and shogaols, which exhibit anti-inflammatory and analgesic properties. These compounds inhibit the cyclooxygenase (COX) and lipoxygenase (LOX) pathways, thereby reducing the synthesis of prostaglandins and leukotrienes, key inflammatory mediators involved in the pathogenesis of primary dysmenorrhea. Through modulation of these inflammatory pathways, ginger may reduce uterine hypercontractility and alleviate menstrual pain, supporting its potential role as a complementary therapeutic option for the management of primary dysmenorrhea.

#### Other herbal infusions offer distinct mechanical advantages:

**Chamomile (*Matricaria chamomilla*):** A systematic review of seven clinical trials proved that German chamomile extract significantly drops pain scores and limits heavy bleeding in primary dysmenorrhea while taking the edge off cycle-related mood disorders (Niazi & Moradi, 2021). Its central active compound, apigenin, binds selectively to estrogen receptors to promote baseline stability.

**Spearmint:** This infusion acts as an effective anti-androgen. Regular consumption delivers a statistically significant drop in free testosterone levels, successfully restoring menstrual regularity in patients with PCOS (Grant, 2010).

**Hibiscus (*Hibiscus sabdariffa*):** *Hibiscus sabdariffa* (hibiscus) is rich in anthocyanins, flavonoids, and other polyphenolic compounds that exhibit antioxidant and anti-inflammatory properties. In addition, the presence of phytoestrogenic compounds may contribute to the modulation of hormonal balance. These biological activities suggest that regular consumption of hibiscus tea may help reduce oxidative stress and support endocrine function, although further clinical studies are required to establish its therapeutic efficacy in reproductive disorders (Campbell et al., 2023).

**Fennel (*Foeniculum vulgare*):** Is another medicinal plant that has been traditionally used to relieve menstrual discomfort. Its principal bioactive constituent, trans-anethole, possesses antispasmodic properties and has been shown to promote relaxation of uterine smooth muscle. By reducing uterine contractions associated with prostaglandin activity, fennel may help alleviate the pain and cramping characteristic of primary dysmenorrhea.

**Ayurvedic herbal infusions** have also attracted considerable interest for their potential benefits in women's reproductive health. Shatavari (*Asparagus racemosus*), described in the Charaka Samhita and Sushruta Samhita as an important *Rasayana* for women's health, has traditionally been used to support reproductive function and maintain hormonal balance. Similarly, Tulsi (*Ocimum tenuiflorum*) is recognized for its adaptogenic, antioxidant, and anti-inflammatory properties, which may contribute to improved stress adaptation and overall physiological homeostasis (Gohil & Patel, 2024).

The available evidence suggests that the regular inclusion of these herbal infusions as part of a balanced dietary and lifestyle approach may provide complementary benefits for reproductive health. However, additional well-designed randomized controlled trials are needed to establish their long-term efficacy, optimal dosage, and safety in the management of specific gynecological conditions.

## Applied Strategies and Clinical Considerations

### Dietary Counselling for Female Reproductive Health

Dietary counselling for women with menstrual and reproductive disorders should be individualized and tailored to the patient's age, reproductive stage, clinical condition, dietary preferences, cultural practices, and socioeconomic circumstances. A personalized nutritional approach is more likely to improve adherence and optimize clinical outcomes than standardized dietary recommendations. An effective dietary strategy should emphasize adequate intake of nutrients that play essential roles in reproductive and endocrine function. Omega-3 fatty acids, obtained from sources such as flaxseed, walnuts, and fatty fish, contribute to the regulation of inflammatory pathways and hormonal homeostasis. Iron intake should be optimized through the consumption of iron-rich foods, with vitamin C-rich foods included in meals to enhance non-haem iron absorption. In addition, adequate dietary calcium and zinc, obtained from dairy products, legumes, seeds, and whole grains, are important for maintaining bone health, ovarian function, and normal menstrual physiology. Dietary patterns that support a healthy gut microbiome, including the regular consumption of fermented foods and other probiotic-rich foods, may further contribute to endocrine and metabolic health.

For women experiencing premenstrual syndrome (PMS) or dysmenorrhea, dietary modifications aimed at reducing systemic inflammation may provide additional benefits. Limiting the intake of refined sugars, excessive caffeine, and foods containing trans fats, while increasing the consumption of omega-3 fatty acids, green leafy vegetables, fruits, whole grains, and antioxidant-rich spices such as turmeric, may help reduce inflammatory processes associated with menstrual symptoms. The use of food diaries or food–symptom records can facilitate individualized dietary assessment, improve patient engagement, and assist clinicians in monitoring the relationship between dietary habits and symptom patterns.

The integration of traditional dietary practices may further enhance the effectiveness of nutritional counselling, particularly in populations where these practices are culturally accepted. In Ayurveda, dietary recommendations are individualized according to Prakriti (constitutional type), *Dosha* balance, digestive capacity (*Agni*), seasonal variations (*Ritucharya*), and daily regimen (*Dinacharya*). Incorporating these principles, together with evidence-based nutritional recommendations, may improve dietary adherence and provide a holistic approach to the management of menstrual and reproductive health. Nevertheless, further clinical studies are needed to evaluate the effectiveness of integrative dietary interventions across diverse populations.

### The Integration: Ayurveda and Modern Nutritional Practice

The integration of Ayurvedic principles with contemporary nutritional science has emerged as an area of increasing interest in women's reproductive healthcare. Both systems emphasize the importance of nutrition in maintaining physiological homeostasis, although they describe these processes using different conceptual frameworks. An integrative approach that combines traditional knowledge with evidence-based nutritional practices may provide a more comprehensive strategy for the prevention and management of menstrual and reproductive disorders.

Several conceptual similarities can be identified between Ayurvedic theory and modern nutritional science. In Ayurveda, *Rasa Dhatu*, the primary nutritive tissue formed after digestion, serves as the foundation for the nourishment of subsequent *Dhatu*s (body tissues). This concept parallels the modern understanding that efficient digestion, nutrient absorption, bioavailability, and tissue utilization are essential for maintaining normal physiological function. Classical Ayurvedic texts recommend the consumption of warm, easily digestible, and nourishing foods during menstruation, together with foods traditionally recognized as rich in iron, such as pomegranate and jaggery, to support recovery following menstrual blood loss. In addition, *Rasayana* herbs such as Shatavari (*Asparagus racemosus*) have long been used to promote female reproductive health and support menstrual function.

Emerging scientific evidence has begun to explore the relationship between Ayurvedic concepts and contemporary biomedical understanding. For example, Tiwari et al. reported that the maintenance of healthy *Rasa Dhatu* is closely associated with normal menstrual function, while disturbances in *Rasa Dhatu* (*Rasa Dushti*) may correspond to physiological alterations that contribute to menstrual and endocrine disorders. Although these observations provide an important basis for integrative research, further studies are required to establish direct correlations between Ayurvedic concepts and modern biological mechanisms.

Current approaches to integrative women's healthcare increasingly incorporate both conventional clinical assessment and traditional Ayurvedic evaluation. In addition to laboratory investigations and standardized menstrual symptom assessment tools, practitioners may consider constitutional assessment (*Prakriti*), dietary habits, digestive status (*Agni*), and lifestyle factors when developing individualized management plans. Such patient-centered approaches are consistent with the biopsychosocial model of healthcare and may improve the personalization of nutritional and lifestyle interventions. Furthermore, the World Health Organization's Traditional Medicine Strategy supports the evidence-based integration of traditional medicine into national healthcare systems, emphasizing the importance of safety, quality, effectiveness, and scientific validation in clinical practice.

### Recommendations

The convergent data from both nutritional science and Ayurvedic medicine yields a clear, actionable set of clinical recommendations for reproductive wellness:

**Omega-3 Optimization:** The daily consumption of omega-3-dense foods, such as 10 grams of ground flaxseed, walnuts, or cold-water fatty fish, to suppress inflammatory prostaglandin production and stabilize the endocrine axis.

**Microbiome Support:** Integrate traditional, non-dairy probiotic vectors—such as authentic fermented pickles, curd, or fermented rice—to support the estrobolome and streamline estrogen clearance.

**Micronutrient Security:** Secure strict baseline targets for iron, calcium, vitamin B6, and zinc to prevent cycle-driven deficiencies and blunt

the severity of PMS.

**Targeted Adaptogens:** Inclusion of premier *Rasayana* botanicals like Shatavari and Ashwagandha under qualified clinical supervision to enhance stress resilience and normalize hormonal output.

## Future Directions

Although growing evidence supports the role of nutrition, functional foods, and traditional dietary practices in promoting women's reproductive health, several important gaps in the current literature remain. Future research should prioritize well-designed, large-scale randomized controlled trials to evaluate the efficacy of specific dietary interventions in the prevention and management of menstrual disorders across diverse populations. Such studies would help establish evidence-based dietary recommendations and strengthen the translation of research findings into clinical practice.

Longitudinal studies are also needed to investigate the long-term effects of microbiome-targeted interventions on reproductive, metabolic, and psychological health outcomes. A better understanding of the interactions between the gut microbiome, endocrine regulation, and reproductive physiology may facilitate the development of personalized nutritional strategies for women with conditions such as polycystic ovary syndrome (PCOS), endometriosis, and menstrual irregularities.

In addition, further mechanistic research is warranted to elucidate the molecular pathways through which functional foods influence reproductive health. In particular, studies exploring the interaction of flaxseed-derived lignans with estrogen receptors and estrogen signaling pathways in disorders such as PCOS and endometriosis may provide valuable insights into their therapeutic potential. Similar investigations examining the effects of probiotics, fermented foods, and other bioactive dietary components on endocrine function and inflammatory pathways would further strengthen the current evidence base.

The integration of modern nutritional science with evidence-informed traditional dietary practices represents a promising direction for women's healthcare. Future efforts should focus on developing standardized, scientifically validated, and culturally appropriate nutritional guidelines that incorporate both contemporary research evidence and relevant traditional knowledge. Such an integrative approach has the potential to improve the prevention and management of menstrual and reproductive disorders while promoting holistic women's health.

## Conclusion

Female reproductive health is a multidimensional domain shaped by the complex interplay of nutritional status, hormonal regulation, gut microbiome integrity, psychological well-being, and cultural dietary practices. This chapter has demonstrated that both modern nutritional science and classical Ayurvedic medicine offer complementary and mutually reinforcing frameworks for understanding and addressing the wide spectrum of reproductive health conditions that affect women across the life course.

The evidence reviewed confirms that adequate intake of omega-3 fatty acids, iron, calcium, zinc, and vitamin B6, alongside the maintenance of a diverse and balanced gut microbiome, is fundamental to hormonal homeostasis, menstrual regularity, and the mitigation of PMS and *Dysmenorrhoea*-related symptom burden. Flaxseeds, through their dual action as omega-3 sources and phytoestrogenic lignans, and fermented foods, through their modulation of the estrobolome, represent particularly promising and culturally accessible functional dietary interventions for Indian women. Herbal teas and decoctions — including ginger, chamomile, fennel, spearmint, hibiscus, *Shatavari*, and *Tulsi* — further extend the repertoire of evidence-supported dietary strategies for managing menstrual pain, hormonal imbalance, and psychological symptoms associated with the menstrual cycle.

From the Ayurvedic perspective, the classical concepts of *Stree Roga*, *Artava Dhatu*, *Dosha*-specific menstrual disorders, and *Rasayana* and *Vajikarana* therapeutics provide a rich and clinically meaningful framework that aligns meaningfully with contemporary biomedical understanding of reproductive physiology. The integration of these two systems within an applied healthcare science context offers a holistic, individualised, and culturally responsive model of care that addresses not only the physical but also the psychological and social dimensions of female reproductive health.

Future research should prioritise large-scale, culturally contextualised randomised controlled trials validating traditional Indian dietary interventions; longitudinal microbiome studies in women of reproductive age; and the development of standardised integrative care protocols that incorporate both nutritional and Ayurvedic assessment tools. The convergence of ancient wisdom and modern science holds profound promise for advancing women's reproductive health and well-being globally.

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