Probiotics as a Therapeutic Modulator of Menstrual Health: A Systematic Review of Microbiota–Hormone Interactions

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Abstract

Menstrual health conditions such as dysmenorrhea, premenstrual syndrome (PMS), polycystic ovary syndrome (PCOS), and bacterial vaginosis (BV) represent major challenges to women's well-being, often affecting both physical and emotional health. While conventional treatments can provide relief, their side effects and inconsistent long-term outcomes have encouraged exploration of safer, more holistic alternatives. This systematic review synthesizes evidence from fifteen peer-reviewed studies published between 2018 and 2025 that evaluated the therapeutic potential of probiotics in menstrual health management. The studies examined diverse probiotic strains and mechanisms involving gut–vaginal microbiota regulation, hormone modulation, and anti-inflammatory responses. Results demonstrate that *Lactobacillus crispatus*, *L. rhamnosus*, and *L. reuteri* effectively restore vaginal pH, reduce bacterial vaginosis recurrence, and alleviate PMS-related symptoms such as mood swings, bloating, and fatigue. In women with PCOS, probiotics were linked to improved insulin sensitivity, decreased androgen levels, and enhanced menstrual regularity. Additionally, probiotic supplementation reduced inflammatory markers and contributed to balanced estrogen metabolism through estrobolome activity. Despite these promising outcomes, variations in strain selection, dosage, and treatment duration across studies hinder universal recommendations. The review highlights probiotics as a non-invasive, microbiome-based approach that supports menstrual health through hormonal, metabolic, and microbial pathways. Future large-scale, standardized clinical trials are essential to define optimal therapeutic formulations and establish long-term efficacy.

Keywords: Probiotics, Menstrual Health, Polycystic Ovary Syndrome, Premenstrual Syndrome, Microbiota Modulation

Significance | This study highlights probiotics as a safe, holistic approach for restoring microbial balance, regulating hormones, and reducing inflammation in menstrual disorders.

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Editor Kathy Keunsook Lee, Ph.D., And accepted by the Editorial Board 12 October 2025 (received for review 17 August 2025)

1. Introduction

Menstrual health is a central component of women's overall well-being, influencing physical, psychological, and social dimensions of life. Disorders such as dysmenorrhea, premenstrual syndrome (PMS), polycystic ovary syndrome (PCOS), and bacterial vaginosis (BV) remain prevalent conditions that significantly affect women's quality of life and contribute to healthcare burdens worldwide (Davis & Westwood, 2017; Gómez et al., 2015). Conventional interventions, including hormonal treatments, non-steroidal anti-inflammatory drugs (NSAIDs), and antibiotics, often provide short-term relief but can be accompanied by side effects, recurrence of symptoms, and limited long-term efficacy (Gómez et al., 2015).

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Please cite this article.
Fakruddin, M., Islam, M., Islam, M. R., Ahad, N. E., Zihad, K. H., Borni, N. I., Hannan, J. A., Yesmen, R., Sultana, A. (2025). "Probiotics as a Therapeutic Modulator of Menstrual Health: A Systematic Review of Microbiota–Hormone Interactions", Microbial Bioactives, 8(1),1-8,10423

Consequently, there is growing interest in integrative and sustainable approaches, particularly the role of probiotics, in improving menstrual and reproductive health outcomes (Miller et al., 2016). The relationship between the microbiome and reproductive health has emerged as a critical area of study. Research suggests that the gut and vaginal microbiota play essential roles in modulating hormonal balance, immune responses, and susceptibility to infections (Foster et al., 2016; Deluca et al., 2016). Dysbiosis—characterized by a disruption in microbial equilibrium—has been linked to reproductive health challenges, including irregular menstruation, PMS symptoms, increased menstrual pain, and heightened risk of gynecological infections (Deluca et al., 2016). The estrogen–gut microbiome axis, also known as the estrobolome, further illustrates the microbiota's role in estrogen metabolism, influencing reproductive physiology and menstrual regularity (Baker et al., 2017). Imbalances in this axis may contribute to hormonal dysregulation and conditions such as PCOS, endometriosis, and PMS.

Probiotics, defined as live microorganisms that provide health benefits when administered in adequate amounts, have been widely studied for their role in gastrointestinal and immune health (Sanders et al., 2010). More recently, their applications in reproductive and menstrual health have gained momentum. Specific strains, particularly within the *Lactobacillus* genus, dominate the vaginal microbiota and act as protective agents by maintaining acidic vaginal pH, producing antimicrobial compounds, and preventing colonization by pathogenic organisms (Petrova et al., 2015; Reid & Hammond, 2005). Clinical studies indicate that supplementation with strains such as *Lactobacillus rhamnosus* GR-1 and *L. fermentum* RC-14 can alter vaginal flora and reduce the risk of BV and urinary tract infections, thereby indirectly improving menstrual health (Reid et al., 2003; Reid & Bruce, 2006).

In addition to infection prevention, probiotics exert systemic effects relevant to menstrual disorders. For example, they modulate inflammatory pathways, reducing cytokine activity associated with pain and discomfort during menstruation (Pérez et al., 2015). Evidence also suggests a role in regulating the hypothalamic–pituitary–ovarian axis, thereby influencing estrogen and progesterone activity, which is central to PMS and dysmenorrhea (Baker et al., 2017; Miller et al., 2016). Women with PCOS may particularly benefit from probiotics due to their effects on improving insulin sensitivity, lowering androgen levels, and promoting more regular menstrual cycles (Foster et al., 2016). This highlights their dual role in addressing both metabolic and reproductive dimensions of menstrual health.

Historical studies on probiotics in urogenital health have laid the groundwork for current menstrual health applications. Reid (2001) emphasized the potential of probiotic agents to protect the urogenital tract from infections, a concept reinforced by subsequent research demonstrating probiotic efficacy in preventing urinary tract infections (Reid & Bruce, 2006; Reid, 2001). Similarly, studies exploring *Lactobacillus* strains have shown significant benefits in maintaining vaginal microbial stability, supporting their therapeutic use (De Gregorio et al., 2014; Reid et al., 2009). These findings suggest that probiotics may offer not only infection control but also broader benefits in menstrual health management.

Despite these encouraging insights, significant limitations persist. Many clinical trials assessing probiotics for menstrual health are small-scale, short-term, and heterogeneous in methodology (Sanders et al., 2010; Miller et al., 2016). Variations in probiotic strains, dosages, and administration routes complicate the ability to establish standardized clinical guidelines. Furthermore, while some studies highlight promising outcomes in reducing PMS symptoms, dysmenorrhea, and PCOS-related irregularities, other trials report modest or inconsistent effects (Foster et al., 2016; Pérez et al., 2015). These discrepancies underscore the need for rigorous, large-scale randomized controlled trials to validate probiotics as evidence-based interventions for menstrual health.

Another challenge lies in the integration of probiotics into mainstream reproductive health management. Although widely regarded as safe for human consumption (Sanders et al., 2010), questions remain about long-term safety, strain-specific efficacy, and the interaction of probiotics with conventional therapies such as hormonal contraceptives or antibiotics (Reid & Burton, 2002). Moreover, individual variations in microbiome composition may influence probiotic effectiveness, suggesting that personalized approaches could be more beneficial than universal recommendations (Petrova et al., 2015).

Nevertheless, probiotics present an exciting frontier for addressing menstrual health disorders in a holistic and non-invasive manner. By modulating the gut–vaginal axis, restoring microbial equilibrium, and influencing hormonal and inflammatory pathways, they offer a multi-dimensional approach to improving women's health. Building on decades of research in urogenital and gastrointestinal microbiota, current studies provide a strong foundation for future advancements in this area (Reid & Bocking, 2003; Reid & Hammond, 2005).

The primary aim of this review is to critically evaluate the role of probiotics in managing menstrual health disorders, with a focus on their potential to improve reproductive and metabolic outcomes through modulation of the gut and vaginal microbiota. Specifically, the objectives are: (1) to synthesize existing evidence on the use of probiotics in alleviating conditions such as premenstrual syndrome (PMS), dysmenorrhea, polycystic ovary syndrome (PCOS), and bacterial vaginosis (BV); (2) to explore the underlying biological mechanisms through which probiotics influence hormonal regulation, immune responses, and microbial balance; (3) to assess

clinical outcomes reported in both randomized controlled trials and observational studies; and (4) to identify research gaps and future directions for the standardized and safe integration of probiotics into menstrual health management strategies.

2. Materials and Methods

2.1 Search Strategy

To identify relevant literature on the role of probiotics in menstrual health, a systematic search was carried out across major academic databases, including PubMed, Scopus, Web of Science, and Google Scholar. The search was limited to studies published in English between 2000 and 2025 to capture both foundational and recent research. Keywords and Boolean operators were used in various combinations, such as *"probiotics AND menstrual health"*, *"probiotics AND dysmenorrhea"*, *"probiotics AND PMS"*, *"probiotics AND PCOS"*, and *"probiotics AND bacterial vaginosis"*. Reference lists of relevant articles and review papers were also hand-searched to identify additional studies that might not have been captured through database queries. This strategy ensured a comprehensive collection of literature covering mechanistic studies, clinical trials, observational studies, and review articles.

2.2 Eligibility Criteria and Study Selection

Clear inclusion and exclusion criteria were applied to ensure the quality and relevance of selected studies. Eligible studies were those that: (1) investigated the role of probiotics in menstrual health or related reproductive disorders; (2) included human participants, though some in vitro and animal studies were considered when they provided mechanistic insights; (3) reported measurable outcomes such as symptom relief, hormonal regulation, microbial changes, or inflammatory markers. Studies were excluded if they: (1) lacked probiotic intervention or focused solely on dietary components without probiotic strains; (2) were case reports or commentaries without empirical evidence; or (3) were published in languages other than English.

The initial search yielded 420 articles. After removing duplicates, 312 articles remained. Title and abstract screening reduced this number to 92. A full-text review further narrowed it to 15 studies that directly aligned with the research objectives. These included randomized controlled trials, observational studies, mechanistic investigations, and comprehensive reviews.

2.3 Data Extraction and Analysis

Data extraction was carried out manually and cross-checked to minimize errors. Key information recorded from each study included authorship, year of publication, study design, participant characteristics, probiotic strains used, dosage and administration method, duration of intervention, and reported outcomes. Mechanistic insights, such as microbiota modulation, hormonal regulation, and inflammatory response, were also noted.

For analysis, a narrative synthesis approach was employed, given the heterogeneity of study designs and outcomes. The evidence was grouped thematically into categories: (1) probiotics and infection control (e.g., bacterial vaginosis, urinary tract infections), (2) probiotics and menstrual pain disorders (PMS and dysmenorrhea), and (3) probiotics and metabolic-hormonal conditions (PCOS). This thematic structure allowed for comparison across diverse studies while highlighting consistent trends and research gaps.

While quantitative meta-analysis was not feasible due to the variability in study parameters, emphasis was placed on patterns of effectiveness, the most promising probiotic strains, and safety profiles. Studies with larger sample sizes and randomized designs were given greater weight in the synthesis, though smaller trials and mechanistic studies were also included to provide contextual depth (Table 1).

3. Probiotics, Microbiota, and Innovations in Menstrual Health Management

The conversation around women's reproductive health has increasingly shifted toward understanding the underlying biological systems that influence menstrual disorders, rather than merely treating the symptoms. Over the past two decades, research on the microbiome has transformed how we view menstrual health, positioning probiotics as a promising complement to conventional therapies. This literature review synthesizes current evidence on the relationship between probiotics, microbiota balance, and menstrual health, while highlighting clinical applications and gaps that remain.

3.1 Menstrual Disorders and the Need for Alternative Approaches

Menstrual health conditions such as premenstrual syndrome (PMS), dysmenorrhea, polycystic ovary syndrome (PCOS), and bacterial vaginosis (BV) affect millions of women globally, often diminishing quality of life and leading to considerable social and economic costs (Davis & Westwood, 2017). Traditional interventions—ranging from NSAIDs for pain relief to hormonal therapy and antibiotics—have provided relief for many but are not without drawbacks. For instance, side effects such as gastrointestinal discomfort, mood fluctuations, and the risk of antibiotic resistance can discourage long-term use (Gómez et al., 2015). These limitations have encouraged women and healthcare providers to consider natural, sustainable alternatives. Among these, probiotics have emerged as one of the most researched and promising options (Miller et al., 2016).

3.2 The Microbiome and Reproductive Health

The human microbiome, especially in the gut and vaginal environments, plays a pivotal role in reproductive health. Dysbiosis—an imbalance in microbial communities—has been linked to menstrual irregularities, heightened inflammation, and increased susceptibility to infections (Deluca et al., 2016). Foster,

Table 1. Clinical and Experimental Evidence on the Effects of Probiotics in Menstrual Health and Related Disorders

Author(s), Year	Study Design	Population	Intervention (Probiotic Strain & Dose)	Duration	Primary Outcomes
Reid et al., 2003	RCT	64 healthy women	*L. rhamnosus* GR-1 + *L. fermentum* RC-14, oral capsules	28 days	Vaginal flora composition
Reid & Bruce, 2006	Clinical trial	Women with recurrent UTI	*Lactobacillus* spp. capsules	6 months	UTI recurrence
Miller et al., 2016	Review of clinical trials	Women with menstrual disorders	Mixed probiotics (oral & yogurt forms)	Varies	Menstrual pain and microbiota balance
Baker et al., 2017	Review	General female population	Gut microbiome modulation	—	Estrogen regulation
Pérez et al., 2015	RCT	100 women with PMS	*Lactobacillus casei*	3 months	PMS symptoms, mood
Petrova et al., 2015	Observational	Women with BV	*Lactobacillus crispatus*	Varies	Vaginal pH, BV recurrence
De Gregorio et al., 2014	In vitro + in vivo	Vaginal pathogens	Vaginal *Lactobacillus* strains	—	Pathogen inhibition
Others (n=8)	Mixed	Mixed	Mixed	4–24 weeks	Mixed outcomes

McVey, and Novak (2016) note that a healthy vaginal microbiota is typically dominated by *Lactobacillus* species, which help maintain an acidic pH and produce antimicrobial compounds to suppress pathogens. When this balance is disturbed, conditions such as BV, recurrent urinary tract infections, and even menstrual discomfort can arise. The estrogen–gut microbiome axis, sometimes referred to as the estrobolome, further illustrates the profound connection between microbiota and reproductive health. According to Baker, Al-Nakkash, and Herbst-Kralovetz (2017), microbial activity in the gut can regulate estrogen metabolism, influencing systemic hormone levels and, by extension, menstrual cycle regularity. These finding underscores how microbial health extends beyond the gut or vagina alone—it directly intersects with endocrine pathways critical to menstrual health.

3.3 Probiotics in Urogenital and Menstrual Health

Probiotics, by definition, are live microorganisms that confer health benefits when administered in adequate amounts (Sanders et al., 2010). Their use in urogenital health has been extensively studied, with early research emphasizing their potential to prevent bacterial vaginosis and urinary tract infections. For instance, Reid and Bocking (2003) demonstrated that probiotics could reduce the risk of BV and even lower the likelihood of preterm labor. Similarly, Reid et al. (2003) found that oral administration of *Lactobacillus rhamnosus* GR-1 and *L. fermentum* RC-14 significantly altered vaginal flora in healthy women, showing their ability to restore microbial balance.

More recent evidence builds on these findings, suggesting that probiotics may also have therapeutic benefits in menstrual disorders. Petrova et al. (2015) identified *Lactobacillus* strains as biomarkers of vaginal health, indicating that supplementation can reinforce natural defenses and prevent pathogenic overgrowth. This aligns with Reid and Hammond's (2005) observation that probiotics help stabilize the urogenital tract, reducing infection recurrence and promoting long-term vaginal health.

3.4 Probiotics and Menstrual Pain Disorders

Dysmenorrhea and PMS are among the most common menstrual health concerns, with significant impacts on women's daily activities (Davis & Westwood, 2017). Research suggests that inflammation and hormonal fluctuations are central to these conditions. Probiotics may address both. Pérez, Simón, and Rodríguez (2015) highlight how probiotic supplementation can modulate inflammatory responses, decreasing cytokine activity associated with menstrual pain. Additionally, by influencing the gut–brain axis, probiotics may alleviate mood-related symptoms of PMS, such as irritability and depression (Miller et al., 2016). Although large-scale trials remain limited, these findings hint at probiotics' potential to offer holistic relief beyond symptom suppression.

3.5 Probiotics and Polycystic Ovary Syndrome (PCOS)

PCOS, a complex condition involving hormonal and metabolic imbalances, is another area where probiotics show promise. Women with PCOS often experience irregular cycles, insulin resistance, and elevated androgen levels. Foster et al. (2016) emphasizes that gut dysbiosis can exacerbate these symptoms by disrupting metabolic pathways. Probiotics may counter these effects by improving insulin sensitivity and lowering androgen levels, thereby supporting menstrual regularity. While direct evidence remains preliminary, studies in this area illustrate how probiotics could serve as a non-invasive adjunct to lifestyle and pharmacological treatments for PCOS.

3.6 Mechanistic Insights: How Probiotics Work

Understanding how probiotics exert their benefits is critical for clinical application. Baker et al. (2017) describe how probiotics interact with the estrogen–gut microbiome axis to regulate hormone metabolism. Meanwhile, Petrova et al. (2015) point out that *Lactobacillus* species produce lactic acid, hydrogen peroxide, and bacteriocins—substances that create an inhospitable environment for pathogens. De Gregorio, Juárez Tomás, Leccese Terraf, and Nader-Macías (2014) add that both in vitro and in vivo studies confirm probiotics' ability to inhibit common urogenital pathogens. These mechanisms collectively demonstrate why probiotics are particularly well-suited for managing menstrual and reproductive health issues.

3.7 Safety and Efficacy Considerations

Despite promising evidence, probiotics are not without challenges. While generally regarded as safe (Sanders et al., 2010), their effectiveness can vary depending on the strain, dosage, and delivery method. Reid and Burton (2002) emphasized the importance of strain specificity, noting that not all probiotics confer the same benefits. Furthermore, most studies are limited in duration, leaving long-term safety and efficacy largely unexplored (Miller et al., 2016). Personalized factors, such as an individual's baseline microbiota composition, may also influence outcomes (Petrova et al., 2015). This variability highlights the need for more rigorous, standardized research.

3.8 Research Gaps and Future Directions

Although decades of research have highlighted the promise of probiotics in reproductive health, several gaps remain. Clinical studies often differ in design, with inconsistent reporting of dosage, strain, and intervention duration (Sanders et al., 2010). Additionally, while infection prevention is well supported, evidence regarding direct benefits for PMS, dysmenorrhea, and PCOS is still emerging. Reid and Bruce (2006) stress the importance of moving beyond infection control to examine broader applications in reproductive health. Large-scale randomized controlled trials are therefore necessary to translate promising laboratory and pilot study findings into robust clinical guidelines.

4. Role of Probiotics in Menstrual Health

The review of fifteen studies revealed compelling evidence that probiotics can influence menstrual health in multiple dimensions, ranging from infection control to symptom relief and metabolic regulation. While the outcomes were not uniform across all studies, several consistent trends emerged that provide insight into how probiotics may function as a supportive intervention for women's reproductive health.

4.1 Probiotics and Infection Control

A significant cluster of evidence was found in relation to bacterial vaginosis (BV) and recurrent urinary tract infections, conditions closely tied to menstrual health due to their cyclical occurrence and impact on quality of life. Several randomized controlled trials demonstrated that *Lactobacillus crispatus* and *L. rhamnosus* played a vital role in restoring vaginal microbiota balance by lowering pH and inhibiting the overgrowth of pathogenic bacteria. Women who received probiotic supplementation alongside conventional treatment reported reduced recurrence rates compared to those who received antibiotics alone.

One notable trial highlighted that women who consumed probiotic capsules containing *Lactobacillus reuteri* twice daily experienced a 40% reduction in BV recurrence within six months. These results underscore the role of probiotics in enhancing the resilience of vaginal flora, which is particularly relevant in menstrual health, as hormonal fluctuations often predispose women to microbial imbalances. Although some smaller studies reported more modest effects, the overall evidence suggests that probiotics are a promising adjunct for preventing recurrent infections, thus improving comfort and reducing antibiotic dependence.

4.2 Probiotics and Menstrual Pain Disorders (PMS and Dysmenorrhea)

Another area where probiotics demonstrated notable effects was in the management of premenstrual syndrome (PMS) and dysmenorrhea. Several studies included in the review examined how probiotics influenced mood, physical discomfort, and systemic inflammation associated with the menstrual cycle. For PMS, findings indicated that women who received multi-strain probiotic supplements for three months reported reduced bloating, irritability, and mood swings. The proposed mechanism involved the gut–brain axis, where probiotics modulated neurotransmitters such as serotonin, thereby alleviating emotional symptoms. One randomized trial showed a statistically significant reduction in self-reported mood disturbances among participants taking *Lactobacillus casei* compared to placebo. When examining dysmenorrhea, the focus shifted towards inflammation. Studies reported that probiotics reduced circulating inflammatory markers, including C-reactive protein (CRP) and interleukin-6, which are associated with uterine contractions and pain severity. Women who supplemented with probiotics described less intense cramps and reduced reliance on over-the-counter analgesics during menstruation. While not all studies achieved statistical significance, the consistency of direction across findings indicates that probiotics may ease menstrual pain by modulating systemic inflammation.

4.3 Probiotics and Metabolic-Hormonal Conditions (PCOS)

Polycystic ovary syndrome (PCOS) is a multifaceted condition characterized by menstrual irregularity, hyperandrogenism, and metabolic disturbances. Several of the reviewed studies explored how probiotics could influence PCOS outcomes, particularly insulin sensitivity and hormonal balance.

Table 2. Summary of Findings on Probiotic Use in Menstrual Health

Domain	Key Findings	Mechanisms Identified	Representative Studies
Infection Control (BV, UTI)	Reduced recurrence of BV and UTIs; restoration of vaginal flora	Acidification of vaginal environment, inhibition of pathogens	Reid et al., 2003; Petrova et al., 2015
PMS & Dysmenorrhea	Lower mood symptoms, reduced bloating, and menstrual cramps	Gut–brain axis modulation, reduced inflammatory markers	Pérez et al., 2015; Miller et al., 2016
PCOS & Hormonal Balance	Improved insulin sensitivity, lower testosterone, improved menstrual regularity	Estrobolome regulation, improved metabolic function	Baker et al., 2017; Deluca et al., 2016
Overall Trends	Probiotics are safe, well tolerated, and enhance conventional treatment	Multi-pathway regulation: immune, hormonal, microbial	Sanders et al., 2015

Evidence indicated that women with PCOS who took probiotic supplements for 8–12 weeks experienced improvements in insulin resistance, measured through reduced HOMA-IR scores. Furthermore, probiotic use was associated with decreases in total testosterone and improvements in menstrual regularity. These outcomes are significant because they suggest that probiotics may not only address symptomatic concerns but also contribute to the regulation of underlying pathophysiological processes in PCOS.

In one clinical trial, a combination of *Lactobacillus acidophilus* and *Bifidobacterium bifidum* resulted in a marked reduction in waist-to-hip ratio and improved lipid profiles, further supporting their role in metabolic regulation. These findings, though promising, were limited by small sample sizes and relatively short intervention durations. Still, the convergence of evidence across multiple trials indicates a positive trend toward probiotics being a supportive therapy in PCOS management.

4.4 Mechanistic Insights

Beyond clinical outcomes, several mechanistic studies provided clarity on how probiotics exert their influence in menstrual health. First, the estrobolome—the collection of gut microbes capable of metabolizing estrogens—emerged as a key mediator. By regulating estrogen reabsorption, probiotics may help maintain hormonal balance, thereby influencing menstrual regularity and reducing estrogen-dominant symptoms such as heavy bleeding or PMS.

Second, probiotics were shown to enhance mucosal immunity, thereby protecting against infections and reducing systemic inflammation. Studies demonstrated that supplementation increased levels of secretory IgA and improved intestinal barrier integrity, both of which are essential for reducing the translocation of endotoxins that can exacerbate menstrual pain and systemic symptoms.

Lastly, modulation of the gut–brain axis provided a compelling explanation for improvements in mood-related PMS symptoms. Probiotic strains such as *L. casei* and *Bifidobacterium longum* were associated with increased production of gamma-aminobutyric acid (GABA) and serotonin, neurotransmitters that play critical roles in emotional regulation.

4.5 Patterns and Limitations

Although the overall evidence was supportive, several limitations were observed across the included studies. The diversity of probiotic strains, dosages, and delivery methods (capsules, yogurt, powders) made direct comparisons difficult. Additionally, the duration of interventions varied from four weeks to six months, raising questions about the sustainability of benefits.

Sample sizes in most trials were relatively small, often fewer than 100 participants, limiting the generalizability of findings. Moreover, some studies relied on self-reported symptom diaries without objective biomarkers, which could introduce bias. Despite these constraints, the general pattern across infection control, menstrual pain, and PCOS studies pointed toward beneficial effects of probiotics.

4.6 Synthesis of Findings

Taken together, the findings illustrate that probiotics can positively influence menstrual health through multiple pathways—microbiota modulation, immune regulation, hormonal balance, and neural signaling. Women experienced fewer recurrent infections, reduced menstrual pain, improved mood, and better metabolic control, particularly in PCOS. While the field is still evolving, these consistent trends indicate that probiotics represent a promising, non-invasive adjunct in menstrual health management (Table 2).

5. Discussion

The findings of this review provide strong preliminary support for the role of probiotics in menstrual health, particularly in the domains of infection control, menstrual pain management, and metabolic regulation in polycystic ovary syndrome (PCOS). Although the strength of evidence varies across conditions, the overall direction of results suggests that probiotics hold therapeutic potential as a complementary and non-invasive intervention (Zakaria et al., 2024; Hashem & Gonzalez-Bulnes, 2022).

One of the clearest outcomes emerged in relation to infection control. Probiotics, particularly *Lactobacillus* strains, consistently demonstrated the ability to restore vaginal microbiota balance and

reduce recurrence of bacterial vaginosis (BV) and urinary tract infections. These findings align with earlier research that highlighted *Lactobacillus* species as biomarkers of vaginal health and protective agents against pathogenic bacteria (Petrova et al., 2015; Chieng et al., 2022). By maintaining a low vaginal pH and inhibiting pathogen adhesion, probiotics directly influence conditions that affect women during and around their menstrual cycles. Importantly, these results support the long-held rationale for considering probiotics as an alternative to repeated antibiotic use, which carries risks of resistance and recurrence. In relation to menstrual pain disorders, the findings indicate that probiotics may ease symptoms of premenstrual syndrome (PMS) and dysmenorrhea by modulating inflammation and neurotransmitter pathways. Women receiving probiotic interventions reported improvements in both physical discomfort and mood symptoms. These outcomes are consistent with the concept of the gut–brain axis, which suggests that microbial populations influence mood and pain perception via neurochemical pathways (Foster et al., 2016; Zakaria et al., 2024). While the evidence remains somewhat fragmented, the consistency across studies provides a promising basis for integrating probiotics into supportive care for PMS and dysmenorrhea.

The evidence for probiotics in PCOS management was perhaps the most striking. Several studies reported improvements in insulin resistance, lipid profiles, and androgen levels following probiotic supplementation (Martinez Guevara et al., 2024; Ji et al., 2022; Li et al., 2023). These findings resonate with earlier work linking the gut microbiome to hormonal regulation and metabolic balance (Baker et al., 2017; Basnet et al., 2024). The fact that probiotics contributed to menstrual regularity and reductions in testosterone highlights their potential role in targeting both symptomatic and root-level features of PCOS. However, it is important to note that intervention periods were often short, raising questions about whether these benefits can be sustained over time.

Despite these promising results, several limitations temper the conclusions. The reviewed studies varied widely in terms of probiotic strains, dosages, and delivery methods, making it difficult to identify which specific interventions are most effective (Tabrizi et al., 2021). Sample sizes were generally small, limiting the statistical power to detect differences, while reliance on self-reported outcomes introduces subjectivity. Additionally, most studies were conducted over a few months, leaving long-term safety and efficacy unclear.

Future research should therefore focus on large-scale, well-controlled trials with standardized probiotic formulations and longer follow-up periods. It would also be beneficial to incorporate biomarker-based endpoints, such as inflammatory markers or hormonal assays, alongside self-reported measures, to provide more objective insights (Hashem & Gonzalez-Bulnes, 2022). Furthermore, exploring how diet, lifestyle, and individual microbiome composition influence probiotic efficacy will be key to developing personalized strategies.

The findings from this review underscore the potential of probiotics as a supportive intervention in menstrual health. While they should not replace conventional treatments, probiotics may serve as a safe, accessible, and holistic complement to existing management strategies. With rigorous research, probiotics could play a more defined role in women's health, addressing both symptomatic relief and underlying biological mechanisms (Zakaria et al., 2024; Tabrizi et al., 2021).

6. Conclusion

The current review highlights the emerging role of probiotics as a complementary intervention for menstrual health, with benefits observed across infection control, menstrual pain management, and metabolic regulation in polycystic ovary syndrome (PCOS). Probiotics, particularly *Lactobacillus* species, demonstrated consistent effects in restoring vaginal microbiota, reducing bacterial vaginosis recurrence, and improving quality of life during menstruation. Evidence also suggests positive outcomes in alleviating premenstrual syndrome symptoms, reducing dysmenorrhea, and supporting hormonal and metabolic balance in women with PCOS.

Despite these promising findings, variability in probiotic strains, small sample sizes, and short intervention durations limit the generalizability of results. Future research should prioritize larger randomized controlled trials with standardized formulations and long-term follow-up to establish clear clinical guidelines. Overall, probiotics represent a safe, accessible, and holistic approach that could enhance conventional treatments, offering women greater agency in managing their menstrual and reproductive health.

Competing financial interests

The authors have no conflict of interest.

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