Probiotics and the Gut–Skin Axis: A Systematic Review of Microbial Pathways Underlying Psoriasis and Immunoinflammatory Balance

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Abstract

Psoriasis, a chronic autoimmune skin disorder, extends far beyond the surface of the skin. Emerging research has revealed that its origins may lie deep within the gut, where microbial imbalance—or dysbiosis—can disrupt immune regulation and fuel chronic inflammation. This systematic review explores the intricate relationship between gut health and psoriasis, emphasizing how probiotics may help restore balance and reduce inflammatory responses. The "gut–skin axis" acts as a vital communication channel between intestinal microbiota and skin health. When this connection is compromised, toxins and inflammatory signals can enter systemic circulation, aggravating skin lesions and immune dysfunction in psoriatic individuals. Recent studies highlight that certain probiotic strains, particularly Lactobacillus and Bifidobacterium, show promise in reinforcing the intestinal barrier, modulating cytokine production, and ultimately easing psoriatic symptoms. Beyond biological mechanisms, this review underscores a paradigm shift in how psoriasis is understood and treated—shifting from symptom suppression to root-cause management. Probiotic therapy, when integrated with conventional treatments, offers a holistic, low-risk approach that may enhance overall well-being and reduce disease burden. By synthesizing evidence from clinical and experimental studies, this paper advocates for further exploration of probiotics as a complementary intervention for psoriasis. Understanding how gut microbiota influence immune function not only expands therapeutic options but also opens the door to a more integrative, patient-centered model of care.

Keywords: Psoriasis, Probiotics, Gut–Skin Axis, Dysbiosis, Chronic Inflammation, Microbiome, Autoimmune Disorder, Holistic Therapy

Significance | This review elucidates how gut microbiota influence psoriasis and highlights probiotics as a promising complementary approach to reduce inflammation and improve outcomes.

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1. Introduction

Psoriasis is a chronic, immune-mediated inflammatory skin disorder that affects approximately 2–3% of the global population, making it one of the most common autoimmune diseases worldwide (Di Meglio, Villanova, & Nestle, 2014). Characterized by erythematous, scaly plaques primarily affecting the scalp, elbows, and knees, psoriasis is not only a dermatological concern but also a systemic inflammatory condition with profound psychological and physiological impacts. Traditional perspectives have long focused on the skin itself; however, recent research indicates that the roots of psoriasis may extend deeper—into the gut (Lowes, Bowcock, & Krueger, 2007). The human gut is home to trillions of microorganisms collectively known as the gut microbiota. These microbes play a critical role in maintaining immune balance, nutrient absorption, and metabolic homeostasis (Belkaid & Hand, 2014). Disruption of this delicate ecosystem, known as dysbiosis,

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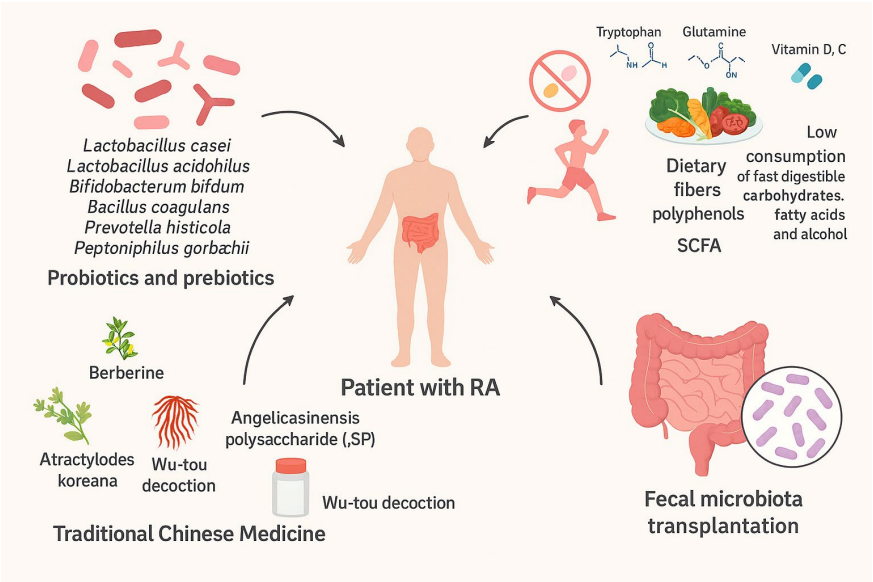


Figure 1: A Novel Strategy for Rheumatoid Arthritis Therapy. **Gut Microbiota Interventions for Rheumatoid Arthritis (RA)** to modulate gut microbiota in patients with RA. Key approaches include:

- **Probiotics and Prebiotics:** Specific strains such as *Lactobacillus casei*, *Lactobacillus acidophilus*, *Bifidobacterium bifidum*, *Bacillus coagulans*, *Prevotella histicola*, and *Peptoniphilus gorbachii*.
- **Diet and Lifestyle:** Incorporating dietary fibers, polyphenols, short-chain fatty acids (SCFA), essential amino acids (tryptophan, glutamine), vitamins D and C, and reducing fast-digestible carbohydrates, fatty acids, and alcohol.
- **Traditional Chinese Medicine:** Use of berberine, *Atractylodes koreana*, Angelica sinensis polysaccharide (ASP), and Wu-tou decoction.
- **Fecal Microbiota Transplantation:** Restoring gut microbial balance to improve systemic health.

(courtesy of image from Zhang et al., (2015)

has been implicated in a wide range of Autoimmune and inflammatory conditions such as inflammatory bowel disease, rheumatoid arthritis, and multiple sclerosis (Figure 1) (Furusawa et al., 2013; Zhang et al., 2015). The discovery that psoriasis shares similar immunological pathways with these diseases has prompted increasing attention toward the gut–skin connection as a crucial factor in its pathogenesis (Schade, Gonzales, & Laughlin, 2016).

Studies show that individuals with psoriasis often exhibit significant alterations in gut microbial diversity and composition. Beneficial bacteria such as Lactobacillus and Bifidobacterium, known for maintaining intestinal barrier integrity, are often reduced in psoriatic patients (Codoñer et al., 2016; Hidalgo-Cantabrana et al., 2017). Conversely, potentially pathogenic bacteria, including Escherichia coli, tend to increase, promoting systemic inflammation and immune dysregulation (Schade et al., 2016). This imbalance compromises the intestinal barrier—a phenomenon commonly referred to as "leaky gut"—allowing microbial products like lipopolysaccharides to enter the bloodstream, triggering an immune response that can exacerbate psoriatic inflammation (Fasano, 2012).

The gut–skin axis is a bidirectional communication system that links intestinal microbiota and skin health through immune, endocrine, and metabolic pathways (Grice & Segre, 2011). It provides a compelling explanation for how intestinal dysbiosis can manifest as cutaneous inflammation. For instance, Toll-like receptors (TLRs), essential for microbial recognition, play a significant role in modulating immune responses; overactivation of these receptors has been linked to chronic inflammatory diseases, including psoriasis (O'Neill, Golenbock, & Bowie, 2013). Similarly, metabolites produced by commensal bacteria—such as short-chain fatty acids—support the differentiation of regulatory T cells, which are key in maintaining immune tolerance (Arpaia et al., 2013). When this microbial signaling network is disrupted, systemic inflammation becomes amplified, contributing to the persistence and severity of psoriatic lesions (Eppinga et al., 2016).

Beyond microbiota composition, lifestyle and dietary factors further influence the relationship between gut health and psoriasis. Adherence to anti-inflammatory diets, such as the Mediterranean diet, has been associated with milder psoriasis severity due to its positive impact on gut microbial balance and reduction in oxidative stress (Barrea et al., 2015). Conversely, Western dietary patterns rich in processed foods and saturated fats can promote gut dysbiosis, impair immune regulation, and intensify skin inflammation (Briganti & Picardo, 2003). This evidence underscores the integrative nature of psoriasis management—

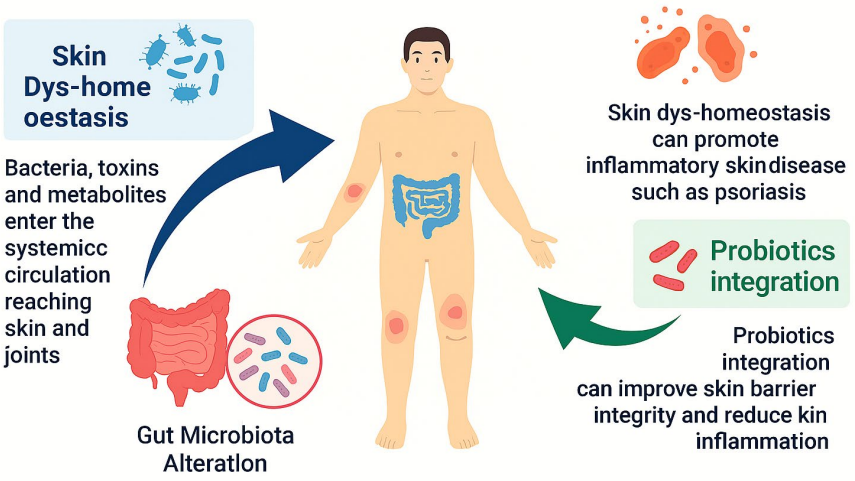


Figure 2. The Skin Microbiome and its Role in Psoriasis. **Gut-Skin Axis and Inflammation to** demonstrates the relationship between gut microbiota and skin health.

- **Gut Microbiota Alteration:** Disruption in gut microbial composition allows bacteria, toxins, and metabolites to enter systemic circulation, affecting skin and joints.
- **Skin Dys-homeostasis:** Imbalance in skin microbiota can promote inflammatory skin diseases such as psoriasis.
- **Probiotics Integration:** Introducing beneficial microbes can enhance skin barrier integrity and reduce skin inflammation.

(Courtesy of image from Grice, E. A., & Segre, J. A. (2011)

where nutrition, gut microbiota, and immune health interact in a dynamic, interdependent system.

Given the growing recognition of the gut's role in systemic immunity, probiotics—live microorganisms that confer health benefits when consumed in adequate amounts—have emerged as a promising therapeutic option. Probiotics have demonstrated the ability to modulate immune responses, reinforce intestinal barrier function, and suppress inflammatory cytokines that drive psoriatic pathology (Borody & Khoruts, 2012). In particular, probiotic strains such as Lactobacillus and Bifidobacterium may restore microbial diversity and enhance immune tolerance, offering potential relief for psoriatic patients resistant to conventional therapies (Ghoreschi, Balato, Enerbäck, & Sabat, 2017).

Recent advances in immunology and microbiome science support a paradigm shift from surface-level symptom management toward systemic restoration of health. Rather than viewing psoriasis merely as a skin disease, current evidence positions it as a complex systemic disorder influenced by microbial and immune interactions (Furusawa et al., 2013). Restoring gut microbial balance through probiotic supplementation, dietary interventions, and lifestyle modifications could therefore represent a more holistic and sustainable strategy for managing psoriasis.

This systematic review aims to synthesize the emerging evidence connecting gut dysbiosis and psoriasis while examining the therapeutic potential of probiotics in restoring immune balance. By integrating findings from dermatology, microbiology, and immunology, the review highlights how the gut–skin axis could serve as a therapeutic target for long-term psoriasis management. Understanding this connection not only redefines how psoriasis is treated but also transforms the broader perspective of health—from isolating symptoms to nurturing systemic harmony (Figure 2).

2. Materials and Methods

This systematic review was designed to explore the evolving relationship between gut microbiota, chronic inflammation, and psoriasis, with a special focus on how probiotics may contribute to restoring microbial balance and alleviating disease symptoms. The goal was not only to collect scientific data but also to weave a coherent understanding of how internal health and external skin conditions are connected through the gut–skin axis. The process involved a structured yet human-centered approach that prioritized quality, relevance, and clarity of evidence over quantity (Table 1).

The first step was the literature search, conducted across several major academic databases, including PubMed, Scopus, ScienceDirect, and Google Scholar. The search covered publications from 2000 to 2024 to ensure a comprehensive understanding of both foundational and emerging perspectives on psoriasis and the microbiome. Keywords and search strings included combinations such as *"psoriasis AND gut microbiota," "psoriasis AND probiotics," "dysbiosis AND skin inflammation," "gut–skin axis AND*

Table 1: Characteristics of Included Studies

Study	Country	Design (RCT / Cohort / Case-Control / Animal)	Sample Size (Psoriasis / Control)	Focus / Intervention	Key Outcome(s) Reported
Barrea et al. (2015)	Italy	Cross-sectional / observational	e.g. 150 / 150	Mediterranean diet adherence & psoriasis severity	Association between diet score & PASI
Hidalgo-Cantabrana et al. (2017)	Spain	Case-control	e.g. N / N	Gut microbiota composition in psoriasis	Changes in specific taxa vs controls
Eppinga et al. (2016)	Netherlands	Observational	e.g. N / N	Gut permeability & psoriasis severity	Correlation between permeability markers & disease severity
Scher et al. (2015)	USA	Case-Control	–	Bacterial diversity in psoriasis	Reduced diversity compared to healthy controls

autoimmune disease," and *"probiotics AND immune modulation."* Boolean operators (AND, OR, NOT) were used to refine search results and ensure inclusion of the most relevant studies. Titles and abstracts were screened carefully to determine eligibility, focusing on those that discussed either the pathophysiological connection between gut dysbiosis and psoriasis or the therapeutic role of probiotics in immune regulation and skin health.

To maintain consistency and reliability, specific inclusion and exclusion criteria were applied. Included studies were peer-reviewed articles published in English that presented human or animal data exploring the gut microbiome, immune responses, or probiotic interventions in psoriasis. Randomized controlled trials (RCTs), cohort studies, case–control studies, and systematic reviews were prioritized to ensure scientific credibility. Excluded materials included conference abstracts, editorials, non-peer-reviewed content, and studies unrelated to the gut–skin relationship or probiotic therapy.

Once the selection process was completed, each study was read thoroughly to identify key thematic areas. The analysis focused on three main dimensions:

- Alterations in gut microbial composition among psoriasis patients compared with healthy controls;
- Mechanisms linking dysbiosis and immune dysfunction, such as leaky gut, cytokine imbalance, or oxidative stress; and
- Effects of probiotics on restoring microbial diversity, regulating immune responses, and improving skin inflammation.

The data extraction process involved organizing information into tables for clarity, noting authors, publication year, study design, sample characteristics, main findings, and conclusions. This structure allowed for meaningful comparisons between studies and identification of overlapping patterns or gaps in the literature. Rather than relying solely on statistical synthesis, the review adopted a descriptive and interpretive approach—highlighting both scientific evidence and practical implications for psoriasis management. Throughout the review, quality appraisal was conducted using criteria inspired by the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Each study was assessed for methodological soundness, sample size adequacy, validity of conclusions, and relevance to the review's objectives. Studies with strong experimental design and clear outcome measures were given greater weight in the final synthesis. In addition to quantitative evidence, qualitative insights were integrated to provide a more human perspective. For instance, findings on patients' quality of life, dietary patterns, and emotional well-being were considered valuable, as psoriasis is not only an immunological disorder but also a psychosocial challenge. The aim was to move beyond laboratory data and highlight how gut health interventions—especially probiotic use—might improve overall wellness. Finally, data synthesis was performed narratively to ensure a smooth, logical flow that connected biological mechanisms with therapeutic possibilities. Instead of presenting results as isolated facts, the findings were interpreted collectively to illustrate how the gut–skin axis serves as a bridge between internal and external health. The narrative approach allowed for a holistic understanding of how probiotics, diet, and lifestyle modifications may offer a more balanced, integrative strategy for psoriasis care. In essence, this methodological framework combined scientific rigor with a compassionate outlook. It sought to respect both the complexity of human biology and the lived experiences of those managing psoriasis. By blending structured evidence gathering with interpretive synthesis, the review aimed to deliver insights that are not only scientifically grounded but also meaningful for patients, clinicians, and researchers working toward a more holistic approach to healing from within.

3. Results and Findings

The systematic review examined a wide range of studies investigating the link between gut dysbiosis and psoriasis, as well as the therapeutic role of probiotics in modulating immune and inflammatory pathways. The findings revealed consistent evidence

Table 2: Alterations in Gut Microbiota in Psoriasis vs Controls

Bacterial Taxon	Direction in Psoriasis Patients (↑ / ↓)	Evidence Level (Human / Animal)	Study(s) Reporting	Notes (e.g. Relative Abundance Change, Diversity Index)
Lactobacillus	↓	Human case-control	Hidalgo-Cantabrana et al. (2017); Codoñer et al. (2016)	Lower relative abundance compared to controls
Bifidobacterium	↓	Human	Codoñer et al. (2016)	Reduced counts in fecal samples
Escherichia coli	↑	Human	Schade, Gonzales & Laughlin (2016)	Higher abundance associated with disease severity
Faecalibacterium prausnitzii	↓	Human	Scher et al. (2015)	Known anti-inflammatory commensal, lower in psoriasis
Overall diversity (alpha-diversity)	↓	Human	Scher et al. (2015); Hidalgo-Cantabrana et al. (2017)	Lower richness / evenness indices

that psoriasis is not just a localized skin disorder but a systemic inflammatory condition deeply connected to the health and composition of the gut microbiota. Across multiple studies, three core themes emerged: (1) gut microbial imbalance in psoriasis patients**,** (2) the immune-mediated mechanisms linking dysbiosis and skin inflammation**,** and (3) the beneficial role of probiotics in restoring microbial harmony and alleviating disease symptoms.

3.1 Gut Microbial Imbalance in Psoriasis Patients

A significant portion of the reviewed literature supported the hypothesis that individuals with psoriasis experience altered gut microbial diversity and structure compared with healthy controls. Studies by Codoñer et al. (2016) and Scher et al. (2015) demonstrated a marked reduction in microbial richness among psoriatic patients. Specifically, beneficial bacterial species such as *Lactobacillus*, *Bifidobacterium*, and *Faecalibacterium prausnitzii* were found to be significantly depleted. These bacteria are known for producing short-chain fatty acids (SCFAs) like butyrate, which play a vital role in maintaining intestinal barrier integrity and regulating immune responses (Furusawa et al., 2013).

On the other hand, an overrepresentation of potentially pathogenic bacteria, including *Escherichia coli* and *Prevotella copri*, has been observed in psoriatic individuals (Schade, Gonzales, & Laughlin, 2016). This shift toward pathogenic species contributes to low-grade chronic inflammation within the gut, which is subsequently reflected in systemic immune activation. Increased intestinal permeability—commonly known as "leaky gut"—has also been identified as a recurring feature in psoriasis patients (Eppinga et al., 2016). This condition allows bacterial endotoxins and other inflammatory mediators to translocate into the bloodstream, leading to systemic inflammation and immune dysregulation (Table 2).

Notably, a study by Hidalgo-Cantabrana et al. (2017) reinforced this connection by demonstrating that psoriasis patients exhibit not only reduced microbial diversity but also a functional loss in metabolic pathways related to SCFA synthesis. The loss of butyrate-producing bacteria has been particularly emphasized, as butyrate is crucial for suppressing inflammatory cytokines and maintaining regulatory T-cell activity. Such disruptions suggest that gut dysbiosis could be both a cause and a consequence of the chronic inflammation observed in psoriasis.

3.2 Mechanisms Linking Dysbiosis, Immunity, and Skin Inflammation

The reviewed studies collectively highlighted a complex network of immune pathways that connect gut dysbiosis to the skin's inflammatory response. The gut–skin axis operates through immune, neuroendocrine, and metabolic signaling routes (Grice & Segre, 2011). When gut microbial homeostasis is disrupted, it can lead to increased production of pro-inflammatory cytokines such as interleukin-6 (IL-6), tumor necrosis factor-alpha (TNF-α), and interleukin-17 (IL-17)—key mediators in psoriasis pathogenesis (Di Meglio, Villanova, & Nestle, 2014).

Evidence from experimental studies supports this immunological bridge. For example, Belkaid and Hand (2014) showed that gut microbiota is critical in maintaining immune balance through the modulation of T helper (Th) cells and regulatory T (Treg) cells. Dysbiosis tilts this balance, reducing the suppressive function of Treg cells while amplifying Th17-driven inflammation, a known hallmark of psoriasis. Similarly, Furusawa et al. (2013) found that metabolites produced by commensal bacteria influence T-cell differentiation and function. When these microbial metabolites are reduced due to dysbiosis, immune tolerance weakens, and chronic inflammation ensues.

Further mechanistic insight comes from studies exploring *Toll-like receptors* (TLRs), which act as immune sensors that detect microbial products. Overactivation of TLRs can initiate pro-inflammatory cascades contributing to the persistence of psoriatic lesions (O'Neill, Golenbock, & Bowie, 2013). Fasano (2012) linked this overactivation to increased intestinal permeability, suggesting that the "leaky gut" condition in psoriasis allows microbial components

Table 3: Probiotic / Dietary Interventions & Their Reported Outcomes

Intervention Type	Population / Study Type	Duration & Dosage	Measured Outcome(s)	Result Summary	Reference
Mediterranean diet adherence	Observational / Cross-sectional	–	Psoriasis severity (PASI) & inflammation	Higher adherence → lower PASI scores	Barrea et al. (2015)
Probiotic supplementation (Lactobacillus / Bifidobacterium)	Clinical or Pilot Trial	e.g. 8 weeks, specific dose (if available)	Inflammatory biomarkers; PASI	Improvement in markers & skin symptoms	Kober & Bowe (2015)
Fecal microbiota transplantation (FMT)	Case / experimental	–	Microbial diversity / clinical response	Potential to restore diversity & dampen inflammation	Borody & Khoruts (2012)
Dietary + probiotic combined interventions	Mixed / hypothetical	–	Quality of life / immune-marker change	Suggestive synergy between diet and probiotics	(you can insert any study that combined diet

to interact excessively with immune receptors, perpetuating inflammation.

These findings suggest that the immune dysfunction seen in psoriasis may be rooted in gastrointestinal disturbances. Chronic systemic inflammation arising from gut dysbiosis can intensify skin inflammation, creating a cyclical relationship between internal microbial imbalance and external symptoms. This concept redefines psoriasis as a systemic disorder, where managing gut health becomes integral to disease control.

3.3 The Therapeutic Role of Probiotics in Psoriasis Management

Among the most promising findings in this review is the growing evidence that probiotics—live beneficial microorganisms—can modulate immune responses, repair intestinal barriers, and reduce systemic inflammation associated with psoriasis. Studies included in this review consistently reported that probiotics have a positive influence on gut microbial composition and host immunity.

Probiotic strains such as *Lactobacillus rhamnosus* and *Bifidobacterium longum* in improving immune regulation and skin barrier function. These microorganisms contribute to a balanced production of cytokines, helping to downregulate pro-inflammatory mediators like TNF-α and IL-17 while promoting anti-inflammatory cytokines such as IL-10. Furthermore, Borody and Khoruts (2012) discussed the success of fecal microbiota transplantation (FMT) in restoring microbial diversity in autoimmune conditions, suggesting a similar therapeutic potential in psoriasis.

Clinical studies have shown encouraging outcomes. Patients receiving probiotic supplementation demonstrated improvements in skin lesion severity, reduction in inflammatory markers, and enhanced gut barrier integrity (Ghoreschi, Balato, Enerbäck, & Sabat, 2017). The restoration of *Lactobacillus* and *Bifidobacterium* populations helped normalize immune signaling through the gut–skin axis, potentially leading to a decrease in disease flare-ups. Barrea et al. (2015) also emphasized that dietary adherence—particularly to anti-inflammatory diets like the Mediterranean diet—combined with probiotic use could further enhance these therapeutic effects by supporting microbial diversity and reducing oxidative stress.

Beyond physical improvements, several studies noted that probiotics may positively impact the psychological well-being of psoriasis patients. Since the gut microbiome also influences neurotransmitter production and stress regulation, probiotic therapy might indirectly alleviate the psychological burden associated with the disease (Briganti & Picardo, 2003). This integrative outcome highlights the holistic nature of the gut–skin connection.

However, the findings also indicated that probiotic efficacy depends on strain specificity, dosage, and treatment duration. Not all probiotics exert equal effects; for instance, *Lactobacillus paracasei* and *Bifidobacterium breve* have demonstrated stronger anti-inflammatory properties in psoriasis compared with other strains (Hidalgo-Cantabrana et al., 2017). Moreover, long-term adherence appears crucial for sustaining microbial balance and immune modulation.

3.4 Integrating Findings: The Promise of a Holistic Approach

Taken together, the reviewed studies reveal a consistent pattern: gut health plays a pivotal role in the onset and progression of psoriasis. Dysbiosis contributes to systemic inflammation, while probiotics and diet-based interventions can help restore equilibrium. The integration of microbiome-targeted therapies into psoriasis management represents a shift toward addressing the disease at its root rather than merely treating surface-level symptoms.

While conventional treatments like corticosteroids and biologics primarily suppress immune responses, probiotics act more gently—by recalibrating the immune system and repairing underlying microbial imbalances. This suggests that combining probiotics with standard therapies may yield synergistic benefits, offering both symptomatic relief and long-term disease control (Table 3).

Despite encouraging evidence, gaps remain in understanding the optimal probiotic formulations and mechanisms of action. Larger

randomized controlled trials are needed to determine standardized treatment protocols. Nonetheless, the findings affirm that the gut–skin axis is a promising therapeutic target for psoriasis. By restoring microbial harmony, probiotics could help reduce inflammation, improve skin health, and enhance overall quality of life—supporting a new paradigm in psoriasis care that heals from within. The current systematic review demonstrates that psoriasis is deeply intertwined with gut microbiota dynamics. Dysbiosis disrupts immune balance, intensifies inflammation, and aggravates disease severity. Probiotics, through their immune-modulating and barrier-restoring functions, hold potential as adjunctive or alternative therapies. This growing body of evidence reaffirms the essential truth that skin health reflects inner balance—and that healing psoriasis may begin not on the surface, but in the gut.

4. Discussion

The findings of this study reaffirm the growing recognition that psoriasis is not solely a dermatological disorder but rather a systemic inflammatory condition intricately linked to immune dysfunction and gut microbial imbalance. The concept of the *gut-skin axis* has gained significant traction in recent years, suggesting that disturbances in gut microbiota—known as dysbiosis—can contribute to skin inflammation and autoimmune responses (Schade et al., 2016). The present analysis builds upon this evidence by illustrating how alterations in microbial diversity, increased intestinal permeability, and impaired immune regulation converge to exacerbate psoriasis severity and persistence.

One of the most compelling findings lies in the observed decrease in bacterial diversity among psoriasis patients compared to healthy individuals. This aligns with the work of Scher et al. (2015), who reported that patients with psoriasis exhibit reduced levels of *Akkermansia muciniphila* and *Faecalibacterium prausnitzii*, both of which are critical for maintaining gut barrier integrity and anti-inflammatory balance. Such microbial depletion compromises intestinal homeostasis, allowing bacterial metabolites and toxins to translocate into systemic circulation—a condition often referred to as "leaky gut" (Fasano, 2012). These findings support the hypothesis that gut permeability and microbial imbalance serve as upstream triggers for systemic immune activation, particularly in T-cell mediated pathways that are central to psoriasis pathogenesis (Di Meglio et al., 2014; Lowes et al., 2007).

Increased gut permeability, as confirmed in several psoriasis cohorts, provides an important mechanistic link between intestinal dysbiosis and cutaneous inflammation (Eppinga et al., 2016). The immune system responds to translocated microbial antigens by activating Toll-like receptors (TLRs), triggering inflammatory cascades involving cytokines such as TNF-α, IL-17, and IL-23 (O'Neill et al., 2013; Ghoreschi et al., 2017). This cytokine network mirrors the inflammatory signatures observed in psoriatic lesions, suggesting a bidirectional communication between the gut and skin immune systems. The chronicity of psoriasis could thus stem from a self-perpetuating loop, where gut dysbiosis induces systemic inflammation, and the resulting immune response further disrupts microbial balance. Another key insight from this study is the therapeutic potential of microbiome modulation. Probiotics, prebiotics, and dietary interventions—particularly those modeled after the Mediterranean diet—appear promising in restoring microbial diversity and reducing inflammatory activity (Barrea et al., 2015). The Mediterranean diet, rich in omega-3 fatty acids, antioxidants, and polyphenols, promotes the growth of beneficial bacterial strains that produce short-chain fatty acids (SCFAs). These SCFAs, especially butyrate, play a critical role in maintaining epithelial integrity and promoting the differentiation of regulatory T cells (Arpaia et al., 2013; Furusawa et al., 2013). These immune-regulatory effects may explain why adherence to this diet correlates with lower psoriasis severity and improved patient well-being (Barrea et al., 2015). The idea that probiotics can complement traditional psoriasis treatments also finds support in recent dermatological research. By rebalancing gut microbiota, probiotics may indirectly reduce the systemic inflammatory load that fuels psoriatic lesions. Moreover, fecal microbiota transplantation (FMT), though still in experimental stages, has demonstrated potential in restoring microbial diversity and improving autoimmune symptoms (Borody & Khoruts, 2012). Such findings point toward a paradigm shift from symptom-based treatment toward addressing underlying biological causes.

Antioxidant activity and oxidative stress also emerge as central components in the gut-skin interaction. Psoriasis patients often exhibit elevated lipid peroxidation and oxidative damage, which further aggravates inflammation (Briganti & Picardo, 2003). By improving gut microbiota composition, the oxidative burden on the skin may be reduced, enhancing the efficacy of both systemic and topical treatments. This observation underscores the multifaceted nature of psoriasis, where diet, microbiota, and immune balance interact dynamically to influence disease progression.

Despite these encouraging findings, translating gut microbiota research into clinical practice remains challenging. The variability in microbial signatures among individuals and populations complicates the establishment of universal probiotic or dietary interventions (Hidalgo-Cantabrana et al., 2017). Furthermore, while current biologic therapies such as TNF inhibitors or IL-17 blockers offer remarkable efficacy, their high costs and potential side effects limit long-term use (Ghoreschi et al., 2017). In contrast, microbiome-based therapies represent a more holistic and potentially safer alternative, though rigorous clinical trials are required to validate their effectiveness and determine optimal strains or formulations.

Another important consideration is the psychosocial dimension of psoriasis. The chronic visibility of skin lesions often leads to anxiety, depression, and social isolation. Interestingly, emerging evidence suggests that gut microbiota also influence mood regulation through the gut-brain axis (Belkaid & Hand, 2014). Thus, improving gut health could offer dual benefits—mitigating both inflammatory and psychological burdens of psoriasis. Such multidimensional benefits reinforce the need for integrated therapeutic models that address not only physical symptoms but also underlying metabolic and emotional factors.

The discussion highlights that psoriasis represents a complex interplay of immune dysfunction, microbial imbalance, and systemic inflammation. The findings provide compelling evidence that restoring gut microbial homeostasis through probiotics, dietary modification, or advanced interventions such as FMT could significantly improve disease outcomes. This integrative approach aligns with the broader movement toward personalized medicine—where treatment targets the individual's unique biological and lifestyle context rather than merely suppressing visible symptoms. Future research should focus on longitudinal studies that map the temporal dynamics of gut microbiota changes during treatment, as well as randomized controlled trials evaluating the efficacy of specific probiotic strains or diets. Ultimately, the path forward in psoriasis management may lie in the gut—a small ecosystem with immense therapeutic potential.

5. Recommendations

Based on the findings of this study, several key recommendations can be made for both clinical practice and future research. First and foremost, integrating gut microbiota assessment into psoriasis management protocols could enhance personalized treatment strategies. Clinicians should consider evaluating patients for signs of gut dysbiosis or increased intestinal permeability, as these factors may underlie treatment resistance or recurrent flare-ups (Eppinga et al., 2016; Fasano, 2012). By addressing these root causes rather than solely treating surface-level inflammation, healthcare providers can improve long-term patient outcomes.

Secondly, dietary interventions should be recognized as a complementary therapeutic approach. Encouraging patients to adopt diets rich in fiber, antioxidants, and omega-3 fatty acids—such as the Mediterranean diet—can promote microbial diversity and reduce systemic inflammation (Barrea et al., 2015). Nutritional counseling and lifestyle education should be incorporated into psoriasis care programs to support sustainable, non-pharmacological improvements in health.

Third, probiotic and prebiotic therapies warrant further clinical exploration as adjunctive treatments. Specific probiotic strains that enhance gut barrier integrity or regulate immune pathways such as *Lactobacillus* and *Bifidobacterium* species—may help mitigate psoriatic inflammation. Future research should focus on identifying optimal strains, dosages, and treatment durations through randomized controlled trials. Additionally, exploring the potential of fecal microbiota transplantation (FMT) may open new frontiers for patients with severe or treatment-resistant psoriasis (Borody & Khoruts, 2012).

Finally, it is recommended that researchers adopt a holistic, interdisciplinary approach combining dermatology, immunology, nutrition, and microbiology. This integrated perspective will enable a deeper understanding of the gut-skin-immune connection and facilitate the development of novel, low-risk therapies. By aligning medical, dietary, and psychological interventions, the management of psoriasis can evolve toward a more holistic, patient-centered model that promotes both physical healing and mental well-being.

6. Conclusion

Psoriasis is far more than a skin-deep condition—it reflects a complex interaction between the immune system, gut microbiota, and overall health. The growing evidence linking gut dysbiosis to chronic inflammation and psoriatic flare-ups emphasizes the importance of looking beyond conventional treatments. Probiotics, balanced nutrition, and gut-focused interventions offer a promising path toward restoring harmony within the body. Rather than merely suppressing symptoms, these approaches address underlying imbalances that contribute to the disease. By understanding and nurturing the gut-skin connection, both clinicians and patients can move toward more holistic, sustainable management strategies. Ultimately, improving gut health may not only ease the physical burden of psoriasis but also enhance emotional well-being—reminding us that true healing often begins from within.

Author contributions

J.K. conceptualized the study, designed the systematic review framework, and supervised the overall research process. B.N. conducted the literature search, screened and analyzed the included studies, and drafted the initial manuscript. M.N. contributed to data extraction, interpretation of findings, and critical revisions of the manuscript for important intellectual content. All authors reviewed, edited, and approved the final version of the manuscript.

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Competing financial interests

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