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Probiotics as a Novel Approach in the Treatment of Psoriasis – A Literature Review

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Abstract

Psoriasis is a chronic, immune-mediated inflammatory skin disease. Recent studies have demonstrated a decreased diversity in the gut microbiota of individuals with psoriasis, suggesting a potential correlation between intestinal dysbiosis and disease severity. Emerging evidence highlights the relevance of the gut–skin axis, where shifts in microbial composition—marked by increases in certain bacterial species and reductions in others—may contribute to systemic inflammation. These microbial imbalances have been associated with immune dysregulation, including activation of inflammatory pathways involving T helper 17 (Th17) cells, which play a pivotal role in psoriasis pathogenesis.

As a result, increasing attention is being directed toward modulating the gut microbiome as a therapeutic strategy. This review aims to evaluate the efficacy of probiotics as an adjunctive treatment in patients with psoriasis. The analysis of current literature indicates that probiotic supplementation, particularly with strains from the Lactobacillus and Bifidobacterium genera, may improve clinical outcomes when used alongside conventional therapies. Most of the reviewed studies reported statistically significant improvements in comparison to control

groups. Nevertheless, large-scale, long-term clinical trials are required to fully elucidate the role of gut microbiota modulation in the management of inflammatory skin disorders.

Keywords: Psoriasis; Gut microbiota; Microbial dysregulation; Gut; Probiotics; Assisted therapy

I. Introduction

Psoriasis is a chronic, immune-mediated systemic disease characterized by excessive keratinization of the epidermis [1]. The prevalence of the disease varies depending on the region of the world, with a higher incidence observed in developed countries [2]. Due to its generalized inflammatory nature, psoriasis often coexists with metabolic disorders, cardiovascular diseases, kidney diseases, mood disorders including depression, malignant neoplasms—primarily lymphomas—and gastrointestinal disorders [3;4].

An increasing number of studies suggest a common mechanism between the occurrence of skin lesions and gastrointestinal symptoms. This has led to the development of the gut-skin axis concept, supported by numerous studies indicating quantitative and qualitative changes in the gut microbiota composition in patients with psoriasis [5;6;7;8]. In preclinical studies on mice with imiquimod-induced psoriasis-like symptoms, probiotics were observed to alleviate the condition [9]. As research progressed, closer attention was paid to the gut microbiota and the potential use of various bacterial strains in treating psoriasis. Further studies on probiotic use may contribute to better management of psoriasis and its associated gastrointestinal symptoms. The aim of this article is to present current research on the therapeutic potential and effectiveness of probiotics in psoriasis.

II. Methodology

Search Strategy

A literature review was conducted using databases such as PubMed, Google Scholar, and Wiley Online Library. The review covered publications from 2010 to December 2024. The search included a combination of keywords such as: “psoriasis,” “probiotics,” “microbiome,” “treatment,” “gut,” and “dysbiosis.”

Inclusion/Exclusion Criteria

Articles included in this literature review had to meet the following criteria: human-based studies, access to full text, patients with symptomatic psoriasis, case-control study, and the article written entirely in English.

Study Selection

A manual review of the article list obtained using the search strategy was conducted. Based on the inclusion and exclusion criteria, the articles were assessed for their relevance. Full texts of the selected articles were then thoroughly reviewed and analyzed for common patterns and findings. From this process, seven studies were identified and further analyzed in this article.

III. Gut Microbiota

The gut microbiota is a complex community of microorganisms, primarily composed of bacteria. In a healthy host, the dominant bacterial phyla are Bacteroidetes and Firmicutes [10]. The gut flora fulfills four primary functions in the host organism: metabolic, protective, neurological, and structural. It is closely linked to the host's immune system, with immunosuppressive properties due to its influence on immune cells [10;11]. The structural function of the microbiota supports the maintenance of tight junctions between cells, creating an impermeable intestinal barrier [11].

Each section of the gastrointestinal tract has a unique bacterial composition, resulting from the varied functions of each segment and the differing conditions present [11]. Throughout life, the gut microbiota undergoes changes and adapts to the surrounding environment [12]. It has been shown that early childhood is critical for the development of gut flora, which has long-term effects on gut health. The first days of life significantly influence its composition. It has been observed that children born via cesarean section, fed with formula milk, or raised without siblings tend to have lower diversity in their gut microbiota [13].

In later stages of life, the quantity and quality of gut flora are influenced by factors such as diet, infections, and medication use [14]. Investigating the mechanisms and identifying the

factors leading to gut dysbiosis is crucial for better understanding the pathomechanisms of associated diseases and developing strategies for prevention.

IV. Gut Dysbiosis in Psoriasis

In healthy conditions, the gut microbiota forms a balanced ecosystem. When changes occur in the composition of the microbiota, it leads to gut dysbiosis. This imbalance may result from changes in the proportions of bacterial species present in the intestines of healthy individuals, or from the expansion of new species that are not typically part of the healthy gut microbiota [15].

Numerous studies have observed a strong link between the gut and the skin, connecting gut health with skin health. In patients with psoriasis, not only is gut dysbiosis observed, but also a reduced diversity of the gut microbiota [16]. It has been noted that the more severe the psoriasis, the lower the diversity [17].

An element that links gut dysbiosis and psoriatic skin changes are helper T cells subpopulation 17 (Th17). They play a significant role in maintaining tissue homeostasis [16;18]. The pathogenesis of psoriasis, due to its complexity, is not fully understood. However, in the inflammatory mechanism, dendritic cells are activated, which, through tumor necrosis factor (TNF) and interleukins 12 and 23, stimulate the differentiation and proliferation of Th17 cells [19]. The same inflammatory cells are involved in gut dysbiosis.

In psoriasis patients, a decreased abundance of bacterial species such as Faecalibacterium prausnitzii, Prevotella, Akkermansia, and Ruminococcus has been observed. This change contributes to a decrease in the amount of butyrate produced in the gut [20]. Butyrate is an antioxidant and an inflammatory response modulator, as it inhibits adhesion, cytokine production, and helps maintain a healthy gut barrier. Due to butyrate deficiency, there is an increased conversion of naive lymphocytes (lymphocytes that have not yet been stimulated by any antigen) into Th17 cells, instead of regulatory cells, leading to excessive activation and growth of keratinocytes. Additionally, there is increased permeability of the gut barrier, which promotes bacterial translocation into the bloodstream, activating the immune system and causing the characteristic psoriatic changes [17]. Another bacterium responsible for maintaining gut barrier integrity is Bacteroides, whose abundance also significantly decreases in psoriasis [6]. However, gut permeability and bacterial translocation are not caused by one specific bacterial species but are likely a result of an imbalance in gut microbiota [5].

As previously mentioned, an abnormal gut microbiota composition has been observed in psoriasis patients. Additionally, a decrease in the number of bacteria such as Lactobacillus spp., Parabacteroides, and Coprobacillus has been noted, further supporting the theory of an altered gut microbiota in psoriasis [20;21]. However, data regarding changes in the abundance of certain species are conflicting. One study suggests a decrease in the number of Bifidobacterium species [20], while another reports comparable levels to healthy individuals [6]. An interesting finding, however, is the decrease in Streptococcus, as this bacterium is often a triggering factor in the onset and exacerbation of psoriasis. This trend may suggest a poorer ability to shape immune response [6].

It has also been observed that the abundance of some bacterial species has increased, including Salmonella sp., Campylobacter sp., Helicobacter sp., Escherichia coli, Alcaligenes sp., Mycobacterium sp., as well as Firmicutes, Proteobacteria, Acidobacteria, Schlegelella, Streptococcaeae, Rhodobacteracaea, Campylobacteraceae, and Moraxcellaceae [20;21].

Bacteroidetes and Firmicutes are the most prevalent species in the gut microbiota. In many studies of psoriasis patients, an increased ratio of Firmicutes to Bacteroidetes is described. Some studies show a positive correlation with the PASI score [17], while others present this relationship as statistically insignificant [6]. Nevertheless, the correlation between these two species may influence psoriasis symptoms. This means that the individual abundance of a given species may not affect the severity or alleviation of psoriasis, but their mutual ratio may show such a relationship [6;17]. Despite numerous studies on the differences in gut microbiota in psoriasis patients compared to healthy populations, the exact mechanisms and relationships are still unknown. Research so far has focused on describing the composition of gut microbiota in psoriasis patients. Moreover, discrepancies are often found in studies, which may result not only from differences in the populations studied but also from changes in the technologies used in these studies.

V. The Use of Probiotics in Psoriasis

Probiotics are live, selected microorganisms that positively affect the maintenance of gut health [22]. In psoriasis, probiotic mixtures and specific bacterial strains are primarily used, although attempts at fecal microbiota transplantation (FMT) have also been made. The most commonly used bacterial species in research are Lactobacillus and Bifidobacterium. One study evaluated the effectiveness of administering Bifidobacterium infantis 35624, which showed a reduction in inflammatory markers in plasma after applying this strain. Three

parameters were monitored: C-reactive protein (CRP), interleukin 6 (IL-6), and tumor necrosis factor (TNF-α), and a significant decrease was observed in 75% of psoriasis patients. Additionally, an increase in inflammatory parameters was noted in the control group, although it should be emphasized that this group was not treated with steroids during the study [23].

In a 2022 study, the Lactobacillus rhamnosus strain was used, and no decreasing trend in inflammatory factors was observed, as was seen in the previous study. In the probiotic group, a slight increase in the concentrations of interleukin 17 and 23 was observed. However, despite the lack of the expected reduction in inflammatory parameters, a decrease in the severity of skin lesions was observed in patients receiving probiotic treatment compared to the control group. Importantly, patients in both groups continued their previous treatments, including topical and systemic drugs such as methotrexate and biological therapies, during the study. The authors also highlight the advantage of probiotic treatment, which is its low frequency of side effects and the lack of the need for monitoring [24].

Several studies used probiotic mixtures. In one of them, a synbiotic called Lactocare, consisting mainly of Lactobacillus bacteria, was used. A significant improvement in skin lesions was observed in the experimental group. During the study, patients also received local treatment with a mild steroid—hydrocortisone. The greatest improvement in all indicators, including PASI, was observed 12 weeks after treatment compared to the control group, with all patients who received probiotics showing improvement. Additionally, no statistically significant differences in response to treatment were observed between male and female patients. The authors themselves note that a limitation of this study was the COVID-19 pandemic, which impacted cooperation with all participants [25]. In another study, after using a probiotic mixture combined with topical steroids and calcipotriol, a higher percentage of patients showed improvement in their psoriasis lesions by the 12th week of observation. In this case, a mixture dominated by Bifidobacterium species was used. Interestingly, in the intervention group, a reduction in Micromonospora and Rhadococcus species was observed, while Collinsella and Lactobacillus increased when comparing baseline and final samples. No such changes were observed in the control group. Additionally, three patients from the control group required biological therapy due to a severe disease flare, which was not observed in the probiotic group. Furthermore, patients in the intervention group required less topical steroid

treatment. No serious side effects were observed during the study, and according to the authors, the probiotic mixture is considered safe [26].

An interesting study, which differs from the others, involved using Streptococcus salivarius K12 strains in psoriasis. Patients also received emollients and vitamin D derivatives. One of the inclusion criteria was a streptococcal infection of the tonsils, and the participants also included children over the age of 7. Patients treated with the bacterial strain showed improvement in skin lesions and did not experience a psoriasis relapse throughout the observation period. No side effects were observed during the study. This highlights the potential for preventing and treating psoriasis using products containing Streptococcus salivarius K12. Additionally, this study involved children, and further research should also include younger children under the age of 7 to fully establish the effectiveness of this bacterial strain [27].

Another study used Provotella histicola bacteria. The number of participants was small, with a 2:1 ratio between the experimental and control groups. The patients were further divided into two cohorts, one receiving a dose of $1{,}6x\,10^{11}$, and the other receiving a dose of $8{,}0x\,10^{11}$. Improvement was observed after 4 weeks of treatment, and this trend continued in the group receiving the higher dose. A 25% or greater improvement in the PASI score was observed in 6 out of 12 patients in the higher-dose group, while in the placebo group, only 1 patient showed improvement. The results of this study suggest modifications in the inflammatory state using commensal bacteria that do not colonize the gut [28].

While many studies demonstrate the positive impact of probiotics on psoriasis, there has also been one study showing no intended therapeutic effect. In this study, fecal microbiota transplantation was used. Participants had either plaque psoriasis or psoriatic arthritis. No significant side effects were observed during the study, with the most commonly reported being gastrointestinal discomfort. A limitation of this study was the small number of participants with active skin psoriasis, as only 10 patients had severe skin changes at the time of inclusion. This small sample size makes it difficult to reliably assess the role of the microbiota in skin inflammation. Additionally, failure of treatment was considered when biological therapy was needed. Biological therapy was started in the 12th week in 8 out of 15 patients in the experimental group, compared to 2 out of 16 patients in the control group [29].

At this point, there are few studies on the therapeutic use of probiotics in psoriasis. Furthermore, these studies have limitations, which is why more research is necessary to obtain a clear answer about the effectiveness and benefits of using probiotics in psoriasis.
Table 1 (Tab. 1) contains a summary comparing studies using probiotics in psoriasis.

Table 1. Applied Treatment, Participants, Study Duration, and Results

Study Identifier	Applied Treatment	Participants	Study Duration	Results
[23]	*Bifidobacterium infantis* 35624	26 patients with plaque psoriasis	8 weeks	A significant reduction in all three inflammatory parameters (CRP, TNF-α, IL-6) was observed in the study group.
[24]	Lactobacillus rhamnosus	35 patients with common psoriasis and palmoplantar psoriasis, participants continued their ongoing psoriasis treatment during the study, including topical and systemic medications	60 days	A reduction in the severity of skin lesions in the study group; additionally, no decrease in inflammatory interleukin levels was observed during probiotic use
[25]	Lactocare Synbiotic	52 psoriasis patients, 12 did not complete the	12 weeks	Improvement of skin lesions in all patients who received probiotics

		study, patients also used hydrocortisone during the study		
[26]	Probiotic strain mixture: Bifidobacterium longum CECT 7347, B. lactis CECT 8145, Lactobacillus rhamnosus CECT 836	90 patients with mild/moderate plaque psoriasis, 2 participants did not complete the study, patients also used topical steroids and calcipotriol	12 weeks	Improvement in skin lesions and reduced need for topical steroids in the study group.
[27]	Streptococcus salivarius K12	198 patients with mild/moderate common psoriasis, with a history of tonsillar streptococcal infection and the ability to measure antibodies against streptococcus and antistreptolysin O, emollients and vitamin D	24 months	Significant improvement in skin lesions compared to the control group and no recurrence of psoriasis during the study period.

		derivatives were also used		
[28]	Prevotella histicola	30 patients with mild or moderate plaque psoriasis.	42 days	Reduction in the severity of skin lesions; a higher dose of the preparation showed greater effectiveness.
[29]	Fecal microbiota transplantation in the form of a fecal donation suspension	31 participants, 30 completed the study, diagnosed with psoriasis and psoriatic arthritis (≥3) and treated with methotrexate for at least 3 months	26 weeks	No desired therapeutic effect was achieved in the majority of patients in the study group

VI. Discussion

This review is focused on studies conducted on humans. However, there are numerous studies investigating the use of probiotics in psoriasis conducted on mice, in which psoriasis-like lesions were induced using imiquimod. Most of these studies concentrate on examining specific bacterial strains and identifying those that contribute to improving psoriasis symptoms. One study demonstrated that the Bifidobacterium breve CCFM 1078 strain achieved the best anti-inflammatory effectiveness in mice. Additionally, a correlation was observed between increased acetate levels and the alleviation of skin symptoms. Furthermore, acetate levels were found to be negatively associated with interleukin-17 levels [9].

In another study, also using Bifidobacterium breve, this time the CCFM683 strain, an effective dose of 10^9 and 10^{10} CFU/day was established to alleviate skin symptoms. However, this dose was determined for mice, and it is currently unclear whether it would be equally effective in patients with psoriasis [30]. Another strain showing efficacy in treating psoriasis in a mouse model is Lactobacillus pentosus GMNL-77 [31]. Despite all these studies being conducted on small animal groups, the results are promising. The human body differs

from that of mice, but in the future, further research using these bacterial strains could be considered to evaluate their effectiveness in people with psoriasis. Another study conducted on mice used an ethanol extract isolated from the probiotic strain Lactobacillus sakei Probio-65, known as SEL001. Not only was a reduction in psoriasis severity observed, but it was also noted that topical administration of SEL001 reduced skin thickness and inflammatory infiltration. SEL001 has already demonstrated efficacy in treating patients with atopic dermatitis. Considering the overall research on SEL001, it presents a promising future perspective for treating patients with psoriasis [32].

A number of studies indicate changes in the gut microbiome of patients with psoriasis. Recently, there has also been growing interest in the skin microbiome and its therapeutic potential. It has been shown that psoriatic lesions display increased variability in the composition of the skin microbiota compared to the skin of healthy individuals. However, it remains unclear whether the observed changes in the microbial population are a cause or consequence of the disease.

In the pathogenesis of psoriasis, four main types of bacteria have been identified: Propionibacterium, Staphylococcus, Corynebacterium, and Streptococcus. There appears to be a decrease in the abundance of Actinobacterium and Propionibacterium. Many studies have analyzed the composition of skin microflora, but their results are not consistent, which may be due to individual differences [33].

In one study, topical probiotic mixtures with different compositions were used. It was observed that mixtures containing various strains of Cutibacterium acnes integrated most effectively, and the first changes were noticeable after only three days of applying the preparation. Over time, an increase in similarity was observed between the skin microflora of donors and recipients. It was demonstrated that the skin microbiota composition could be modified in a manner similar to fecal microbiota transplantation. However, the study was limited to areas rich in sebaceous glands [34].

Intervention in both the gut and skin microbiota appears to be a promising direction for the future. A personalized approach tailored to each patient selecting the appropriate dose and specific strains for individual microbiota disturbances seems to be a future perspective. Further research is needed to determine the role of the gut microbiota in treating patients with psoriasis and how it affects the skin.

In this literature review, a systematic analysis of randomized studies was conducted, revealing certain correlations. In most of them, significant improvements in PASI and DLQI indices were observed following probiotic supplementation. Moreover, it was noted that in some cases, the highest improvements were achieved after 12 weeks of treatment. However, certain limitations should be taken into account. Two randomized studies were suspended due to the COVID-19 pandemic, which may have influenced the observation results [25;29]. Additionally, in most studies, both the control and treatment groups received topical therapy, suggesting that the significant improvements observed in the probiotic-treated groups resulted from the synergistic effects of topical and probiotic treatments.

VII. Conclusion

This literature review summarizes the current knowledge regarding the potential use of probiotics in the treatment of psoriasis. It also emphasizes the important role of the gut-skin axis and demonstrates the relationship between gut dysbiosis and psoriatic lesions. Several studies have shown a positive therapeutic effect of gut microbiota interventions, resulting in improvements in psoriatic symptoms and patients' overall well-being. However, the exact mechanisms occurring in the body are still not fully understood. The long-term risks of probiotic use also remain unclear, as the existing studies involved short observation periods. More research is needed to determine the long-term effects of such interventions and to establish the appropriate composition and dosage of probiotics. Additionally, current studies have not included patients with severe forms of psoriasis, who may not respond to this type of treatment or may require significantly longer probiotic therapy. Due to the limitations of existing studies, further research on this topic is necessary in the future.

Disclosure

Author's contribution

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