REVIEW ARTICLE

Intestinal dysbiosis and its manifestations in dermatologic diseases: Systematic review

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Key words: Intestinal microbiota, dysbiosis, psoriasis, atopic dermatitis, probiotics, prebiotics

How to cite this article: Ayala M., Ayala G., Narváez M. Disbiosis intestinal y su expresión en la patología cutánea: Revisión sistemática. - Artículo de revisión. Rev Dermatol Cent Úraga. 2026;8(1).

Date of receipt: 14/7/2025
Date of acceptance: 20/2/2026

ABSTRACT

A dysfunction of the intestinal microbiota has been postulated in skin disorders such as psoriasis, atopic dermatitis, acne, vitiligo, rosacea, autoimmune diseases, among others. During this study, a review was conducted of articles published between January 2019 and October 2024 that identified and analyzed the dermatopathies in patients with dysbiosis, the most analyzed being atopic dermatitis and psoriasis. Studies on psoriasis in which probiotics or prebiotics were added to conventional treatment demonstrated improvement in the Psoriasis Severity Index (PASI) and Dermatology Life Quality Index (DLQI), as well as reduction in IL-6 levels, and were also associated with lower rate of flares (20% vs placebo of 41.9%). Regarding atopic dermatitis, a decrease in the Scoring Atopic Dermatitis (SCORAD) was also evident after the introduction of prebiotics. Fecal transplants in different pathologies showed significant changes in the intestinal microbiota, which could influence clinical improvement. None of the studies reported serious adverse effects related to the interventions.

INTRODUCTION

Skin diseases are on the rise; worldwide, between 30% and 70% of the population will experience some form of dermatologic condition. Significant dysfunction of the intestinal microbiota has been postulated in cutaneous disorders such as psoriasis, vitiligo, acne, rosacea, atopic dermatitis, eczema, alopecia areata, and bullous dermatoses.[1-5] The term microbiota refers to a group of commensal, symbiotic, and pathogenic microorganisms that inhabit a defined environment, whereas microbiome refers to bacteria, viruses, fungi, genes, and their surrounding metabolites.[6] Humans acquire their microbiota at birth, and it is fully developed by the age of three.[7,8] The dominant intestinal bacterial phyla in adults are Firmicutes and Bacteroidetes (approximately 90%), followed by Proteobacteria, Fusobacteria, among others. Dysbiosis is a condition characterized by the loss of beneficial microorganisms or an increase in harmful microorganisms.[1,7,8]

This study contributes to the literature by providing new evidence on intestinal dysbiosis and dermatologic diseases, including the most prevalent conditions (psoriasis and atopic dermatitis), demonstrating that treatment with probiotics and prebiotics improves disease severity scores and quality of life indices.

MATERIALS AND METHODS

A literature search was conducted in PubMed, ScienceDirect, and Google Scholar, including articles published between January 2019 and October 2024 that identified and analyzed dermatologic diseases associated with dysbiosis and matched the predefined search terms. Studies published in English and Spanish were included, encompassing observational, analytical, prospective, and retrospective studies, as well as clinical trials, case-control studies, and cohort studies. Abstracts and letters to the editor were excluded.

The search terms used were "Dysbiosis," "Dermatopathy," "Dermatosis," "Cutaneous disease," "Skin disease," and "Cutaneous diseases".

This systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Additionally, the Methodological Expectations of Cochrane Intervention Reviews (MECIR) were followed during the review process, Chapter III.[9]

RESULTS

Two review authors independently extracted the data and assessed the risk of bias using the Cochrane Risk of Bias Tool for randomized clinical trials and the ROBINS-I tool for non-randomized studies.

A comprehensive search for relevant studies was conducted in the following databases: PubMed (23 results), ScienceDirect (115 results), and Google Scholar (130 results). The initial search was performed on October 14, 2024, and updated the following day.

The following flow diagram illustrates the progression from the initially identified records to the studies included in the review. Eleven studies met the inclusion criteria (PRISMA flow diagram). (Figure 1)

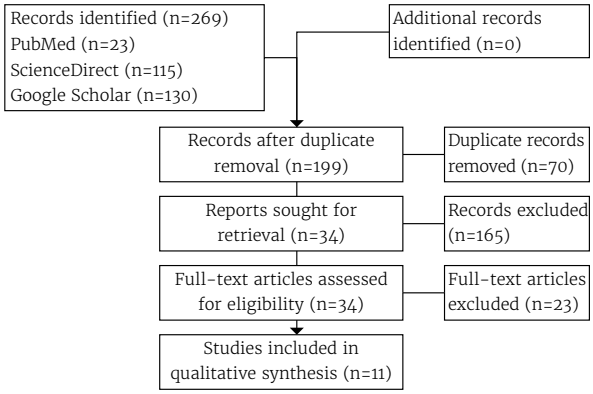


Imagen 1.

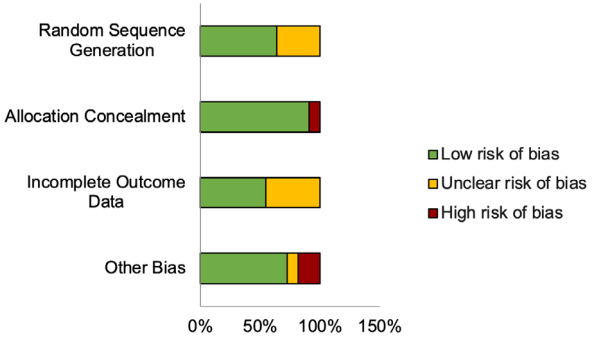


Imagen 2.

STUDY	RANDOM SEQUENCE GENERATION	ALLOCATION CONCEALMENT	INCOMPLETE OUTCOME DATA	OTHER BIAS
Ana 2023	0,5	0	0,5	1
Buhas 2023	0,5	1	1	1
Bziouche 2023	0,5	1	0,5	0
D'Auria 2021	1	1	0,5	0,5
Guo 2023	1	1	1	1
Han 2024	1	1	1	0
Huang 2022	0,5	1	0,5	1
Martínez 2023	1	1	1	1
Moulodi 2021	1	1	1	1
Ramírez 2019	1	1	0,5	1
Yang 2024	1	1	1	1

Imagen 3.

Additionally, a thorough assessment of the risk of bias was conducted for each included study using appropriate tools according to study design. A general summary of the risk-of-bias assessments is presented below; 75% of the studies demonstrated a low risk of bias. (Figures 2 and 3)

Table 1: General description of the included studies and key characteristics

STUDY NAME, YEAR, AND COUNTRY	STUDY DESIGN	INTERVENTION DETAILS	POPULATION (SAMPLE SIZE, INTERVENTION/CONTROL GROUP SIZE)	OUTCOMES	DURATION
Type of Intervention: Probiotic treatment vs. placebo					
Martínez, 2024	RCT	Probiotic treatment vs. Placebo.	Adults; 128 patients assessed (90 included in the study: 46 in the probiotic group and 44 in the placebo group).	The probiotic group showed a lower relapse rate compared with the placebo group (20% vs. 41.9%).	2, 6 and 12 weeks
Buhas, 2023	RCT	Probiotics (Bacillus indicus [HU36], Bacillus subtilis [HU58], Bacillus coagulans [SC208], Bacillus licheniformis [SL307], Bacillus clausii [SC109]) and prebiotics (fructooligosaccharides, xylooligosaccharides, galactooligosaccharides).	Adults; 63 patients evaluated (42 in the intervention group and 21 in the control group).	Patients receiving probiotics and prebiotics showed improvements in measures of disease activity.	12 weeks
D'Auria, 2021	RCT	Lactobacillus paracasei vs. placebo (oral intervention).	Infants; 60 participants (30 in each group).	No significant differences were observed.	12 weeks
Costas, 2019	RCT	Probiotic vs. placebo (oral administration, 12 weeks).	Adults; 50 participants (24 in the placebo group and 26 in the probiotic group).	Significant improvement was observed in the probiotic group.	4, 8, and 12 weeks
Martínez, 2023	RCT	Probiotic formulation vs. Placebo.	Adults: 90 patients (18–70 years) with mild-to-moderate plaque psoriasis.	PASI 75 was achieved by 66.7% of the probiotic group and 41.9% of the placebo group ($p < 0.05$).	12 weeks
Moludi, 2021	RCT	Probiotic beverage supplementation (Lactobacillus) vs. Placebo.	50 patients with plaque psoriasis.	Significant improvement in quality-of-life scores (DLQI) and depression scores (BDI) in the probiotic group. Improvements were also observed in PASI and Perceived Stress Scale (PSS) scores.	8 weeks
Comparative Analysis of Intestinal and Cutaneous Microbiota					
Bzioueche, 2021	RCT	Comparative analysis of gut and skin microbiota (lesional and non-lesional) in patients with vitiligo.	Adults; 20 participants (10 patients with vitiligo and 10 healthy controls).	Dysbiosis was observed in both gut and skin microbiota.	
Han, 2024	Prospective observational study.	Fecal sample collection and 16S rRNA gene sequencing.	38 healthy controls (HC), 32 patients with bullous pemphigoid (BP), and 19 patients with pemphigus vulgaris (PV).	Differences in gut microbiota composition were observed among BP, PV, and healthy controls.	
Guo, 2023	Cross-sectional observational study.	Fecal sample collection, metagenomic sequencing, and LC–MS-based metabolomics analysis.	43 patients with pemphigus and 26 healthy controls.	Alterations in gut microbiota composition and metabolomic profiles were observed in patients with pemphigus compared with healthy controls.	
Type of Intervention: Fecal microbiota transplantation (FMT)					
Huang, 2022	Single-arm pilot clinical trial.	Encapsulated fecal microbiota transplantation (FMT) from healthy donors.	20 patients with active systemic lupus erythematosus (SLE).	Reduction in SLEDAI-2K scores and decreased anti-dsDNA antibody levels were observed.	12 weeks
Type of Intervention: Treatment with immunomodulators					
Yang, 2024	RCT	Dupilumab treatment vs. control group (no treatment).	44 patients with atopic dermatitis and 48 healthy controls.	Significant improvement in gut microbiome dysbiosis, with increased colonization by Bifidobacterium and Ruminococcus. Improved expression of genes related to tryptophan metabolism was also observed.	16 weeks

- CBA: Controlled before-and-after study
- MA: Meta-analysis of standardized effect sizes
- ED: effect direction
- RCT: randomized controlled trial
- PASI: Psoriasis Area and Severity Index
- SCORAD: SCORing Atopic Dermatitis
- SLE: Systemic lupus erythematosus
- DLQI: Dermatology Life Quality Index

cRCT: cluster randomized controlled trial; ITS: interrupted time series; MVPA: moderate-to-vigorous physical activity; RCT: randomized controlled trial.

The review included studies comparing microbiota-based interventions (probiotics, fecal microbiota transplantation, and microbiota analysis) with placebos or controls in adult populations with conditions such as psoriasis, pemphigus, systemic lupus erythematosus (SLE), and atopic dermatitis. Outcomes of interest were grouped into critical and important categories based on their clinical relevance.

Placebo-controlled studies, such as that by Costas (2023), reported that probiotic treatments significantly reduced the relapse rate of psoriasis. Similarly, Buhas (2023) identified improvements in disease activity measured by the Psoriasis Area and Severity Index (PASI) and enhanced quality of life assessed by the Dermatology Life Quality Index (DLQI) following the administration of probiotics and prebiotics (Bacillus spp. and oligosaccharides). D'Auria (2021) and Ramírez (2019) found that intervention with Lactobacillus paracasei reduced disease severity according to the Scoring Atopic Dermatitis (SCORAD) index at different time points (4, 8, and 12 weeks). Moludi (2021) documented improvements in PASI, DLQI, and stress levels assessed by the Perceived Stress Scale (PSS) following probiotic treatment. (Table 1)

Studies with healthy controls: Bzioueche (2021) reported a reduction in dysbiosis and clinical improvement in patients following microbiota analysis. Guo (2023) observed changes in microbiota composition in patients who underwent fecal microbiota transplantation. Han (2024) confirmed differences in microbiota profiles through rRNA sequencing, suggesting intervention-associated changes.

Other comparisons: Yang (2024) compared the use of dupilumab versus no treatment and reported significant improvements in gut microbiota diversity and disease severity, as measured by the Eczema Area and Severity Index (EASI), over a 16-week period. (Table 1) The included studies varied in design, ranging from randomized controlled clinical trials to cross-sectional studies, with populations primarily consisting of patients with dermatologic conditions (such as psoriasis and atopic dermatitis) as well as healthy controls. Overall, treatments involving probiotics and prebiotics demonstrated a reduction in psoriasis flare-ups and improvements in patients' quality of life, measured using scales such as PASI and DLQI. (Table 2)

Regarding clinical outcomes, treatments with Lactobacillus paracasei and oral probiotics demonstrated a positive impact on skin conditions, with a reduction in SCORAD scores. However, studies focusing on the microbiome—such as those employing fecal microbiota transplantation—showed significant improvements in gut microbiota composition, which may contribute to clinical improvement.

It is noteworthy that most studies (particularly randomized controlled trials) reported significant improvements in clinical indices such as SCORAD, PASI, DLQI, and others, associated with probiotic supplementation and fecal microbiota transplantation. These interventions have shown promise in reducing symptoms and improving quality of life in dermatologic and immunologic conditions. None of the studies reported serious adverse events related to the interventions, further supporting the safety of these therapies.

It should be noted that several studies had relatively small sample sizes and lacked conclusive data regarding complete remission rates.

DISCUSSION

In a systematic review published in 2021, Zeng evaluated the effects of probiotics versus placebo in psoriasis, demonstrating significant improvement as assessed by the Psoriasis Area and Severity Index (PASI), along with reductions in C-reactive protein (CRP) and tumor necrosis factor-alpha (TNF-α), although no significant changes were observed in interleukin-6 (IL-6). In contrast, our study revealed improvements in inflammatory markers associated with this dermatosis, evidenced by reductions in IL-6, TNF-α, and IL-17.[1,10,11]

Yajia Li, in a meta-analysis published in 2024, reported significant improvements in PASI scores along with reductions in inflammatory markers. Similarly, our study

Table 2: Summary of study descriptions, analyses, interventions, and outcomes.

AUTORES	DISEÑO DE ESTUDIO	RIESGO DE SESGO	INTERVENCIONES	NÚMERO TOTAL DE PARTICIPANTES	RESULTADOS PRINCIPALES	EFECTOS ADVERSOS GRAVES	MEJORA DE SÍNTOMAS	TASA DE CURACIÓN	CURACIÓN TOTAL
Martínez 2024	RCT (doble ciego, controlado con placebo)	Medio	Probiótico vs. placebo	128	Menor tasa de brotes en el grupo probiótico (20% vs 41.9%).	Pocos efectos secundarios	Mejor respuesta clínica en grupo probiótico	No especificada, mejores resultados con probióticos.	No especifica
Buhas 2023	Estudio abierto, unicéntrico, no aleatorizado (2:1)	Medio	Pro y prebiótico	63	Mejora en PASI, DLQI y marcadores inflamatorios.	No reportados	Mejoría clínica notable	No especificada	No especifica
Bzioueche 2021	Estudio diagnóstico	Medio	Análisis de microbiota cutánea e intestinal	20	Disbiosis en microbiota intestinal y cutánea; implicaciones inmunológicas y mitocondriales.	No reportado	No evaluada	No abordada (estudio diagnóstico)	No abordada (diagnóstico)
D´Auria 2021	RCT (doble ciego, controlado con placebo)	Medio	Lactobacillus paracasei vs. placebo	60	Reducción en SCORAD en ambos grupos, sin diferencias significativas.	No reportados	Leve mejora en dermatitis atópica	Sin diferencias significativas	No alcanzada
Costas 2019	RCT (doble ciego, controlado con placebo)	Medio	Probiótico vs. placebo	50	Mejoras significativas en SCORAD a partir de la semana 4.	No reportados	Mejora significativa	No especificada	Mejora clínica significativa
Guo 2023	Estudio transversal, observacional	Bajo	Análisis de microbiota y metaboloma	43	Alteraciones en microbiota intestinal y metaboloma, disminución de bacterias anti-inflamatorias.	No reportados	No determinada	No abordada (biomarcadores diagnóstico)	No determinada
Han 2022	RCT (doble ciego, multicéntrico)	Bajo	Suplementación probiótica vs. placebo	85	Mejoras en índices de severidad y calidad de vida a las 8 semanas.	No observados	Reducción significativa en SCORAD y DLQI.	No especificada	
Huang 2024	Estudio piloto (único brazo)	Bajo	Trasplante de microbiota fecal	20	Reducción en SLEDAI-2K, respuesta SRI-4 (42.12% a 12 semanas).	No observados	Mejora de microbiota y biomarcadores	No especificada	Mejora de biomarcadores
Martínez 2023	RCT (doble ciego, controlado con placebo)	Bajo	Preparado probiótico vs. placebo	90	66.7% del grupo probiótico alcanzó PASI 75; mejoría en PGA.	No reportados	Mejora en PASI y reducción de recaídas	No especificada	No total, menor riesgo de recaídas
Moludi 2021	RCT (doble ciego, controlado con placebo)	Bajo	Bebida probiótica (Lactobacillus) vs. placebo	50	Mejoras en DLQI, BDI, PASI y PSS; reducción de inflamación y aumento en TAC.	No reportados	Mejora significativa en calidad de vida	No especificada	No total, mejora significativa
Yang 2024	Cohorte observacional (16 semanas)		Dupilumab vs. sin tratamiento	44	Mejora significativa en disbiosis y síntomas de dermatitis atópica.	No reportados	Mejora en disbiosis y dermatitis	No especificada	Mejora significativa

demonstrated improvements in microbiota composition, particularly with an increase in Lactobacillus genera.[12–16]

In her 2020 systematic review, Camila Stofella reported reductions in SCORAD scores and pruritus in atopic dermatitis. Enrique Limoli (2008) not only demonstrated a decrease in SCORAD but also reductions in immune translocation and lymphocyte activity. Our study likewise showed reductions in both SCORAD and DLQI scores, reflecting improvements in disease severity and quality of life.[17–21]

Li-Si, in a 2024 study on intestinal dysbiosis, reported clinical improvements in cutaneous conditions such as vitiligo, lupus, and pemphigus, suggesting alterations in gut microbiota composition associated with these diseases.[22–25]

Finally, fecal microbiota transplantation, mentioned in several publications—including the 2021 article by Jacob Mashiah entitled Clinical Efficacy of Fecal Microbiota Transplantation in Adults with Moderate-to-Severe Atopic Dermatitis—demonstrated a reduction in SCORAD scores in patients with atopic dermatitis. Liu Xiaochun, in a 2024 publication, reported that this therapy is highly effective in patients with moderate-to-severe atopic dermatitis, showing reductions in disease severity scales (EASI). In our review, improvement was also observed in conditions such as lupus.[26–30]

CONCLUSION

Modulation of the intestinal microbiota may reduce the severity of various inflammatory dermatoses, including psoriasis, vitiligo, and atopic dermatitis, among others. Furthermore, it leads to improvements in patients' quality of life and a reduction in inflammatory markers, such as various interleukins.

ACKNOWLEDGMENTS

No specific acknowledgments are presented in this article.

FUNDING

No specific funding was received from any public, commercial, or not-for-profit funding agency to carry out the work described in this article.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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