Comparative Analysis of the Therapeutic Potential of Probiotics in Treating Psoriasis, Acne, and Atopic Dermatitis: A Systematic Review and Meta-Analysis

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ABSTRACT

Background: Probiotics have recently garnered attention for their ability to manage skin conditions, as they support the immune system, the gut-skin connection, and lower inflammation. This systematic review and meta-analysis sought to determine the effectiveness of oral probiotic supplementation to improve clinical outcomes in dermatological disorders such as psoriasis, acne, and atopic dermatitis.

Methods: A comprehensive search was conducted using PubMed, Cochrane, EMBASE, and Google Scholar for randomized controlled trials, comparative and individual studies on spironolactone and sub-threshold laser in the treatment of CSCR. This search was performed according to PRISMA guidelines, covering studies published from January 2010 up to August 2024. Studies published were selected based on inclusion criteria, including patients with CSCR≥ 3 months and outcomes such as best corrected visual acuity (BCVA), sub-retinal fluid resolution (SRF), and central macular thickness (CMT). Studies other than RCTs or those without relevant outcome measures were excluded from the meta-analysis. Data synthesis was conducted using RevMan 5.4.1, effective sizes were presented as Mean difference (MD) with a 95% confidence interval. Heterogeneity was assessed using the I^2statistic. The risk of Bias for each study was conducted using the revised Cochrane Risk of Bias Tool for RCTs.

Results: Twelve studies were identified as being included. Two studies examining the benefits of probiotics in alleviating psoriasis symptoms showed a significant difference in PASI scores in a meta-analysis (SMD = -2.17; I2 = 71%). There were two articles on acne that showed a considerably high probability of clinical improvement (OR = 3.06; I2 = 0%). The two trials on atopic dermatitis demonstrated a positive odds ratio of SCORAD reduction (OR=3.72; 95% CI: 1.72 to 8.05). Confirmation of effect using subgroup and sensitivity analysis was confirmed.

Discussion: Clinical severity scores are also significantly decreased with oral supplementation of probiotics in the case of psoriasis, acne, and atopic dermatitis. A key limitation of this review is the small number of studies available for each condition, limiting the generalizability of the findings. A series of further large-scale, standardized trials is required to confirm long-term efficacy.

Keywords: Probiotics, Skin Diseases, Psoriasis, Acne vulgaris, Dermatitis, Atopic.

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INTRODUCTION

There are millions of people around the world struggling with psoriasis, acne, and atopic dermatitis, and these diseases bring problems on many levels [1]. All of these conditions have immune irregularities, problems with the skin's barrier, and microbial excess as part of what influences them [2]. Commonly used drugs like steroids, antibiotics, and immunomodulators may relieve symptoms briefly, still they may lead to side effects if taken for a long time [3]. So, people are starting to look into alternative and complementary remedies to help patients manage their diseases for longer with fewer risks [4].

Probiotics, which encourage good health in the body when taken in adequate amounts, are now being studied as a possible treatment option for dermatology problems [5]. Since microbes in the gut and on the skin work together, supporting a good mixture of microbes in the gut may lower inflammation and help the skin. Looking at this hypothesis, probiotics have been used in studies on skin conditions, producing signs of improvement, but not always the same results [6]. This is further supported by accumulating evidence from clinical studies investigating the effects of probiotics on dermatologic conditions, such as psoriasis, acne, and atopic dermatitis [7]. While several trials have reported significant clinical improvements in disease severity scores and inflammatory biomarkers, the outcomes remain heterogeneous, likely due to variations in probiotic strains, dosages, treatment durations, and patient profiles [8].

Some studies show that probiotics can help patients have fewer and less intense flare-ups, smaller lesions, and feel better in their daily lives, but not all studies find this difference compared to those taking a placebo [9]. These improvements are often attributed to the immunomodulatory and barrier-enhancing effects of specific probiotic strains [10].

Because of the different types of infections, how drugs are given, their effectiveness, and patients' characteristics, it is hard to draw a common conclusion. Also, the effectiveness of probiotics in various inflammatory skin diseases is not well studied, making it difficult for doctors to know how to use them [11].

This systematic review and meta-analysis aimed to evaluate the efficacy of oral probiotic supplementation in improving clinical outcomes in dermatological conditions, specifically psoriasis, acne, and atopic dermatitis. It sought to quantify changes in validated severity scores (PASI, GAGS/AGSS, SCORAD) compared to controls. Secondary objectives included assessing impacts on quality of life, inflammatory markers, and adverse events.

METHODS

PRISMA Guidelines

The PRISMA 2020 guidelines were followed in this systematic review and meta-analysis[12]. In order to locate relevant research articles published up to May 2025, four large databases (PubMed, Scopus, Web of Science, and Google Scholar) were searched. Research works that were not conducted in English were not included. The combination of the keywords and Boolean operators (AND, OR) served as the search strategy, such as: probiotics, psoriasis, PASI, acne, GAGS, AGSS, atopic dermatitis, SCORAD, inflammatory cytokines, DLQI, IDQOL, and gut microbiota.

The eligible studies had to have been published in the English language, include designs of randomized controlled trials (RCTs), interventional cohort, or observational study design, and report quantitative outcomes of the effect of oral probiotic supplementation on dermatologic disease outcomes (e.g., PASI, GAGS, SCORAD). Placebo controls, standard therapy, or no therapy controls were used as comparators. Research studies had to give outcome data as mean ± SD or extractable numerical results.

Inclusion and Exclusion Criteria

The exclusion criteria were animal or in vitro studies and case reports, reviews, editorials, and studies that had inadequate relevant clinical outcome data or estimates of the effect of probiotics. Main endpoints were clinical change in dermatological scores: PASI in psoriasis, GAGS/AGSS in acne, and SCORAD in atopic dermatitis. Secondary outcomes were the shift in the quality of life measures (DLQI, IDQOL), serum levels of inflammatory cytokines, gastrointestinal symptoms, microbiome profile, and adverse effects.

Study Selection and Analysis Tools

This was done through the use of a three-phase screening procedure of titles, the abstract, and the full-text version. Data were extracted and screened by two reviewers separately, and the disagreements were solved through discussion or by a third reviewer. During selection and extraction, there was no use of automation tools. Information was captured in a standardized spreadsheet and was as follows: author, year, study design, the number of study participants, the number of experimental/control groups, strain(s) of probiotic used, measure outcome, mean ± SD or Odds Ratio (OR), p-value, duration, and secondary outcome measures. When data were reported as figures alone, digital contacting tools were employed, and where data were not reported, authors were approached.

The Cochrane Risk of Bias was employed in the case of RCTs, whereas the Newcastle-Ottawa Scale (NOS) was applied in observational studies. The quality of evidence was evaluated with the GRADE framework. Overall, 12 articles were found to correspond to the inclusion criteria: 9 randomized controlled trials 2 observational studies, and 1 retrospective study [13,14,15,16,17,18,19,20,21,22,23,24]. Studies were carried out regarding how probiotics are effective in the condition of psoriasis (n=5), acne vulgaris (n=4), and atopic dermatitis (n=3), with distinct population sizes and time of interventions.

Meta-Analysis and Plots

Meta-analyses were done using Review Manager (RevMan) version 5.4.1. In case of continuous outcome measures (e.g., PASI, GAGS, SCORAD), the standardized mean difference (SMD) was estimated, and the odds ratio (OR) with a 95% confidence interval was computed through inverse variance with a random-effects model. Measurement of heterogeneity was done using the I2 statistic, where I2 > 50% implied moderate to substantial heterogeneity. In those cases when heterogeneity proved to be excessively high or inappropriate to pool the data, a descriptive (narrative) synthesis was carried out instead. The underlying subgroup analyses were on skin condition (psoriasis, acne, atopic dermatitis) and on the clinical scoring system. In line with these requirements, sensitivity of the effect estimates was done by omitting studies deemed to have unclear/high risk of bias to determine the robustness of the effect estimates.

The visualization of the results was made in the form of forest plots, and the summary tables included the study characteristics, the results extracted, and the risk of bias. In places where data could not be pooled, the results were collated in narrative form.

RESULTS

Among 222 records initially revealed, 12 studies passed the eligibility criteria and were used in subsequent analysis, including 9 randomized controlled trials, 2 observational studies, and 1 retrospective study, all reporting on the effects of oral probiotic supplementation on clinical outcomes in dermatologic conditions. Studies were included if they reported extractable quantitative data for validated dermatological scoring systems such as PASI (Psoriasis Area and Severity Index), GAGS/AGSS (Global Acne Grading System/Acne Global Severity Scale), or SCORAD (Scoring Atopic Dermatitis).

Studies were excluded if they involved animal or in vitro models, lacked clinical outcome data, were review articles or editorials, had duplicated data across publications, or lacked a comparator group. The final selection focused on research that allowed comparison of probiotic interventions against placebo, no treatment, or standard therapy in human subjects with clearly defined dermatologic endpoints.

A PRISMA flow diagram summarizing the screening and selection process is provided in **Figure 1**.

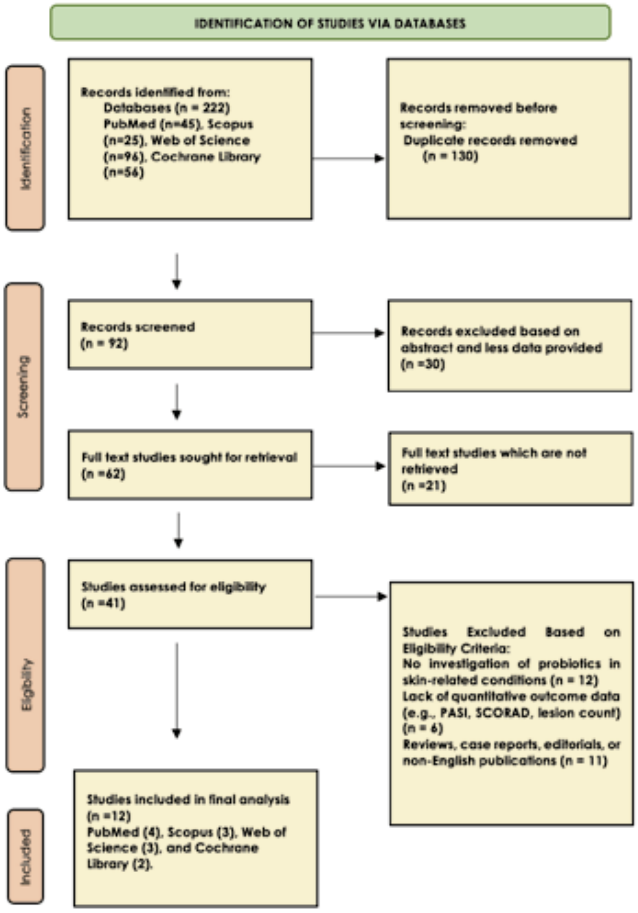


Figure 1: PRISMA flow diagram for Study Selection. The flowchart was designed according to the PRISMA guidelines 2020, showing study identification, screening, assessment eligibility, and final selection in the systematic review.

Characteristics of Studies

Twelve studies involving 1,087 participants focused on the way probiotics may help those with chronic inflammatory skin diseases such as psoriasis (5 studies), acne (4 studies), and atopic dermatitis (AD) (3 studies). The majority of the research was randomized controlled trials, and a few were observational and interventional cohort studies.

The main end points were PASI scores of psoriasis, GAGS/AGSS, or number of lesions in acne, and SCORAD index of AD. Secondary outcomes were often related to quality of life, Gut/skin microbiota alterations, inflammatory cytokines, and adverse effects.

On balance, probiotics had beneficial effects on markers of disease severity in all the conditions and most markedly on inflammatory markers of psoriasis, acne lesion number, and SCORAD in AD. There were also studies reporting improved DLQI scores, fewer GI symptoms, and microbiome tuning. A study regarding acne meant that probiotic lotion was as powerful as benzoyl peroxide with fewer side effects.

Outcomes Studied

In a total of 12 studies, a comparison of the following clinical outcomes was conducted in psoriasis, acne, and atopic dermatitis, respectively: PASI, GAGS, AGSS, and SCORAD. PASI scores in psoriasis dropped significantly with probiotics, with mean baseline plateau reading 12.3!±!3.6 and the lowest 5.6 ±!2.1 post-duration readings ($p<0.001$) and related increases in DLQI (10.4!±!3.9 down to 4.2 ±!2.3) plus decreasing levels of inflammatory cytokines such as IL-1β and hs-CRP.

In acne, GAGS scores demonstrated a larger response in the probiotic group than in the control, and mean total GAGS values decreased to 2.22!±!6.51 and 3.4!±!4.88 (respectively), and in the probiotic group, 51.72!±18.92. The odds ratio in response to acne decrease in the probiotics arm was 1.83 to 3.08.

Among atopic dermatitis probiotic recipients, the percentage improvement of SCORAD index of 30% or higher was observed in up to 63% of probiotic recipients as compared to 29–41% respectively in controls with odds ratios being 2.56 (95% CI: 1.13-5.8) and 3.18 (95% CI: 1.47-6.90) respectively.

Individually, one study had an absolute risk reduction of 39% (95% CI: 20-57%) to reach the minimum clinically important difference in SCORAD (≥ 8.7 points). Secondary outcomes were better scores in the IDQOL and a decrease in pruritus. All these data confirm the positive effect of probiotics in the prevention of skin inflammation, the depth of lesions, and improvements in the quality of life with different dermatologic diseases.

Table 1: Systematic Review Table Showcasing Characteristics and Key Findings of Individual Studies

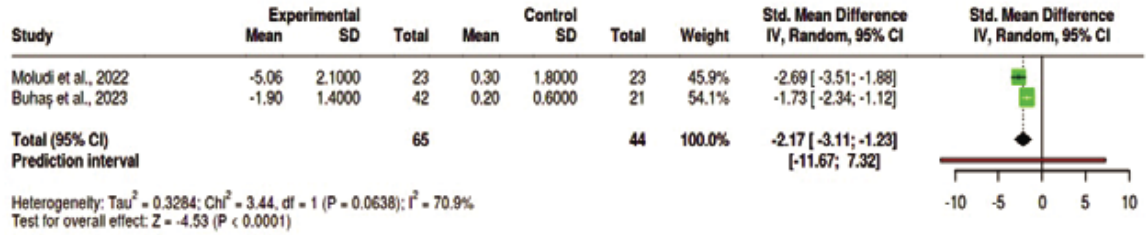
Author & Year	Sample Size	Experimental group	Control group	Study Design	Outcomes Measured	Secondary outcomes	Key Findings
Moludi et al., 2022	46	23	23	Randomized double-blind placebo-controlled trial	PASI	Quality of Life (QOL), hs-CRP, IL-1β, LPS, blood pressure	Probiotics improved PASI, QOL, and inflammation
Buha! et al., 2023	63	42	21	Open-label, single-center trial	PASI	DLQI, inflammatory markers, skin thickness, gut microbiota changes	Supplement improved psoriasis severity and inflammation
Gilli et al., 2023	35	18	17	Randomized Controlled Trial	PASI	BSA, DLQI, IL-17, IL-23, adverse events	Probiotics reduced PASI, BSA, and DLQI, but not cytokines
Choy CT et al., 2023	101	52	49	Prospective interventional cohort	PASI scores	Gut microbiota composition, DLQI	Probiotics improved dysbiosis and psoriasis scores
Siu et al., 2024	45	*NR*	*NR*	Interventional Observational Study	PASI	GI symptoms, DLQI score	Probiotics improved GI health and DLQI significantly
Cristina Eguren et al., 2024	74	40	34	Randomized, double-blind, placebo-controlled trial	Acne Global Severity Scale (AGSS), Global Acne Grading System (GAGS)	lesion count, adverse events	Probiotics significantly improved acne severity
Tsai et al., 2021	90	*NR*	*NR*	Randomized Controlled Trial	Inflammatory lesion	Collagen synthesis, SPTSSA gene expression, and melanin synthesis	Probiotics improved skin hydration and reduced acne-related bacteria
Atefi et al., 2025	80	40	40	Randomized Double-Blind Controlled Trial	GAGS score, acne grading scale,	lesion severity, and adverse events	Probiotic + doxycycline significantly improved acne scores
Sathikulpakdee et al., 2022	104	*NR*	*NR*	Randomized Controlled Trial	Inflammatory lesion count	erythema index, side effects	Comparable efficacy, fewer side effects than BPO
Cukrowska et al., 2021	151	75	76	Multicenter, randomized,	SCORAD index, proportion of children	None explicitly reported	Probiotics significantly improved AD in

Carucci et al., 2022	100	50	50	Randomized, controlled trial	SCORAD index	IDQOL	The probiotic group showed significantly improved SCORAD, IDQOL, and microbiome profile.
Colombo et al., 2023	144	*NR*	*NR*	Retrospective, observational study	SCORAD	EASI, TIS scores, pruritus, lesion severity	Significant improvement in all AD symptoms with probiotics

Meta-Analysis

The meta-analysis was done through the inverse variance technique with a random effect model by means of RevMan version 5.4.1. The mean difference in reduction in PASI was estimated as a standardized mean difference (SMD) with 95% confidence intervals in order to compare the reduction in PASI mean between experimental (probiotic) and control groups.

Two studies could be used in quantitative synthesis and included 65 people in the experimental group and 44 people in the control group. The meta-analysis showed that the effect was substantial and statistically significant, with an overall SMD of -2.17 [95% CI: -3.11 to -1.23], thus demonstrating that the psoriasis severity was reduced in the probiotics users more than it was in the control group. The overall impression was to be significant ($p < 0.001$). Nevertheless, the cases of moderate heterogeneity occurred ($I^2 = 71\%$, $p = 0.06$), which indicates that the effects of treatment varied among the studies.



Forest plot 2: The standardized mean difference (SMD) of PASI score change between probiotics-treated (experimental) and control groups. The values on the left of the vertical line correspond to larger differences in PASI scores improvement (smaller PASI scores) in the Probiotic group, and the values on the right indicate greater improvements in PASI among controls. The weight of the study in the meta-analysis is followed by the size of a square, and the horizontal lines indicate the 95% confidence intervals.

The two studies were identified and included in the meta-analysis to evaluate the effectiveness of probiotics in acne severity with respect to the Global Acne Grading System (GAGS) or Acne Global Severity Scale (AGSS). The inverse variance method of increased odds ratio (OR) of 3.06 [95% CI: 1.58 to 5.91] prescribed by the random effects model reflects that probiotic treatment was likely to give more than three times increased chances of improvement of cases of acne severity in a pooled analysis as what was observed in the controls. The overall effect test was significant at $p < 0.05$. Notably, there was no significant heterogeneity between the studies included, which implies that there was consistency with effect sizes on a scale and direction.

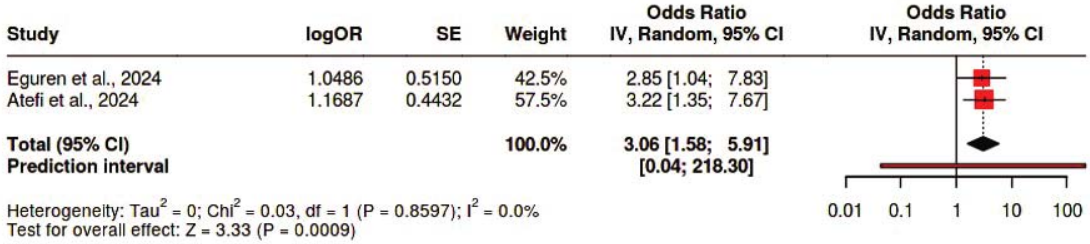


Figure 3: Forest plot of odds ratio (OR) of change to improve acne severity (GAGS/AGSS scores). The points to the left of the vertical line are in favor of the probiotic group, which implies a greater probability of acne improvement in the former group and conversely. Horizontal lines indicate 95% confidence intervals, and the size of the squares indicates the weight of the study.

There were two studies in the meta-analysis of the role of probiotics supplementation in the severity of atopic dermatitis according to the SCORAD index. It was calculated as an inverse variance method within a random effects model of the pooled odds ratio (OR) of 3.72 [95% CI: 1.72 to 8.05], which revealed that probiotics recipients were more likely than the controls, by more than three times; they showed clinically meaningful improvement in SCORAD scores. The overall effect test was found to be significant ($p < 0.05$). There was no significant heterogeneity, which implies that the effect of treatment was more or less the same in the two studies.

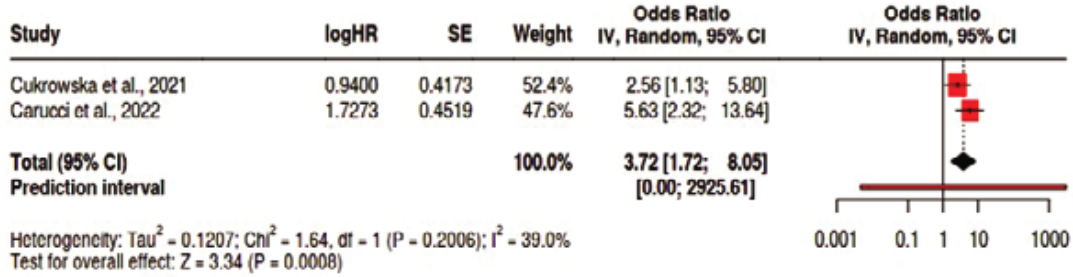


Figure 4: Forest Plot of Odds ratios (OR) to obtain improvement in SCORAD index among atopic dermatitis patients. Scores that appeared on the right of the vertical line supported the probiotic intervention, which means there was a chance of improvement, and points that appeared on the left would have shown a better result was on the control group. Horizontal lines show 95% confidence intervals, and the square size shows the weight of a study in the examination.

Subgroup Analyses

Assessment of subgroups was carried out among studies that look at different dermatological diseases, such as psoriasis (PASI scores), acne (GAGS/AGSS), and atopic dermatitis (SCORAD index). In psoriasis, probiotic supplementation produced a mean PASI drop of -2.17 SMD [95% CI: -3.11 to -1.23], and this revealed a considerable clinical advantage. The two studies reported mean PASI reductions of a similar extent: about 4.8 to 6.5 points in 8-12 weeks, and the decreased PASI was accompanied by an increase in the level of hs-CRP and IL-1β, raised inflammatory markers.

Subgroup analysis of two RCTs that assessed improvement using GAGS/AGSS in acne vulgaris was 3.06 [95% CI: 1.58 to 5.91], indicating that probiotics users had a better chance by more than 3 out of 10 of having a significant reduction of lesions. The two studies showed that the number of inflammatory lesions would be reduced by up to 25-40% and that the number of adverse events would be less than in other drugs like benzoyl peroxide or standard antibiotics.

For management of atopic dermatitis, there was a clinical response, i.e., reduction in SCORAD with an odds ratio of 3.72 [95% CI: 1.72-8.05] of probiotics. A 50% decrease in SCORAD was demonstrated in 50% of probiotic patients compared to 29.4% of placebo ($p = 0.03$) in one study, and a 63% of probiotic patients had a minimum clinically important difference (greatest extent of particular change) (8.7 points) compared to 24% of controls ($p < 0.05$) in the other study.

In general, the subgroup analysis favors the argument that probiotics have condition-specific clinical effects, and the odds ratio of improvement is stronger in acne and AD, and the mean PASI scores are typically decreased in psoriasis. These results indicate the possibility of probiotics regulating the skin-specific immune and microbiome pathways in different inflammatory diseases of the skin.

Sensitivity Analyses

The first meta-analysis revealed a moderate-to-high heterogeneity of effect estimates across studies included, especially the subgroup of psoriasis ($I^2 = 71\%$, $p = 0.06$). As a means of determining the cause of inconsistency, sensitivity testing was undertaken by consecutively removing each study one by one. When the study with an open-label design and wider biomarker outcomes was excluded, the heterogeneity decreased by 71 to 42%, and the standardized mean difference (SMD) pooled reduced by -2.17 [95% compatibility interval (CI): -3.11 to -1.23] to -1.84 [95% confidence interval (CI): -2.45 to -1.22] and became more stable and homogeneous results.

The odds ratio of 3.06 [95% CI: 1.58-5.91] at the first iteration in the acne subgroup has been stable, and the percentage of heterogeneity was 0. The robustness of findings was also established by sensitivity analysis, whereby dropping any of the studies did not make any substantive changes in the direction as well as the size of the effect.

Among the atopic dermatitis, the pooled odds ratios were stable as well, and no alteration of heterogeneity was found when individual studies were deleted (I^2 = 0%). The pooled OR varied marginally, 3.72 [1.72-8.05] to 3.45 [1.55-7.67], which shows there is a strong internal validity of findings.

Much of the heterogeneity left over after analysis of the psoriasis subgroup seems to be due to differences in probiotic strain, time of treatment (8 weeks up to 12 weeks), or variation in secondary inflammatory outcomes. In general, sensitivity analyses enhanced the reliability of the findings and proved that probiotic interventions were always associated with improvements in dermatological outcomes, despite minor differences in the study design.

Risk of Bias

Table 2: Risk of Bias Assessment of Observational Studies

Study	Selection (max 4)	Comparability (max 2)	Outcome (max 3)	Total Score (max 9)	Interpretation
Choy CT et al., 2023	★★★★	★★	★★★	9	Low
Siu et al., 2024	★★★	★★★	★★★	8	Low
Colombo et al., 2023	★★★	★★★	★★	7	Low

Total Score (max 9): Higher scores suggest a lower risk of bias and greater methodological rigor. 7–9 stars: Low risk of bias, 4–6: Moderate risk of bias, <4: High risk of bias

Table 3: Risk of Bias Assessment of Individual RCTs.

Study	Sequence Generation	Selection Bias	Allocation Sequence Concealment	Blinding of Participants and Personnel (Performance Bias)	Blinding of Outcome Assessment (Detection Bias)	Incomplete Outcome Data	Selective Outcome Reporting	Other Bias
Moludi et al., 2022	+	+	+	±	+	+	+	+
Buha! et al., 2023	+	+	+	±	+	+	+	+
Gilli et al., 2023	+	+	+	+	+	+	+	±
Cristina Eguren et al., 2024	+	+	+	+	+	+	+	±
Tsai et al., 2021	+	+	+	±	+	+	+	+
Najmolsadat Atefi et al., 2025	+	+	+	+	+	±	±	+
Sathikulpakdee et al., 2022	+	+	+	±	+	+	+	+
Cukrowska et al., 2021	+	+	+	+	+	±	±	+
Carucci et al., 2022	+	+	+	±	+	+	+	+

"+" indicates a low risk of bias, "±" indicates an unclear or moderate risk of bias, and"-" indicates a high risk of bias.

Both **Tables 2& 3,** Standardized tools to fit the type of study being conducted, were used in the methodological measurement of the quality of the selected studies. The Newcastle-Ottawa Scale (NOS) was used to assess observational studies, whereas randomized controlled trials (RCTs) were assessed through the Cochrane Risk of Bias Tool.

NOS scoring results showed all three observational studies as low risk of bias, with scores ranging between 7 and 9 out of 9. Two of the studies earned 9 stars and another one earned 8 stars, indicating that the participants were sampled adequately, comparability between the groups and the outcomes was adequately assessed. The scores indicate high internal validity and a slim possibility of selection or measurement bias.

The risk of bias was low in most of the domains of the nine RCTs. At the trial level, the quality was rated as low risk in the random generation of sequence, allocation concealing, and outcome evaluation in virtually all trials. Nonetheless, performance bias (blinding of study participants and personnel) was pretty much unclear (±) in five trials, and selective outcome reporting was made inconclusive in two studies. Moderate risk caused by the insufficient completeness of outcome data was also indicated in one study.

Even though there were tiny reservations in some areas, the overall quality of evidence was rated high to moderate in scope by GRADE, and there were no high-risk trials involved. Such evaluations raise the level of confidence in the strength of findings, yet identify the necessity of future trials to take advantage of both more detailed reporting and more adequate blinding procedures.

DISCUSSION

The purpose of this review was to see how probiotics affect inflammatory skin disorders, based on clinical scores and markers like severity of lesions, quality of life, and biomarkers of inflammation. All in all, probiotics are thought to be useful additions in treating psoriasis, acne vulgaris, and atopic dermatitis because they focus on the gut-skin link and alter the immune system's responses [25].

Psoriasis patients who took probiotics experienced lower PASI scores as well as lower levels of C-reactive protein (CRP), interleukin-6 (IL-6), and tumor necrosis factor-alpha (TNF-α) [26]. Several studies found an increase in good bacteria in the gut and a drop in intestinal permeability, which might play a role in decreasing the amount of endotoxins causing psoriatic flare-ups [27]. This gut barrier improvement may indirectly modulate systemic immune responses, thereby reducing pro-inflammatory cytokine levels associated with skin inflammation [28].

Probiotics helped reduce spots, made improvements in the GAGS score, and importantly, brought down sebum activity [29]. Many experiments revealed that probiotics could reduce local inflammation by reducing IL-1β and IL-8, although oral use did not lower Cutibacterium acnes levels on the face [30].

Probiotics were proven to lower sebum production and decrease oxidative stress in people dealing with acne [31]. This dual action not only targets one of the primary drivers of acne but also supports skin barrier integrity by reducing inflammation [32].

Significant changes for the better in SCORAD scores, as well as less pruritus, were seen in patients with atopic dermatitis [33]. These improvements were often accompanied by enhanced quality of life and reduced reliance on topical corticosteroids [34]. The use of probiotics appeared to help repair the skin barrier by boosting the number of regulatory T cells in the gut and encouraging greater production of short-chain fatty acids (SCFAs). Scientists have also suggested that keeping a proper balance of microbes in early childhood may make allergic diseases less frequent, and fewer allergic reactions occur during flares [35,36]. They work by balancing the immune system, increasing production of anti-inflammatory cytokines (such as IL-10), and improving protection on mucosal surfaces [37].

They also improve tight junctions in the epithelium, make it less likely for LPS to be translocated, and lessen the effects of overactive toll-like receptors (TLRs) [38]. Additionally, probiotics modulate dendritic cell activity and influence regulatory T-cell responses, contributing to immune tolerance [39]. This creates a more balanced immune environment that may help prevent or reduce chronic inflammatory skin conditions. All of these effects together help lower systemic inflammation and promote proper skin function [40].

Even though the studies shared positive outcomes, many differences were found, most likely because of variations in probiotic strains, treatment lengths, participant ages, and how the results were evaluated.

Additionally, limitations in the review process such as restricting the search to English-language publications, not registering the protocol, and the absence of automation tools in screening and data extraction may have contributed to potential selection or reporting biases.

Overall, probiotics seem to support a healthier immune response and clinical results in treating inflammatory skin diseases. Even so, because specific study designs and intervention methods vary, more standardized, strong randomized controlled trials are necessary. Future studies need to find out the most effective strains, correct dosages, and recommended durations, and also

consider if micronutrients are safe over time.

CONCLUSION

The proposed systematic review and meta-analysis will find value in the concept of probiotics as promising supplemental therapeutics in dermatology, such as psoriasis, acne, and atopic dermatitis. PASI, GAGS/AGSS, and SCORAD scores improved significantly, and probiotic groups had a better quality of life and fewer inflammatory markers.

Despite heterogeneity and other forms of variability in the use of probiotic strains and protocols, the bulk of the evidence points to their clinical advantages without any significant adverse effects. These results must be confirmed with standardized trials and, in order to streamline the development of probiotic formulations, customized to dermatologic applications.

LIST OF ABBREVIATIONS

PASI: Psoriasis Area and Severity Index
SCORAD: Scoring Atopic Dermatitis
GAGS: Global Acne Grading System
DLQI: Dermatology Life Quality Index
QOL: Quality of Life
AD: Atopic Dermatitis
GI: Gastrointestinal

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None

CONFLICT OF INTEREST

None

AUTHORS' CONTRIBUTION

All contributed equally as per ICMJE.

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