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REVIEW

Efficacy of Probiotic Supplements and Topical Applications in the Treatment of Acne: A Scoping Review of Current Results

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Abstract: Acne vulgaris is a prevalent dermatological condition characterized by comedones, papules, and pustules, with significant physical and psychological implications. Conventional treatments for this condition, including antibiotics and retinoids, face challenges, such as side effects and antibiotic resistance, necessitating alternative treatments. Recent studies show the potential of probiotics to modulate skin microbiome and alleviate acne symptoms. Therefore, this study aimed to consolidate evidence from randomized controlled trials (RCTs) and clinical investigations, evaluating the efficacy of probiotics in acne management. A comprehensive literature search was conducted across PubMed, Scopus, and Cochrane databases using several keywords, such as "probiotic", "microbiome", and "acne vulgaris". Inclusion criteria are RCTs and clinical studies from 2009 to 2024 examining probiotics for acne treatment. Studies were selected, screened, and analyzed based on population, intervention, design, and results. Descriptive statistics were used to summarize study characteristics. Fifteen studies including 811 participants met the inclusion criteria. The studies tested various oral and topical probiotics, including *Lactobacillus, Bifidobacterium, Bacillus*, and *Enterococcus* strains, over treatment periods ranging from 4 to 12 weeks. The results showed that probiotics, reduced acne lesions, improved skin barrier function, and decreased inflammatory markers. Both oral and topical probiotics showed potential in balancing skin microbiome and reducing acne severity. Some studies reported outcomes comparable to conventional acne treatments, such as antibiotics and benzoyl peroxide. However, there is variability in individual responses to different probiotic strains, and potential side effects, though rare, have been reported in some cases. Probiotics presented a natural, effective alternative to conventional acne treatment. However, future studies are needed to determine optimal treatment protocols.

Keywords: probiotics, skin microbiome, acne vulgaris, bacterial imbalance, inflammatory skin conditions

Introduction

Acne vulgaris is one of the most prevalent dermatological conditions globally, affecting individuals across diverse age groups and socioeconomic backgrounds.[1] This multifactorial disorder is characterized by the formation of comedones, papules, pustules, and, in severe cases, nodules and cysts. Furthermore, acne vulgaris significantly impacts both physical appearance and psychological well-being.[2] Despite the contribution of various factors to its pathogenesis, recent studies show the relationship between skin microbiome and acne development.[3,4]

Skin, a complex ecosystem hosting a myriad of microbial communities, plays an important role in maintaining cutaneous homeostasis.[5] However, perturbations in this delicate balance, termed dysbiosis, have been implicated in acne pathophysiology.[3] *Propionibacterium acne*, now recognized as *Cutibacterium acne (C. acne)*, has been a subject of particular interest due to the association with inflammatory acne lesions.[6] A previous study observed alterations in the

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relative abundance of other commensal and pathogenic bacteria in acne-affected skin, suggesting a broader dysregulation of skin microbiota.[7]

According to previous studies, the efficacy of current antibiotic treatments for acne has diminished due to increased resistance and reduced effectiveness,[8,9] leading to a shift toward novel treatment methods. Probiotics, live microorganisms known for conferring health benefits when administered in sufficient quantities, have surfaced as promising agents in rebalancing the microbiome and alleviating symptoms.[3,4] These probiotics have garnered increasing attention for the potential to modulate skin microbiota and mitigate inflammatory skin conditions, including acne vulgaris.[10]

While the benefits of probiotics have been extensively studied, concerns about potential side effects remain. Some studies have reported mild gastrointestinal discomfort, such as bloating or diarrhea, in individuals consuming certain probiotic strains.[11] However, the systemic absorption of probiotics applied topically is minimal, suggesting a lower risk of adverse effects.[12] Additionally, clinical trials examining the use of probiotics for acne management have shown minimal safety concerns, further supporting their potential as adjunctive therapies.[13]

Despite the evidence supporting the plausibility of probiotics as adjunctive therapeutic agents in acne management, a comprehensive evaluation of the efficacy, optimal strains, dosages, and mechanisms of action remains essential. This evaluation consolidates existing evidence from randomized controlled trials (RCT) or clinical studies to assess the potency of probiotics in enhancing microbiome balance and ameliorating acne vulgaris. Therefore, this study aimed to elucidate the potential of probiotics as a promising avenue for future treatment in modulating skin microbiome to alleviate acne-related manifestations.

Methods

A comprehensive search was conducted across PubMed, Scopus, and Cochrane, using keywords, such as "probiotic", "microbiome", "acne vulgaris", "clinical trial", and "randomized controlled trial" to identify relevant studies. The Boolean operators were adopted, using "OR" to expand the scope within each concept and "AND" to refine the search for pertinent results, aiming to capture a broad and focused selection of relevant studies. All original studies and clinical reports published from 2009 to 2024 regarding the use of probiotics in acne management were included. The inclusion criteria were original studies with RCT designs, as well as interventional and clinical studies investigating the efficacy of probiotics for acne treatment. Exclusion criteria were abstracts from conference proceedings, case reports, commentaries, editorials, and study protocols. Figure 1 shows a detailed selection process of studies.

The collected information included authorship, methods, country, population/sample size, intervention, study design, duration, and results regarding the role of probiotics in acne vulgaris. The results were analyzed, using a structured method to derive meaningful conclusions. Descriptive statistics were used to delineate the prevalence of specific study characteristics. The results were presented narratively, with extensive discussions to ensure the precision and reliability of the conclusions.

Results

The searches conducted on MEDLINE, Scopus, and Cochrane found 461, 164, and 97 records, respectively, and 722 registers. After eliminating 651 duplicates, 71 records were screened and 40 were identified for full-text assessment. In the final review, 15 studies were included. The selection process is shown in Figure 1 of PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flowchart.

Clinical studies collectively enrolled 811 subjects, with each sample size ranging from 20 to 112 per study. Most studies focused on subjects with mild to moderate acne. However, a few trials included more severe forms, such as inflammatory acne or papular pustular rosacea. The age of the subject varied widely, ranging from 12 to 62 years old.

The types of probiotics used in these studies were diverse, covering both oral and topical formulations. Oral probiotics included strains, such as *Lactobacillus plantarum, Lactobacillus reuteri, Lactobacillus rhamnosus, Lactobacillus casei, Lactobacillus salivarius, Lactobacillus acidophilus, Lactobacillus delbrueckii* subspecies

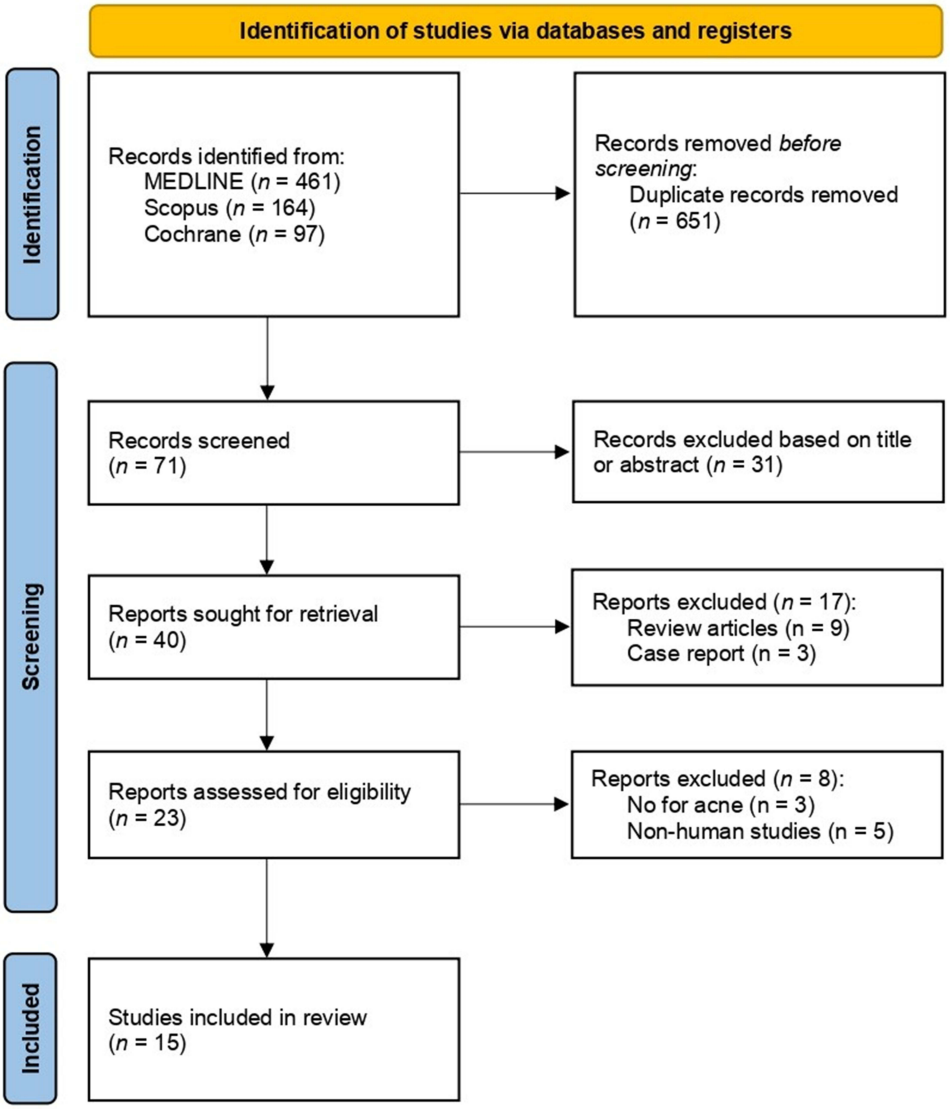

Figure 1 The flowchart of the study selection process.

bulgaricus, *Bacillus indicus, Bacillus subtilis, Bacillus coagulans, Bacillus licheniformis, Bacillus clausii, Escherichia coli* Nissle, the cyanobacterium *Arthrospira platensis, Bifidobacterium bifidum, Bifidobacterium breve*. Meanwhile, topical probiotics included strains, such as *Lactobacillus paracasei, Lactobacillus acidophilus, Lactobacillus salivarius, Lactobacillus plantarum, Lactobacillus rhamnosus, Lactobacillus pentosus, Enterococcus faecalis, Enterococcus faecalis* and *Bifidobacterium animalis*. Some trials combined probiotics with conventional treatments, such as benzoyl peroxide, isotretinoin, or minocycline.

The experimental periods varied, typically ranging from 4 to 12 weeks, with most studies measuring outcomes at intervals, namely 4, 8, or 12 weeks. Some studies also included shorter treatment periods, such as the 30-day intervention in Ukraine or the 4-week study conducted in Korea. The summaries of the studies on probiotics for acne vulgaris were presented in Tables 1 and 2 for oral and topical probiotics, respectively.

Table 1 Efficacy of Oral Probiotic Use in Acne Vulgaris Patients

No	Methods	Country	Population/ Sample Size	Intervention	Study Design	Time	Results	References
1.	Interventional study	Italy	Subjects aged >18 years with mild to moderate acne (30 subjects)	Oral supplement composed of biotin and 3 strains of lactic ferments (*Lactobacillus plantarum, Lactobacillus reuteri, Lactobacillus rhamnosus*) orally a day + topical gel composed of azelaic acid, hydroxypinacolone retinoate, and α-hydroxy acids.	Before (baseline) and after treatment (60 days)	60 days	There was a reduction of • 37.4% in the Global Acne Grading System (GAGS) Score. • 40.7% in the assessment of Seborrhoea using SEBUTAPEtm score. • 18% in the transepidermal water loss (TEWL) Score. • 44% in the T-Blue Test Score (for evaluation of the inflammatory state of oxidative stress).	[14]
2.	Prospective Placebo-Controlled Trial, Single Blind	USA	Subjects aged 19–62 years with acne (25 subjects)	Oral spore-based probiotic (*Bacillus indicus, subtilis, coagulans, licheniformis*, and *clausii*)	• First 4 weeks: placebo • Next 4 weeks: Oral spore-based probiotic (2 capsules per day)	8 weeks	• Probiotic supplementation decreased facial sebum excretion rates and increased TEWL. • Participants with acne experienced reductions in total, non-inflammatory, and inflammatory lesion counts, along with improved gut permeability markers. • Akkermansia levels increased in the gut microbiome of those without acne, while *Lachnospiraceae* and *Ruminococcus gnavus* levels rose in those with acne. • Probiotics also raised the circulating acetate/propionate ratio.	[15]

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3.	RCT, non-blinded prospective clinical trial	Ukraine	Subjects with acne, popular pustular rosacea, and seborrheic dermatitis (57 subjects: 37 in the treatment group, 20 in the control group)	Oral *Escherichia coli* Nissle	• Control group: Vegetarian diet + topical therapy (ointments containing tetracycline, steroids, and retinoids) • Treatment Group: Vegetarian diet + topical therapy + oral *Escherichia coli* Nissle (2 capsules daily, 1 month)	1 month	• The test group showed significant improvement or complete recovery in 89% of cases, compared to 56% in the control group ($p < 0.01$). • IgA levels significantly increased to normal values, and pro-inflammatory IL-8 was suppressed ($p < 0.01$ for both). • In the test group, 79% and 63% of patients exhibited a shift towards protective microbiota dominated by bifidobacteria and lactobacilli ($> 10^7$ CFU/g stool), respectively ($p < 0.01$), with no changes in the control group. • The detection rate of pathogenic flora in the test group decreased from 73% to 14% ($p < 0.01$), while the control group showed no significant changes (80% befor e and 70% after, $p > 0.05$).	[16]

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Table 1 (Continued).

No	Methods	Country	Population/ Sample Size	Intervention	Study Design	Time	Results	References
4.	Randomized, double-blind, placebo-controlled, clinical trial	Spain	Subjects aged 12–30 years with acne vulgaris (74 subjects: 34 in control group, 40 in treatment group)	Oral capsule composed of probiotic *Lacticaseibacillus rhamnosus* and the cyanobacterium *Arthrospira platensis*	• Control group: placebo • Treatment Group: oral capsules probiotic once daily	12 weeks	• Improvement on the Acne Global Severity Scale was seen in 50% of the treatment group vs 29.41% of the control group ($p = 0.03$). • Non-inflammatory lesions significantly decreased in the treatment group (–18.60) vs the control group (–10.54) ($p = 0.03$). • Total lesion reduction in the treatment group (–27.94) was nearly significant compared to the control group (–18.31) ($p = 0.06$). • 42.50% of the treatment group improved on the GAGS vs 20.58% of the control group ($p = 0.02$). • Adverse events were similar in both groups.	[17]
5.	Prospective, Randomized, Open-Label Trial	Canada	Subjects aged 18–35 years with mild to moderate acne (45 subjects)	Oral probiotics, which contain a combination of *Lactobacillus acidophilus, Lactobacillus delbrueckii* subspecies bulgaricus, and *Bifidobacterium bifidum*	• Group A: only probiotic twice daily • Group B: only minocycline ones daily after dinner • Group C: both probiotic and minocycline ones daily after dinner	12 weeks	• All patients showed a significant reduction in lesion count at 4 weeks ($p < 0.001$), with continued improvement ($p < 0.01$). • At 8 and 12 weeks, group C had a greater reduction than groups A ($p < 0.001$) and B ($p < 0.001$).	[18]

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6.	Randomized, Open-Label Trial	China	Subjects aged 18–30 years with acne vulgaris, had 20 to 50 facial lesions, graded III to IV per Chinese Acne Treatment Guidelines, and more than 10 inflammatory lesions (105 subjects)	Oral probiotic *Lactobacillus plantarum* MH-301	The baseline treatment was oral doxycycline for 4 weeks • Group I: Oral isotretinoin for 12 weeks • Group P: Oral Lactobacillus plantarum MH-301 for 12 weeks • Group IP: Combined probiotics and isotretinoin for 12 weeks	12 weeks	The combination of *Lactobacillus plantarum* MH-301 and isotretinoin significantly decreased the number of skin lesions compared to using each treatment separately ($p < 0.001$).	[19]
7.	Randomized, double-blind, four-arm, placebo-controlled clinical trial	Italy	Adult subjects with mild to moderate acne (112 subjects)	• Oral probiotics containing *Bifidobacterium breve, Lacticaseibacillus casei*, and *Ligilactobacillus salivarius* • Botanical extract (lupeol from *Solanum melongena* L. and Echinacea extract)	Subjects were instructed to take the supplements once a day after breakfast for 8 weeks. • Group I: placebo • Group II: study agent • Group III: botanical extracts • Group IV: probiotics	8 weeks	• Group II (study agent) showed a significant reduction (−56.67%) in superficial inflammatory lesions ($p < 0.05$), compared to group III (−40.00%), group IV (−38.89%), and placebo (−10.00%). • There were significant decreases in mean desquamation score, sebum secretion rate, and porphyrin count ($p < 0.05$), specifically in group II. • After 4 and 8 weeks, there was a significant decrease in *C. acne* and *Staphylococcus aureus* ($p < 0.01$) and an increase in *Staphylococcus epidermidis* ($p < 0.05$) in group II.	[20]

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Table 1 (Continued).

No	Methods	Country	Population/ Sample Size	Intervention	Study Design	Time	Results	References
8.	Randomised, double-blinded, placebo-controlled trial	Italy	Subjects with active inflammatory acne on their back (20 subjects)	Liquid supplement containing probiotic strain *Lactobacillus rhamnosus* SP1 (LSP1)	• Control group: placebo • Treatment group: LSP1 at a dose of 3×109 cfu/day (75 mg/day)	12 weeks	• Probiotic group showed a 32% decrease in IGF1 and a 65% increase in FOXO1 gene expression in skin (P<0.001), while no changes were seen in placebo group. • Patients in probiotic group were 28.4 times more likely to be rated as improved by physicians (95% CI = 2.2–411.1, P<0.05). • Supplementing with probiotic strain LSP1 normalizes skin insulin signaling genes and improves adult acne.	[20]
9.	Randomized, double-blind, placebo-controlled trial	Korea	Subjects aged 19–39 years with mild to moderate acne vulgaris (28 subjects)	An oral supplement containing probiotic *Lactobacillus plantarum* CJLP55	• Control group: placebo • Treatment Group: 1.0 _ 1010 CFU of *Lactobacillus plantarum* CJLP55 (CJLP55 group) daily for 12 weeks	12 weeks	• The CJLP55 supplement reduced acne lesions, sebum triglycerides, and increased skin hydration and ceramide 2, supporting skin lipid barrier, compared to the placebo. • It also lowered Proteobacteria, raised Firmicutes levels, and reduced the Bacteroidetes ratio, indicating improved bacterial balance. • No changes were observed in skin pH, other lipids, or urine bacterial EV phylum between the two groups.	[21]

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Table 2 Efficacy of Topical Probiotic Use in Acne Vulgaris Patients

No	Methods	Country	Population/ Sample Size	Intervention	Study Design	Time	Results	References
1.	RCT, Double Blind	Korea	Mild to moderate acne (20 subjects)	Topical Probiotic *Enterococcus faecalis* CBT SL-5	• Control Group: vehicle lotion on one side of the face • Treatment Group: *Enterococcus faecalis* lotion on the other side	4 weeks	• The mean improvement score was significantly higher on the test side compared to the control side at all time points (P<0,05). • The treatment success rate was higher on the test side (20,0%) than on the control side (5,0%) at weeks 4 and 6. • However, statistically significant differences were not found among the two groups (P=0,116).	[22]
2.	RCT	Thailand	Subjects with mild-to-moderate acne vulgaris (104 subjects)	Topical probiotic-derived lotion (*Lactobacillus paracasei* MSMC 39–1)	• Control group: 2.5% benzoyl peroxide • Treatment Group: topical probiotic-derived lotion (*Lactobacillus paracasei* MSMC 39–1)	4 weeks	• The inflammatory acne lesion counts and erythema index significantly decreased from baseline in both groups ($p < 0.001$), with no significant difference between the two ($p > 0.05$). • Four patients (7.69%) in the treatment group and 14 patients (26.92%) in the control group reported treatment-related side effects. • Probiotic-derived lotion is safe and effective for treating mild to moderate acne vulgaris, offering comparable results to 2.5% benzoyl peroxide.	[23]
3.	RCT	Taiwan	Subjects with acne vulgaris (20 subjects)	Topical probiotic with three strains TYCA06/AP-32/CP-9 (TAC) TYCA06 is a strain of *Lactobacillus acidophilus*, AP-32 is a strain of *Lactobacillus salivarius*, CP-9 is a strain of *Bifidobacterium animalis*	Patients treated with TAC/ Collagen probiotics	4 weeks	• The clinical trial results showed that TAC/ Collagen gel improved skin in vivo moisture score, reduced the inflammation index and accelerated the healing of acne-related wounds. It also diminished the appearance of brown patches and porphyrins on the face. • In vitro, TAC/Collagen postbiotics effectively suppressed the growth of *C. acne*, reduced TSLP and IL-33 inflammation, and enhanced wound healing in HaCaT cell cultures.	[24]

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Table 2 (Continued).

No	Methods	Country	Population/ Sample Size	Intervention	Study Design	Time	Results	References
4.	Interventional study	China	Subjects aged > 16 years with mild to moderate acne (22 subjects)	Topical lotion containing ferment lysate produced by *Lactobacillus plantarum* VHProbi R E15	Subjects applied the anti-acne lotion twice daily, with parameters measured at baseline and after 2 and 4 weeks	4 weeks	• After 2 weeks of treatment, acne lesions significantly improved from baseline ($P < 0.01$), with continued improvement through the study's end. • At 4 weeks, transepidermal water loss and sebum production were both significantly reduced ($P < 0.05$). • Additionally, slight improvements were observed in pore size and stratum corneum hydration in the treatment.	[25]
5.	Randomized, double-blind, placebo-controlled trial	Korea	Subjects aged > 12 years with mild to moderate acne (70 subjects)	Topical lotion containing probiotic *Enterococcus faecalis* SL-5 (CBT SL-5)	• Control group: placebo • Treatment Group: CBT SL-5 lotion was applied twice daily after cleansing: once in the morning and at least 1 hour before bed	8 weeks	Topical application of CBT SL-5 significantly reduced inflammatory lesions, such as pustules, compared to the placebo group ($P<0.05$).	[26]
6.	Randomized, open-label, double-blind placebo-controlled trial	Belgium	Subjects aged 12–33 years with acne and a minimum of nine inflammatory lesions (79 subjects)	Topical cream containing encapsulated lactobacilli	• Control group: placebo • Treatment Group: 108 CFU of live lactobacilli per application (±1 g/application) for 8 weeks twice daily	8 weeks	Topical probiotic cream was well tolerated and improved skin hydration, increasing by 37.3% after 14 days and 45.6% after 28 days, a rare benefit for acne treatment.	[44]

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Discussion

Acne is a multifactorial skin condition affecting millions globally, particularly during adolescence and adulthood. This condition arises from factors, such as excess sebum production, clogged pores, bacterial overgrowth, and inflammation.[27] Conventional treatments of acne, including antibiotics, retinoids, and benzoyl peroxide, are often effective but may lead to side effects, such as skin irritation and antibiotic resistance.[28–30] In recent years, probiotics have become an alternative and complementary option in acne treatment, promising fewer side effects while promoting skin health.

Probiotics are live microorganisms that confer health benefits by balancing microbial populations when consumed or applied to skin.[31,32] The mechanisms by which oral and topical probiotics address acne vulgaris differ but complement one another. Oral probiotics primarily function through the gut-skin axis and restore balance to the gut microbiome, reducing systemic inflammation that can increase the condition of acne[33,34] By promoting the growth of beneficial bacteria, such as *Lactobacillus* and *Bifidobacterium* species, oral probiotics help decrease the levels of pro-inflammatory cytokines and regulate immune responses, indirectly benefiting skin health. This reduction in systemic inflammation often leads to less sebum production and fewer acne lesions.[21] Meanwhile, topical probiotics function directly on skin by modulating the local microbiome. These probiotics compete with pathogenic bacteria, such as *C. acne*, reducing overgrowth and inflammation at the site of acne lesions. Topical probiotics enhance skin barrier function, increase hydration, and reduce irritation, creating a healthier environment for skin to heal.[20,35]

The most commonly used probiotics for acne vulgaris treatments are from the *Lactobacillus* strain, followed by *Bacillus, Bifidobacterium, Enterococcus*, and *Escherichia coli*. Lactobacillus strains were the most prevalent in the studies, showing substantial improvements in acne severity and skin condition. For instance, a study conducted in Korea showed that *Lactobacillus plantarum* CJLP55 significantly reduced acne lesions and improved skin hydration, enhancing skin lipid barrier.[36] *Lactobacillus rhamnosus* SP1 decreased Insulin-like Growth Factor 1 (IGF-1) levels and enhanced the expression of Forkhead Box O1 (FOXO1),[17] suggesting a modulation of insulin signaling pathways that may be relevant in acne pathogenesis.[37] Elevated insulin levels, often due to resistance, can increase the production of androgens (male hormones), thereby stimulating sebaceous glands to produce more sebum. Excess sebum can clog hair follicles, producing a conducive environment for the growth of *C. acne*, a key contributor to inflammation.[24] The study conducted in Spain showed that *Lactobacillus rhamnosus* and *Arthrospira platensis* caused significant reductions in inflammatory lesions.[38] This result showed the role of *Lactobacillus* in improving acne symptoms through both immune modulation and skin health enhancement.[34]

In topical administration, a study from Taiwan showed that topical formulation containing a combination of *Lactobacillus* strains improved the moisture score of skin and reduced inflammation.[25] This result supports the idea that topical probiotics may enhance skin barrier function and reduce acne-related inflammation directly at the site of application.[15,20] Moreover, the study from China featuring topical lotion containing ferment lysate from *Lactobacillus plantarum* showed significant improvements in acne lesions and reduced sebum production.[39] This result suggests that topical probiotics can exert direct effects on skin, improving local conditions and enhancing healing processes.

Previous studies using *Bacillus* strains showed positive effects on acne treatment. USA (United States of America) study found that oral supplementation with these probiotics decreased sebum excretion rates and also improved gut permeability markers, suggesting a systemic effect on skin health.[40] This result shows the potential of *Bacillus* probiotics to influence both local and systemic factors contributing to acne. However, this *Bacillus* strain has not been tested for topical administration.

In the context of *Bifidobacterium*, the study from Italy showed the effectiveness of probiotic formulation containing *Bifidobacterium breve*. The results showed a significant reduction in inflammatory lesions compared to control groups.[41] This suggests that *Bifidobacterium* strains may also play a crucial role in acne management, possibly through the modulation of the gut-skin axis. The strains help maintain a balanced gut microbiome, producing short-chain fatty acids (SCFAs) that possess anti-inflammatory properties, enhance intestinal barrier integrity, and reduce systemic inflammation connected to acne.[42,43] Additionally, these strains modulate immune responses, influence hormonal regulation related to insulin and androgens, and produce metabolites that support skin barrier function and hydration.[22,26] The gel preparation containing *Bifidobacterium* combined with *Lactobacillus* strains has been shown to improve the moisture score of skin

in vivo, reduce the inflammation index, and accelerate the healing of acne-related wounds.[25] It also diminished the appearance of brown patches and porphyrins on the face, which are connected to acne.[25] The mechanism behind this effect includes the ability of probiotics to enhance skin barrier by promoting ceramide production, which improves hydration and reduces transepidermal water loss (TEWL).[16,34] Additionally, probiotics modulate the immune response, reducing pro-inflammatory cytokines. In vitro, studies showed that this combination effectively suppressed the growth of *C. acne*, reduced pro-inflammatory cytokines, such as thymic stromal lymphopoietin (TSLP) and interleukin-33 (IL-33), and enhanced wound healing in human keratinocyte (HaCaT) cell cultures.[25]

Enterococcus faecalis was used in two studies, both showing the ability to improve acne lesions when applied topically. The first study showed significant improvement scores on the treated side compared to the control. However, the treatment success rate did not show a significant difference.[14] The second study showed a marked reduction in inflammatory lesions with topical application of *Enterococcus faecalis* SL-5.[18] The mechanism of action is believed to include the production of bacteriocins by *Enterococcus faecalis*, which target and reduce the population of *C. acne*, a key contributor to inflammation. This probiotic can modulate local immune responses by reducing the release of pro-inflammatory cytokines and promoting an anti-inflammatory environment, leading to reduced lesion formation and inflammation.[14,18] Meanwhile, in a study conducted in Ukraine, *Escherichia coli* Nissle contributed to significant improvement in acne outcomes alongside dietary changes. This result shows the potential of *Escherichia coli* to modulate skin health through the gut microbiome.[19]

In general, these trials show the potential of probiotics, either topically or orally, to significantly reduce acne lesions and inflammation, improve skin health, and restore a healthy skin microbiome. However, some showed comparable efficacy to conventional treatments, such as benzoyl peroxide and antibiotics. These results suggest that probiotics could be a safe and effective alternative or adjunct to conventional acne treatments.

Despite the promising effects of probiotics on acne treatment, there are potential side effects and limitations that should be considered. Some individuals may experience mild gastrointestinal discomfort, such as bloating or diarrhea, especially with oral probiotics, though these effects are typically transient and resolve with continued use.[11] Topically, while probiotics are generally well-tolerated, allergic reactions or skin irritation may occur in sensitive individuals.[12] Additionally, the variability in individual responses to different probiotic strains poses a challenge in determining the most effective formulation for acne treatment.[23] The need for further research to standardize dosages, strains, and administration methods is crucial to minimize these side effects and maximize the therapeutic benefits of probiotics in acne management. Furthermore, while probiotics may be beneficial for mild to moderate acne, their role in severe cases, where inflammation and bacterial resistance are more pronounced, remains uncertain and requires additional investigation.

Conclusion

In conclusion, the use of probiotics, both oral and topical, showed great promise as a treatment for acne. Oral probiotics modulated the gut microbiome and reduced systemic inflammation. Meanwhile, topical probiotics offered a direct, gentler method to balanced skin microbiome and reduced acne lesions. Advancements in studies showed that probiotics could become a mainstream treatment option for acne, offering a natural and effective alternative to conventional treatments. However, more standardized study was necessary to determine the most effective probiotic strains, combinations, and treatment regimens for different types of acne. While most studies highlighted the positive effects of probiotics, some limitations, such as strain-specific efficacy and variability in individual responses, must be addressed. Furthermore, the role of probiotics in managing severe acne requires additional investigation to assess their utility as an adjunctive therapy alongside conventional treatments.

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