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CASE REPORT

Effects of probiotics supplementation on reducing inflammation in burn patients : Evidence based case report

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Abstract

Background: Burn injuries cause significant physical trauma and complex inflammatory responses, accounting for more than 300,000 deaths per year. Probiotics may help modulate inflammation in burn patients by improving biomarkers such as hs-CRP and IgA levels. This case report aims to investigate the effect of probiotics supplementation on reducing inflammation in burn patients.

Methods & Materials: A literature search was on three large databases: PubMed, Cochrane Library, and Google Scholar. MeSH terms, advanced search, and eligibility criteria were used for title and abstract screening after removing duplicates. Critical assessment tools and levels of evidence of the final articles are based on the Oxford Center for Evidence-Based Medicine.

Results: Two randomized controlled trials (RCTs) met the PICO and eligibility criteria. One RCT found that probiotics supplementation significantly reduced hs-CRP levels (21.38 ± 44.45 vs 36.36 ± 79.03; **p < 0.001**) and improved wound healing in burn patients. The other RCT found that single and mixed strain probiotic administration significantly increased IgA levels ($p < 0.001$ and $p = 0.025$, respectively) in burn patients.

Conclusions: Probiotics supplementation demonstrates significant benefits in reducing systemic inflammation and enhancing immune function. Further research is necessary to provide recommendations of probiotic use in burn care.

Keywords: probiotic, inflammation, burn patients

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Case Scenario

Mr. TM, a 58-year-old male, was admitted to the High Care Unit with burn injuries on his face, arms, and legs sustained two days prior due to a gas stove explosion at his home. The injury accounted for 35% total body surface area with superficial dermal to full-thickness burns. His initial treatment included fluid resuscitation, antibiotics, pain management, and albumin supplementation. His primary survey indicated stable vital signs and no respiratory distress. The patient was assessed as having a normal weight with a risk of malnutrition (NRS 3). Several important inflammation markers such as leukocyte count (initially 14,600/µL, peaking at 24,640/µL on day 13), procalcitonin (initially 2.06 ng/mL), and albumin levels (initially 2.4 g/dL, dropping to 2.2 g/dL on day 13) were closely monitored. The patient was referred by a plastic surgeon to a clinical nutrition specialist to provide nutrition therapy and education appropriate for the patient's condition and to inquire whether probiotics can help improve the patient's inflammation process.

Introduction

Burn injuries represent a significant global health challenge, particularly in low- and middle-income countries where resources for specialized burn care may be limited. These injuries often result in severe physical trauma and complex inflammatory responses, increasing the risk of infections and eventual death. According to the World Health Organization, burn injuries account for approximately 300,000 deaths globally each year.[1,2] An epidemiological study conducted at the Burn Unit (ULB) of Dr. Cipto Mangunkusumo National Central General Hospital (RSCM) recorded a burn-related mortality rate of 25.8%, with the primary cause of death being septic shock.[2]

Previously, skin and soft tissue infections were considered the primary cause of sepsis in burn patients. However, recent research indicates that bacterial translocation from the intestines to the bloodstream is the main cause of sepsis. In burn patients, there is a dramatic increase in intestinal permeability, leading to an imbalance in intestinal flora and the translocation of microorganisms and/or their products from the gastrointestinal tract to extra-intestinal sites, resulting in systemic sepsis and multiple organ failure.[3–5]

Various treatment modalities have been investigated to prevent bacterial translocation and enhance immune function after thermal injuries. Recent studies have shown that probiotics may be beneficial as a potential adjunct therapy for modulating inflammation in burn patients, especially its major strains which include *Lactobacillus* and *Bifidobacterium* species.[4] These bacteria can maintain gut equilibrium and prevent bacterial translocation through several mechanisms, including maintaining the gut barrier function and inhibiting the growth of pathogenic bacteria through the production of organic acids and bacteriocin-like substances.[4,6]

Oral probiotic administration has been advocated for the treatment and prevention of a diverse range of disorders, such as antibiotic-associated diarrhea, inflammatory bowel disease, or after major abdominal surgery.[4] However, the probiotic effect has not been thoroughly examined in the clinical burn setting. Study by Zha et al.[7] has shown augmentation of the gut barrier with the use of probiotics in burn rat models. Study by Masoumi et al.[3] found aligned results with significant reductions in high-sensitivity C-reactive protein (hs-CRP) levels and increases in immunoglobulin A (IgA) levels. On the contrary, study by Wang et al.[8] found no significant difference in infection rates or clinical outcomes with probiotic administration in critically ill patients, including those with severe burns. Therefore, this study was undertaken to evaluate the effect of probiotics supplementation on reducing inflammation in burn patients.

Clinical question

P : Adult burn patients
I : Probiotic supplementation
C : Placebo
O : Inflammation

Clinical question: Could probiotics

supplementation reduce inflammation in burn patients?

Methods

Literature search was performed using combination of MeSH terms and Title/Abstract on three large databases: Pubmed, Cochrane Library and Google Scholar. Search was conducted on May 29th, 2025. The keywords used were probiotic, inflammation, thermal injury, and burn patients. Critical appraisal tools and determination of the level of evidence were created based on Oxford Centre for Evidence-Based Medicine.

Eligibility criteria

Inclusion criteria includes subjects over 18 years of age with burn injury, burn surface area ≥ 20%, received oral probiotics supplementation, study design was randomized controlled trial (RCT), *systematic review* or meta-analysis, has inflammatory outcome, published between year 2020 to 2024, and was written in English. Exclusion criteria animal study and article not available in full text.

Results

The authors found nine articles in the Pubmed database, 134 articles in the Cochrane Library and 61 articles in Google Scholar **(Table 1)**. Duplicates removal was performed using *Covidence*. The articles were assessed for eligibility based on PICO and eligibility criteria (**Figure 1**), resulting in the selection of two articles. The study characteristics of these articles were listed in **Table 2.** The level of evidence for these articles is presented in **Table 3,** and all the articles were found to be relevant for answering the clinical question (**Table 4**).

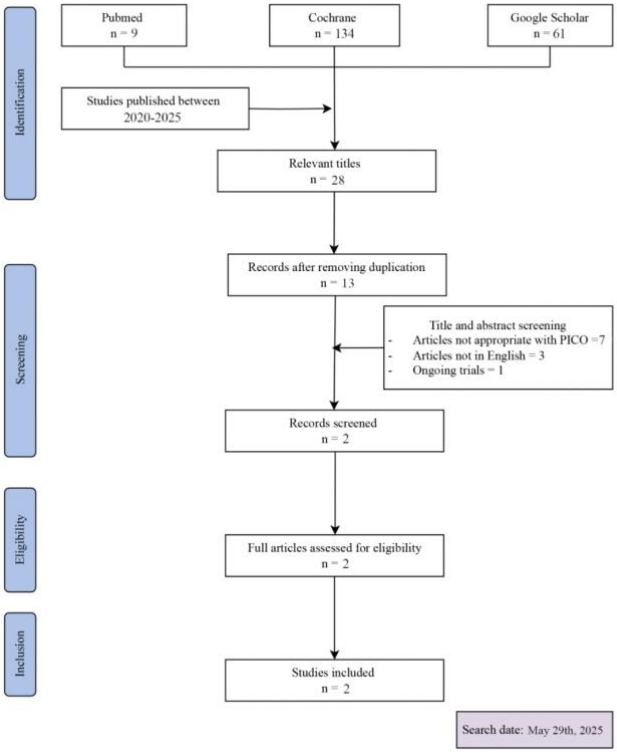

Figure 1. Prisma's Flow Chart

Table 1. Resources and search strategy

Database	Terminology	Hits	Eligible
PubMed	#1 ((probiotic[MeSH Terms]) OR (probiotics[MeSH Terms])) AND (probiotic[Title/Abstract]) #2 ((inflammation[MeSH Terms]) OR (inflammations[MeSH Terms])) OR (inflammation[Title/Abstract]) #3 (((burn[MeSH Terms]) OR (burns[MeSH Terms])) OR (thermal injury[MeSH Terms])) OR (burns[Title/Abstract]) #1 AND #2 AND #3	9	0
Cochrane	#1 MeSH descriptor: [Probiotic] explode all trees #2 (probiotic):ti,ab,kw (Word variations have been searched) #3 MeSH descriptor: [Inflammation] explode all trees #4 (inflammation)ti,ab,kw (Word variations have been searched) #5 MeSH descriptor: [Burn] explode all trees	13	2

	#6 (burn)ti,ab,kw (Word variations have been searched) #1 OR #2 #3 OR #4 #5 AND #6			
Google Scholar	allintitle: probiotic inflammation burn	73	2	

Table 2. Study characteristic

No	Author	Study design	Population characteristics	Number of subjects	Details of probiotic administration	Outcomes	Results
1	Masoumi *et al.* (2023)[3]	RCT, double blind	Adult participants with burn degree of 20-70% of total body surface area (TBSA), second degree with thermal burns, hospitalization within 24 hour post-burn, able to eat and drink through the mouth.	80	LactoCare® capsules containing *L. casei, L. acidophilus, L. rhamnosus, L. bulgaricus, B. breve, B. longum, S. thermophilus,* and prebiotic fructo-oligosaccharide. Given orally, twice daily for 14 days.	Level of inflammation status (hs-CRP and IgA)	Probiotic supplementation significantly mitigated inflammatory status. The hs-CRP reduced following probiotics (21.38 ± 44.45) consumption compared to placebo intake (36.36 ± 79.03) ($p < 0.001$). Also, the plasma level of IgA significantly increased in the intervention group (0.88 ±0.65) than in the control group (0.79 ± 0.18) ($p <0.001$).
2	Saputro *et al.* (2019)[5]	RCT, double blind	Adult participants with extensive burns ≥20% TBSA less than 24 hours after injury, could be fed orally and enterally during the study period.	17	Single strain: *L. acidophilus, B. longum, S. thermophilus.* Mixed train: *L. casei, L. rhamnosus, L. acidophilus, L. delbrueckii, B. breve, B. longum, S. thermophilus.* Given orally and enterally, once daily for 14 days.	Level of IgA and IL-6	Administration of probiotics significantly increased IgA levels from 1.01±0.67 to 1.89±0.98 mg/mL in the single strain group ($p<0.001$) and from 0.96±0.48 to 2.10±1.09 mg/mL in the mixed strain group ($p=0.025$). For IL-6, no significant changes were observed in the single strain probiotics group ($p=0.804$) or the mixed strain probiotics group ($p=0.683$).

CI, confidence interval; RCT, randomized controlled trial; TBSA, total body surface area; hs-CRP, high sensitive C-reactive protein; IL-6, interleukin-6; IgA, immunoglobulin A

Table 3. Validity criteria

	Study design	Number of patients	Randomization	Similarity treatment and control	Blinding comparable treatment	Domain	Determinant	Measurement of outcomes	Quality of evidence	Level of evidence
Masoumi *et al.* (2023)[3]	+	+	+	+	+	+	+	+	Moderate	1B
Saputro *et al.* (2019)[5]	+	+	+	+	+	+	+	+	Moderate	1B

* Quality of evidence according to GRADE guidelines, https://www.ncbi.nlm.nih.gov/pubmed/21208779
**Level of evidence according to Oxford Center of Evidence-based Medicine (CEBM), http://www.cebm.net.
+ clearly mentioned in the article; - not done; ? Not stated clearly
Systematic review and meta-analysis with troublesome heterogeneity

Table 4. Relevance criteria

Article	Similarity Population	Similarity determinant/intervention/indicators	Similarity outcome
Masoumi *et al.* (2022)[3]	+	+	+
Saputro *et al.* (2022)[5]	+	+	+

Discussion

In burn patients, a high level of pro-inflammatory cytokines stands as a critical component of the healing process.[9] The inflammatory process in burns is characterized by the immediate release of pro-inflammatory cytokines, such as tumor necrosis factor-alpha (TNF-α), interleukin-1 (IL-1), and interleukin-6 (IL-6). These cytokines are pivotal in orchestrating the inflammatory response, leading to vasodilation, increased vascular permeability, and the recruitment of immune cells like neutrophils and macrophages to the injury site.[10] This cytokine storm not only helps in containing the injury but can also cause systemic inflammatory response syndrome (SIRS) if excessive, contributing to complications such as multi-organ failure.[11]

The cascade of inflammatory responses triggered by burns is closely intertwined with disruptions in the gut barrier, which commonly manifest as increased intestinal permeability and bacterial translocation, thereby exacerbating systemic inflammation. The gut barrier plays a pivotal role in regulating homeostasis and preventing the translocation of harmful pathogens and toxins from the gut lumen into systemic circulation. Therefore, its impairment post-burn injury can significantly contribute to the systemic inflammatory burden experienced by burn patients.[3,5,6]

However, recent investigations have shed light on the potential therapeutic role of probiotics in ameliorating inflammation in burn patients. Probiotics, defined as live microorganisms conferring health benefits when administered in adequate amounts, have garnered attention for their ability to modulate the gut microbiota composition and enhance intestinal barrier function.[3,12] Notably, probiotics have been shown to exert anti-inflammatory effects by downregulating pro-inflammatory cytokines and reducing gut permeability in various clinical settings.[3,8]

The notable strains include *Lactobacillus fermentum*, *Lactobacillus delbrueckii*, *Lactobacillus acidophilus*, *Lactobacillus rhamnosus*, and *Lactobacillus casei*.[3,4] These probiotics help by maintaining the

gut barrier function, preventing bacterial translocation, and enhancing immune responses. Mechanisms include increasing intestinal acidity, motility, and mucin production, as well as inhibiting pathogenic bacteria through the production of organic acids and bacteriocin-like substances. They also stimulate cells of the innate immune system, boosting the activity of natural killer (NK) cells, macrophages, and lymphocytes.[5–8]

In an RCT by Masoumi et al.[3] involving 80 patients with 20-70% total body surface area burns, the use of probiotics significantly mitigated inflammation and improved wound healing. The study showed that patients receiving probiotics had a significant reduction in hs-CRP levels (21.38 ± 44.45 mg/L) compared to the placebo group (36.36 ± 79.03 mg/L, $p < 0.001$). Additionally, plasma levels of IgA significantly increased in the probiotic group (0.88 ± 0.65 g/L) compared to the control group (0.79 ± 0.18 g/L, $p < 0.001$). Although there was no significant difference in wound culture results between the groups, the incidence of bacterial colonization was slightly lower in the probiotic group ($p = 0.159$). Probiotics also accelerated wound healing, with a notable difference in the healed wound area by the end of the study period ($p < 0.001$).

Similarly, findings from an RCT by Saputro et al.[5] showed that the administration of single and mixed strain probiotics to severe burn patients (with more than 20% total body surface area burned) significantly increased serum levels of IgA. The study included 17 patients divided into two groups: one receiving a single strain probiotic and the other receiving mixed strains, both administered once daily for 14 days. IgA levels increased significantly from 1.01±0.67 to 1.89±0.98 mg/mL in the single strain group ($p<0.001$) and from 0.96±0.48 to 2.10±1.09 mg/mL in the mixed strain group ($p=0.025$).

Based on the critical review of the literature, the findings from both RCTs consistently demonstrate the potential benefits of probiotics in managing inflammation and improving outcomes in burn patients. The anti-inflammatory effects of probiotics are thought to occur via modulation of gut microbiota and the host immune response. Probiotics reduce intestinal permeability, decrease translocation of endotoxins, and suppress systemic inflammation by downregulating pro-inflammatory cytokines such as IL-6 and TNF-alpha. This results in decreased hepatic production of hs-CRP, an acutre-phase protein.[13-16] In addition, probiotics enhance mucosal immunity by stimulating the production of secretory IgA through activation of dendritic cells and B lymphocytes in gut-associated lypmnphoid tissue.[17-18]

Regarding the type of probiotics used, both single strain and mixed strain formulations showed significant increases in IgA levels in the study by Saputro et al.[5] However, the mixed strain group achieved a higher post-intervention IgA level (2.10 vs 1.89 mg/mL) and was more consistent with the findings of Masoumi et al.[3], who used a multistrain prodyct and demonstrated significant reductions in hs-CRP. There results suggest that mixed strain probiotics may offer broader immunomodulatory effects compared to single strain in burn patients.

It is also important to consider the role of nutritional status in modulating clinical outcomes among burn patients.[2,3,5] Although the patient in this case was categorized as “at risk” yet clinically well-nourished, nutritional adequacy, particularly energy and protein sufficiency, has been shown to support immune function, reduce catabolism, and facilitate wound healing. In the reviewed RCTs, while probiotic supplementation independently improved markers such as hs-CRP and IgA, these outcomes were likely optimized within the context of adequate nutritional intake.[3,5] Thus, the interplay between baseline nutritional status and probiotic efficacy cannot be overlooked, and future trials should better control for this variable.

The characteristics of patients included in these studies were similar to those of the case patient, suggesting that the research findings can be applied to the patient in this case as well. Probiotics supplementation demonstrated significant reductions in hs-CRP levels and increases in IgA levels.[3,5] These results support

the potential of probiotics in modulating inflammation and improving clinical outcomes in burn patients.

Conclusion

Probiotics supplementation emerges as a promising adjunctive therapy for burn patients, with evidence demonstrating its potential in reducing systemic inflammation and enhancing immune function. Based on the critical reviews of two RCTs included in this evidence-based case report, probiotics were effective in improving key inflammatory markers (hs-CRP and IgA) and promoting wound healing. While both single and mixed strain probiotics improve IgA levels, only mixed strains demonstrated consistent anti-inflammatory effects, suggesting a potential advantage in clinical use. Therefore, it is recommended to consider probiotics as part of the treatment strategy for the case patient and similar burn patients, with individualization based on inflammatory markers and gut health status. Nevertheless, the overall nutritional status of the patient may influence probiotic effectiveness, and its role should be considered in future protocols and research.

Limitations of this evidence-based case report include the small number of studies reviewed, variation in probiotic strains and dosages, and the lack of long-term outcome data. Further large-scale, placebo-controlled trials are needed to determine the optimal type, dose, and duration of probiotic therapy in burn care.

Conflict of interest

The authors declared no conflict of interest regarding this article.

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References

1. World Health Organization. Burns. WHO. 2023. Diakses pada 3 Juni 2024. Diakses dari: https://www.who.int/en/news-room/fact-sheets/detail/burns.
2. Wardhana A, Winarno GA. Epidemiology And Mortality Of Burn Injury In Ciptomangunkusumo Hospital, Jakarta: A 5 Year Retrospective Study. Jurnal Plastik Rekonstruksi. 2020 Jan 15;6(1):234–42.
3. Masoumi S, Mahdavi-Roshan M, Majidiniya A, Ghaffari ME, Pirdastan S, Hajian A, et al. Effect of probiotic administration in inflammatory responses of thermal burns. Eur J Inflamm. 2023;21.
4. El-Ghazely MH, Mahmoud WH, Atia MA, Eldip EM. Effect of probiotic administration in the therapy of pediatric thermal burn. Annals of Burns and Fire Disasters. 2016;268-73.
5. Saputro ID, Putra ON, Pebrianton H, Suharjono. Effects of probiotic administration on IgA and IL-6 level in severe burn patients: A randomized trial effects. Annals of Burns and Fire Disasters. 2019;10-21.
6. Putra O, Pebrianton H, Suharjono S, Iswinarno I, Rahayu D. The Role of Probiotics in Inflammatory Responses of Critically-Ill Burn Patients (A Randomized Clinical Trial). In Atlantis Press; 2017.
7. Zha X, Su S, Wu D, Zhang P, Wei Y, Fan S, et al. The impact of gut microbiota changes on the intestinal mucus barrier in burned mice: a study using 16S rRNA and metagenomic sequencing. Burns Trauma. 2023;11.
8. Wang K, Zeng Q, Li KX, Wang Y, Wang L, Sun MW, et al. Efficacy of probiotics or synbiotics for critically ill adult patients: A systematic review and meta-analysis of randomized controlled trials. Vol. 10, Burns and Trauma. Oxford University Press; 2022.
9. Rousseau AF, Losser MR, Ichai C, Berger MM. ESPEN endorsed recommendations: Nutritional therapy in major burns. Clinical Nutrition. 2013;32:497–502.
10. Afr S, Clin J, Prins N. Review: Nutritional management of the burn patient. Vol. 22, S Afr J Clin Nutr. 2009.
11. Ogunbileje JO, Porter C, Herndon DN, Chao T, Abdelrahman DR, Papadimitriou A, et al. Hypermetabolism and hypercatabolism of skeletal muscle accompany mitochondrial stress following severe burn trauma. American Journal of Physiology-Endocrinology and Metabolism. 2011;165–78
12. Mahmooud WH, Mostafa W, Abdel-Khalek AH. Effect of immune-enhancing diets on the outcomes of patients after major burns. Ann Burns Fire Disasters. 2021;192-6.
13. Plaza-Diaz J, Ruiz-Ojeda FJ, Gil-Campos M, Gil A. Mechanisms of action of probiotics. Adv Nutr. 2019;10:S49–66.

14. Azad MA, Sarker M, Li T, Yin J. Probiotic species in the modulation of gut microbiota: an overview. *Biomed Res Int*. 2018;94:78-90.
15. Wang Y, Wu Y, Wang Y, Xu H, Mei X, Yu D, et al. Antioxidant properties of probiotic bacteria. Nutrients. 2017;9(5):521.
16. Kobyliak N, Conte C, Cammarota G, Haley AP, Styriak I, Gaspar L, et al. Probiotics in prevention and treatment of obesity: a critical view. Nutr Metab (Lond). 2016;13:14.
17. Park JH, Um JY, Hong SH. Mechanism of immunomodulation by probiotics. J Biosci Bioeng. 2015;120(3):247–55.
18. Ouwehand AC. A review of dose-responses of probiotics in human studies. Benef Microbes. 2017;8(2):143–51.