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IMPACT OF ORAL PROBIOTIC THERAPY ON MODULATION OF SUBGINGIVAL MICROBIOTA AND RESPONSE TO CONVENTIONAL PERIODONTAL TREATMENT

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Pedro Guimarães Sampaio Trajano dos Santos[1], Luciano Barreto Silva[2], Rosana Maria Coelho Travassos[3], Alexandre Batista Lopes do Nascimento[4], Eliana Santos Lyra da Paz[5], Vanessa Lessa Cavalcanti de Araújo[6], Maria Regina Almeida de Menezes[7], Josué Alves[8], Maria Tereza Moura de Oliveira Cavalcanti[9], Carlos Fernando Rodrigues Guaraná[10] Kaick Mascarenhas de Santana Lima Silva[11]

[1] Undergraduate in Dentistry
Recife Dental School, Brazil
Recife – Pernambuco, Brazil
E-mail: pedroguimaraessampaio@gmail.com
[2] PhD in Endodontics
University of Pernambuco
Recife – Pernambuco, Brazil
E-mail: lucianobarreto63@gmail.com
[3] PhD in Endodontics
University of Pernambuco
Recife – Pernambuco, Brazil
E-mail: rosana.travassos@upe.br
[4] PhD in Dentistry
University of Pernambuco
Recife – Pernambuco, Brazil
E-mail: Alexandre.nascimento1@upe.br
[5] PhD in Biological Sciences
University of Pernambuco, UPE
Recife, Pernambuco, Brasil
E-mail: eliana.lyra@upe.br
[6] Professor at the University of Pernambuco
University of Pernambuco
E-mail: vanessa.lessa@upe.br
[7] PhD
University of Pernambuco, UPE
Recife, Pernambuco, Brasil
E-mail: regina.menezes@upe.br
[8] PhD
University of Pernambuco
Recife – Pernambuco, Brazil
E-mail: Josue.alves@upe.br
[9] PhD in Dentistry
University of Pernambuco
Recife – Pernambuco, Brazil
E-mail: tereza.moura@upe.br
[10] PhD in Biological Sciences
Federal Rural University of Pernambuco, UFRPE
Recife, Pernambuco, Brasil
E-mail: carlos.guarana@ufrpe.br
[11] Specialist in endodontics
Faipe College
Recife, Pernambuco, Brasil

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and Daniela Siqueira Lopes[12]

ABSTRACT
Objective: The objective of this narrative literature review article is to address the use of probiotics as an adjunct in the conventional treatment of periodontal diseases and how this remodels the subgingival microbiota. Methodology: The work of Rother (2007) was the study selected as a guide, an article that addresses systematic and narrative reviews, describing both, highlighting their characteristics and differences, contributing to the formation of the present study. In addition, to acquire the maximum amount of rich and scientifically proven information, searches were made in the following online databases: The Cochrane Library; ScienceDirect; Elsevier; COCHRANE; PubMed; Scielo and Google Academy. To acquire only articles and studies related to the topic addressed in the present study, the following keywords were used within the listed databases: Probiotics; Periodontitis; Periodontal Diseases; Microbiota. Results: Studies have analyzed the use of probiotics as an adjunct to periodontal treatment, where probiotic strains such as those of the Lactobacillus and Bifidobacterium genera have demonstrated the ability to reduce pocket depth in addition to increasing periodontal clinical parameters. The effects occur through mechanisms, through factors such as: competitive inhibition of periodontal pathogens, modulation of the host's immune response and the production of antimicrobial substances. Conclusion: Studies have shown promising results on the use of probiotics as adjuncts to conventional periodontal treatments; however, there is a clear need for more randomized clinical trials in order to establish a standardization on the use of these probiotics, in addition to studies that seek to analyze whether there are future consequences derived from the use of these probiotics.

Keywords: Probiotics. Periodontitis. Periodontal Diseases. Microbiota.

E-mail: drkaickmascarenhas@gmail.com
[12] PhD
University of Pernambuco
Recife – Pernambuco, Brazil
E-mail: daniela.siqueira@upe.br

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INTRODUCTION

Periodontal diseases are diseases that affect the periodontium, an essential structure for the teeth, composed of the protective periodontium (gums) and the supporting periodontium (alveolar bone, periodontal ligaments and cementum), structures that protect the tooth and maintain its stability in the mouth, allowing it to perform its functionality. Periodontal diseases are diseases that in the vast majority of cases are related to a lack or poor quality of oral hygiene, causing the oral microbiota to be deregulated, contributing to the formation of an environment conducive to bacterial development, where bacteria begin to proliferate, invading the human biological space and producing substances that are harmful to the body, triggering an inflammatory response, which if left untreated, may lead to wear of the periodontium, which may cause the tooth to lose its insertion in the alveolus, which in the long term may cause the person to lose their teeth affected by this pathology (dos Santos et al., 2025; dos Santos et al., 2024). Conventional treatment of periodontal diseases consists of mechanical debridement combined with the use of chlorhexidine-based oral rinses in order to remove pathogens and control the oral microbiota. However, in certain cases, recolonization of these pathogens can occur in a few short weeks or colonization of even more pathogenic pathogens can occur within a few months (TeughelS et al., 2007).

Probiotics are live microorganisms that in small quantities, administered in specific amounts, can be beneficial to the nutrition of the human body, in addition to helping to improve the health of the host in a systemic or local manner (Guarner et al., 2005). Probiotics, when administered orally, have a non-alcoholic content combined with a set of ingredients such as herbs, minerals, vitamins, amino acids, fruits and other types of added ingredients (Magno et al., 2019). These probiotics are commonly administered in different ways, through capsules, yogurt, milk, gum, tablets, ice cream and other different forms (Mcgee & Gould, 2003).

Probiotic bacteria can compete with bacteria that are harmful to the human body. This ability allows the use of probiotics to inhibit colonization, adhesion, and formation of pathogenic biofilm, which is beneficial to oral health as a whole. The reduction in colonization of periodontal pathogenic bacteria will also reduce the immuno-inflammatory cascade, which can help in the treatment of periodontal diseases. Thus, considering that probiotics can be beneficial in reducing periodontal pathogenic bacteria, the objective of this narrative literature review article is to address the use of probiotics as an adjunct in the

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conventional treatment of periodontal diseases and how this remodels the subgingival microbiota.

METHODOLOGY

During the construction of this narrative literature review article, it was seen the need to use a published and scientifically accepted work, a work that addresses how the structure, approach and characteristics of this type of article should be, in order to follow standards that are accepted in the scientific community, maintaining the proven scientific basis, raising the level of this work. Thus, the work of Rother (2007) was the study selected as a guide, an article that addresses systematic and narrative reviews, describing both, highlighting their characteristics and differences, contributing to the formation of the present study. In addition, in order to acquire the maximum amount of rich and scientifically proven information, searches were made in the following online databases: The Cochrane Library; Science Direct; Elsevier; COCHRANE; PubMed; Scielo and Google Academy. In order to acquire only articles and studies related to the topic addressed in the present study, the following keywords were used within the listed databases: Probiotics; Periodontitis; Periodontal Diseases; Microbiota.

RESULTS

PROBIOTICS: THERAPEUTIC BENEFITS, CELLULAR MECHANISMS, AND FUNCTIONAL ROLES

Probiotics are live microorganisms that, when administered in adequate amounts, confer health benefits to the host, acting both locally and systemically (FAO/WHO, 2002). In the context of oral health, especially periodontal health, probiotics have been investigated for their ability to modulate the subgingival microbiota, reduce inflammation and promote microbial homeostasis (Gruner et al., 2016). The mechanisms by which probiotics exert their therapeutic effects include:

1. Competition for adhesion sites with periodontal pathogens, such as Porphyromonas gingivalis, Tannerella forsythia and Aggregatibacter actinomycetemcomitans.
2. Production of antimicrobial substances, such as bacteriocins, lactic acid, hydrogen peroxide and biosurfactants that inhibit the growth of pathogenic microorganisms.

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3. Modulation of the immune response, promoting the production of anti-inflammatory cytokines (IL-10, TGF-β) and suppressing inflammatory mediators such as IL-1β, TNF-α and IL-6 (Teughels et al., 2008).
4. Stabilization of the epithelial barrier, through strengthening of intercellular junctions and induction of the production of mucins, antimicrobial proteins and defensive peptides (Matsubara et al., 2021).

Strains such as Lactobacillus reuteri, L. salivarius, L. rhamnosus and Bifidobacterium animalis are the most studied in periodontal health, with positive effects reported on clinical parameters such as probing depth, gingival bleeding index and clinical attachment gain (Ince et al., 2020; Seminario-Amez et al., 2020).

ADJUNCTIVE USE OF PROBIOTICS IN PERIODONTAL THERAPY: A CLINICAL AND MICROBIOLOGICAL PERSPECTIVE

Conventional periodontal therapy, focusing on scaling and root planing (SRP), still represents the basis for clinical control of periodontal disease. However, this approach alone may not be sufficient to restore the balance of the subgingival microbiota, especially in cases of advanced chronic periodontitis. Studies show that, after mechanical treatment, recolonization by pathogens can occur within weeks, especially in patients with aggravating systemic factors or persistent immune imbalance (Teughels et al., 2007). The introduction of probiotics as adjuvant therapy emerges in this scenario as an innovative bioecological tool. Unlike antibiotics, probiotics act through mechanisms that aim to reestablish eubiosis and not just eliminate pathogens. Among the benefits observed in the literature are:

1. Reduction in probing depth (PD).
2. Reduction in bleeding on probing (BS).
3. Improvement in bacterial plaque indices (PI).
4. Reduction of periodontal pathogenic species and increase of beneficial species (Twetman et al., 2009; Seminario-Amez et al., 2020).

In clinical studies, strains such as Lactobacillus reuteri (Krasse et al., 2006), L. salivarius and Bifidobacterium animalis have demonstrated efficacy in reducing inflammatory mediators such as IL-1β and TNF-α, in addition to modulating the host's immune system. The anti-inflammatory and immunoregulatory action is, therefore, complementary to the antimicrobial effect, which expands its applicability in patients with

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systemic periodontal disease, such as pregnant women (Dos Santos et al., 2024) and immunocompromised individuals (Bamashmous & Elfirt, 2025).

In addition, regular administration of probiotics can positively influence alveolar bone metabolism. A recent review (Dos Santos et al., 2025) indicated that probiotic microorganisms favor the maintenance of bone architecture by stimulating osteoblast differentiation and reducing osteoclast activity through regulation of the RANK/RANKL/OPG pathway. From a microbiological point of view, modulation of the subgingival microbiota occurs through the replacement of pathogenic species by oral commensals, such as Streptococcus sanguinis, Actinomyces naeslundii and Rothia dentocariosa, promoting the ecological stability of the biofilm (Teughels et al., 2008). This replacement favors the balance of the oral ecosystem, reduces the acidic pH generated by anaerobic bacteria and creates an environment less favorable to inflammation and tissue destruction. It is important to highlight that the effects of probiotics depend on factors such as: Route of administration (lozenges, capsules, gums, mouthwashes); Exposure time (minimum of 3 weeks);

1. Viability of the strain;
2. Frequency of use;
3. Patient's immune and nutritional status.

However, there are still limitations: oral colonization by probiotics tends to be temporary, requiring continuous or cyclical administration. In addition, existing studies present methodological heterogeneity, which makes clinical standardization difficult. Thus, the adjuvant use of probiotics represents a promising field for personalized periodontal therapy, with the potential to be integrated into preventive and therapeutic strategies in specific populations such as pregnant women, the elderly, diabetic patients, and individuals with special needs (Bamashmous & Elfirt, 2025; Dos Santos et al., 2024).

DISCUSSION

The use of probiotics as adjuvant therapeutic agents in periodontics represents an advance in oral medicine based on the microbial ecosystem. In contrast to traditional antibiotics, which act non-selectively and can compromise the beneficial microbiota, probiotics exert a modulating and restorative effect, promoting eugenobiosis. Despite the promising initial evidence, there are still substantial challenges to be overcome before their widespread adoption in clinical practice. One of the main obstacles is the variability between studies which differ in relation to the strains used, forms of administration, time of

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use, sampling and evaluation parameters. Methodological heterogeneity limits the extrapolation of results and requires standardized protocols in future investigations (Martin-Cabezas et al., 2016).

Another crucial point is the transient colonization of probiotics in the oral cavity. Many studies report that, despite the positive clinical effects, the administered strains do not remain permanently in the oral microbiota, which raises questions about the need for continuous use and long-term effects (Allaker, 2017). In addition, factors such as oral hygiene habits, diet, antibiotic use, systemic comorbidities (such as diabetes and autoimmune diseases) and smoking can negatively impact the efficacy of probiotic therapy, requiring a more individualized approach integrated with other therapeutic strategies.

From a translational perspective, the integration of personalized microbiological diagnostics and the selection of probiotics specific to the individual dysbiosis profile may represent the next frontier of precision periodontics.

CONCLUSION

Studies have shown promising results on the use of probiotics as adjuncts to conventional periodontal treatments; however, there is a clear need for more randomized clinical trials in order to establish a standardization on the use of these probiotics, in addition to studies that seek to analyze whether there are future consequences derived from the use of these probiotics.

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