



ARTICLE REVIEW

Advantages of the application of *Lactobacillus* and *Bifidobacterium* strains in oral hygiene

Ventajas de la aplicación de cepas de *Lactobacillus* y *Bifidobacterium* en la higiene oral

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ABSTRACT

Introduction: in modern dentistry, various strategies are used to prevent and treat oral diseases; these include, as an alternative, the use of probiotics such as *Lactobacillus* and *Bifidobacterium*.

Objective: analyze the current use of some probiotics in oral health care.

Methods: search engines such as PubMed, Scielo, Scopus and Google Scholar allowed the search for systemic reviews, meta-analyses, clinical trials, case reports published in a period of five years, using the following keywords: *Lactobacillus*, *Bifidobacterium*, caries, periodontal disease, probiotics. Inclusion and exclusion criteria were used to select literature.

Results: Some species of these bacterial groups have the ability to produce hydrogen peroxide (H₂O₂), a substance that acts as an antimicrobial agent, preventing the growth of harmful bacteria. Additionally, they effectively compete for cell adhesion sites in the oral cavity, making it difficult for harmful bacteria to attach and reproduce on tooth surfaces and gums. Probiotic organisms are capable of producing antimicrobials, competing for cell adhesion sites, modulating the immune system, and degrading toxins.

Conclusions: *Lactobacillus* and *Bifidobacterium* with probiotic attributes can be used in combination to prevent and treat oral diseases, such as dental caries and periodontal disease.

Keywords: Oral Health; Probiotics; *Lactobacillus*.

RESUMEN

Introducción: en la odontología moderna, se utilizan diversas estrategias para prevenir y tratar las enfermedades bucodentales, estas incluyen como alternativa el uso de probióticos como los *Lactobacillus* y *Bifidobacterium*.

Objetivo: analizar el uso actual de algunos probióticos en el cuidado de la salud bucal.

Métodos: motores de búsqueda como *PubMed*, *Scielo*, *Scopus* y *Google Scholar* permitieron la búsqueda de revisiones sistémicas, metaanálisis, ensayos clínicos, reportes de casos publicados en un período de cinco años, haciendo uso de las siguientes palabras clave: *Lactobacillus*, *Bifidobacterium*, caries, enfermedad periodontal, probióticos. Para la selección de literatura se utilizaron criterios de inclusión y exclusión.

Resultados: Algunas especies de estos grupos bacterianos tienen la capacidad de producir peróxido de hidrógeno (H₂O₂), una sustancia que actúa como agente antimicrobiano, lo que impide el crecimiento de bacterias dañinas. Además, compiten de manera efectiva por los sitios de adhesión celular en la cavidad oral, lo que dificulta que las bacterias nocivas se fijen y se reproduzcan en las superficies dentales y las encías. Los organismos probióticos son capaces de producir antimicrobianos, competir por sitios de adhesión celular, modular el sistema inmunológico y degradar toxinas.

Conclusiones: los *Lactobacillus* y *Bifidobacterium* con atributos probióticos pueden ser utilizados de manera combinada para prevenir y tratar enfermedades bucales, como la caries dental y la enfermedad periodontal.

Palabras clave: Salud Bucal; Probióticos; Lactobacillus.

INTRODUCTION

Oral diseases are currently a global public health problem. The WHO reports that they affect almost half of the population, and that three out of four affected people live in low- and middle-income countries. Oral diseases are caused by a variety of modifiable risk factors that are common to many non-communicable diseases, and there is a strong correlation between socioeconomic conditions and their prevalence and severity.⁽¹⁾

That is why, in modern dentistry, various strategies have been used to prevent and treat oral diseases, including the use of probiotics such as lactobacillus and bifidobacterium as an alternative, so more and more attention is being paid to their research and use in oral health.⁽²⁾

In the last ten years, probiotics have gained popularity and have been used to combat plaque, gingivitis and cariogenic bacteria, using them mainly as bacteriotherapy, and administration of *L. rhamnosus* SP1 has been shown to significantly reduce the progression of dental caries. Probiotics have the ability to generate antimicrobials, compete for cell adhesion sites, modulate the immune system and improve oral health. Studies in the field have focused on reducing the frequency of dental caries, improving the prognosis of periodontitis, and decreasing halitosis and candidiasis.⁽³⁾

The human oral cavity harbors a variety of microbial communities that live in the form of biofilms: highly ordered assemblages of microbes associated with the surface and embedded in an extracellular matrix. Oral microbial communities contribute to human health by adjusting immune responses and reducing dietary nitrates.⁽⁴⁾

Dental plaque is recognized as a polymicrobial biofilm, defined as a community of microbial cells embedded in an extracellular matrix, which grows at an interface between two phases of material, e.g., the solid surface of the tooth and the gingivo-crevicular fluid. The structure of dental plaque biofilms is thought to depend on specific physical and chemical interactions between taxa, environmental pressures, host factors that favor growth, factors that favor growth in saliva and gingivo-crevicular fluid (GCF) and inhibit growth, such as antimicrobial peptides, lysozyme, secreted antibodies, and other factors.⁽⁴⁾

Dental calculus represents the first fossilized record of bacterial communities as evidence of evolutionary biology. The development of dental calculus is a process that begins with a non-mineralized biofilm that eventually calcifies.⁽⁵⁾

Periodontal disease is a common condition that affects the oral health of individuals. Although the use of probiotics in the treatment of this disease has been investigated, there is still a lack of knowledge about their effect. However, it has been shown that certain probiotic strains, such as *Lactobacillus reuteri*, can reduce the amount of periodontal pathogens, decreasing plaque levels and gingival inflammation in patients with moderate to severe gingivitis.⁽³⁾

The most studied probiotic bacterial species belong to the *Lactobacillus* and *Bifidobacterium* genera. These bacteria are considered part of the oral biofilm and show a symbiotic relationship with humans, protecting against the growth of pathogenic bacteria.⁽⁶⁾ Some probiotic strains, such as *Lactobacillus rhamnosus* LCR35 and *Lactobacillus salivarius*, have been shown to reduce the colonization of cariogenic bacteria and to improve oral pH.⁽²⁾

Dental caries is another common oral disease that results from demineralization of tooth enamel due to acids produced by bacteria in dental plaque. Studies have shown that a dysbiotic plaque microbiota, characterized by an imbalance of bacterial species, contributes to the development of dental caries. Although the use of probiotics, such as *Bifidobacterium*, to prevent dental caries has been investigated, their safety and efficacy have not yet been confirmed.^(2,3)

METHODS

The present study is a bibliographic review that used search engines such as PubMed, Scielo, Scopus, Google Scholar from which scientific articles were taken such as: systemic reviews, meta-analysis, clinical trials, case reports published in an established period of time, making use of the following keywords: *Lactobacillus*, *Bifidobacterium*, caries, periodontal disease, probiotics. Inclusion and exclusion criteria were used for the selection of literature, which are detailed below.

Inclusion criteria

Time: scientific articles not older than five years.

Language: Spanish, English, Portuguese.

Scientific information: only from the aforementioned search engines.

Articles where the population is human beings.

Articles including *Lactobacillus* and *Bifidobacterium*.

Exclusion criteria

Degree papers.

Papers in the form of a report.

Papers that do not deal with the subject to be investigated.

RESULTS

A search was carried out with the keywords: Lactobacillus, Bifidobacterium, caries, periodontal disease, probiotics, where initially 1829 results were obtained, when applying the first inclusion filter (time no longer than 5 years) the results were reduced to 406, with the following filter (only articles) it was reduced to 304 (oriented to the topic) 97, when considering the population (only human beings) this was reduced to 28, after the complete reading and analysis 11 articles were chosen that met the inclusion criteria, most of the discarded articles had commercial purposes, the results are summarized in a table below.

Table 1. articles that meet the inclusion criteria.

Author	Study Type	Population or Sample	Intervention	Probiotics Type	Results
Fierro C et al Col ⁽³⁾ 2017	Bibliographic review	The following databases were searched: Web Of Science, PubMed and SciELO.	Bibliography search	Lactobacillus rhamnosus GG (LGG) and Bifidobacterium animalis subespecie lactis BB-12	Probiotics are able to produce antimicrobials, compete for cell adhesion sites, modulate the immune system and degrade toxins, generating studies in the dental community that focus on: reducing the incidence of caries, improving the prognosis of periodontitis and reducing halitosis and candidiasis. Probiotics can be a valuable complement for the prevention of oral diseases.
Invernici et al., ⁽⁷⁾ 2020	Randomized clinical trial	41 patients	Probiotic tablets	Bifidobacterium lactis HN019	Significant reduction in periodontal pocket depth (PPD) compared to the control group. In addition, a decrease in clinical attachment loss (CAL) and an improvement in clinical and microbiological parameters related to periodontal disease were observed.
Godino & Barra, 2022	Descriptive	Lactobacillus, Streptococos and Bifidobacterium	Probiotic therapy in caries prevention	CRISPR-Cas	CRISPR/Cas3 can be used in targeted therapy of periodontal biofilm formation, with the goal of eventually eliminating periodontal pathogens.

Araujo et al., ⁽²⁾ 2022	Bibliographic review	Individuals affected by oral diseases	Periodontitis and peri-implant mucositis	Bifidobacterium animalis subsp. lactis HN019	This probiotic strain has the potential to be used in various dental applications due to its benefit to the host, as it can reduce microbiota pathogenicity and immuno-inflammatory changes, and mediate bacterial co-aggregation with pathogens and modulate the immune response.
Invernici et al., ⁽⁸⁾ 2018	Review	Patients with chronic generalized periodontitis	Use of probiotic gragenes for 30 days	Bifidobacterium animalis subsp. lactis HN019	The latter presented lower plaque index (30 days) and lower marginal gingival bleeding (90 days) compared to the Control group (Placebo). Additionally, higher expressions of beta-defensin (BD)-3, Toll-like receptor 4 (TLR4) and cluster of differentiation (CD)-4 were observed in the gingival tissues of the studied group.
de Almeida Silva Levi et al., ⁽³⁾ 2023	Clinical trial	60 patients with generalized plaque-induced gingivitis	Oral administration of probiotic lozenges, 2 times a day for 8 weeks	Bifidobacterium lactis HN019	Both the test group and the control group showed a reduction in the percentage of plaque index (no significant difference). However, the test group had a lower percentage of bleeding on probing (BoP) and a higher percentage of sites with Gingival Index (GI) ≤ 1 compared to the control group at the end of the study, the test group showed significantly lower levels of inflammatory mediators IL-1 α , IL-1 β and MCP-1 in crevicular fluid
López et al., ⁽⁹⁾ 2023	Exploratory systematic review	Patients with dental caries	Mechanisms of action involved in the inhibition of cariogenic bacteria.	Lactobacillus: L. gasseri, L. paracasei, L. brevis, L. plantarum and L. acidophilus produced H2O2.L. plantarum, L. paracasei, L. rhamnosus and L. brevis are the strains most involved in the inhibition	Probiotic strains possess special and intrinsic characteristics of each species and therefore exhibit different mechanisms for the inhibition of dental caries.

				of oral pathogens.	
Wasfi et al., ⁽¹⁰⁾ 2018	In vitro study	Streptococcus mutans	Culture	Lactobacillus casei (ATCC 393), Lactobacillus reuteri (ATCC 23272), Lactobacillus plantarum (ATCC 14917) and Lactobacillus salivarius (ATCC 11741).	Lactobacillus sp. can inhibit dental caries by limiting the growth and virulence properties of Streptococcus mutans, and found a significant overall reduction in the expression of most of the genes tested among the different groups, both in planktonic forms and in biofilm-forming cells.
Soderling et al., ⁽¹¹⁾ 2011	In vitro study	Streptococcus mutans (reference strains NCTC 10449 and Ingbritt and clinical isolates 2366 and 195)	Culture with addition of probiotic strains and observation.	Lactobacillus rhamnosus GG, L. plantarum 299v and L. reuteri cepas PTA 5289 y SD2112	All probiotic Lactobacillus strains inhibited biofilm formation of Streptococcus mutans clinical isolates, as well as S. mutans reference strains, in vitro. The inhibitory effect of probiotics on biofilm formation ranged from 77 to 92% for the different S. mutans strains.
Chou Chein et al (17)	Clinic Study	18 children aged 7 and 11	Daily consumption of standard Yakult for 7 days	Lactobacillus casei Shirota	There was a significant increase in the minimum pH from 4.88 to 5.14, a reduction in the area under the Stephan curve by 18.2% and a decrease in pH recovery time by 29.3%. However, no significant differences were observed in S. mutans and Lactobacillus counts or caries risk after the intervention.
Lin et al., ⁽¹²⁾ 2017	Experimental	S. mutans	Culture	Bifidobacterium	Bifidobacterium produced mainly acetate from glucose, whereas S. mutans produced mainly lactate. Furthermore, the lactate ratio increased at pH 5.5 in both Bifidobacterium and S. mutans. A similar trend was observed for lactose metabolism. However, for Bifidobacterium the lactate ratio was higher in the presence of lactose than in the presence of glucose.

DISCUSSION

Lactobacillus and Bifidobacterium are two types of probiotic bacteria that are naturally found in the gastrointestinal tract and, increasingly, have also been shown to play a crucial role in oral health care. These probiotic bacteria can offer to maintain a healthy and balanced oral cavity.⁽⁴⁾

The presence of Lactobacillus and Bifidobacterium in the mouth can contribute to maintaining a proper balance of the oral microbiome. These probiotic bacteria compete with other potentially harmful bacteria, which helps prevent excessive colonization by pathogenic microorganisms. A balanced oral microbiome is associated with a lower incidence of caries, gingivitis and other oral pathologies.⁽³⁾

Studies have suggested that Lactobacillus and Bifidobacterium have the ability to produce organic acids that lower the pH in the mouth, creating an environment less conducive to the growth of cariogenic bacteria. In addition, these probiotic bacteria can adhere to the tooth surface and compete with caries-causing bacteria, helping to prevent their proliferation.⁽¹³⁾

The use of Lactobacillus and Bifidobacterium as probiotics may decrease gingival inflammation associated with gingivitis. These beneficial bacteria can modulate the immune response in the oral cavity, thereby reducing inflammation and promoting greater gingival health. In cases of periodontitis, the use of probiotic bacteria such as Lactobacillus and Bifidobacterium may be beneficial as an adjuvant to conventional periodontal treatment. These bacteria can help to reduce the bacterial load and improve the host response, favoring recovery and promoting the long-term stability of periodontal tissues.^(3,7)

The inclusion of Lactobacillus and Bifidobacterium in oral care can provide numerous benefits for maintaining a healthy oral cavity. These probiotic bacteria help balance the oral microbiome, protect against caries, reduce gingival inflammation and provide support in periodontal treatment.⁽⁷⁾ As research continues, it is likely that we will continue to discover more about the potential of these probiotics to improve overall oral health.⁽⁸⁾

Probiotic strains, such as Lactobacillus and Bifidobacterium, operate through specific mechanisms that inhibit cariogenic bacteria and oral pathogens. For example, these strains have the ability to produce hydrogen peroxide (H₂O₂), a substance that acts as an antimicrobial agent, preventing the growth of harmful bacteria. In addition, they effectively compete for cell attachment sites in the oral cavity, making it difficult for harmful bacteria to attach and reproduce on tooth surfaces and gums.

In the field of periodontal disease, it has been observed that the use of probiotics, such as the strain Bifidobacterium Lactis HN019 can be beneficial in the management and treatment of this condition. These probiotics help reduce gingival inflammation and may contribute to restoring the balance of the oral microbiota, which is critical in the management of periodontal diseases such as gingivitis and periodontitis.

CONCLUSIONS

Probiotics, particularly *Lactobacillus* and *Bifidobacterium* strains, have emerged as promising agents in oral health care due to their multiple benefits. One of the key aspects is their ability to restore and balance the oral microbiome, which contributes to maintaining a healthy oral environment. This translates into a significant reduction in the risk of dental caries, one of the most common and harmful oral diseases.

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