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ARTICLE REVIEW

Application and benefit of probiotics in dentistry

Aplicación y beneficio de los probióticos en odontología

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ABSTRACT

The use of probiotics in dentistry has been one of the investigations with a positive effect on patient care due to their antimicrobial and anti-inflammatory benefits. To determine the application and benefit of probiotics in dentistry, a literature review was carried out in the PubMed/MedLine, Scopus and SciELO databases. It was found that the administration of probiotics in adequate amounts can reduce the microorganisms found in the oral cavity, as well as prevent dental caries, halitosis and even periodontal diseases. Their use in vulnerable populations such as children, pregnant women and older adults is documented, showing satisfactory results. The use of probiotics is a contribution to oral care from a healing and preventive approach, which can lead to a decrease in the consumption of antibiotics when suffering from diseases of the oral cavity and an alternative to antimicrobial resistance.

Keywords: Probiotics; Dentistry; Anti-Bacterial Agents; Anti-Infective Agents; Dental Caries.

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RESUMEN

El empleo de los probióticos en odontología ha sido una de las investigaciones con efecto positivo en la atención al paciente por sus beneficios antimicrobianos y antiinflamatorios. Para determinar la aplicación y beneficio de los probióticos en odontología se realizó una revisión bibliográfica en las bases de dato PubMed/MedLine, Scopus y SciELO. Se encontró que la administración de los probióticos en cantidades adecuades puede reducir los microorganismos que se encuentran en la cavidad oral, así como prevenir las caries dentales, halitosis e incluso enfermedades periodontales. Su uso en poblaciones vulnerables como niños, gestantes y adultos mayores está documentado, mostrando resultados satisfactorios. El uso de probióticos son un aporte para el cuidado bucal desde un enfoque de curación y prevención, que puede devenir en una disminución de consumo de antibióticos al padecer de enfermedades de la cavidad oral y una alternativa a la resistencia antimicrobiana.

Palabras clave: Probióticos; Odontología; Antibacterianos; Antiinfecciosos; Caries Dental.

INTRODUCTION

The origin of the microbiota dates back to the early 20th century, where it was found that a large number of microorganisms, including viruses, bacteria and yeasts, are present in various places of the human body such as the skin, gut, oral cavity, lung.[1]

The oral microbiome was first identified by the Dutchman Antony Van Leeuwenhoek, using a microscope he built. It nurtures numerous microorganisms including bacteria, fungi, viruses and protozoa. The oral cavity is a complex habitat where microorganisms colonize the soft tissues of the oral mucosa and the hard surfaces of the teeth. Due to the ease of specimen collection in the oral cavity, it has become the best studied microbiome to date.[2]

Throughout history, different definitions of the term probiotic have been issued based on the scientific results available at each time. They have been defined as non-pathogenic live microorganisms, which when administered in adequate portions confer a health benefit to the host.[3] They are involved in important functions such as the prevention and treatment of infectious diseases; however, they are not exempt from adverse effects such as vomiting and diarrhea.[4]

In order to consider the use of microorganisms as probiotics as useful, several technical, functional and safety properties are required. Among the safety requirements it is mentioned that human strains are preferably of human origin, isolated from healthy people, non-pathogenic and non-toxic. One of the functional properties of probiotics is that they must have a survival in the gastrointestinal environment in which they adhere to the epithelial surfaces; they must also be immunostimulant, but not anti-inflammatory.

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The technical aspects to consider for probiotics are that they contain live bacterial strains in sufficient quantity to produce a beneficial effect, resistance to phages, survival during processing, stability in the product and during storage. Products containing probiotics have been very successful in Europe, Asia, and recently, in other regions of the world; this success starts in the consumption and development of new products. To date, probiotics do not require approval by the Food and Drugs Administration for their use.(5)

Various products containing probiotics can be found in the market: drugs, supplements and nutritional formulas, foods, etc; many of them are not single strains, but combinations of several microorganisms and sometimes they are associated with vitamins. The main probiotics included in foods are lactic acid-producing bacteria belonging to the Lactobacillus genus -for food fermentation- and Bifidobacterium.(6)

In the oral cavity there are different microorganisms, and therefore conditions such as dental caries, halitosis, fungi (Candida Albicans), periodontal or peri-implant gum disease of teeth and implants, colloquially called pyorrhea in teeth.

Probiotics are identified by their specific strain, which includes the genus, species, subspecies and an alphanumeric strain designation the seven major genera of microbial organisms most commonly used in probiotic products. These are Bifidobacterium, Saccharomyces, Streptococcus, Enterococcus, Escherichia, Bacillus,(7) Lactobacillus acidophilus, Lactobacillus rhamnosus GG, Saccharomyces boulardii. Bifidobacterium bifidum and Bacillus coagulans.(8)

In the oral cavity of a healthy person there is a well-balanced microbiota consisting of approximately $1.0x10^{11}$ microbes/g biofilm, distributed in more than 700 bacterial species. Lactobacillus are considered a normal part of the oral biofilm and comprise approximately 1 %; Bifidobacterium occur only in minute quantities in the oral biofilm.(9)

Probiotics have been proposed as a promising alternative to prophylactic antimicrobials, with beneficial effects justified in their mechanisms of action. Probiotics inhibit the growth of pathogenic bacteria at pH below 4, reduce rotavirus clearance time, decrease intestinal permeability, lactic acid production, increase in lactase activity, competitive effect on pathogenic bacteria, increase in secretory immunoglobulin A and finally participate in the increase of T helper lymphocyte production.(10)

The aim of the present study is to describe the application and benefit of probiotics in dentistry.

METHODS

A search for information was carried out in the databases PubMed/MedLine, Scopus, SciELO. For this purpose, a search formula was structured using the terms "probiotic", "microbiota", "strains", "biofilm", "Mouth", "Oral cavity", "dental cavity", "periodontal disease", "Probiotics/metabolism", "Mouth/microbiology", and their English translations.

For the selection of the information, the abstracts and titles of the articles were reviewed, eliminating those that did not coincide with the object of study. Subsequently, the same process was carried out with the full texts.

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DEVELOPMENT

Lactobacillus reuteri is 100 % natural, since it lives in the gastrointestinal tract in humans and produces a broad-spectrum antibiotic substance called reuterin, which in sufficient quantity causes the desired antimicrobial effect to maintain the intestinal microbiota intact. Its daily use is recommended in children as well as in adults and people under stressful situations. It is recommended in patients at high risk of periodontal problems such as pregnant women, diabetics, smokers or the elderly, and for people taking medications that increase gum sensitivity such as oral contraceptives or antihistamines.[11]

Currently there is a probiotic for dental use that is an oral hygiene product that fights plaque, gingivitis and cariogenic bacteria by means of a patented combination of two strains of Lactobacillus reuteri.[12]

A study conducted by the University of Chile and the University of Antofagasta used the strategy of a randomized controlled clinical trial in humans over a period of three months, where the intervention consisted of the daily administration of a tablet of Lactobacillus reuteri. The results were included in a total analysis of 30 subjects, where there were no differences between groups, but after three months of intervention there was a statistically significant decrease in the gingival index, bleeding on probing index and plaque index. It was concluded that the use of Lactobacillus reuteri, as a treatment for gingivitis, reduces the number of sites with more severe inflammation.[13]

At the Faculty of Dentistry of the Vita-Salute San Raffaele University, Via Olgettina Milan, Italy, a randomized, double-blind, single-center, placebo-controlled clinical study was conducted for 12 months to evaluate the efficacy of tablets containing Lactobacillus reuteri. The patients attended were 20 and were randomly divided into two groups. The test group received two three month administrations of Lactobacillus reuteri in which two tablets were administered daily after brushing with a three month washout period; the control group received a placebo. During the one-year duration of the study, there was no loss of teeth, complications or adverse events; there was a small reduction in pocket depth at PD probing at the temporary sites. The study concluded that the use of Lactobacillus reuteri probiotic tablets could be considered as an adjunct in the maintenance therapy of patients with generalized Periodontitis stage III and IV, grade C.[14]

A study conducted in India in 2019,[15] with a sample of 30 patients studied the effects of Lactobacillus brevis. It administered 2 tablets daily for a dose of a 1x1012 CFU dose of Lactobacillus brevis for three weeks. This strain was found to significantly reduce the gingival index, probing depth, gingival bleeding index, plaque index and microbiological levels of Porphyromonas gingivalis, Actinobacillus actinomycetemcomitans, Prevotella intermedia and Tannerella forsythensis.

An in vitro study suggested that Lactobacillus rhamnosus GG can inhibit colonization by streptococcal cariogenic pathogens, thereby reducing the incidence of caries in children. It was considered that this probiotic may reduce the risk of a high level of Streptococcus mutans occurrence.[16]

A randomized controlled trial in Poland used the Lactobacillus salivarius strain on 140 children over a 14-day period. Each child was given 28 chewable tablets of 10 mg of Lactobacillus salivarius, in a dose of two tablets daily. The result obtained showed that it reduced the increase of caries in 12 months, therefore, it was concluded that the use of Lactobacillus salivarius reduced the rate of affected areas of dental caries.[17]

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A clinical trial at the Faculty of Dentistry, Umm Al-Qura University, Makkah, Saudi Arabia, analyzed 40 patients with chronic periodontitis. Probiotic tablets were administered twice daily for 30 days. Combinations of Lactobacillus salivarius, Lactobacillus acidophilus, Lactobacillus rhamnosus, Lactobacillus casei and Bifidobacterium bifidum were included. It was concluded that in the treatment of chronic periodontitis probiotics decrease the levels of bleeding and gingival crevicular fluid.[18] This result has been supported by other studies.[19]

A review,[20] synthesized the results of several studies from Chile (Lactobacillus rhamnosus SP1 with dose $2x10^7$ CFU, 1 sachet daily for three months), India (Lactobacillus brevis with dose $1x10^{12}$ CFU 2 tablets daily for three weeks) and Peru (Lactobacillus reuteri Prodentis with dose $2x10^8$ CFU, one tablet for 30 days). The review concluded that all studies showed a high effectiveness of probiotics in the treatment and prevention of oral cavity infections.

Similarly, the literature shows that Lactobacillus rhamnosus, Lactobacillus plantarum, Bacillus mesentericus have a significant contribution in the treatment of gingivitis due to their anti-inflammatory and antihemorrhagic effects and their mediation in the control of biofilm. It significantly reduces the plaque index, gingival index, calculus index and the level of Streptococus mutans in salivary samples.[21]

The discovery of probiotics generated a positive impact on the study of bacterial infections and their applications. However, nowadays, research on their potential antibiotic effect has gained momentum due to the increasing antimicrobial resistance. This is causing the adoption of lines of research on new therapeutics to treat this growing problem, with worldwide impact.[22]

CONCLUSIONS

The administration of probiotics in adequate amounts can reduce the microorganisms found in the oral cavity, as well as prevent dental caries, halitosis and even periodontal diseases. Their use in vulnerable populations such as children, pregnant women and older adults is documented, showing satisfactory results. The use of probiotics is a contribution to oral care from a healing and preventive approach, which can lead to a decrease in the consumption of antibiotics when suffering from diseases of the oral cavity and an alternative to antimicrobial resistance.

Conflict of interest
The authors declare that there is no conflict of interest.

Authors' contribution
All authors participated in conceptualization, formal analysis, project management, writing - original draft, writing - revision, editing and approval of the final manuscript.

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