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# Effects of Probiotics on Oral Health

Rahmani Abdullah[1]

[1]Clinic Department, Stomatology Faculty, Spinghar Institute of Higher Education Jalalabad, Afghanistan. ab.rahmani88@gmail.com

## ABSTRACT

Studies examining the function of the microbes living inside the human body in various contexts over the past few decades have shown how easily they can be controlled to treat and prevent diseases. For more than a century, probiotics have been used to treat infections and inflammation, one of their most notable uses. Despite the advantages of other probiotics, gastrointestinal infections, urogenital infections, tooth decay, and periodontal disease can all be treated or prevented with the help of *Bifidobacterium* and *Lactobacillus* species, the ones that are most often used. Influence of the gut microbiota, a probiotic therapeutic target, since a variety of bacteria species reside in the gastrointestinal tract that influences host metabolism and immune response either directly or indirectly, and can also be seen in the biology of the defense system. Therefore, it is not unexpected that probiotics have shown promise in reducing the symptoms of inflammatory disorders that affect humans, including inflammatory bowel illness; type 1 diabetic, multiple sclerosis, and rheumatoid arthritis, among others. This review's goal is to evaluate the possibility of probiotic-based treatment techniques to limit infection and the onset of inflammation in human patients.

**Keywords:** Probiotics; Halitosis; Periodontal diseases; Dental caries

## INTRODUCTION

The name "probiotics" comes from the Greek language and sense "for life." They contain a diverse range of microbial species and strains (Isolauri and colleagues, 2001). When administered in sufficient concentrations, live bacteria are referred to as probiotics and are said to have health rewards (Reid et al., 2003). A few varieties of *bifidobacteria* and *lactobacilli*, as well as *Saccharomyces spp*., have been used as probiotics. However, some commensal *Escherichia coli*, *streptococci*, and *enterococci* have also been said to have favorable effects under specific conditions (Caglar et al, 2005; Reid et al, 2003; Picard et al, 2005; Moreno et al, 2006).

Live bacteria known as probiotics can help the host's health when provided in adequate amounts (Ai-Qun, 2016). Most probiotic products currently on the market contain lactic acid bacteria (LAB) from the genera *Lactobacillus* and *Bifidobacterium*. The preparation or composition of Probiotic products may have an impact on variety of results. Some probiotics were said to require viability and stability to be effective (Seal et al., 2007), whereas recent research revealed the therapeutic effects of living and sluggish LAB were comparable (Lopez, 2008; Fang, 2014). Synbiotics (combining prebiotics and probiotics) Moreover, mixtures of two or more probiotics can sometimes outperform a single probiotic strain (Le Leu, 2010). Probiotics have been demonstrated in numerous

studies to directly improve the host's gut flora in addition to this indirect benefit and have the potential to reduce tumor formation and metastasis due to increased gut barrier function, reduced bacterial translocation, immunological modulation, microbiota modulation, anti-inflammatory, anti-pathogenic activity, anti-inflammatory, and anti-pathogenic activity (Le Leu, 2010).

Probiotics have also been suggested by several researchers for dental health. Probiotics have been shown to extend the life of vocal prostheses by preventing undesirable microorganisms from adhering to them (Busscher et al., 1997; Schwandt et al., 2005). *Bifidobacterium* and *Lactobacillus* are two of the most regularly utilized probiotic species of bacteria (Saxelin et al., 2005). These bacterial genera are considered to be a natural feature of the human microbiome. Less than 1% of the oral cavity's total cultivable microbiota is made up of *lactobacilli;* however, there are no known species that are only found there. Certain species, on the other hand, are present in feces as well as oral samples (Ahrne et al., 1998; Maukonen et al., 2008). Species like *L. paracasei*, *L. plantarum*, *L. rhamnosus*, and *L. salivarius* are frequently isolated from saliva samples (Ahrne et al., 1998; Simark-Mattsson et al., 2007). According to culture-based research, among the *bifidobacteria* are the earliest anaerobes to colonize the oral cavity. Breast milk contains lactobacilli and *bifidobacteria*, suggesting early exposure to these bacteria in the oral cavity (Gueimonde et al., 2007; Abrahamsson et al., 2009). Oral samples have yielded *Bifidobacterium bifidum*, *Bifidobacterium dentium*, and *Bifidobacterium* long for isolation (Maukonen et al., 2008; Crociani et al., 1996; Beighton et al., 2008).

A chronic inflammatory disease called periodontitis is characterized by the resorption of alveolar bone and the loss of connective tissue (Allaker, 2017). The majority of treatments are aimed at slowing disease progression, restoring periodontal tissue, and harmonizing the host's reaction to pathogenic organisms' virulence factors. In 1998, Socransky described many bacterial combinations associated with periodontal health and disease. The most frequent microorganisms linked to periodontal disease are red and orange complex bacteria (Agarwal, 2015). Although there has been a drop in the prevalence of dental caries in western countries (Campus, 2009), it remains one of the most frequent diseases worldwide. The syndrome develops over time as a result of the interaction of cariogenic bacteria (mostly *mutant streptococci* and *lactobacilli*), a high-fermentable carbohydrate diet, and host factors including saliva production rate and buffering ability (Selwitz, 2007). For a very long time, *Mutants streptococci* (MS) were believed to be the most important pathogens in caries formation. However, it has recently been reported that caries cause changes in the microorganisms on the surface of teeth, to a majority of MS and other non-mutant bacteria, such as *lactobacilli* and *Bifidobacterium spp*, from a prevalence of *non-mutants streptococci* and *Actinomyces spp* (Takahashi, 2011).

Probiotic use in the oral cavity is a new idea. The purpose of this review is to summarize the effects of probiotics on oral health as well as potential mechanisms of probiotic bacteria in the oral cavity. They are crucial in the clinical therapy of periodontal, dental, and halitosis problems. As it is well known, probiotics are helpful in preserving the body's microbial balance.

## Probiotic effects in the oral cavity and their method of action

The broad processes of probiotics are grouped into three categories: normalization of the gut flora, immune response modulation, and metabolic impacts (Parvez et al., 2006). The mechanisms of probiotic effect in the oral cavity may be similar to those previously discovered in the intestine. Possible ways that probiotics might affect oral health are summarized in **Fig 1**.

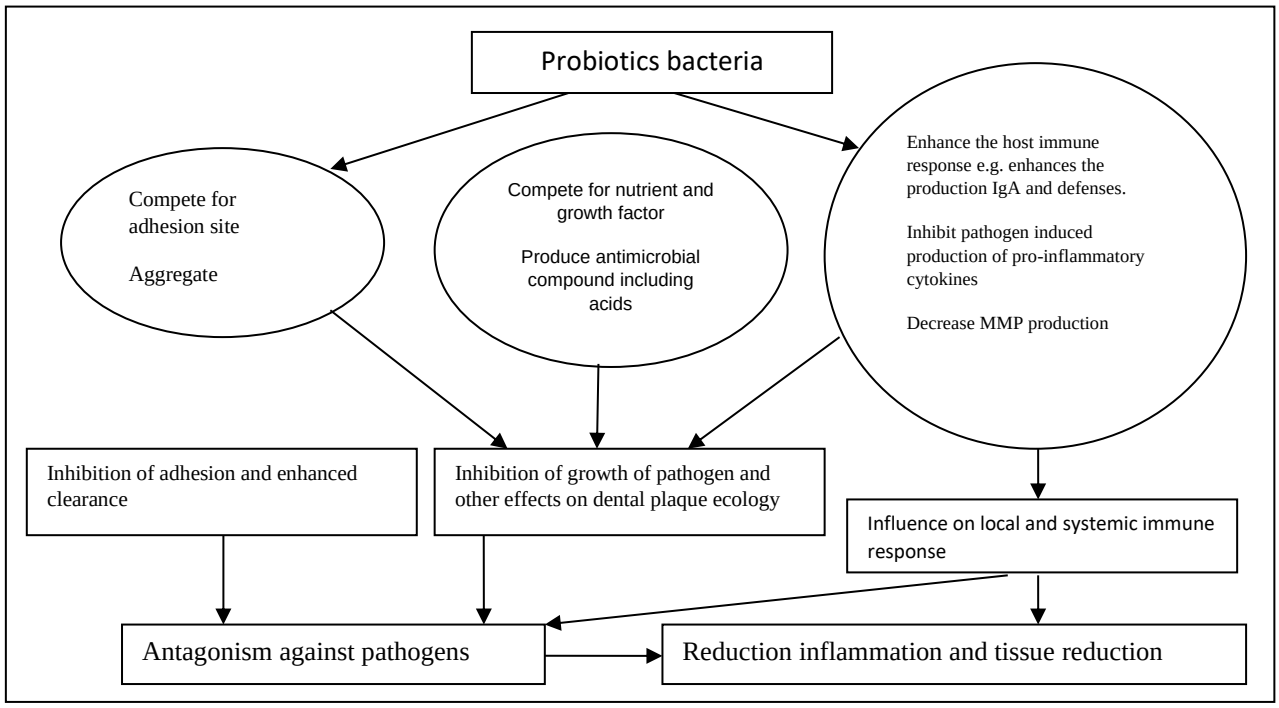


**Fig 1.** Potential ways that probiotic microorganisms may have an impact on dental health (Revised from 76; includes supplementary references) (Hatakka et al., 2008; Hojo K et al., 2007; Haukioja A et al., 2006).

Although total IgA levels in saliva appear unaltered by probiotic usage, oral colonization by probiotic bacteria has long been believed to be necessary for them to generate oral benefits. Despite this, systemic effects cannot be ruled out (Kekkonen et al., 2008; Paineau et al., 2008). Surprisingly, the content of breast milk appears to be influenced by maternal use of particular probiotic strains (Rautava, Kalliomaki, and Isolauri 2002). Several factors support the assumption that bacteria could be beneficial for the treatment or prevention of oral illnesses can be found in commensal oral microorganisms. Indeed, several probiotic benefits have been suggested to be shared by multiple species, rather than being unique to a few well-studied strains (Haukioja et al., 2006; Haukioja et al., 2008). According to the ecological plaque theory, selective force in the environment is able to alter the equilibrium between dental fitness and illness (Marsh, 2003). Because bacteria may impact their environment, and because bacteria in dental plaque have both synergistic and antagonistic interactions, Bacteria may contribute to the ecological plaque hypothesis's description of environmental pressure. Second, it is well known that a balanced oral microbiota guards against infections in the mouth. And finally, there exist bacterial species exactly as there link to oral disorders. Additionally, several species might be related to dental health (Becker et al., 2002; Stingu et al., 2008; Riep et al., 2009). However, it's unclear if bacteria consumed in food might affect the mouth's rather stable microbiota, especially in adults. It's also worth noting that the clinical evidence is mostly based on short clinical pilot trials, whereas all of the mechanisms discussed in this section are based on in vitro observations. Recent research has revealed that probiotics actively reduce the symptoms of gingivitis, dental caries, periodontitis, and halitosis by utilizing a variety of oral microbial species that are beneficial to oral health in place of the harmful ones (Agarwal et al., 2015 & Bartel, D. P. 2015). Additionally, probiotic strains' effectiveness in

enhancing oral health benefits has showed promise when combined with nitrate-reducing bacteria. (Haukioja A., 2010).

## Periodontal ligaments and probiotics

Initial research on the benefits of probiotics for oral health centered on reducing periodontal inflammation (Kragen, 1954). Patients were treated locally with an *L. acidophilus* culture supernatant for periodontal conditions like gingivitis, periodontitis, and pregnant gingivitis. Almost every patient experienced a significant improvement. Recently, a lot of people are interested in employing probiotics to treat periodontal disease. *Bacillus subtilis*, *L. brevis* (CD2), *L. casei Shirota*, *L. reuteri strains*, and *L. salivarius* WB21 were among the probiotic strains employed in these investigations. Gingival health has improved with *L. reuteri* and *L. brevis*, as evidenced by reduced gum bleeding. (Krasse et al., 2006; Della et al., 2007; Twetman et al., 2009). *L. reuteri* ATCC 55730 and ATCC PTA 5289, two probiotic strains of chewing gum, also decreased GCF (Greatest common factors) levels of pro-inflammatory cytokines. According to (Twetman et al. 2009). MMP (Matrix metalloproteinase) (collagenase) activity besides other inflammatory markers in saliva was reduced when *L. brevis* was used (Della et al. 2007). There are insufficient experimental studies on the use of probiotics in periodontal problems, mostly because of a lack of knowledge regarding the precise etiology of the condition and the environments that encourage wellness. In contrast to a placebo group, patients who received one of two *L. reuteri* formulations for moderate to severe gingivitis showed lower plaque and gingivitis scores (Krasse et al, 2006). When compared to a placebo control group, regular (three times per day for eight weeks) administration of tablets containing *Lactobacillus* salivarius in smokers at high risk for periodontal disease led to advantages in terms of pocket probing depth and plaque index (Hamou, 2019). Further researches are sought to uncover creatures with the prospective to act as probiotics in the prevention of periodontal diseases. Several oral *streptococci* and *lactobacilli* (Koll et al.,2006; Sookkhee et al., 2001; Koll-Klais et al.,2005) and *bifidobacteria* (Hojo et al. 2007) strains have been shown to exhibit inhibitory effect against periodontal pathogens in vitro, some are more effective against *mutant streptococci* (Simark-Mattsson et al., 2007; Koll et al., 2008).

## Probiotics and dental caries

An infectious microbial disease of the oral cavity known as caries is brought on by bacteria that ferment biological compounds, causing how much mineral is in the tooth construction to dissolve. *S. mutants* are the principal organism to be blamed. Dental caries is becoming more common, especially among children, as a result of increased refined sugar consumption and poor oral hygiene. (Tinanoff et al., 2019). When *L. reuteri*, *Bifidobacterium lactis* BB-12, and *L. rhamnosus* GG strain were consumed as probiotics, the amount of *S. mutants* was significantly reduced. They may limit the adherence of the surface of the tooth with germs and so minimize the incidence of dental caries by deterring the microbiota of dental plaque. There is a significant reduction in cariogenic bacteria when multiple species or strains of probiotic organisms are utilized (Meurman et al., 2007). Similarly, when the *L. rhamnosus* 1b21 strain is combined with fluoride in milk, the result is the same (Galdeano et al., 2007).

## Probiotics and Halitosis

Halitosis is a broad term that refers to any unpleasant stench of expired air, regardless of its source (Aydin et al, 2014). *Fusobacterium nucleatum*, *Porphyromonas gingivalis*, *Porphyromonas intermedia*, and *Trichophyton denticola* are the bacteria that generate the odor. The microbiota triggers putrefactive amino acid metabolism, which results in VSCs (hydrogen sulfide, methyl mercaptan, dimethyl sulfide) (Niles et al, 1996). The dorsal

surface of the tongue has many papillae surface acts as a habitat for the accumulation of bacteria. Probiotics aid in the reduction of microbial dysbiosis on the tongue, particularly the difficult-to-clean posterior portion (Gurpinar et al., 2019). *W. cibaria*, when given as a probiotic, inhibited *F.nucleatum*, resulting in a decrease in Hydrogen peroxide production (Kang et al, 2006). One of the pioneer probiotic strains, *Streptococcus salivarius* (K12 strain), secretes Bacteriocin, when taken in the form of lozenges, aids in the reduction of Solobacterium moorei, hence lowering oral bad breath (Wescombe et al, 2010). *L. reuterin* has also been shown to aid in the promotion of oral health and the reduction of bad breath. *F. nucleatum* and *P. gingivalis* manufacture methionine lyase by down-regulating the enzyme (Fujiwara et al, 2017).

## CONCLUSION

This study's objective is to look at the available research on probiotics and their impact on oral health. It is well-recognized that probiotics, aid in the maintenance of the human body's microbial equilibrium. Probiotics are a relatively new notion within the mouth. They are important in the treatment of halitosis, dental caries, and periodontal illnesses in the clinic. These findings imply that probiotics can help to lower pathogen loads while also restoring the microbiota of the host. To fully comprehend the potential of probiotics, the probiotic organism's capacity for survival, reproduction and therapeutic effect needs further study. To identify dosages and delivery schedules, interactions with other substrates, and other factors, we also need well-designed, lengthy follow-up studies, and analysis of oral health hazards associated with long-term probiotic usage, so that we can highlight and practice the same appropriately.

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