



# Role Of Nano Probiotic As Potential Alternative Therapy Source For Oral Health

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## Abstract

Probiotics have the potential to be used in the management of multifactorial disorders, including dental caries and periodontal disease, by more effectively addressing the interface between host bacteria to restore balance, that cannot be achieved by conventional treatments. Oral health plays an important role in maintaining overall health, and the use of probiotics has attracted considerable attention as a potential alternative therapy for oral health conditions. different. Probiotics are live microorganisms that, when given in adequate quantities, confer a health benefit to the host. With advancements in nanotechnology, nanoprobiotics have emerged as a promising method to improve the therapeutic effects of probiotics on oral health. Probiotics have a special ability to create biofilms, act as a protective layer and help clear any infection that develops biofilms. The combination of probiotics with nanomaterials is truly a life-changing tool for the food industry, enabling the development of new products with nutritional and functional properties that improve stability. of these compounds, increase encapsulation, delay oxidation, increase efficiency, control their release. and improved bioavailability. This review article aims to explore the role of nano probiotics as a potential alternative therapy for oral health and discuss their mechanisms of action. Additionally, recent studies and clinical trials will be reviewed to provide evidence of their effectiveness.

**Keywords:** nano probiotics, oral health, alternative therapy, nanotechnology, mechanisms of action

## Introduction

Probiotics can be defined as "feed ingredients of live microorganisms that benefit the host by improving the microbial balance in its gut". Probiotic is a Greek word meaning "for survival". Most clinical concern is the prevention or treatment of gastrointestinal tract infections and disorders. Probiotics can exert their effects in several ways, such as by inducing antimicrobial metabolites, immunomodulatory, improving mucosal barrier function, and displacing microbial flora through the compete with pathogenic strains for cell adhesion(1). Conditions, such as tooth decay, periodontal disease and oral infections, pose significant challenges worldwide. Traditional treatments often involve antibiotics and antimicrobials, which have limitations such as antimicrobial resistance and disruption of the oral microbiome. As a result, there is growing interest in alternative therapies, with probiotics emerging as a promising avenue due to their ability to restore and maintain oral health. However, the effectiveness of traditional probiotics may be limited due to challenges in administration, penetration, and persistence in the oral cavity.

## Nano probiotics; where technology meets oral and gut health

The association of phenomena with probiotic science, another emerging and potentially promising field for the prevention and treatment of a number of human gastrointestinal and extraintestinal disorders using the beneficial microorganisms, creating "nanoprobiotics", an area that focuses on the application of nanoscience in the probiotic-related world. Nanoprobiotics, a combination of probiotics and nanotechnology, offers a new approach to overcome these challenges and enhance the therapeutic potential of probiotics for oral health applications. Nanoencapsulation techniques help protect probiotic strains during storage and transport, as well as targeted delivery to specific sites in the oral cavity (2). In addition, the small size and large surface area of the nanoparticles facilitate enhanced interactions with oral tissue, biofilms and pathogens, which improves treatment outcomes.

## Probiotics' mode of action

The mechanism of action of nano-probiotics on oral health is very diverse. First, the nanoencapsulation process protects probiotic strains from environmental stresses, such as low temperature, humidity and pH, increasing their survival rates during storage and transport. . Nanoencapsulation also allows for controlled release of probiotics, ensuring a sustained and effective supply.

Second, the nanoscale size of the delivery systems allows enhanced interactions with oral tissues and biofilms. Nanobiotics can penetrate the biofilm matrix, which is often a major barrier to traditional probiotics, allowing them to directly target and modulate the oral microbiome. In addition, nanoparticles can disrupt the integrity of biofilms and inhibit the growth of pathogenic bacteria(3).

Third, probiotics can also alter the pH and/or redox capacity of the surrounding medium, which may prevent the formation of infections. Finally, they have beneficial effects by promoting nonspecific immunity and controlling humoral and probiotics that significantly reduce the growth rate of caries-causing bacteria. Another important mechanism may be the production of antibacterial agents by beneficial bacterial species that inhibit other oral bacteria. Indirect effects of probiotics in the oral cavity, especially the regulation of innate and adaptive immune function. Nano-Probiotics for Cavity  
Tooth decay, commonly known as tooth decay, is a common oral health problem caused by the demineralization of tooth enamel. Cavity-causing bacteria, primarily *Streptococcus mutans*, play an essential role in the initiation and progression of tooth decay(4). Another study explored the use of probiotic-filled nanoparticles to inhibit the growth and activity of bacteria that cause tooth decay. The nanoparticles effectively penetrated the biofilm matrix and disrupted the adhesion of *S. mutans* to the tooth surface. The controlled release of probiotics from the nanoparticles prolongs their antibacterial activity and contributes to the prevention of tooth decay. Several studies have investigated the effectiveness of nano-probiotics in the prevention and treatment of dental caries.

In addition, in vitro studies have demonstrated the antibacterial activity of nano-probiotics against periodontal pathogens, including *Porphyromonas gingivalis*. The nanoparticles effectively delivered probiotics to the bacterial biofilm, resulting in inhibition of pathogen growth and disruption of the biofilms (5).

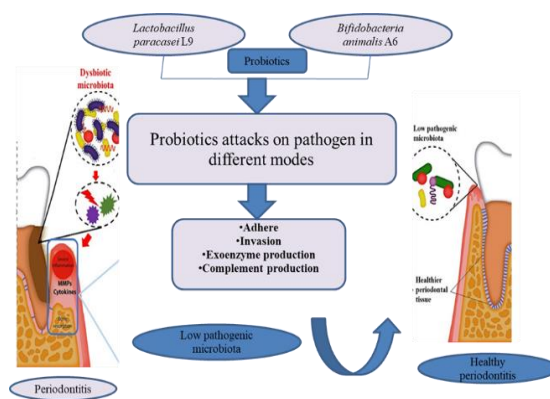


Fig. 3. Probiotic activity against periodontitis

### Role of Probiotics in Oral health and oral associated diseases.

Periodontal ligaments and other tissues that support teeth are disrupted by periodontal infections (periodontitis and gingivitis), a group of inflammatory periodontal conditions. Immune-mediated pathway, ultimately leading to tooth loss(6). Early research on using probiotics to improve oral health focused on controlling periodontitis. Probiotics have recently attracted a lot of attention as a potential treatment for periodontal disorders. Before probiotic therapy is commonly used to treat gingivitis and periodontitis, a few things need to be better understood. These include the timing and type of therapy given to prevent the periodontal microbiota from returning to the dysbiotic ecosystem after initial treatment (7). The use of nanomaterials has shown improved properties for probiotic encapsulation. Due to their unique physical and chemical properties, nanostructured encapsulation materials hold promise for protecting microorganisms from acidic conditions in the stomach, increasing absorption and thus allowing the release of attack the beneficial bacteria cells trapped in the intestinal lumen with the natural pH(8). The clinical efficacy of oral probiotics is further diminished by the loss of viability during gastrointestinal passage, resulting in poor distribution in the gut.

### Future Application

Nanotechnology is a potential new technology in food, one of the key resources for development and innovation. Reducing the particle size of bioactive compounds can improve bioavailability, release control, delivery targeting, and solubility. The use of probiotics may be expanded in the future to treat a wide range of medical conditions. For many oral health conditions, such as tooth decay, periodontal disorders, and halitosis, oral lactic acid bacteria and bifidobacteria have recently been isolated and described. Oral probiotics may be used as an alternative therapy in the future. Oral probiotics may be used as an alternative therapy in the future (9).

The field of nano-probiotics in oral health is still in its infancy and more research is needed to fully understand their potential. Future studies should focus on optimizing nanobiological formulation and delivery strategies, investigating their safety and long-term efficacy, and exploring their application in specific oral health conditions(10). In addition, clinical trials with larger sample sizes and longer follow-up periods are needed to confirm the results obtained from the preliminary studies.

## Conclusion

Nanoprotobiotics offer a promising alternative therapy for oral health problems, addressing the limitations associated with traditional probiotics. The combination of probiotics and nanotechnology enables targeted delivery, enhanced interactions with oral tissues and biofilms, and enhanced treatment outcomes. Evidence from studies and clinical trials supports the effectiveness of nano-biotics in promoting oral health, including the prevention and treatment of tooth decay and periodontal disease. Further research and clinical studies are needed to explore the full potential of nanobiological products and optimize their formulation and delivery strategies. As the field of nanotechnology advances, nanobiotics hold great promise as a valuable addition to oral health strategies. The long-term efficacy and safety of probiotics must be demonstrated in a preventive or therapeutic setting to confirm clinical safety recommendations. They are used to treat many dental and general health problems. Whether probiotics can be used to improve oral health remains an open question. Much work remains to be done to determine the most suitable probiotic for oral administration. Probiotics are a new area of research in the dental world, representing an emerging field of dental research, and this idea opens up new possibilities for understanding how nutrition affects oral health.

## Safety and Regulatory Considerations

The safety of nano-probiotics for oral health applications is an important consideration. Although nanomaterials have shown promise in improving treatment outcomes, their potential toxicity and long-term effects need to be carefully evaluated. Researchers and regulatory agencies should work together to establish guidelines and standards for the development, production, and clinical use of nanobiological products.

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