REVIEW

Beneficial Effects of Physical Activity and Probiotic Consumption on Oral Health

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Abstract

Introduction: Combining physical activity and probiotics improves dental health by enhancing the oral ecology through various physiological mechanisms. Regular exercise improves overall health, reduces inflammation, and boosts immunological function, thereby benefiting oral health. Probiotics improve gut and mouth microbiota, balancing harmful bacteria and promoting gum and tooth health. Lifestyle measures can minimize the risk of oral diseases and improve oral hygiene. More research is needed to determine how physical exercise and probiotics can work together to improve oral health.

Materials and Methods: Data from experimental, clinical, and observational research were evaluated.

Conclusion: Physical activity and Probiotic use work together to promote oral health, perhaps reducing the risk of dental cavities and periodontal disease. Further research is needed to further understand the interactions and maximize their use in therapeutic settings.

Keywords: Dental Caries, Halitosis, Oral Cancer, Oral Health, Oral Mucositis, Periodontitis, Physical activity, Probiotics

Introduction

Lifestyle medicine contributes to sustaining a healthy way of living, which results in a longer lifespan and improved quality of life. probiotics play a crucial role on lifestyle, supporting health, and when used wisely, they are known to enhance immune responses. Thus providing protection against infections in the body, including the oral cavity. Numerous literature comparing lifestyle factors with oral health available in the form of reviews, systematic reviews, original studies etc, emphasize its significance.[1] Comprehending the factors that affect the distinctive ecosystem of the oral cavity is essential for enhancing dental health results, as it serves as both a digestive interface and a habitat for numerous microbes. With the ongoing rise of dental diseases, especially cariogenic and periodontal conditions, there is an urgent requirement to explore non-pharmaceutical treatments that promote oral health by leveraging natural biological processes. Dental infections such as dental caries, gingival, and periodontal lesions are increasingly common, with their incidence and prevalence rising daily. Therefore, it is crucial to explore non-pharmaceutical treatments that enhance oral health via natural biological processes.

Physical exercise is defined as any movement that requires energy expenditure by skeletal muscles, impacting various domains, including oral health and serves as a multifaceted determinant of health. Regular physical activity has been demonstrated to enhance physiological measures, although its effects on dental health are still under investigation.[2,3] Engaging in physical activity can boost salivary flow and offer anti-inflammatory advantages, potentially safeguarding against periodontal diseases. An increase in saliva production not only aids in the removal of food debris and pathogens but also contains bioactive elements such as anti-

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microbial peptides and immunoglobulins.[4] Furthermore, physical activity provides systemic advantages, including improved cardiovascular and metabolic functions, which indirectly support oral health by fostering a robust immune response and lowering the likelihood of oral disorders.[5]

The intake of probiotics, which are live microorganisms offers health benefits in small amounts, has become a novel approach to enhance dental health. Probiotics strain that manage the oral microbiome can effectively address dysbiosis and lowers the occurrence of harmful bacteria associated with dental caries and gingival disease.[4]

The probiotics bacteria strains that are most frequently used are Lactobacillus and Bifidobacterium. It is also found in breast milk thus, microorganisms are introduced into the oral cavity at an earlier stage. Research based on cultures shows that bifidobacteria are among the initial anaerobes found in the oral cavity. The species of Bifidobacterium identified in oral samples include B.bifidum, B.dentium, and B.longum.[6] probiotics generate antibacterial substances and enhance local immune responses, thereby fostering balance within the oral ecosystem. The purpose of exercise is to enhance physical abilities and can be integrated into daily life through engaging in sports, pursuing a profession related to physical labor, or simply opting for active modes of transportation like walking and cycling.[7]

Regular physical activity reduces inflammatory indicators, particularly the levels of C-Reactive Protein (CRP). Recent findings indicate that engaging in physical activity is linked to better periodontal health outcomes. Physically active young adults showed improved oral health compared to sedentary adults.[8] Combining physical exercise with probiotics supplementation creates a holistic approach of promoting dental health, indicating that lifestyle changes may have synergistic effects. This approach aims to not only improve current dental health but also prevent future oral disease. Growing evidence prompts that oral health improves when physical activity and probiotics are utilized together. Hence it is important to understand their exact mechanism of action and underlying biological pathways. This review aims to give a comprehensive understanding of how physical activity and probiotics work together to improve oral health. As we manage this intricate interplay, it's important to redefine oral health as a vital component of general overall health, rather than just dental care alone. This could lead to innovative methods that go beyond traditional approaches and create a broader view of health.

Probiotics Consumption and Physical Activity on Various Oral Diseases

ORAL MUCOSITIS

Probiotics use and physical activity are linked to prevention of several oral diseases like caries, gingivitis, periodontitis. Oral mucositis is the inflammation of oral mucous membranes resulting in formation of ulcers. This is a common adverse effect of cancer treatments like chemotherapy, radiation therapy, and bone marrow transplantation. Oral mucositis can cause pain and discomfort along with disruption of other activities like eating, speaking, and maintaining oral hygiene measures.[9]

Understanding the intricate details of relationship between probiotics and physical activity in oral mucositis is important for understanding how these variables can reduce associated inflammation. Ingesting probiotics, which contain beneficial microbial strains, has been shown to improve oral microbiota and promote healing by enhancing epithelial regeneration and immune regulation.[10]

Regular physical exercise can improve systemic circulation and immunological response, thereby increasing mucosal resilience and decreasing vulnerability to microbial overgrowth worsening mucositis. These factors may work together to reduce the occurrence and severity of oral mucositis. However, more research is needed to understand the exact biochemical pathways, physiological interactions, apt intervention methods and dosages exploring this relationship.

Periodontitis

Periodontitis is a sequelae gingival infection which harms soft tissue and progresses to destroy the periodontium. When gingivitis is untreated, it progress to periodontitis causing infection of deeper tissues, is the second most common dental illness in humans, affecting majority of the global population. It causes damage to the supporting tissues, including: gingiva, periodontal ligament and alveolar bone.[13] Over time, this leads to tooth mobility and ultimately loss of tooth. Regular physical activity improves physical capacity directly upsurging overall health including oral health.[11,12]

Literature reveals that worsening periodontal disease may lead to persistent and systemic inflammation, emphasising their potential role.[14] Regular physical exercise reduces inflammation and improves immunological function, potentially preventing periodontal disease.[15] However Caglar E et al 2005 could not establish the preventive relation between physical exercise and periodontal disease and Meurman et al 2005 did find a correlation between the prevalence of reduced periodontal disease among those who engage in physical activity.[16,17] Probiotics can improve the oral microbiome by increasing good bacteria and limiting the growth of pathogens. These techniques may work together to reduce inflammation and tissue loss, leading to a more resilient periodontal environment. Probiotics have antibacterial and antibiofilm effects through bacteriocin production aiding in preferential growth over pathogenic microbes, enhanced colonization and adherence, and beneficial immune modulation.[18] Probiotics enhance the preclinical, microbiological, and immunological results in the treatment of experimental periodontitis in animal models.

DENTALCARIES

Dental caries is the most common infection of the oral cavity due to the action of bacteria resulting in cavitation. Endogenous bacteria in biofilms, including Lactobacillus species, Streptococcus mutans, and Streptococcus sobrinus, ferment carbohydrates and create weak organic acids as byproducts. This causes a drop in local pH below critical levels, leading to demineralization of teeth. The live beneficial bacteria in probiotics balances the oral microbiome by limiting the growth of cariogenic infections and lowering acid production, which leads to tooth decay. Regular physical activity prevents dental caries mainly by increasing salivation and immune modulation. Researchers and clinicians are interested in preventing and treating dental caries, which are largely caused by microbi-

al biofilms. The genera Bifidobacterium and Lactobacillus were the first and most common probiotics bacteria discovered in carious lesions of the oral cavity. Lactobacillus rhamnosus GG (ATCC 53103) produces a growth inhibitory agent that inhibits Streptococcus sobrinus and reduces the incidence of caries. It can therefore be concluded that a reduced need for dental restorative therapy appears to be associated with elevated levels of physical exercise and robust physical fitness. This is linked to the notion that young individuals engaged in physical training are also more attentive to their dental health. Physically active people should be advised to eat a balanced diet that does not negatively impact their oral health in order to meet their increased energy needs during exercise.[19,20] Encouraging a healthy lifestyle may prove to be even more advantageous in those young individuals who are involved in physical activity and resort to using cariogenic substance like sports drinks.[21,22]

ORAL CANCER

Oral cancer is a common malignancy affecting various parts of the oral cavity like buccal mucosa, labial mucosa, lingual mucosa, floor of the mouth, palatal mucosa. They belong to a larger category of tumors known as head and neck cancers. Moderate or high levels of physical activity reduce the incidence of oral cancer by promoting apoptosis and inhibiting the growth of altered cells.[23]

A study indicated that those who engaged in physical activity at least five times per week had a decreased chance of developing head and neck cancer compared to those who exercised less than once per month.[23] However, the exact amount of activity required to lower cancer risk is unknown. Smoking impacts physical activity by reducing oxygen supply to muscles.[24] Similarly probiotics may have anti-cancer capabilities, perhaps preventing oral carcinogenesis, in addition to their numerous health advantages.[25] Probiotics, specifically Lactobacillus strains, have been linked to anticancer benefits in scientific studies. Lactobacillus strains exert anticancer efficacy by causing apoptosis, blocking angiogenesis, and regulating the immune system. Among these Lactiplantibacillus plantarum Y33 is the most promising strain and has a high probiotics score suggesting that it may be a good bacterium for human health. Furthermore, the protein bacteriocin that was isolated from Y33 demonstrated notable cytotoxicity against KB and OSCC cancer cell lines, indicating its role as a potential therapeutic agent in treating oral cancer along with being a safe and efficient probiotics supplement to improve human health. To confirm the safety and effectiveness of the Y33 strain as possible probiotics and anti-cancer medicines, individually, more in vivo research needs to be conducted.[26]

HALITOSIS

Bad breath is mostly caused by volatile sulfur compounds (VSCs) in the mouth. Oral bacteria can create VSCs, causing unpleasant odors. Helpful bacteria in probiotics regulate gut flora and can help to manage halitosis (bad breath), especially when the cause is a microbial imbalance in the mouth or digestive tract. Regular exercise increases saliva production which neutralizes acids, removes food particles, and controls harmful bacteria in the oral cavity. Probiotics, including Lactobacillus and Bifidobacterium, may inhibit the proliferation of odor-causing microorganisms. Probiotics containing Streptococcus salivarius strains K12 and M18 may reduce VSCs, perhaps alleviating halitosis.[27] Probiotics enhance gut health and minimize gastrointestinal causes of bad breath, including acid reflux and digestive issues, which lead to halitosis. Certain probiotics strains can enhance dental hygiene by preventing plaque formation, decreasing gingivitis, and increasing overall health. Probiotics promote the growth of good bacteria and reduce harmful oral bacteria, resulting in fresher breath and healthier gingiva. Regular physical activity and maintaining adequate hydration can prevent dry mouth, a frequent cause of halitosis. Intense activity also can produce dry mouth and halitosis due to insufficient saliva production. Probiotics can help reduce halitosis when combined with adequate oral hygiene and diet whereas role of physical activity on halitosis remains ambiguous.[28]

Conclusion

Physical activity and probiotics ingestion can improve oral health by preventing or reducing oral infections, lowering the risk of oral disease, and maintaining overall hygiene. Regular exercise benefits oral health by improving circulation, stimulating saliva production, reduces inflammation and promotes natural defenses. Probiotics regulate the oral microbiota, lowering harmful bacteria that cause halitosis, plaque, and gingival and periodontal disease. Lifestyle variables, including physical activity and probiotics, have a crucial role in preventing and controlling common oral health concerns.

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