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Novel Chewing Gum Formulated with Betel Leaf and Sweet Lime Peel for Oral Biofilm Prevention and Dental Implant Protection

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Dental implants have transformed oral rehabilitation, yet their long-term success is frequently challenged by biofilm formation on implant and tooth surfaces, leading to inflammation and implant failure. Once established, biofilms protect bacteria from conventional oral hygiene, making them difficult to eradicate. This project proposes a novel functional chewing gum incorporating bioactive powders from betel leaf and sweet lime peel, selected for their rich antimicrobial and antioxidant properties. These ingredients are formulated with suitable excipients into a stable and palatable gum designed to prevent early biofilm establishment by inhibiting bacterial adhesion, offering a convenient and patient-friendly preventive strategy. Importantly, the formulation also promotes sustainability by reusing agricultural waste in the form of discarded sweet lime peels. Clinical trials on antimicrobial chewing gums have shown promising effects in reducing plaque and harmful bacteria, supporting the feasibility of this approach, though herbal formulations have shown inconsistent outcomes. To strengthen compound selection, molecular docking and AI-based screening were employed to identify key phytochemicals from betel leaves and sweet lime peel with anti-biofilm potential. Building on these insights, our gum integrates synergistic natural bioactive specifically targeting microbial colonization on implant surfaces, while also serving as a simple daily routine for maintaining cleaner oral health in the general population. The innovation lies in converting an everyday habit into a targeted, sustainable antimicrobial therapy that addresses a critical unmet challenge of biofilm-associated infections. This approach offers a cost-effective, scalable, and impactful solution to enhance implant longevity and promote overall oral health.

Keywords: Betel leaf, Biofilm prevention, Chewing gum, Dental implants, Sweet lime Peel

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