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A Review on Potential of Tannins in Oral Infectious Diseases

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Abstract

Many low- and middle-income nations are unable to provide services to prevent and treat oral health conditions due to the high cost of treatment. Infections of the teeth and gums are frequently treated with medicinal plants and other herbal products because they are inexpensive, readily available, and effective. Traditional medicines have known about various herbal formulas for treating oral infections, and these formulas are successfully utilized in current treatment. Natural treatments for oral health have a lot going for them because they can target a variety of different things and involve complex processes. They can support bacterial communities that are good for oral health, bring the oral microbiota into equilibrium, and reduce the amount of bacteria in the mouth.

Keywords: Tannins • Flavanoids • Oral infectious diseases

Introduction

Natural products may decrease microbial virulence, including adhesivity, biofilm production, saccharolytic and proteolytic activity, or suppress microbial metabolism, if they are not used to direct microbicidal activity against oropathogenic microorganisms. The biofilm-repressing, biofilm-killing, or majority extinguishing action is likewise an unrealistic property of regular items remembered for the armamentarium of solutions for treat oral irresistible infections. Calming, cell reinforcement, and immunomodulatory exercises supporting mending and smothering oxidation stress in periodontal tissue are likewise positive properties. In addition, the inhibition of host metalloproteinases may also play a crucial role in the treatment of periodontal disease. During periodontal disease treatment, supportive interventions include relieving pain, reducing gum bleeding, and reducing halitosis. To avoid dental caries, enamel must be protected and regenerated. Natural products can successfully be included in the complex approach to treatment and prevention of dental caries and periodontal disease alongside the treatment of underlying diseases, improved oral hygiene, and a change in diet and lifestyle. The European Medicines Agency (EMA) says that oral infections and inflammations can be treated with traditional European medicinal plants like oak, agrimony, marigold, witch hazel, rose, and many others. Polyphenols, also known as flavonoids or tannins, are the primary active compounds found in the aforementioned plants. These compounds have antimicrobial, antioxidant, anti-inflammatory, and wound-healing effects. However, there are numerous specific or endemic plants and natural products available in traditional medicines in other parts of the world that can effectively treat oral infections and diseases [1-3].

Description

As a plant response to microbial infection, flavonoids are produced; As a result, they are effective against a wide variety of pathogenic microorganisms. Flavonoids' antibacterial activity begins with their interaction with the phospholipid bilayer of the cell membrane. The lipophilicity or hydrophilicity of the particular flavonoid determines whether the interaction occurs outside or inside the bilayer. Lipophilic substituents, for example, prenyl gatherings, alkylamino chains, alkyl chains, and nitrogen or oxygen-containing heterocyclic moieties in the flavonoid structure are an assumption for more strong antibacterial action. In conclusion, flavonoids exhibit antibacterial activity through a variety of means: inhibition of cell membrane porins, alteration of membrane permeability, inhibition of attachment and biofilm formation, inhibition of energy metabolism, inhibition of nucleic acid synthesis, and attenuation of pathogenicity. Antibiotic resistance can be reversed and the effectiveness of current antibiotics enhanced by some flavonoids. It is a well-known target for the creation of novel antibiotics. The glucosyltransferase (GTF) synthesis of extracellular glucans, a known virulence factor involved in the pathogenesis of caries, is one of the flavonoid molecular targets. By encouraging the adhesion and accumulation of cariogenic streptococci on the tooth surface, glucans increase the pathogenic potential of dental plaque.

In their molecule, some flavonoids have lipophilic chains or chains of varying lengths. Both gram-positive and gram-negative bacteria were effectively inhibited by these prenylated flavonoids. In addition, a heterocyclic ring can be produced by the prenyl group reacting with the OH groups in close proximity. In medicinal plants, flavonoids are extremely potent active substances. Because of their antimicrobial and mitigating impacts, the activity of certain flavonoids is similar to that of ordinary anti-infection agents. Prenylated flavonoids, which are lipophilic substitutes for flavonoids, are particularly effective in this setting. Many flavonoids have the ability to suppress virulence factors and prevent biofilm formation. The structures of the most common flavonoids. Furthermore, the research demonstrates that the utilization of flavonoids in conjunction with antibiotics has the potential to reduce resistance to antibiotics.

Tannins are polyphenolic compounds that are well-known for having an astringent effect on a wide range of biological processes. The interaction of proteins in the oral mucosa and saliva with tannins, the main players being histidine parts of proteins, is what causes the intense astringent sensation in the mouth when eating foods high in tannins. Tannins and flavonoids share similar biological functions. Tannins have antibacterial and anti-inflammatory properties, among other biologically interesting effects. Iron chelation, the inhibition of cell wall synthesis and membrane disruption, and the inhibition of fatty acid biosynthetic pathways are all part of tannins' antibacterial mechanism. Tannins may also act as quorum sensing inhibitors and influence the gene expression of virulence factors like biofilms, enzymes, adhesins, motility, and toxins. Condensed tannins, or proanthocyanidins (PACs), are molecules that attack and defend plants and have numerous positive effects on human health. They exert antioxidant and antimicrobial effects across a wide range of functions. The primary compounds of numerous edible berries and fruits are represented by PACs. Plant-based toothpastes and mouthwashes contain significant amounts of extracts from medicinal plants with high tannin content. The maturation of red wine is closely linked to the bark of oak trees.

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It is common knowledge that aged wines benefit greatly from oak's tannins and other phenolics. In contrast to the controls, the green tea group saw a significant increase in the mean level of antioxidants measured in plasma and gingival crevicular fluid. Green tea was shown to significantly reduce the release of cytokines induced by bacterial endotoxins. Green tea inhibits pathogen adhesion to cells, which may account for part of the antibacterial activity. Rodents with exploratory periodontal irritation were treated with the effective utilization of a green tea catechin-containing dentifrice. At 8 weeks, the periodontal lesions had significantly less inflammatory cell infiltration than the control dentifrice [4-7].

Tannins, substances with a high molecular weight, are responsible for the formation of non-absorbable complexes due to their ability to bind to proteins and other organismal molecules. However, after degradation, some might be absorbed as smaller units. Due to their lipophilic nature, flavonoids (aglycones) are also poorly soluble. They only have a limited amount of oral bioavailability. Modern delivery systems that make use of biocompatible and biodegradable materials that are thought to be safe for humans, such as nano encapsulation, may increase the bioaccessibility of flavonoids and tannins [8].

Conclusion

Flavonoids and tannins are the primary polyphenols in plants. Due to their extensive pharmacological activities, which include antibacterial and anti-inflammatory properties, both groups are ideal candidates for treating bacterial infections. Extracts from medicinal plants are frequently used in traditional medicine to treat wounds and inflammation of the skin or mucosa. Polyphenols have been shown to modulate bacterial biofilms and slow the growth of carcinogenic bacteria over the past ten years of research. The significance of the findings from both preclinical and clinical studies attests to the proper place that traditional medicinal plants play in modern medicine. Natural product research is still an important part of finding new antimicrobial molecules. Some polyphenols are regarded as alternatives to standard antibiotics or may be utilized in conjunction with antibiotics to combat antibacterial resistance. Given their availability, efficacy, safety, and, ultimately, patient compliance, our review demonstrates that many flavonoids and tannins, either as single compounds or in mixtures as natural extracts, are effective agents against the bacteria that cause dental caries, periodontal disease, and other oral infections. Among the best are prenylated flavonoids, catechins, and procyanidins.

Acknowledgement

None.

Conflict of Interest

The authors declare that there is no conflict of interest associated with this manuscript.

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