Review Article

Antibacterial activity of phytochemicals against oral bacteria

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ABSTRACT

Microbial resistance to most of the antibiotics commonly used to treat oral infections has been documented. The resistance of microorganisms against the traditional antibiotics needs urgent attention for the development of the new drug molecules. It is well documented from ancient times that active principles from plant origin have been used as medicines for various diseases and microbial infections. The effect of plant extracts on bacteria has been studied by a large number of researchers in different parts of the world. The antimicrobial activity of phytochemicals against oral bacteria has been reviewed here.

KEY WORDS: Oral bacteria, Phytochemicals, Phytodentistry

INTRODUCTION

Many of the plants used as medicines today were known to the people of ancient cultures. Scientific experiments on the antimicrobial properties of plants and their components have been documented in the late 19th century. Herbal medicines have been the basis of treatment and cure for various diseases and physiological conditions. Plants produce a wide variety of phytochemicals constituents, which are secondary metabolites which are used either directly or indirectly in the pharmaceutical industry. This review describes the studies of phytochemicals that have been shown to be active against oral pathogens.

FLAVONOIDS AND POLYPHENOLS

Two active isoprenylflavones, artocarpin and artocarpesin, were isolated from *Artocarpus heterophyllus* (Moraceae). These inhibited the growth of numerous cariogenic and oral bacteria, including mutans and other oral streptococci, actinomyces, and lactobacilli.[1] Flavonoid phytoalexins from *Sophora exigua* (Leguminosae) have been shown to inhibit the growth of numerous cariogenic bacteria.

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Erythrina variegata (Leguminosae) is used in folk medicine in tropical and subtropical regions and displays a number of biological properties, including antibacterial activity.[2] Seven isoflavonoids isolated from the roots of this plant were tested for their ability to inhibit the growth of cariogenic oral bacteria. Of these, erycristagallin showed the most potent inhibitory activity.

The root bark of *Morus alba* (Moraceae) has been used as a traditional medicine in Asian countries and exhibits antibacterial activity against food poisoning microorganisms.[3] Using activity against *Streptococcus mutans* in bioassay-guided fractionation of a methanol extract of dried root bark and organic solvent fractions of this extract, the active antibacterial constituent was identified as kuwanon G. The compound displayed inhibitory activity against *S. mutans*, which was comparable to chlorhexidine and vancomycin.

A number of components of tea, *Camellia sinensis* (Theaceae), exhibit anticariogenic effects through various modes of action, including bactericidal effects on oral bacteria, prevention of adherence of bacteria to tooth surfaces, inhibition of glucan production, and inhibition of amylases.[4]

The paste of tender leaves of *Psidium guajava* (Myrtaceae) has been used traditionally to maintain

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oral hygiene, while other parts of the plant have various bioactive properties.[5] A methanol extract of *P. guajava* leaves was shown to exhibit inhibitory activity against two strains of *S. mutans*.

Malvidin-3,5-diglucoside (malvin) was identified as the active constituent of an ethanol extract of *Alcea longipedicellata* (Malvaceae) responsible for activity against oral streptococci.[6] The compound macelignan was isolated from *Myristica fragrans* (Myristicaceae) and shown to exert antimicrobial activity against *S. mutans*.[7] Macelignan also displayed antibiofilm activity against *S. mutans*, *Streptococcus sanguis,* and *Actinomyces viscosus*.[8]

Naringin, a polymethoxylated flavonoid commonly found in citrus fruit and an FDA-approved health supplement, was shown to inhibit the growth of periodontal pathogens and other common oral microorganisms.[9] It was shown to be particularly effective against *Actinobacillus actinomycetemcomitans* and *Porphyromonas gingivalis.*

Terpenes

Bakuchiol isolated from the Chinese medicinal plant, *Psoralea corylifolia* (Fabaceae), has shown activity against numerous Gram-positive and Gram-negative oral pathogens. It was able to inhibit the growth of *S. mutans* under a range of sucrose concentrations, pH values, and in the presence of organic acids in a temperature-dependent manner.[10]

Liu *et al.*[11] purified seven new *ent*-rosane diterpenoids and a new labdane diterpene from the Chinese medicinal plant, *Sagittaria sagittifolia* (Alismataceae). Four of these compounds (sagittine A–D) exhibited antibacterial activity against *S. mutans* and *Actinomyces naeslundii,* while another (sagittine E) was only active against *A. naeslundii*.

The same group identified five new diterpenoids from *Sagittaria pygmaea*.[12] None of these displayed activity against *A. actinomycetemcomitans*, while four of the others were active against *A. viscosus* and three were active against *S. mutans*.

Curcuma xanthorrhiza (Zingiberaceae) has traditionally been used to treat a number of disorders. Xanthorrhizol, isolated from a methanol extract of the plant roots, was shown to have high levels of antibacterial activity against oral pathogens and in some cases equal or similar to that of chlorhexidine.[13]

Alkaloids

The alkaloid berberine isolated from *C. rhizome* (Ranunculaceae) showed bactericidal activity against oral bacteria, with greatest activity against *A. actinomycetemcomitans* and *P. gingivalis*, although much less activity was observed against *Lactobacillus* and *Streptococcus* species. Berberine also inhibited the collagenase activity of *A. actinomycetemcomitans* and *P. gingivalis*.[14]

Sugar Alcohols

Xylitol is a sugar alcohol naturally found in plants that are used as an artificial sweetener in many foods. Its anticariogenic properties were investigated. The study concluded that xylitol exhibited anticariogenic effects by inhibiting the growth of *S. mutans* while not affecting other streptococci that are part of the normal oral flora.[15]

Other Phytochemicals

Several constituents found in hops, *Humulus lupulus* (Cannabaceae), have been found to display antibacterial activity against *S. mutans*, *Streptococcus salivarius,* and *S. sanguis* in disc diffusion assays.[16]

CONCLUSION

Increasing resistance among pathogens to conventional antibiotics and undesirable side effects of existing therapies have made plants and their metabolites an attractive source to screen for antimicrobial activity.

Furthermore, the emerging health-care companies can explore the option of using phytochemicals from plants in manufacturing newer products for oral application.

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