

ROLE OF TANNINS IN ORAL HEALTH CARE

Shruthi Chandrasekaran

**Department of physiology
Saveetha dental college
162, Poonamalle high road
Chennai – 77**

ABSTRACT:

Tannins are water-soluble polyphenols that are present in many plant foods. Tea polyphenols and many tannin components were suggested to be anticarcinogenic. Many tannin molecules have also been shown to reduce the mutagenic activity of a number of mutagens. Many carcinogens and/or mutagens produce oxygen-free radicals for interaction with cellular macromolecules. The anticarcinogenic and antimutagenic potentials of tannins may be related to their antioxidative property, which is important in protecting cellular oxidative damage. The generation of superoxide radicals was reported to be inhibited by tannins and related compounds. The antimicrobial effects of tannins are found to be vast. The growth of many fungi, yeasts, bacteria, and viruses are inhibited by tannins. The aim of this review is to summarize and analyze the vast effects of tannins on oral health, along with its mechanisms and also its toxic effects above normal therapeutic levels.

KEY WORDS: polyphenols, anticarcinogenic, antimicrobial, antioxidants.

INTRODUCTION

A **tannin** is an astringent, bitter plant polyphenolic compound that binds to and precipitates proteins and various other organic compounds including amino acids and alkaloids.



Tannins are distributed in species throughout the plant kingdom. They are commonly found in both gymnosperms as well as angiosperms.

The best known families of which all species tested contain tannin are:

Aceraceae, *Actinidiaceae*, *Anacardiaceae*, *Bixaceae*, *Burseraceae*, *Combretaceae*, *Dipterocarpaceae*, *Ericaceae*, *Grossulariaceae*, *Myricaceae* for dicot and *Najadaceae* and *Typhaceae* in Monocot.

To the family of the oak, *Fagaceae*, 73% of the species contain tannin. For those of acacias, *Mimosaceae*, 39% of the species tannin, among Solanaceae rate drops to 6% and 4% for the Asteraceae. Some families like the *Boraginaceae*, *Cucurbitaceae*, *Papaveraceae* contain no tannin-rich species.

Tannins are found in leaf, bud, seed, root, and stem tissues. An example of the location of the tannins in stem tissue is that they are often found in the growth areas of trees, such as the

secondary phloem and xylem and the layer between the cortex and epidermis. Tannins may help regulate the growth of these tissues.

USES OF TANNINS IN ORAL HEALTHCARE

DENTAL CARIES

Caries is caused by bacterial acid production in tooth plaque, which can cause deep localized lesions if it remains too near the tooth for any length of time. If left the bacteria then may penetrate the tooth further and progress into the soft pulp tissue. Untreated dental caries can lead to incapacitating pain, potential tooth loss and loss of dental function. The development and progression of dental caries is due to a number of factors, specifically bacteria in the dental plaque (particularly *Streptococcus mutans*) on susceptible tooth surfaces and the availability of fermentable carbohydrate on of tooth decay.[1,11,12]

Apple a day may keep the dentist away. So might a cup of tea or coffee, a bar of chocolate, a glass of beer, a bowl of rhubarb or other foods and beverages loaded with plant compounds called tannins. Used to prevent infection for centuries, tannins have only recently been recognized as potential tooth protectors, with qualities that may make the compounds more effective than fluoride in fighting tooth decay.[2,13,14]

The commonly understood reason is that the chemical structure of a tannin allows it to bind to large numbers of bacteria and hence prevent caries. Another reason is that tannins in tea can inhibit salivary amylase thereby reducing the cariogenic potential of starch-containing foods.[15]

DENTAL PLAQUE

Tannins, tannic acid, Sulfated compounds and benzyl isothiocyanate, are reported to have antimicrobial effects and help the healing of gum inflammation[3].A number of studies have also demonstrated that tannic acid inhibits the growth of *S.mutans* bacteria, a major factor in the build-up of dental plaque.

In a study conducted, chemical evaluation of the semi-purified fraction from the seeds of *guaraná, Paullinia cupana* H.B.K. var. *sorbilis*, yielded the following compounds: caffeine, catechin, epicatechin, *ent*-epicatechin, and procyanidins B1, B2, B3, B4, A2, and C1. Measurement of the antioxidant activity by reduction of the DPPH radical confirmed the anti-radical properties of the aqueous and crude extracts and semi-purified fractions. The EPA fraction showed radical-scavenging activity and protected DPPH from discoloration at , and for the phosphomolybdenum complex showed a higher Relative Antioxidant Capacity (RAC) . *In vitro* assessment of the antibacterial potential of the *Paullinia cupana* extracts against *Streptococcus mutans* showed that these could be used in the prevention of bacterial dental

plaque.[4]

PERIODONTITIS

Periodontal disease results from inflammation of the gum (gingivitis) that gradually causes destruction of the bone supporting the teeth. Gingivitis usually results from infection from debris that has accumulated at crevices at the base of the teeth. It has been suggested that tannins also promotes periodontal health by reducing inflammation, preventing bone resorption and limiting the growth of certain bacteria associated with periodontal diseases.[5,6,18] Also, it was found that the tannin-fluoride preparation (HY preparation), which might have a caries-reductive, plaque inhibiting and astringent action, could reduce the incidence of gingival inflammation around abutment teeth.

Reactive oxygen species have been implicated as important pathological mediators in many clinical disorders, including periodontal disease. As a possible alternative for the treatment of periodontal disease, the antimicrobial activity of six tannins isolated from *Vaccinium vitis-idaea* L., with confirmed antioxidant activity, were assayed by the agar dilution method against selected periodontal pathogens, *Actinobacillus actinomycetemcomitans*, *Porphyromonas gingivalis* and *Prevotella intermedia*. The results showed that epicatechin-(4beta-->8)-epicatechin-(4beta-->8, 2beta-->O-->7)-catechin had strong antimicrobial activity against *P. gingivalis* and *P. intermedia*, but not *A. actinomycetemcomitans*. The other tannins tested did not show antimicrobial activity. We conclude that tannins isolated from *V. vitis-idaea* L. with antimicrobial activity could potentially be used for the treatment of periodontal disease.[7,16,17]

ORAL CARCINOMA

Tannins have been gaining immense interest in recent years due to its antioxidant properties. So these polyphenols are expected to reduce the effects of various life style related diseases such as cancers etc.[8]More than 500 varieties of hydrolysable tannins have been found useful as anti-viral,anti-tumor promoting and for inhibition of some enzymes.[20]

Ellagitannin(a newly derived tannin) was found to be more potent than other types of tannins.When their cytotoxicity was assessed against a human oral tumor cell against normal human gingival fibroblasts (HGF), it was found more potent against the tumor cell than the HGF cell.The cytotoxicity was partly attributed to apoptosis induced by the ellagitannin as characterized by DNA fragmentation.[9,10,19]

ORAL ULCERS:

Again this anti-inflammatory and anti-ulcer effects are attributed to the antioxidant properties of tannins.

Tannins are used in medicine primarily because of their astringent properties. These properties are due to the fact that tannins react with the tissue proteins with which they come into contact. In ulcers, this tannin-protein complex layer protects the oral mucosa by promoting greater resistance to chemical and mechanical injury or irritation. Moreover, in several experimental models of ulcer, tannins have been shown to present antioxidant activity, promote tissue repair etc. The presence of tannins explains the anti-ulcer effects of many natural products.

CONCLUSION:

In conclusion, the tannins can be of effect on the control of growth of dental plaque bacteria and dental caries, periodontal diseases and even oral cancer. Therefore, they can be used in toothpastes and can be beneficial in controlling dental caries. Tannins & its monomers have profound effects on health which is mainly attributed to its antioxidant properties, astringent nature and enzyme inhibiting actions. It is not advisable to take a large quantity of tannins, as they may be toxic. Hence it is important to determine the correct dosage of tannins for promoting optimal health and extracting maximal benefit.

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