

**BEAT THE DECAY IN A FOODY FASHION****KEERTHI VENKATESAN^{*1} AND MANISH RANJAN²**¹Senior Lecturer, Thai Moogambigai Dental College and Hospitals, Chennai, India.²Senior Lecturer, Saveetha Dental College and Hospitals, Chennai, India.**ABSTRACT**

Dental caries commonly referred to as tooth decay is a dynamic, progressive, infectious, diet-dependent and most prevalent chronic disease with a global distribution. Individuals of any age are susceptible to this disease at any point of time throughout their life. This disease is reversible if detected at the earliest possible stage. Dental caries can be the outcome when pathological factors leading to demineralization exceeds the protective factors leading to remineralization. Research is still being carried out to increase the caries resistance of teeth and to reduce the risk of cariogenic bacteria. This review focuses on various naturally occurring products which includes green tea, cranberry, coffee, chocolate and probiotics which are anticariogenic nutritionally.

KEYWORDS: Dental caries, green tea, polyphenols, probiotics, streptococcus mutans.^{*}corresponding author**KEERTHI VENKATESAN**Senior Lecturer, Thai Moogambigai Dental College and Hospitals,
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INTRODUCTION

“An ounce of prevention is worth a pound of cure” - Benjamin Franklin Dental caries is an infectious microbiological disease of the teeth that results in localized dissolution and destruction of calcified tissues¹. However interaction between microorganisms, tooth, substrate and time results in caries. This infection leads to loss of minerals from outer surface of tooth i.e., enamel progressing towards dentin and pulp at a later stage. In order to preserve the vitality of tooth, it is necessary to detect and prevent dental caries at the earliest possible stage. *Streptococcus sobrinus* in conjunction with *Streptococcus mutans* is considered to be pathogenic in the development of dental caries. In clinical scenario, this group is referred to as mutans streptococci. Mutans streptococci produce bacterial enzyme glucosyltransferase and synthesize an adherent and water insoluble glucan from sucrose at low pH which causes organisms to adhere firmly to tooth surface leading to formation of biofilm². This group in turn continuously produces lactic acid metabolising carbohydrates at low pH which eventually leads to demineralization of enamel causing caries³. Lots of research have been carried out resulting in prevention of dental caries to a large extent. Primary prevention is the key to minimal intervention dentistry.

Prevention is a philosophy whose main objectives include⁴:

- To consider patient as a whole entity and not as isolated tissues.
- To inform and instruct patients to maintain their oral health and protect them from oro-dental diseases for as long as possible.
- To arrest the progress of disease at the earliest possible stage.

Prevention of dental caries in a nutritional way is a cost effective intervention. This article evaluates the various natural products available in the prevention of dental caries.

PLANT STIMULANT BEVERAGES

Tea (Camellia Sinensis L.)

Camellia Sinensis is a perennial shrub belonging to *Theaceae*, native to Southwest Asia. Tea is classified into three types which include green tea, black tea and oolong tea. Both green tea as well as black tea helps in prevention of caries. The main chemical difference is that former contains simple catechins (polyphenols with molecular weight <450 Da) whereas in latter oxidised and condensed theaflavins and thearubigins are present. These are microbiologically active molecules. In addition, black tea still contains simple catechins like epicatechin [EC], epicatechin gallate [ECG] and epigallocatechin gallate [EGCG] which are present in green tea also⁵.

Mode of Action

Anti-streptococcal activity

Minimal inhibitory concentration of individual catechins is between 50 and 500 mg/L against mutans streptococci⁶.

Inhibition of adherence

Otake et al. has demonstrated that mixture of simple catechins derived from green tea at 100 mg/L caused a prominent inhibition of adherence of *Streptococcus mutans* to saliva-coated hydroxyapatite⁷. Both high and low molecular weight fractions bind to bacterial surface proteins, decreasing hydrophobicity and inducing cellular aggregation⁸.

Inhibition of glucosyl transferase⁹

Epigallocatechin at 167 mg/L caused 91% inhibition.

Epigallocatechin at 450 mg/L caused 50% inhibition.

Inhibition of salivary and bacterial amylase

Salivary amylases catalyzes the hydrolytic cleavage of food starches to maltose and other low molecular weight sugars which have a crucial role in development of caries¹⁰. However, there exist a positive correlation between dental caries and salivary amylase activity¹¹. This is carried

out by water soluble extracts of tea¹². Hara and Honda found that simple catechins as well as theaflavins inhibited salivary amylase¹³.

Studies

Mao-Jung et al. in 2004 performed study to determine the usefulness of green tea leaves and black tea extract for the delivery of catechins and theaflavins to the oral cavity and found that high concentrations of catechins and theaflavins were observed in saliva in the first hour. They concluded that tea leaves can be used as a convenient, slow-release source of catechins and theaflavins and can be used in dental caries prevention¹⁴. Yoshiharu et al. in 2009 performed a study to determine the influence of a bottled green tea beverage on dentin demineralization with a demineralization gel system in which green tea treatment showed significantly lower mineral loss¹⁵.

Chocolate (*Theobroma Cacao L.*)

T.Cacao L is a member of *Bromeliaceae* native to forest of Central and South America. Seeds of *T.Cacao* are used to produce cocoa powder and chocolate tablets. The polyphenolic content of cocoa seeds represent 6-8% of their dry weight. The main polyphenols found are catechins: catechin and epigallocatechin¹⁶.

Mechanism of action

Cocoa products contain inhibitors of enzyme dextransucrase responsible for formation of plaque extracellular polysaccharides from sucrose¹⁷. Phenolic substances present in cocoa may be responsible for anticaries effect¹⁸.

Studies

Verikaki et al. performed an in vivo study which proved that cariogenic potential indices of chocolate with high cocoa levels was less than 40% that of sucrose (10% w/v) and lower than chocolate containing low cocoa levels¹⁹. Further research has proved that incorporation of cocoa powder into hamster diets reduced caries²⁰. According to a recent study wherein a mouth-rinse was prepared from ground husk of cocoa beans (1 mg/ml) given to

children resulted in 20.9% reduction of mutans streptococci counts and 49.6% decrease in plaque scores²¹.

Coffee (*Coffea Arabica L.*)

Coffea Arabica is an evergreen shrub native to Ethiopia. However its cultivation was extended to Asia, America and Africa subsequently. Coffee in roasted form possesses antibacterial activity against streptococcus mutans. Green coffee and roasted coffee contains antiadsorption properties²². This antiadsorption property is due to trigonelline, caffeine and chlorogenic acid²³.

Studies

Gabriella Gazzani and researchers at the University of Ancona analyzed the sampled green and roasted Arabica and Robusta coffee from different countries, and reported that all tested samples inhibited streptococcus mutans adsorption and showed inhibitory activity ranging from 40.5 to 98.1% respectively²⁴. It was also reported that green coffee samples were less active than roasted coffee samples²⁵. Instant coffee had a higher level of inhibitory activity against streptococcus mutans than ground coffee according to research²⁶.

CRANBERRY

It is basically a North American fruit (*Vaccinium macrocarpon* Ait., Ericaceae). Cranberry extracts are a rich source of flavonoids especially flavanols myricetin and quercetin along with the presence of anthocyanins and proanthocyanins. These extracts possess biological properties and provide human health benefits²⁷.

Mechanism of action

Cranberry inhibits mutans streptococci adhesion and biofilm formation with the coaggregation of a number of oral streptococcal species²⁸. This is due to high molecular mass, non-dialyzable material (NDM) obtained from cranberries²⁹. Cranberry has an inhibitory effect on biofilm formation by *S.Sobrinum*, which is prominent in the presence of sucrose³⁰.

Studies

Koo et al. in 2006 proved that 25% cranberry juice inhibit the adhesion of *Streptococcus mutans* to saliva or glucan-coated hydroxyapatite surfaces³¹. Yamanaka et al. in 2004 found that cranberry juice reduces the hydrophobicity of oral streptococci³². Duarte et al. in 2006 proved that cranberry extracts inhibit acid production by *Streptococcus mutans*³³.

PROBIOTICS

Probiotics are dietary supplements which were used to control gastrointestinal disease, urinary tract infections, cancer etc. Probiotics containing foods include yogurt, fermented and unfermented milk, cheese, soy beverages etc. Probiotics were found to be active in the formation and development of oral biofilm with its anticariogenic effect.

Mechanism of action³⁴

- It acts directly by interacting with dental plaque by the following ways :
 - Involvement in binding of oral micro-organisms to proteins (biofilm formation).
 - By competing and intervening with bacteria-to-bacteria attachment with action on plaque formation.
 - Involvement in metabolism of substrates.
 - Production of chemicals that inhibits oral bacteria.
- It acts indirectly by the following ways:
 - Modulating systemic immune function, local immunity, non-immunologic defence mechanism, regulation of

mucosal permeability, antioxidants and prevent plaque formation by neutralizing free electrons.

Studies

Nase et al. performed an in vivo placebo-controlled randomized double-blind intervention study which proved that administration of Probiotic lactobacilli to kindergarten children in Helsinki, Finland reduced the caries risk³⁵. Cagler et al. demonstrated that consumption of bifidobacterium containing yogurt decreases the salivary streptococcus mutans count³⁶.

CONCLUSION

Although tea, coffee and cocoa have polyphenols which seems to be effective against adhesion of bacteria on surface of teeth reducing dental caries, but still there is a need for larger in-vivo studies involving different age groups and geographical areas to prove the potent anticariogenic effect of plant stimulant beverages. Recent research has supported the use of cranberry juice in prevention of oral diseases. It has also been suggested that cranberry juice can be incorporated in mouth rinses or dentrifices to prevent dental caries. On the other hand, probiotics not only prevent dental caries but also prevents periodontal diseases as well. Caries management in a nutritional way proves to be a preventive approach which creates a positive impact globally.

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