

# Synergistic Effect of Different Types of Tea Extract in Combination with Cinnamon Extract against Streptococcus Mutans

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**Abstract:** *Aim: To determine the synergistic effect of different types of tea extracts in combination with cinnamon extract against streptococcus mutans. Method: Antibacterial activity of green tea along with cinnamon was screened by agar well diffusion techniques. Background: Streptococcus mutans is a facultatively anaerobic, gram-positive coccus. It is a common habitant of human oral cavity and is one of the major contributors to the process of dental caries. They play a major role in caries by metabolising sucrose to lactic acid. This acidic environment renders the enamel vulnerable to decay. Till date, many researchers have focused only on the effect of green tea on mutans count. But the studies on other types of tea are handful. This study aims at finding the correlation between different types of tea in combination with cinnamon extract and S.mutans count. Result: The results of this study showed that both green tea and cinnamon has good antibacterial effect. They also showed synergistic activity on the organism tested.*

**Keywords:** Dental caries, agar well diffusion, synergistic effect, green tea, cinnamon

## 1. Introduction

Dental caries can be defined as the destruction of dental hard tissues due to the acidic by products produced by bacteria[6]. Dental caries develops in both crown and roots areas of the teeth. Risk factors are both biological and physical. The risk factors include adequate salivary flow, composition, high number of bacteria poor oral hygiene, poor dietary habits and oral medications containing sugars [6]. Streptococcus mutans is a facultatively anaerobic, gram positive coccus. It is a common inhabitant of human oral cavity. It is also a significant contributor to dental caries. S. mutans can strongly adhere to the tooth surface, produce acidic metabolites and they have the capacity to build up glycogen reserves.. Diet containing sucrose is the main reason for high acid production and so dental caries[7].

Tea- the most preferred beverage of the century. The beverage tea has its roots in Southwest China, where green tea is not just a beverage but a medicinal drink too. The source of tea is Camellia sinensis[4]. This aromatic beverage is commonly prepared by pouring hot or boiling water over the cured leaves of this plant.

There are many different types of tea, such as white tea, green tea, yellow tea, black tea, oolong tea and pu-erh tea. The fact is that all these tea types have a common source, the Camellia sinensis. The processing method of the leaves after harvesting decides the type of tea produced. The different processing methods impart characteristic colour and flavour to the tea leaves. For our study, we chose three tea types, namely green tea, red tea and black tea respectively.

Black tea contains the highest caffeine levels with 40mg of caffeine per cup. It also contains two types of antioxidants – thearubigins and theaflavins. These two antioxidants have been linked to low cholesterol levels.

Red tea (rooibos tea) is rich in many minerals like iron, calcium, copper, zinc, manganese, magnesium, potassium and alpha hydroxy acid. Antioxidants like aspalathin and nothofagin and extremely potent and versatile phenolic compounds are also present. Red tea is devoid of oxalic acid and hence it can be consumed by people with kidney stones too.

Green tea is an excellent source of catechins, another type of antioxidant.

## 2. Materials and Methods

Test microorganism:

Bacterial strain used was Streptococcus mutans. The strain was isolated using mutans sanguis media (Hi media no.: M977) and maintained at 4° C in the department of microbiology, Saveetha Dental College and Hospitals.

Methodology- agar well diffusion technique:

A decoction was prepared for the 3 tea types by boiling tea powder in water to obtain different concentrations. Culture was carried out by the agar well diffusion technique. Broth cultures of the test organisms compared to Mac Farland's standard 0.5 were prepared. Lawn culture of test organisms were made on Muller-Hinton agar (MHA-M1084). plates using sterile cotton swab and the plates were dried for 15 minutes. Well measuring 4mm depth was made on the agar with sterile cork borer. 100 micro litre extract was added to the wells. The plates were incubated overnight and the zone of inhibition of growth was measured in mm diameter. The entire tests were done in triplicate to minimise the test error.

To determine the synergistic activity, 50 micro litres of green tea and 50 micro litres of cinnamon extract from different concentrations were loaded on to the wells. 0.2% chlorhexidine was used as the positive control. The plates

were incubated at 37°C overnight and the zone of inhibition of growth was measured in millimetres. All the tests were done in triplicate to minimise the test error.

### 3. Discussion

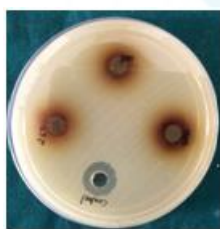
The acidogenic bacterial flora in the oral cavity like *Streptococcus mutans*, *Streptococcus sobrinus*, *Streptococcus oralis*, *Streptococcus intermedius*, *Streptococcus anginosus*, *Lactobacillus acidophilus*, *Streptococcus salivarius*, *Streptococcus mitis*, *Streptococcus sanguis* serve as the potent initiators of dental caries[2,6,8,9].

A wide array of researches testing the antibacterial activity on these bacterial flora were previously carried out using essential oils like cinnamon, thyme, peppermint, clove, neem oils, green tea, oolong tea, etc.,. A previous study had reported a scientific basis for the traditional use of cinnamon, clove and rosemary oil on oral pathogens [1]. This is because of the reported antibacterial, antiviral, insecticidal and antioxidant properties of essential oils[7].

This study focussed on the use of three different teas- green tea, black tea and red tea along with cinnamon extract to study their synergistic effect on *S.mutans*.

There exists a main difference between green tea and black tea. Green tea contains simple catechins. But in black tea many of these catechins have been oxidised and condensed, during a manufacturing process known as “fermentation” to larger dark coloured molecules known as theaflavins and thearubigins[9].

The antibacterial activity of three different types of tea namely, green tea, red tea and black tea at different concentrations was studied separately and in combination with cinnamon extract by agar well diffusion technique. The zone of inhibition was measured in mm diameter. The results have been tabulated in table 1.



Tea extract	Conc. Micro g / ml	E1 mm	E2 mm	Chlorhexidine mm
Green tea	250	15	18	23
	500	21	24	
	1000	26	30	
Red tea	250	12	15	23
	500	20	22	
	1000	24	27	
Black tea	250	10	17	23
	500	17	24	
	1000	21	28	

Where,

E1- zone of inhibition of the type of tea alone

E2- zone of inhibition of the type of tea in combination with cinnamon extract

The results of the study reveal that green tea shows the most effective antibacterial activity against *Streptococcus mutans*, with its zone of inhibition measuring 26mm at a concentration of 1000 micro grams per ml. When combine with cinnamon extract, again green tea shows the highest zone of inhibition of 30mm at 1000 micro grams per ml.

The second highest antimicrobial activity was exhibited by red tea at a concentration of 1000 micro gram per ml with its zone of inhibition measuring 24 mm when used alone and 27 mm in combination with cinnamon extract.

The least antibacterial effect was exhibited by black tea with its zone of inhibition measuring 21 mm, but its zone of inhibition when combined with cinnamon extract was 28 mm, which is quite higher than that of red tea.

The results of recent studies indicate that: 1. green tea mouth rinse proved to be equally effective compared to chlorhexidine which is considered as gold standard [5]

2. oolongteapolyphenols strongly inhibited the enzyme activities of some types of GTases of *mutans streptococci*[3].

### 4. Conclusion

This study proves the significant synergistic effect exhibited by green tea when combined with cinnamon extract. This synergistic effect can be effectively used in a wide range of oral health care products like tooth powders, tooth pastes, mouthwashes, etc,

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