

Synergistic Effect of Clove and Cinnamon Extract Against Oral Pathogens - An In Vitro Study

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ABSTRACT

Aim: To study synergistic effect of clove and cinnamon extract against oral pathogens- an in vitro study
Materials And Method: The plant extract was prepared using 1g of cinnamon and 1g of clove added to 10 ml of distilled water. Placed in the heating mantle for about 20 minutes for condensation and was stored in a centrifuged tube. Using miller hinton agar, the organism was lawn cultured, later well cut cut and dined in micro plate. About 50µl of sample was used, and the micro plate was incubated for 24 hrs at room temperature (37°c) and the zone of inhibition was measured.
Conclusion: Cinnamon and Clove extract has considerable synergistic effect against Streptococcus mutans and Enterococcus and a new tool for minimally invasive and adhesive dentistry avenues.

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INTRODUCTION

Bacteria Dental caries is a multifactorial infectious illness brought on by bacterial acids that seep into enamel and dentine during metabolic activity(1). In particular, Streptococcus mutans and other non-streptococcus species like Lactobacillus acidophilus, which create acid and raise the plaque's pH to a critical level, are the main causative factors(2). Numerous preventive measures have been tried and evaluated, but none have proven to be 100% effective in stopping dental caries, thus the road continues(3). Chlorhexidine is currently regarded as the most effective chemotherapy agent against the most cariogenic bacterium, Streptococcus mutans, but patients are unable to use it due to oral adverse effects such as teeth discoloration, unpleasant taste, dryness, and burning sensations(4). As a result, given that their side effects are minimal and patients receive complete care, current therapeutic research must look into naturally occurring products that are safe for humans and specifically targeted at treating dental caries(5). Numerous studies have been conducted to determine whether common household essential oils like clove and cinnamon can be used as treatments for dental conditions like toothaches and gum swelling. Recent scientific studies have revealed the possible antibacterial effects of these plants' extracts.

KEYWORDS:

cinnamon, clove, Streptococcus mutans and Enterococcus

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Clove (*Syzygium aromaticum*) is time-honored for its medicinal properties; however, its medicinal characteristics are used only in “Ayurvedic medicines.” The principal phenolic components of clove essential oil, eugenol, and eugenyl acetate have been shown to change some physical properties of resin composite such as the adverse effect on surface roughness (6), transverse strength (7), and surface hardness (8). However, clove oil is supposed to cause serious problems like sore throat, vomiting, cytotoxicity, kidney failures, and/or damage to the liver, seizures, difficulty breathing, and others if used in higher doses. Therefore, in the present study small doses showing least cytotoxic effects of this oil have been used.

Cinnamon and ginger (*Zingiber officinale*) may also have antibacterial and antifungal effects, according to research (9), (10). The family of relatives that includes ginger (*Zingiberaceae*) includes turmeric (*Curcuma longa*). Since the advent of Ayurveda in 1900 BC, turmeric has been used for a variety of ailments and conditions, including those affecting the skin, lungs, and gastrointestinal tracts, as well as aches, pains, and liver issues. Although several plants have demonstrated antibacterial activity, to date, their antibacterial activity against cariogenic bacteria is still under research(10,11). Hence in search of novel anti-cariogenic agents, known medical applications have been chosen in this study.

Our team has extensive knowledge and research experience that has translate into high quality publications(12-21)

This study investigated the synergistic effect of clove and cinnamon extract against oral pathogens- an invitro study.

MATERIALS AND METHOD

The plant extract was prepared using 1g of cinnamon and 1g of clove added to 10 ml of distilled water. Placed in the heating mantle for about 20 minutes for condensation and was stored in a centrifuged tube. Using miller hinton agar, the organism was lawn cultured, later wellcut cut and dined in micro plate. About 50µl of sample was used, and the micro plate was incubated for 24 hrs at room temperature (37° c) and the zone of inhibition was measured.

Antibacterial Activity

Antibacterial activity of Clove ,cinnamon and their combination is tested against the strain *Streptococcus mutans*, and *Enterococcus*. Mueller Hinton Agar was utilised for this activity to determine the zone of inhibition. Mueller hinton agar was prepared and sterilized for 15 minutes at 121oC. Media poured into the sterilized plates and let it stable for solidification. The wells were cut using a 6mm sterile polystyrene tip and the test organisms were swabbed. The extract with different concentrations (25µL, 50 µL ,100 µL)were loaded and in the fourth well standard antibiotic amoxyrite was loaded. The plates were incubated for 24 hours

at 37 °C. After the incubation time the zones of inhibition were measured.



Fig.1: Cinnamon and clove extract



Fig.2: condensation of cinnamon and clove



Fig.3: Streptococcus mutans



Fig.4: Enterococcus

RESULT AND DISCUSSION

Zone of inhibition in cinnamon+clove extract for enterococcus is 18mm and streptococcus mutans is 17mm thus the extract shows synergistic effect.

EXT/ORG	ENTEROCOCCUS	S MUTANS
CINNAMON	9mm	12mm
CLOVE	8mm	13mm
CINNAMON AND CLOVE	11mm	17mm
CHX(0.2%)	18mm	23mm

In this study it has been shown that cinnamon and clove have considerable synergistic effect against streptococcus mutans and enterococcus and a new tool for minimally invasive and adhesive dentistry avenues(22).

Changes in the bacterial cell surface after exposure to cinnamon extract (2.5 mg/mL) for 2 hours were compared to unexposed bacterial cells. *S. mutans*, enterococcus. These results suggest that exposure to cinnamon extract may have induced changes in the surface membrane of the tested bacteria. It suggests that the mechanism by which extract induced changes in the surface membrane may differ depending on the bacterial species tested.

Betel leaves, black pepper, cloves, and cinnamon, among other common domestic spices and herbs, have traditionally been used as oral health remedies for conditions like gum swelling and toothache. Recent studies have also demonstrated the potential antibacterial properties of these herb extracts(23).

The high antibacterial activity of the Cinnamon and clove extract is mainly attributed to its secondary metabolites. It has been shown that Cinnamon and clove antimicrobial properties

are mainly related to its cinnamaldehyde and clovaldehyde which is highly electronegative which interferes in biological processes including electron transfer and react with nitrogen-containing components, such as nucleic acids as well as proteins, therefore inhibits the microorganism's growth. Thus cinnamon and clove show synergistic effects compared to the control group(24). Preventive medicine relies mostly upon reducing the bacterial biofilm via oral hygiene. The most often used active ingredients in mouth rinses and toothpastes are chlorhexidine, hyaluronic acid, and fluorides(25). Although effective, chemical products may have some clinical disadvantages: teeth discoloration, taste alterations, mouth dryness, supragingival calculus accumulation, and oral mucosal lesions(26).

For more than four decades, CHX has been regarded as the primary chemical plaque control agent. However, there are a number of negative effects associated with CHX, including tooth stains (27). Mouthwashes containing CHX may precipitate the local color between the tooth-bound CHX and the chromogens in the daily diet, resulting in unpleasant brownish discoloration or staining (28). Additionally, the use of CHX may cause sporadic oral mucosal desquamations and soreness (29). The staining effect of herbal-based mouthwashes was found to be minimal or absent (30).

CONCLUSION

Cinnamon and Clove extract was found to be a much better antagonistic agent, exhibiting a broad range of anti microbial activity against microbes causing dental caries Streptococcus mutans and Enterococcus compared to chlorhexidine and a new tool for minimally invasive and adhesive dentistry avenues. Hence, it represents an alternative source of natural antimicrobial substances for use in chemotherapeutic agents. Thus cinnamon and clove show synergistic effects compared to the control group.

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Authorship contribution

RP compiled the manuscript RVG conducted the study LT designed the study

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