



# Antibacterial activity of the three essential oils on *Streptococcus mutans*- an in-vitro study

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## Abstract:

The aim of the present study was to evaluate the anti bacterial activity of three essential oils Thyme, Peppermint and neem oil on *Streptococcus mutans*, the potent initiator and leading cause of dental caries world wide. Essential oils are distillates of the volatile compounds of a plant's secondary metabolism and may act as phytoprotective agents. Their curative effect has been known since antiquity. It is based on a variety of pharmacological properties which are specific for each plant species. Antibacterial activity of the three essential oils, Thyme, Peppermint and neem oil were screened against *Streptococcus mutans*, using disc diffusion technique. The results of this study showed that the extracts at different concentrations exhibited anti bacterial activity against the bacterial species tested.

**Keywords:** Thyme oil, peppermint oil, neem oil, Anti bacterial, Dental caries, Disc diffusion

## INTRODUCTION

The spread of drug resistant pathogens is one of the most serious threats to successful treatment of microbial diseases. Essential oils and other extracts of plants have evoked interest as sources of natural products. Essential oils also called volatile oils, are aromatic oily liquids obtained from plant materials such as flowers, buds, seeds, leaves, twigs, bark, herbs, wood, fruits and roots.. The antimicrobial activity of essential oils is due to a number of small terpenoids and phenol compounds. Essential oils such as tea tree oil, lavender oil, thyme oil, peppermint oil and eugenol oil have been traditionally used by people for various purposes in different parts of the world.

Thyme (*Thyme vulgaris*) is a perennial herb which is hosting mainly in Mediterranean countries. The medicinal part of thyme is flowering part and branches. Thyme plant is a strong antispasmodic

,antiseptic, aromatic smell, slightly bitter in taste.(1). The main chemical components are  $\alpha$ -thujone,  $\alpha$ -pinene, camphene,  $\beta$ -pinene,  $\beta$ -cymene,  $\alpha$ -terpinene, linalool, borneol,  $\beta$ -caryophyllene, thymol and carvacrol.(2). The health benefits of thyme are undeniable; thyme oil alone, or when used in a mixture of other natural health promoting compounds, has been found to relieve the following conditions. Nail fungus, Parasites, Muscle pain, Chronic fatigue, hair loss , Depression, Fatigue ,Headache, insomnia, snoring, Skin problems. As an antioxidant, thyme protects the body from the effects of aging. As a stellar digestive herb, thyme can enhance appetite and digestion while stimulating the liver. One of the characteristics of pure essential oils is their ability to penetrate mucous membranes. Therefore, their supragingival use yields a beneficial subgingival effect. (3)The clinical protocol presented in this article uses a group of products from Dental Herb Company

(Tooth and Gums Tonic, Paste, Spritz, and Under the Gums Irrigant), which contain pure essential oils and herbal extracts with no ethyl alcohol. The pure essential oils used are red thyme, eucalyptus, peppermint, cinnamon bark, and lavender. This group of products has the ability to act as a proactive therapeutic treatment as well as a reactive care solution, and has been recommended by a variety of dental researchers, authors, and clinicians.<sup>16,24-32</sup> The ingredients have been extensively researched and have the ability to work in 4 distinct, yet synergistic ways: (1) antimicrobial, (2) tissue conditioning, (3) connective tissue rebuilding, and (4) anti-halitosis. These products also include the herbal extracts of echinacea, gotu kola, and green tea. These extracts are effective in the maintenance and health of the periodontium and dentition.

**Peppermint oil**  
Peppermint oil (*Mentha pepperita*) is a herbaceous rhizomatous perennial plant growing to 30–90 cm (12–35 in) tall, with smooth stems, square in cross section. The rhizomes are wide-spreading, fleshy, and bare fibrous roots. The leaves are from 4–9 cm (1.6–3.5 in) long and 1.5–4 cm (0.59–1.57 in) broad, dark green with reddish veins, and with an acute apex and coarsely toothed margins. The leaves and stems are usually slightly fuzzy. Peppermint has a high menthol content. The oil also contains menthone and menthyl esters, particularly menthyl acetate.<sup>(12)</sup> Dried peppermint typically has 0.3-0.4% of volatile oil containing menthol (7-48%), menthone (20-46%), menthyl acetate (3-10%), menthofuran (1-17%) and 1,8-cineol (3-6%). Peppermint oil also contains small amounts of many additional compounds including limoene, pulegone, caryophyllene and pinene.<sup>(4)</sup>

## MATERIALS AND METHODS

### Test microorganisms

Bacterial strain used was *Streptococcus mutans*. The organism was isolated using selective media Mutans -Sanguis agar (Hi media M977), and maintained in nutrient agar slope at 4°C in department of Microbiology, Saveetha Dental College.

### Methodology

The essential oils, Thyme, Peppermint, Neem oil were loaded on sterile filter paper discs measuring 6mm diameter in the following concentrations 50µl, 100µl and 200 µl respectively. The discs were dried and kept aseptically.

### Screening of antibacterial activity (Disc diffusion technique)

Broth culture of the bacterial strain compared to Mac Farland's standard 0.5 was prepared. Lawn culture of the test organisms were made on the Muller Hinton agar (MHA-Hi media M1084) plates using sterile cotton swab and the plates were dried for 15 minutes. Filter paper discs loaded with different concentrations of the essential oils were placed on the respective plates.<sup>(5)</sup> The plates were incubated at 37°C overnight and the zone of inhibition of growth was measured in millimeters. All the tests were done in triplicate to minimize the test error.

## RESULT AND DISCUSSION

The antibacterial activity of the essential oils at different concentrations was screened by disc diffusion technique and the zone of inhibition was measured in mm diameter. The results are given in the table 1. The neem oil was more effective

against *Streptococcus mutans* with a zone of inhibition of 28mm diameter (at conc200 µl.), thyme oil showed a zone of 20mm diameter and with pepper mint oil the zone diameter was 16mm.(6) Dental caries is a microbial disease that result in the destruction of mineralized tissue of the teeth. *Streptococcus mutans* is the potent initiator and leading cause of dental caries world wide. It is considered to be the most cariogenic of all of the oral *Streptococci*. The present study was to evaluate the antibacterial activity of tree tea oil on caries causing organisms. The results obtained from our study shows that the three essential oils have got a very good antibacterial activity against *Streptococcus mutans* (7,8)

**Table 1:** Anti bacterial activity of essential oils

Organism	Conc µl	E1	E2	E3	Chlorhexidine
Strptococcus mutans	50	12	10	15	22
	100	19	14	21	30
	200	24	20	28	38

E1 – Thyme oil, E2 – Pepper mint oil, E3 – Neem oil

## CONCLUSION

Herbs, which are powerful healing agents, must be used appropriately. Herbs contain active ingredients that may interact negatively with prescribed medications or other remedies. It is wise, therefore, to consult a health-care professional in situations in which you question the appropriateness of the herb or its interaction with other remedies.(9) . The use of herbs in dentistry should be based on evidence of effectiveness and safety. The anti-bacterial activities could be enhanced if active components are purified and adequate dosage determined for proper administration. The present results therefore offer

a scientific basis for traditional use of cinnamon, clove and rosemary oil on oral pathogens(10)

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