Research Article

Comparative analysis of antibacterial activity of five essential oils against *Streptococcus mutans*

S. Shree Nidhi, R. V. Geetha*

ABSTRACT

Introduction: *Streptococcus mutans* is a facultatively anaerobic, Gram-positive coccus (round bacterium) normally found in the human oral pit and is a noteworthy supporter of tooth decay. It is a piece of the "streptococci" (plural, and non-italic lowercase), a casual general name for all species in the sort *Streptococcus*. An essential oil is a concentrated hydrophobic liquid containing volatile (easily evaporated at normal temperatures) chemical compound from plants. Essential oils are also known simply as the oil of the plant from which they were extracted, such as oil of clove. An essential oil is "essential" in the sense that it contains the "essence of" the plant's fragrance – the characteristic fragrance of the plant from which it is derived and is used for many other medical uses such as in treating bacterial and fungal infections as well as in aromatherapy. **Aim:** The aim of the study is to compare and analyze the antibacterial activity of five essential oils against *S. mutans.* **Materials and Methods:** The test microorganisms *S. mutans* was obtained from the microbiology department of Saveetha Dental College and stored at 4°C. The essential oils are lemon grass oil, cypress oil, orange oil, Brahmin oil, and pepper oil. **Results:** The lemon grass showed more antibacterial activity than the other oils used and showed a zone of inhibition of 50 mm longest than the other activity showed. **Conclusion:** The study concludes that among all the oils lemon grass showed significant length in the zone of inhibition area of 50 mm. There by proving a good antibacterial activity against *S. mutans*.

KEY WORDS: Antibacterial activity, Essential oils, *Streptococcus mutans*

INTRODUCTION

Despite the implementations of measures to control dental caries and to treat them with fluoride have become more still dental disease in many countries.[1] Caries are multifunctional infectious disease caused by accumulation of biofilm.[2] The accumulations occur when there is an imbalance between the biofilm and host due to the changes that takes place in the biofilm matrix pH caused by the diet intake, microorganism, salivary flow, and their components.[3,4]

Streptococcus mutans is considered the most cariogenic of all oral streptococci.[5] *S. mutans* is able to colonize the tooth surface and produce large amounts of extra and intracellular polysaccharides. This microorganism is highly acidic and metabolizes many salivary glycoproteins thus being responsible for stage of oral biofilm formation and caries lesions.[6] Several products have been used to control dental caries such as fluoride, chlorhexidine, and their association.[7] However, natural products have shown significant contribution to the discovery of chemical structures to create new medicaments to be used.[8,9]

Essential oils are important for their detected antibacterial activity[10-12] including against *S. mutans*.[13] They are complex, volatile, ad natural compounds formed by aromatic plants as secondary metabolite.[14] They are known for their bactericidal, virucidal, and locally anesthetic properties.[15] The aim of this study was to evaluate the activity of essential oils against *S. mutans*.

MATERIALS AND METHODS

The test microorganism *S. mutans* was obtained from the Department of Microbiology from Saveetha Dental College and stored at 4°C. The five essential oils are as follows:

1. Lemon grass oil
2. Brahmin oil
3. Cypress oil

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Department of Microbiology, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India

***Corresponding author:** R. V. Geetha, Department of Microbiology, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India. E-mail: rvgeetha2015@gmail.com

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4. Black pepper oil
5. Orange oil was obtained commercially.

Assay for antibacterial activity using agar well diffusion method. MHA agar was used.

The screening of antibacterial activity of lemon grass oil, Brahmi Oil, cypress oil, black pepper, and orange oil extract was carried out using the agar well diffusion method. The bacterial strain was inoculated into nutrient broth and incubated at 37°C overnight. The culture was then adjusted to 0.5 McFarland turbidity standard. 23–26 Lawn culture of the test organism was made on the Mueller-Hinton agar (MHA-HiMedia M1084) plates using sterile cotton swab and the plates were dried for 15 min. A sterile cork borer was then used to make wells (6 mm diameter) for different concentrations of the extracts, 100 µl of the concentrations of the extracts were introduced into the wells with the help of micropipettes. The culture plates were allowed to stand on the working bench for 30 min for pre-diffusion and were then incubated in the upright position at 37°C for 24 h. After 24 h, antibacterial activity was determined by the measurement of diameter of zones of inhibition (mm). Standard antibiotic disks of amoxicillin (30 mcg/disk) and ciprofloxacin (30 mcg/disc) were used as positive control. All the tests were done in triplicate to minimize the test error.

RESULTS

Effect of five different oils (black pepper, orange oil, Brahmi Oil, lemon grass oil, and cypress oil) was tested against *S. mutans* using agar well diffusion technique. The antibacterial activity of the oils is shown in Table 1.

Lemon grass oil showed the highest antibacterial activity followed by cypress oil, orange oil, and black pepper oil while Brahmi Oil showed no antibacterial activity.

DISCUSSION

The antibacterial activity of the essential oils at different concentrations was screened by disk diffusion technique and the zone of inhibition was measured in mm diameter. The results are given in Table 1. The lemon grass oil was more effective against *S. mutans* with a zone of inhibition of 50 mm diameter (at conc. 100 µl.), cypress oil showed a zone of 24 mm diameter, orange oil showed a zone of 20 mm diameter, and with black pepper oil the zone diameter was 16 mm.[16] Dental caries is a microbial disease that result in the destruction of mineralized tissue on the teeth. *S. mutans* is the potent initiator and leading cause of dental caries worldwide. It is considered to be the most cariogenic of all of the oral Streptococci. The present study was to evaluate the antibacterial activity of the essential oil on caries causing organisms. The results obtained from our study shows that the four essential oils have got a very good antibacterial activity against *S. mutans*.[17,18]

Table 1: Antibacterial activity of essential oils on *Streptococcus mutans*

Oil (in 100 µl)	Zone of inhibition (in mm)
Brahmi Oil	No zone
Cypress oil	24 mm
Lemon grass oil	50 mm
Black pepper oil	16 mm
Orange oil	20 mm

CONCLUSION

Herbs, which are powerful healing agents, must be used appropriately. Herbs contain active ingredients that 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.[19] The use of herbs in dentistry should be based on the evidence of effectiveness and safety. The antibacterial 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 lemon grass, cypress, orange oil, and black pepper on oral pathogens.[20]

REFERENCES

1. Ministério da Saúde, Departamento de Atenção Básica, Coordenação Nacional de Saúde Bucal. Pesquisa Nacional de Saúde Bucal (Projeto SB Brasil 2010). Brasília, Brazil: Ministério da Saúde; 2011.
2. Marsh PD. Are dental diseases examples of ecological catastrophes? Microbiology 2003;149:279-94.
3. Bowen WH, Amsbaugh SM, Monell-Torrens S, Brunelle J, Kuzmiak-Jones H, Cole MF. A method to assess cariogenic potential of foodstuffs. J Am Dent Assoc 1980;100:677-81.
4. Kajfasz JK, Rivera-Ramos I, Abranches J, Martinez AR, Rosalen PL, Derr AM, *et al*. Two Spx proteins modulate stress tolerance, survival, and virulence in *Streptococcus mutans*. J Bacteriol 2010;192:2546-56.
5. Ajdić D, McShan WM, McLaughlin RE, Savić G, Chang J, Carson MB, *et al*. Genome sequence of *Streptococcus mutans* UA159, a cariogenic dental pathogen. Proc Natl Acad Sci U S A 2002;99:14434-9.
6. Alves TM, Silva CA, Silva NB, Medeiros EB, Valença AM. Atividade antimicrobiana de produtos fluoretados sobre bactérias formadoras do biofilme dentario: Estudo *in vitro*. Pesqui Bras Odontopediatr Clín Integr 2010;10:209-16.
7. Bader JD, Shugars DA, Bonito AJ. Systematic reviews of selected dental caries diagnostic and management methods. J Dent Educ 2001;65:960-8.
8. Clardy J, Walsh C. Lessons from natural molecules. Nature 2004;432:829-37.
9. Jeon JG, Rosalen PL, Falsetta ML, Koo H. Natural products in caries research: Current (limited) knowledge, challenges and

future perspective. Caries Res 2011;45:243-63.
10. Simões M. Antimicrobial strategies effective against infectious bacterial biofilms. Curr Med Chem 2011;18:2129-45.
11. Furletti VF, Teixeira IP, Obando-Pereda G, Mardegan RC, Sartoratto A, Figueira GM, *et al*. Action of *Coriandrum sativum* L. Essential oil upon oral *Candida albicans* biofilm formation. Evid Based Complement Altern Med 2011;2011:985832.
12. Botelho MA, Nogueira NA, Bastos GM, Fonseca SG, Lemos TL, Matos FJ, *et al*. Antimicrobial activity of the essential oil from *Lippia sidoides*, carvacrol and thymol against oral pathogens. Braz J Med Biol Res 2007;40:349-56.
13. Silva F. Efeito Antimicrobiano *in vitro* dos Compostos Isolados da *Mikania glomerada* Sobre os Patógenos Orais. [Senior Research Project]. Piracicaba, Brazil: Faculdade de Odontologia de Piracicaba, UNICAMP Universidade Estadual de Campinas; 2005.
14. Bakkali F, Averbeck S, Averbeck D, Idaomar M. Biological effects of essential oils--a review. Food Chem Toxicol 2008;46:446-75.
15. Carvalho JE. Atividade Antiulcerogênica e Anticâncer de Produtos Naturais e de Síntese. Revista MultiCiência: Construindo a História dos Produtos Natusrais. São Paulo: Universidade Estadual de Campinas; 2006. p. 1-18.
16. Palombo EA. Traditional medicinal plant extracts and natural products with activity against oral bacteria: Potential application in the prevention and treatment of oral diseases. Evid Based Complement Altern Med 2011;2011:680354.
17. Chaudhari LK, Jawale BA, Sharma S, Sharma H, Kumar CD, Kulkarni PA. Antimicrobial activity of commercially available essential oils against *Streptococcus mutans*. J Contemp Dent Pract 2012;13:71-4.
18. Collins CH, Lyne PM. Microbiological Methods. London: Butterworths and Co.; 1976. p. 288.
19. Forbes BA, Sahm DF, Weissfeld AS. Bailey & Scott's Diagnostic Microbiology. 11th ed. St. Louis: Mosby; 2002. p. 229-57.
20. Mahon CR, Manuselis G. Textbook of Diagnostic Microbiology. 2nd ed. Philadelphia, PA: Saunders; 2000.

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