



ANTIBACTERIAL EFFECT OF LEMONGRASS OIL ON ORAL MICROORGANISMS: AN IN VITRO STUDY

Ruchika Goyal*, Meena K Ananad

Dept of Periodontology, Manipal College of Dental Sciences, Mangalore, Karnataka, India

E-mail: ruchikadental@gmail.com

DOI: 10.7897/2277-4572.02216

Published by Moksha Publishing House. Website www.mokshaph.com

All rights reserved.

Received on: 13/03/13 Revised on: 21/04/13 Accepted on: 26/04/13

ABSTRACT

Aim of the study was to know antibacterial effect of lemongrass oil on oral microorganisms: *Streptococcus mutans*, *Prevotella intermedia* and *Porphyromonas gingivalis*. The disc diffusion test for the *Streptococcus mutans*, was carried out at various concentrations of lemongrass oil as neat, 1:2, 1:5, 1:10, 1:20 and 1:25. The punch hole diffusion technique was used for *Prevotella intermedia* and *Porphyromonas gingivalis* at various concentrations of lemongrass oil as neat, 1:2, 1:5, 1:10, 1:20 and 1:25. The disc diffusion test for *Streptococcus mutans* showed the zone of inhibition of >40mm, >40mm, >20mm, 14mm, 14mm at the concentration of neat, 1:2, 1:5, 1:10, 1:20 respectively. The punch hole diffusion technique used for *Prevotella intermedia* and *Porphyromonas gingivalis* showed Zone of inhibition of >30mm, >20mm, >10mm at the concentrations of neat, 1:2, 1:5, and 1:10 respectively. The study has demonstrated that essential oil of lemongrass has significant antimicrobial potential against oral microorganisms *S.mutans*, *P. intermedia* and *P. gingivalis*.

Keywords: Essential oil, oral microorganisms, antimicrobial effect.

INTRODUCTION

The antibacterial activity of various essential oil has formed the basis for their wide application in dentistry. The use of Listerine mouthwash, containing thymol, menthol and eucalyptol, as antiseptic agent is well documented.

Lemongrass oil is important essential oil, extracted from Lemon grass which belongs to the section of *Andropogon* called *Cymbopogon* of the family *Gramineae*. The two of the major species are *Cymbopogon citrates* and *C. flexuosus*.¹

It has plethora of medicinal uses. It is said have antibacterial, antifungal, antioxidant, antiseptic, astringent, anti-inflammatory, analgesic, antipyretic and carminative property. Because the herb has not been studied extensively, its effectiveness is based mainly on its centuries-old reputation as a folk remedy².

Exploring its antibacterial property specifically for oral microorganism can help us incorporate this essential oil in dentistry in particular as an adjunctive chemical agent against oral microorganisms. *Streptococcus mutans* is considered to be one of the most important the causative agent for dental caries. *Porphyromonas intermedia* and *Prevotella intermedia* are established periopathogens involved in periodontal disease. Thus in this study the invitro antimicrobial effect of lemongrass essential oil against the three microorganism was evaluated.

MATERIAL AND METHODS

The pure lemongrass oil (*Cymbopogon Citratus*) was obtained from Falcon company, Bangalore, India which is a member of Basic chemicals, pharmaceuticals and cosmetics export promotion council, Government of India and registered with the United States Food And Drug Administration, USA. The test microorganisms: *Streptococcus aureus*, *Streptococcus mutans*, *Porphyromonas gingivalis*, and *Prevotella intermedia* were obtained from the clinical isolates.

Disc diffusion test

Nutrient agar was inoculated with a microbial cell suspension (200 µl in 20ml of medium) and poured into sterile petri dishes. Sterile filter paper discs 6 mm in diameter were impregnated with 20 µl of each oil concentration (neat, 1:2, 1:5, 1:10, 1:20, 1:25), which were prepared using the same solvents, then sterilized via pasteurization and membrane filtration and placed on the inoculated agar surface. After pre-incubation for 2 h in a refrigerator the plates were incubated overnight at 37 °C for 18-24 h. At the end of the incubation period antimicrobial activity was evaluated by measuring the zones of inhibition.

Punch hole diffusion test

Modified nutrient agar was used as a medium. The plates were inoculated with the test organisms. The holes were punched out in the plates. Three drops of the various concentrations of essential oil (neat, 1:2, 1:5, 1:10, 1:20, 1:25) are dropped into the punched holes using pipettes. The plates were incubated for 18- 24 h in anaerobic hood. At the end of the incubation period antimicrobial activity was evaluated by measuring the zones of inhibition.

RESULTS

The zones of inhibition representing the antimicrobial activity of lemongrass essential oil on *Streptococcus mutans*, *Prevotella intermedia* and *Porphyromonas gingivalis* are presented in the table 1- 3 and fig 1-3. The zones of inhibition were measured in millimetres. The zone of inhibitions for *S.mutans* were >40mm, >40mm, >20mm, 14mm, 14mm at the respective concentrations of neat, 1:2, 1:5, 1:10 and 1:20.

The zones of inhibition for *P. intermedia* were >40mm, >30mm, >10mm and >5mm at the respective concentrations of neat, 1:2, 1:5 and 1:10.

The zones of inhibition for *P. gingivalis* were >40mm, >30mm, >10mm and >5mm at at the respective concentrations of neat, 1:2, 1:5 and 1:10.

Table 1- Streptococcus mutans

Concentrations	Zone of inhibition
Neat	>40mm
1:2	>40mm
1:5	>20mm
1:10	14mm
1:20	14mm
1:25	-



Fig – 1 - Streptococcus mutans

Table 2 – Prevotella intermedia

Concentrations	Zone of inhibition
Neat	>40mm
1:2	>30mm
1:5	>10mm
1:10	>5mm
1:20	-
1:25	-

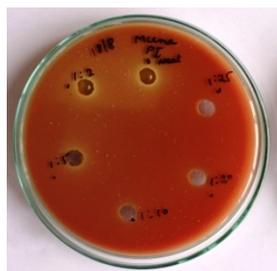


Fig – 2 Zones of inhibition – Prevotella intermedia

Table 3- Porphyromonas gingivalis

Concentrations	Zone of inhibition
Neat	>40mm
1:2	>30mm
1:5	>10mm
1:10	>5mm
1:20	-
1:25	-



Fig – 3 Zones of inhibition – Porphyromonas gingivalis

DISCUSSION

Essential oils are potential sources of novel antimicrobial compounds especially against bacterial pathogens³. An important characteristic of essential oils and their components is their hydrophobicity, which enable them to partition the lipids of the bacterial cell membrane and mitochondria, disturbing the cell structures and rendering them more permeable. Extensive leakage from bacterial cells or the exit of critical molecules and ions will lead to death^{4,5}.

The vitro study was done to find out the effectiveness of the lemongrass oil against oral microorganisms; *S.mutans*, *P.intermedia*, *P.gingivalis*. The study showed that the organisms were sensitive to lemongrass oil at various concentrations of neat, 1:2, 1:5, 1:10, 1:20 and 1:25. The *S.mutans* was inhibited at all the concentration of except at 1:25. The *P. intermedia* and *P. gingivalis* were inhibited at the concentrations of neat, 1:2, 1:15, 1:10. No zones of inhibitions were found at concentrations of 1:20 and 1:25. These results indicate that lemongrass oil can be tried as an alternative adjunctive chemical agent against oral microorganisms.

This is one of the first invitro studies where the antimicrobial effect of lemongrass oil was tested against the oral microorganisms in particular the two important periopathogens *P. intermedia* and *P. gingivalis*. Various other invitro studies have been done earlier for testing the antimicrobial effect of lemongrass oil on many organisms involved in systemic diseases.

Akin- Osanaiya BC, Agbaji AS, and Dakare MA⁶ studied the antimicrobial potentials of essential oils and extracts from the leaves of *Cymbopogon citratus* (lemon grass) and *Eucalyptus* against *Salmonella typhi*, *Staphylococcus aureus* and *E coli*. Zone of inhibition measurement showed that eucalyptus oil was effective against *S.typhi* and *S aureus*. Lemongrass oil was observed to possess highest antimicrobial activity against all three microorganisms. The punch hole diffusion technique was used. Without dilution lemongrass essential oil almost showed no growth. The aqueous extracts were not found to be effective.

Prabuseenivasan S et al.⁷ studied the in vitro antibacterial activity of few plant essential oils by the disk diffusion method. The result obtained for lemongrass oil for *P.vulgaris*

was 14.6 ± 0.7 , 12.1 ± 0.2 and 9.5 ± 0.5 at 1:1, 1:5 and 1:10 dilution and for *P.auregenosa* was 23.4 ± 1 , 19.6 ± 0.5 , 9.1 ± 0.5 at 1:1, 1:5 and 1:10 dilution.

K.A. Hamme et al.⁸ studied the antimicrobial activity of essential oils and plant extracts. They found that Lemongrass, oregano and bay inhibited all organisms at $\leq 2.0\%$ (v/v). The organisms tested in the study were *Staphylococcus aureus*, *Escherichia coli*, *Candida albicans* organisms.

Antifungal⁹ and antiviral¹⁰ activities of lemongrass oil against candida species and HSV type 1 respectively have also shown positive results. Lemongrass oil completely inhibited the HSV 1 replication at concentration of 0.1%. These studies are noteworthy as candida species and HSV 1 are involved in oral diseases.

CONCLUSION

The present study has demonstrated that essential oil of lemongrass has significant antimicrobial potential against oral microorganisms *S.mutans*, *P. intermedia* and *P. gingivalis*.

ACKNOWLEDGMENT

We are grateful to Falcon company, Bangalore, India for providing us pure lemongrass essential oil.

REFERENCES

- Atal CK, and BM Kapur. Cultivation & Utilization of aromatic plants. Regional Res. Labs. CSIR Jammu, 1982 ; 314-317
- Anonymous. The wealth of India (Raw material). 1950; Vol. 11, CSIR. India, pp. 411-415
- Mitscher LA, Drake S, Gollapudi SR, Okwute SK: A modern look at folkloric use of anti-infective agents. *J Nat Prod* 1987; 50: 1025-1040 <http://dx.doi.org/10.1021/np50054a003>
- Knobloch K, Weigand H, Weis N, Schwarm H-M, Vigenschow H: Action of terpenoids on energy metabolism. In Progress in Essential Oil Research: 16th International Symposium on Essential Oils Edited by: Brunke EJ. De Gruyter, Berlin; 1986:429-445.
- Sikkema J, De Bont JAM, Poolman B: Interactions of cyclic hydrocarbons with biological membranes. *J Biol Chem* 1994, 269 : 8022-8028.
- Akin-Osanaiye BC, Agbaji AS and Dakare MA. Antimicrobial activity of oils and extracts of *Cymbopogon citratus* (lemon grass), *Eucalyptus citriodora* and *Eucalyptus camaldulensis*. *J Med Sci*. 2007; 7:694 -697. <http://dx.doi.org/10.3923/jms.2007.694.697>
- Prabuseenivasan S, Jayakumar M and Ignacimuthu S. In vitro antibacterial activity of some plant essential oils. *BMC Complementary*

- and *Alternative Medicine* 2006, 6: 39- 41. <http://dx.doi.org/10.1186/1472-6882-6-39>
8. Hammer K A, Carsonl CF and Rilel TV. Antimicrobial activity of essential oils and other plant extracts. *Journal of Applied Microbiology* 1999, 86, 985–990. <http://dx.doi.org/10.1046/j.1365-2672.1999.00780.x>
9. Abe S, Sato Y, Inouye S et al. Anti-Candida albicans activity of essential oils including lemongrass (*Cymbopogon citratus*) oil and its component, citral. *Jpn J Med Mycol* 2003; 44: 285-91. <http://dx.doi.org/10.3314/jjmm.44.285>
10. Minami M, Kita M, Nakaya T, Yamamoto T, Kuriyama H, and Imanishi. The inhibitory effect of essential oils on herpes simplex virus type-1 replication in vitro. *Microbiol Immunol.* 2003; 47: 681–684.

Source of Support: Nil, Conflict of Interest: None

QUICK RESPONSE CODE	ISSN (Online) : 2277 –4572
	Website http://www.jpsonline.com

How to cite this article:

Ruchika Goyal, Meena K Ananad. Antibacterial effect of lemongrass oil on oral microorganisms: An in vitro study. *J Pharm Sci Innov.* 2013; 2(2): 41-43.