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Effect of oil-pulling on dental caries causing bacteria

T. Durai Anand*, C. Pothiraj, R. M. Gopinath and B. Kayalvizhi

PG Department of Microbiology, V. H. N. S. N. College, Virudhunagar- 626 001, India.

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The effect of oil-pulling on the reduction of total count of bacteria was determined. There was a remarkable reduction in the total count of bacteria. The process of oil- pulling reduced the susceptibility of a host to dental caries. The *in-vitro* antibacterial activity of sesame oil against dental caries causing bacteria was determined. *Streptococcus mutans* and *Lactobacillus acidophilus* were found to be moderately sensitive to the sesame oil.

Key words: Antibacterial activity, *Streptococcus mutans* and *Lactobacillus acidophilus*.

INTRODUCTION

The development of bacterial resistance to presently available antibiotics has necessitated the search for new antibacterial agents (Mylotte et al., 1987). Bacteria are very adaptable organisms because of their very short generation time (as little as 15 to 20 min for some species under ideal conditions) and their propensity for sharing genetic information – even among different species of bacteria. The presence of an antibiotic may kill most of the bacteria in an environment but the resistant survivors can eventually re-establish themselves and pass their resistance genes on to their offspring and, often, to other species of bacteria. Both medical and veterinary uses of antibiotics have resulted in the appearance of resistant strains of bacteria. Resistant bacteria which are human pathogens may cause disease that are difficult to treat; even if the resistant bacteria are not human pathogens, they may still be dangerous because they can transfer their antibiotic resistance genes to other bacteria that are pathogenic (Barton, 1998; Khachatourians, 1998).

The overuse of antibiotics in the treatment of infectious diseases, and the appearance of 'multi-drug resistant' bacterial strains (resistant to two or more antibiotics), has driven research towards the study of antimicrobial agents from essential oils (Hammer et al., 1999; Cox et al., 2000; Dorman and Deans, 2000) . The purpose of this study was to investigate the effect of oil-pulling on dental caries causing bacteria.

Oil pulling or oil swishing is a procedure in which the practitioners rinse their mouth with approximately one tablespoon of an ordinary cooking oil for 3 − 20 min, then spits it out. This procedure is typically performed daily.

Sesame (*Sesamum indicum* L., Pedaliaceae) is a very old cultivated crop and thought to have originated in Africa (Ram et al., 1990). Chlorosesamone obtained from roots of sesame has antifungal activity (Begum et al., 2000).

Sesame lignans have antioxidant and health promoting activities (Kato et al., 1998) . High amounts of both sesamin and sesamolin have been identified in sesame (Sirato-Yasumoto et al., 2001). Both sesamin and sesamolin were reported to increase both the hepatic mitochondrial and the peroxisomal fatty acid oxidation rate. Sesame seed consumption appears to increase plasma gamma-tocopherol and enhanced vitamin E activity which is believed to prevent cancer and heart disease (Cooney et al., 2001).

Dental caries, also known as tooth decay or dental cavities**,** is a disease which damages the structures of teeth. The occurrence of dental caries is globally widespread, and the disease can lead to pain, tooth loss, infection, and, in severe cases, death. It is the most significant cause of tooth loss in children.

The mouth contains a wide variety of bacteria, but only a few specific species of bacteria are believed to cause dental caries: *Streptococcus mutans* and *Lactobacilli* among them. Particular for root caries, the most closely associated bacteria frequently identified are *Lactobacillus acidophilus, Actinomyces viscosus,* and *S. mutans.* Bacteria collect around the teeth and gums in a sticky, creamy-coloured mass called plaque.

In recent years, a large number of oils and their constituents have been investigated for their antimicrobial properties against bacteria and fungi. The current work

*Corresponding author. E-mailduraianand1974@rediffmail.com.

Table 1. Effect of oil-pulling on the reduction of total count of bacteria

Case Study Persons	Number of colonies per ml before oil-pulling	Number of colonies per ml after oil-pulling
1	$15x10^5$	$12 x10^5$
2	$20x10^4$	$18x10^4$
3	$16x10^5$	$14x10^5$
4	$14x10^5$	$11x10^5$
5	$12x10^5$	$9 x10^5$
6	$21x10^4$	$9 x10^5$
7	$15x10^4$	$10 x10^4$
8	$18x10^5$	$15x10^5$
9	$17x10^5$	$13x10^5$
10	$12x10^4$	$9 x10^4$

Oil-pulling is done for a period of 40 days.

presents an evaluation of antibacterial activity of sesame oil and its inhibitory effect against the dental caries causing bacteria.

MATERIALS AND METHODS

Sesame oil

Sesame oil was obtained from V. V. V. and Sons, Virudhunagar, India**.** This oil was used in this study.

The effect of oil-pulling on the reduction of total count of bacteria

Case study

For the case study, persons who had dental caries were selected. Before oil-pulling, they were instructed to wash their mouth with the physiological saline (0. 85% NaCl). This saline was collected in a sterile container. This saline was serially diluted and plated in nutrient agar plates. The plates were incubated aerobically at 37°C for 24 h. After this incubation period, the number of colonies present in 1 ml of the saline was calculated. These persons were then directed to do oil-pulling.

After oil-pulling, the same procedure was followed, that is, they were instructed to wash their mouth with the physiological saline (0. 85% NaCl) . This saline was collected in a sterile container. This saline was serially diluted and plated in nutrient agar plates. After this incubation period, the number of colonies present in 1 ml of the saline was calculated.

Effect of oil pulling on the susceptibility of a host to dental caries

The effect of oil pulling on the susceptibility of a host to dental caries was determined by Snyder method (Snyder, 1941). The test was performed after 40 days of oil-pulling.

Isolation of dental caries causing bacteria

The clinical samples were collected from the case study persons. Cotton swabs were first prepared and dipped in Cary and Blair transport medium in small tubes. Then, swabs along with medium in tubes were sterilized and then used for collection of samples. The swab was gently pressed on the portion of teeth with carious lesion and rotated 2-3 times. Then, swab was immediately dipped in the tube with sterile transport medium. The tube was brought to laboratory and then further processed immediately.

The isolates were identified using the literature methods (Hardie, 1986; Kandler and Weiss, 1986).

S. mutans (MTCC 497) and *L. acidophilus* (MTCC 447) were used as reference strains. The pure culture of *S. mutans* (MTCC 497) was maintained on BHI agar slants and stored at 4^oC. The pure culture of *L. acidophilus* (MTCC 447) was maintained on MRS agar slants and stored at 4^oC.

Antibacterial activity of sesame oil against dental caries causing bacteria

Screening of sesame oil for antibacterial activity was done by the disk diffusion method (Acar and Goldstein, 1991) . It was performed using an 18 h culture at 37°C in 10 ml of Mueller Hinton Broth. The cultures were adjusted to approximately 10^5 CFU/ml with sterile saline solution. Five hundred microliters of the suspensions was spread over the plates containing Mueller-Hinton agar using a sterile cotton swab in order to get a uniform microbial growth on both control and test plates. The sesame oil was dissolved in 10% aqueous dimethylsulfoxide (DMSO) with Tween 80 (0.5% v/v for easy diffusion) and sterilized by filtration through a 0.45 m membrane filter. Under aseptic conditions, HiMedia sterile discs were impregnated with 50 l of different concentrations (1:1, 1:5, 1:10, and 1:20) of the sesame oil and placed on the agar surface. Sterile discs moistened with aqueous DMSO and tween 80 were placed on the seeded Petri plate as vehicle control.

RESULTS AND DISCUSSION

The effect of oil-pulling on the reduction of total count of bacteria

The results of our study have shown the antibacterial effect of sesame oil on total bacteria. The reduction of total count of bacteria ranged from 10 to 33.4%. The average reduction of total count of bacteria was 20% after 40 days of oil-pulling (Table 1). Therefore, the sesame oil is found to be effective in reducing bacterial

Table 2. Effect of oil pulling on the susceptibility of a host to dental caries.

Tube	Colour of Synder test cultures			Caries susceptibility (Yes) or (No
	24 h	48 h	72 h	
Control	Green	Green	Green	**NO**
Case study: 1 to 10 (Before oil-pulling)	Green	Green	Yellow	YES Marked Susceptibility
Case study: 1 (After oil-pulling)	Green	Green	Yellow	SLIGHT Susceptibility is reduced
Case study: 2 (After oil-pulling)	Green	Yellow	Yellow	MODERATE Susceptibility is reduced
Case study: 3 (After oil-pulling)	Green	Yellow	Yellow	MODERATE Susceptibility is reduced
Case study: 4 (After oil-pulling)	Green	Green	Yellow	SLIGHT Susceptibility is reduced
Case study: 5 (After oil-pulling)	Green	Yellow	Yellow	MODERATE Susceptibility is reduced
Case study: 6 (After oil-pulling)	Green	Green	Yellow	SLIGHT Susceptibility is reduced
Case study: 7 (After oil-pulling)	Green	Green	Yellow	SLIGHT Susceptibility is reduced
Case study: 8 (After oil-pulling)	Green	Yellow	Yellow	MODERATE Susceptibility is reduced
Case study: 9 (After oil-pulling)	Green	Green	Yellow	SLIGHT Susceptibility is reduced
Case study: 10 (After oil-pulling)	Green	Yellow	Yellow	MODERATE Susceptibility is reduced

growth and adhesion. Toxins and bacteria from the body might be expelled through the tongue and trapped in the oil and removed from the body.

Effect of oil pulling on the susceptibility of a host to dental caries

There is a remarkable reduction in the susceptibility of a host to dental caries. 50% of the case study persons were converted from marked dental caries susceptibility to slight dental caries susceptibility. 50% of the case study persons were converted from marked dental caries susceptibility to moderate dental caries susceptibility (Table 2).

Antibacterial activity of sesame oil against dental caries causing bacteria

Recently, antimicrobial therapy with *S. mutans* as an indicator organism has been shown to reduce caries activity. Application of disinfectants such as chlorhexidine and iodine directly to the teeth reduce the S. mutans population in plaque for prolonged periods of time, whereas mouth rinsing with chlorhexidine and oral penicillin therapy does not seem to have a long-lasting effect on the *S. mutans* infection (Emilson and Fornell, 1976; Caufield and Gibbons, 1979; Maltz and Zickert, 1982).

Regardless of which agent is the drug of choice for the treatment of oral diseases, dental scientists are still searching for new therapeutic applications to prevent and treat them. Toxicity, mucosal ulceration, and development of resistant bacterial strains are the adverse effects found with several other antibacterial agents. Collectively, these adverse effects of dental medications motivate dentists to use conventional natural therapeutics for the oral cavity ailments (Takahashi et al., 2003).

S*. mutans* and *L. acidophilus* were moderately sensitive to sesame oil. The antibacterial activity was found to be high in 1:1 dilution compared to the other dilutions. The solvents, DMSO and Tween 80, had no antibacterial activity against the target organisms (Table 3). Takahashi et al. (2003) reported the antibacterial effect of mastic gum on *S. mutans,* and *lactobacilli*.

In the present study, sesame oil is found to have the antibacterial activity against *S. mutans*, *lactobacilli*, and total bacteria. Therefore, oil-pulling could be useful for maintaining oral hygiene.

Antibacterial and antifungal properties of essential oil as well as of oil constituents are well documented.

Screening for antimicrobial activity has been the subject of many investigations and oils with very potent

Table 3. Antibacterial activity of sesame oil against dental caries causing bacteria.

Bacterial species	Diameter of Zone of Inhibition (mm)					
	Oil-Solvent Mixture (20 µl)				Solvents (20µl)	
	1:1	1:5	1:10	1:20	DMSO	Tween 80
Control strain (MTCC 497)	11 mm	10 mm	10 mm	10 mm	Nil	Nil
Streptococcus mutans (Isolated strain)	10 mm	10 mm	9 mm	9 mm	Nil	Nil
Control strain (MTCC 447)	10 mm	09 mm	09 mm	08 mm	Nil	Nil
Lactobacillus acidophilus (Isolated strain)	11 mm	10 mm	10 mm	09 mm	Nil	Nil

antibacterial and antifungal activity could be promising agents for the future more extensive research.

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