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ANTIBACTERIAL ACTIVITY OF SESAME OIL AND COCONUT OIL AGAINST THE CARIOGENIC *STREPTOCOCCUS MUTANS* AND *LACTOBACILLUS* SPECIES - AN *IN VITRO* STUDY

Lamyaa Kadhim Baqer

Department of Microbiology, College of Dentistry, University of Basra, Basra, Iraq.
e-mail: lamyaakb73@gmail.com

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ABSTRACT : Oil pulling is a well-known tradition to maintain healthy oral environment. It has low cost and less adverse effects compared to chemically base medicinal products currently used to prevent and treat dental caries and other oral problems. The aim is to evaluate antimicrobial activity of crude coconut oil and sesame oil against cariogenic bacteria (*Streptococcus mutans* and *Lactobacillus* sp.) and to compare this with chlorhexidine containing mouth wash. Clinical isolates of *Streptococcus mutans* and *Lactobacillus* species were obtained from dental caries patients. Crude coconut and sesame oils in concentrations of 25%, 50%, 75% and 100% were separately tested in vitro on the isolated bacteria. Chlorhexidine and DMSO were used as positive and negative controls, respectively. Without dilution, crude sesame oil has greater inhibitory effect than chlorhexidine on both, *Streptococcus* and *Lactobacillus* species. With serial dilutions the inhibitory effect of sesame oil against both microorganisms decreases as evident by reduction in the corresponding MICs value. For crude coconut, no inhibitory effect was reported against Lactobacillus. The activity of coconut oil on *Streptococcus mutans* was less than that of crude sesame oil and chlorhexidine and was, maximum with full strength of the oil and decreases gradually with dilutions to 75, 50 and 25%, respectively. The negative control solution DMSO showed no activity. The study concluded that higher concentration of sesame oil are superior to coconut oil and are comparable to chlorhexidine in the in vitro inhibition of *Streptococcus mutans* and *Lactobacillus* species growth emphasizing its potential usefulness in the prevention of dental caries.

Key words : Sesame oil, coconut oil, *Streptococcus mutans*, *Lactobacillus* sp.

INTRODUCTION

Maintaining oral health is a vital concept for human as it correlates to a great extent with the systemic health and general well-being of human body (Wade, 2013).

Dental treatments are often painful, time consuming and costly leading people to think about prevention rather than restoration of tooth caries (Karlinsey *et al*, 2010). One of the preventive measures is the use of chemically based medicinal products to supplement regular oral hygiene routine of daily tooth brushing and flossing. Nowadays, there are wide range of commercially an available mouth rinses and dentifrices which are known to contain chemicals ingredients that might result in undesirable side effects. Excessive use of these chemical has been reported to change the oral and intestinal flora and can create new adverse side effects such as vomiting, diarrhea, tooth staining and even oral cancer (Taheri, 2010).

Extended mouth swishing with natural oils (oil pulling) is a long established practice, which was used since ancient times for maintaining healthy oral environment. Naturally derived plant products such as oils are known to have less harm with fewer side effects besides being economically affordable for the patients, Although different types of plant oils were used in this type of mouth therapy, the scientific evidence of their action and effectiveness is limited (Saher, 2018). Coconut oil, the most frequently used ingredient in oil pulling is a unique vegetable oil with approximately 50% of its fatty acid compsitive is LA (Lauric Acid) (Lieberman *et al*, 2006; Dayrit, 2014).

The aim of this study is to evaluate the antimicrobial activity of coconut oil and sesame oil against cariogenic bacteria and comparing their potential preventive role in dental caries with chemically based mouth wash.

MATERIALS AND METHODS

Streptococcus mutans and *Lactobacillus* species bacteria were obtained from patients with dental caries consulting dental clinic in College of Dentistry in Basra. The bacterial strains were isolated in the laboratory of

the microbiology department of the same college by culturing the swab material on the appropriate selective media and their identification by the relevant biochemical tests.

Preparation of bacterial inoculums

Bacterial suspension of each type of the tested bacteria was prepared separately by adding 3-10 colonies of *Streptococcus mutans* and *Lactobacillus* species to each labelled test tube containing 1 ml of sterile normal saline 0.9. Turbidity of each tube was adjusted to approximately 1.5×10^8 cfu/ml in comparison to McFarland turbidity standard (Gilbert, 1987).

Bacterial sensitivity to coconut and sesame oil

Agar welldiffusion technique was utilized in the study to detect the inhibitory activity of different concentrations of coconut oil and sesame oil separately on the two microorganisms .Bacterial suspension of 1.5×10^8 cfu/ml. was separately streaked on two different Muller Hinton agar plates using separate sterile cotton swabs.

Four wells of 6 mm diameter were punched into each previously cultured plate using a borer. The base of each pit in the agar was sealed by molten agar. After labeling the wells in the agar, 0.1 ml of crude coconut oil, sesame oil, chlorhexidine (as a positive control) and a diluent DMSO (dimethylsulfoxid) as a negative control were transferred separately into each corresponding wells using the standard method (Al-Shamma *et al*, 2010). Concentrations of 25%, 50%, 75% and 100% of crude coconut oil and sesame oil were also tested in a similar fashion.

Plates were incubated anaerobically at 37°C for 24 hrs, after which the diameter of inhibition zones around wells were recorded in millimeters. Tests were performed in triplicate (Valgas *et al*, 2007).

RESULTS

Growth of *Streptococcus mutans* was inhibited by the crude form of coconut oil, sesame oil, chlorhexidine but not by Hexane. On the other hand, *Lactobacillus* growth was inhibited by crude sesame oil and chorhexidine, but not by crude coconut oil or DMSO (Table 1).

The inhibitory effect of sesame oil on both *Streptococcus mutans* and *Lactobacillus* species increases when the concentration of the oil is increased. The minimum inhibitory zones relative to different concentration of seasame oil are shown in Table 2. Crude sesame oil (i.e 100% concentration) was found to be more effective against *Streptococcus mutans* than on *Lactobacillus* species as evident by zones of inhibition of 26 mm and 19 mm, respectively.

Table 1 : The inhibitory effect of coconut oil, sesame oil extracts and DMSO (dimethylsulfoxid as control) oncariogenic bacteria.

Type of extract	*Streptococcus mutans*	*Lactobacillus* sp.
Crude Coconut oil	Sensitive	Resistant
Crude Sesame oil	Sensitive	Sensitive
Chlorhexidine	Sensitive	Sensitive
DMSO	Resistant	Resistant

Table 2 : The inhibitory effect of Sesame oil on cariogenic bacteria.

Concentration % of sesame oil	*Streptococcus mutans*	*Lactobacillus* sp.
25%	7mm	3 mm
50%	13 mm	9 mm
75%	19 mm	13 mm
100%	26 mm	19 mm

For coconut oil, there was no activity on *lactobacillus* species, but on *Streptococcus mutans* there was also increased activity as the concentration of the oil increases (Table 3). Maximum inhibition of *Streptococcus mutans* growth was obtained at 100% concentration (*i.e.* the crude form) with an inhibition zone of 18mm.

Chlorhexidine resulted in growth inhibition of both*Streptococcus mutans* and *Lactobacilli* with an inhibition zone of 20mm and 17 mm, respectively (Table 4).

Table 3 : The inhibitory effect of coconut oil on cariogenic bacteria.

Concentration % of coconut oil	*Streptococcus mutans*	*Lactobacillus* sp.
25%	4 mm	0 mm
50%	10 mm	0 mm
75%	14 mm	0 mm
100%	18 mm	0 mm

Table4 : The inhibitory effect of cholrhexidine on cariogenic bacteria.

Cholrhexidine	*Streptococcus mutans*	*Lactobacillus* sp.
	20mm	17 mm

DISCUSSION

Dental caries or tooth decay is the continuous process of breakdown of teeth by acids produced by bacteria as they breakdown food debris and sugar. The most frequently associated bacteria with dental caries are *Streptococcus mutans* and *Lactobacilli* sp. In addition to regular tooth brushing and the reduction in the dietary intake of free sugar, different types of antibacterial agents are used to help prevent tooth decay. Chlorhexidine – based preparations are widely used throughout the world in a variety of formulation and strength for its antibacterial

effect on cariogenic bacteria. The cationic chlorhexidine is effective against both gram positive and negative bacteria by its ability to bind to the negative charged bacterial surfaces and due to an increase in permeability of bacterial cell membrane resulting in damage of cytoplasmic macromolecular (Brecx *et al*, 1992; Asokan *et al*, 2011). Various side effects particularly more calculus and extrinsic tooth stain were reported by many authors with the use of chlorhexidine mouth preparations (Eleni and Sardu, 1995; Charles, 2004).

The increased interest in complementary and alternative medicine has led many researches in recent years to test the usefulness of various natural products, particularly of plant origin, against tooth caries (Gilbert, 1987; Aparna *et al*, 2012). These natural productsare both economic and without serious side effects on body tissues (Brecx *et al*, 1992; Nassar and Gregory, 2012). The traditional use in some cultures of oil pulling therapy is widely documented as a method of fighting tooth decay in addition to strengthening the tooth, jaw and gums (Asokan, 2011).

The current study demonstrated that crude coconut oil and sesame oil have got a very good antibacterial activity against cariogenic bacteria, *Streptococcus mutans* and *Lactobacillus* sp. as tested in the laboratory. Particularly crude sesame oil was found in the study to have greater antimicrobial activity against both *S. mutans* and *Lactobacilli* as evident by its greater MICs compared to coconut oil and chlorhexidine.

Several studies had recognized the antimicrobial activities of coconut oil against gram positive and gram negative bacterial cell (Taheri *et al*, 2010; Thaweboon *et al*, 2011; Peedikayil *et al*, 2015) and also against several types of viruses and fungi (Hierholzer and Kabara, 1982; Hornung *et al*, 1994; Anang *et al*, 2007; Abujazia *et al*, 2012; Akinnuga *et al*, 2014; Yeap *et al*, 2015). The mode of antimicrobial action of coconut oil is attributed to its ability to prevent bacterial aggregation and bacterial adhesion on the tooth surface by the high viscosity of the oil (Ahuja and Ahuja, 2014). Also sesame oil was demonstrated by several studies to be an effective agent against biofilm formation on tooth surface (Thaweboon *et al*, 2011; Asokan *et al*, 2011; Saravanan *et al*, 2013). This activity is attributed to its oily structure which is the base of oil pulling preventive theory of dental caries.

The study concluded that crude oil pulling using coconut oil and sesame oil have great potential for application in oral health as preventive measures against dental caries and several other oral problems attributed to bacterial causes.

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