

# THE ANTIMICROBIAL EFFECTS OF SEVEN DIFFERENT TYPES OF ASIAN CHEWING STICKS

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## INTRODUCTION

The Babylonians recorded the use of chewing sticks in 7000 BC and its use ultimately spread throughout the Greek and Roman Empires. Chewing sticks were also used by Egyptians, Jews and in the Islamic Empires. References to the chewing sticks can be found in the Talmud as the Qesum, the Siwak, Miswak and Arak. Its use as a chewing stick was documented in the Arabian Muwasa by Al Washah written in AD 900. It is believed that the counterpart of the modern day toothbrush was unknown in Europe until about 300 years ago. (1) Nowadays chewing sticks (miswak) is being used in Africa, South America, the Middle East and Asia. It has different names in different societies for instance; miswak, siwak or arak is used in the Middle East, miswaki, in Tanzania, datan in India and Pakistan. Its use is deeply rooted in many cultures. (1)

There are various plants which are used as chewing sticks in West Africa, the lime tree (*Citrus aurantifolia*) and the orange tree (*Citrus sinensis*) sometimes provides chewing sticks. The roots of the senna (*Cassia vinnea*) were used by American Negroes and those of African Laburnum (*Cassia sieberianba*) were used in Sierra Leone. Neem (*Azadirachta indica*) is widely used to provide chewing sticks in the Indian subcontinent. (2)

Several studies have been reported on the antibacterial effects of chewing sticks on cariogenic bacteria, such as *Streptococcus mutans* on periodontopathogens particularly *Bacteriodes* species (3-8) and inhibitory action on dental plaque formation. (9) However, a review of the literature has shown that no previous investigation has compared the antibacterial effects of different Asian chewing sticks.

The aim of this study was to compare the antimicrobial effect of aqueous extract of seven different types of chewing sticks found in Pakistan and other Asian countries.

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## MATERIALS AND METHODS

### Collection of chewing sticks

Samples of the most commonly used chewing sticks in Pakistan Neem (*Azadirachta Indica*), Zaitoon (*Olea europaea*) Kikar (*Accacia arabica*), Peelu (*Salvadora persica*), Ban (*Glycosmic pentaphylla*), Khiran (*Capparis aphylla*) and Arak (*Salvadora persica*) from Saudi Arabia were bought from the open market. The chewing sticks were identified by its colour and scent and recognized by agriculturist and vendor. The six chewing sticks were from Punjab province in Pakistan and Arak from Gizan province in Saudi Arabia. The chewing sticks were air shipped to Riyadh, Saudi Arabia. The experiments were carried out at the College of Dentistry Research Center, King Saud University, Riyadh.

### Preparation of extracts

100 gm of each of the chewing sticks were used in the experiment. The chewing sticks were kept sun dried for 2 weeks at 30°C before extract preparation. The sticks were cut into small pieces and ground to powder in a ball mill. The powder was kept separately in sterile, dry screw-capped bottles, which were stored in a dry cool place for one week before aqueous extraction.

Each successive 10 gm quantity was put into a sterile screw-capped bottle to which 100 ml of sterile deionized distilled water was added. The extracts were allowed to soak for 48 hours at 4°C before the mixtures were centrifuged at 2,000 rpm for 10 minutes. (8)

The supernatants were passed through a 0.45 mm membrane filter, the extracts were prepared at 5, 10 and 50 % concentrations (v/v) and stored in 5 ml portions at 20°C. The pH of the chewing sticks extracts was determined. Normal saline solution was used as control for antimicrobial activity.

### Microorganisms

*Streptococcus faecalis*, *Streptococcus mutans*, *Staphylococcus aureus* and *Candida albicans* were obtained from the Department of Microbiology King Khalid University Hospital, King Saud University, Riyadh.

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Antimicrobial susceptibility testing

The ditch plate method was used to test the antimicrobial activity. Three to four colonies of the microorganisms were suspended in 3 ml of sterile distilled water and a lawn culture was produced on the blood agar plate. Into the ditches made at the center of petri dishes, 0.1 ml aliquots of the miswak extract were pipetted.

The plates were left for 1 hr at room temperature and then incubated at 37°C for 48 hours and examined for inhibition zones of the growth of bacteria around the extract. The average of those zones were recorded in millimeters.

RESULTS

There was no antimicrobial effect at low concentration of chewing sticks extracts. There was antimicrobial effect on *Streptococcus fecalis* at 50% concentration of kicar (*Acacia arabia*) from Pakistan and Arak (*Salvadora persica*) from Saudi Arabia. The inhibition zones up to 2 mm were found in these two chewing sticks extracts. The experiment was repeated after one week and no difference in result was found. Normal saline showed no antimicrobial effect. There was no effect on *Streptococcus mutans*, *Staphylococcus aureus* and *Candida Albicans*. (Table 1) by any of the chewing sticks extracts.

Table 1: Growth inhibition of different microbes at 50 % (v/v) concentration of aqueous extract of chewing sticks

Aqueous extracts of chewing sticks		pH	Microorganism							
			1		2		3		4	
Botanical name	Local Name		E1	E2	E1	E2	E1	E2	E3	E4
<i>Azadirachta indica</i>	Neem	7.0	-	-	-	-	-	-	-	-
<i>Olea europaea</i>	Zaitoon	6.8	-	-	-	-	-	-	-	-
<i>Acacia arabica</i>	Kikar	6.1	+ 2mm	+ 2mm	-	-	-	-	-	-
<i>Salvadora persica</i>	Peelu	5.1	-	-	-	-	-	-	-	-
<i>Gynerium pentaphyllum</i>	Ban	7.2	-	-	-	-	-	-	-	-
<i>Salvadora persica</i>	Arak	5.7	+2mm	+2mm	-	-	-	-	-	-
<i>Capparis aphylla</i>	Khitar	5.8	-	-	-	-	-	-	-	-
Saline control		6.6	-	-	-	-	-	-	-	-

1. *Streptococcus faecalis*  
E1 : Experiment 1

2. *Streptococcus mutans*  
E2 : Experiment 2

3. *Staphylococcus aureus*  
- = No microbial inhibition

4. *Candida albicans*  
+ : microbial inhibition

DISCUSSION

The selection of chewing sticks from Pakistan and Saudi Arabia was based on a number of factors. The use of chewing sticks is most common in Asian countries especially in the Indian subcontinent and the Middle East region, furthermore chewing sticks are cheap, readily available in urban and rural areas of the countries. Their taste is agreeable and not unpleasant and reported to have anti-plaque and many other pharmacological properties (10).

A recent survey in Pakistan showed that more than half of the rural population there used chewing sticks as an oral hygiene tool (11). So it was important to find out the antimicrobial properties of those chewing sticks as they

are so commonly used in Pakistan. It is claimed that the mechanical plaque-removing properties of chewing sticks may be similar to that of a conventional toothbrush (12, 13). Results from epidemiological study in Saudi Arabia has shown that the periodontal treatment need is low in habitual chewing stick users (14).

Most studies on chewing sticks have been carried out in Nigeria where more than 90 % of the population uses different types of sticks from trees that grow there such as *Fagara zanthoxyloides*, *Serindei werneckei*, *Neem*, *Paku*, *Acacia arabica* and others (4, 5). Certain chewing sticks including those derived from *S. persica*, *A. indica* and *Acacia arabica* are active against several types of cariogenic bacteria frequently found in the human oral cavity (4, 15).

The antimicrobial effects...

Results from the present study showed that Arak (*Salvadora persica* from Saudi Arabia) and Kikar (*Accacia arabica* from Pakistan) had some antimicrobial activity against *Streptococcus faecalis* at 50 % concentration of the miswak extracts. This is in accord with the previous studies as far (16, 17) as *Salvadora persica* from Saudi Arabia is concerned. Interestingly, Peelu (*Salvadora persica* from Pakistan) did not have any antibacterial activity. It may be attributed to the fact that it took almost one month to test the antimicrobial activity of chewing sticks extracts and they were not fresh, at the time of experiment. While previously it has been shown by ALMAS et al. (17) that *Salvadora persica* had no difference of antimicrobial activity after one month of age. But so far none of the studies have shown the antimicrobial activity or effect of age of Asian chewing sticks. The role of pH has been discussed in other study (17) which showed that the effective pH ranged from 6.1-5.7

(*Accacia arabica*, *Salvadora persica*, while the higher pH value did not show any antimicrobial activity (Table 1). It is recommended that further research should be carried out after adjusting the pH values of different Asian chewing sticks extracts by buffering action and a comparison is needed among freshly cut and old chewing sticks from Asia.

The use of the chewing stick conforms with the notion of primary health care approach (PHCA) and the well established associations with certain cultural and religious beliefs. The chewing sticks have been proven effective as an oral hygiene tool and its use should be promoted with scientific rational and proper method of its preparation and usage. The use of chewing sticks will be a great help in developing countries with financial constraints and limited oral health care facilities for their populations.

ABSTRACT

There are various plants, which are used as chewing sticks in different parts of the world. Several studies have been reported on the antimicrobial effects of chewing sticks on oral bacteria. The aim of this study was to compare the antimicrobial effect of aqueous extract of seven different types of chewing sticks found in Pakistan and other Asian countries. The ditch plate method was used to test the antimicrobial activity of seven Asian chewing sticks. It was found that there was antimicrobial effect on *Streptococcus faecalis* at 50% concentration of Kikar (*Acacia arabica*) from Pakistan and Arak (*Salvadora persica*) from Saudi Arabia. The inhibition zones up to 2 mm were found in those two chewing stick extracts. It is recommended that the chewing sticks will be a great help in developing countries with financial constraints and limited oral health care facilities for their populations.

**Key words :** *chewing sticks (miswak), Asian chewing sticks, in vitro, antimicrobial, aqueous extracts*

RESUME

**Les effets antimicrobiens de sept types de bâtonnets à mâcher provenant d'Asie**

Il existe dans plusieurs régions du monde, une variété de plantes qui sont utilisées comme des bâtons à mâcher. L'effet antimicrobien de ces bâtonnets sur les bactéries orales a été reporté dans plusieurs études. Cette étude a pour but de comparer l'effet antimicrobien de l'extrait aqueux de sept types de bâtonnets à mâcher provenant du Pakistan et d'autres pays d'Asie. Pour tester l'effet antimicrobien des sept bâtons à mâcher, la méthode de la plaque du fossé a été utilisée. L'effet antimicrobien du *Streptococcus faecalis* a une concentration de 50 % du Kikar (*Acacia arabica*) provenant du Pakistan et l'Arak d'Arabie Saoudite a été retrouvé. Il a été retrouvé des zones d'inhibition jusqu'à 2 mm au niveau des bâtonnets sus-cités. Il est recommandé l'utilisation des bâtonnets à mâcher dans les pays non développés ayant des services de santé amoindris.

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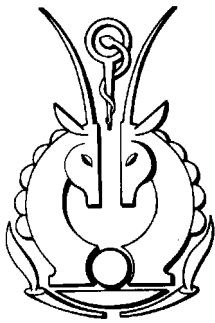
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