

## MISWAK AS AN ALTERNATIVE TREATMENT MODALITY IN MEDICINE AND DENTISTRY: A REVIEW

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### ABSTRACT

Herbal chewing sticks, commonly known as miswak, are among the ancient and traditional oral hygiene aids. It is considered as "Nature's little toothbrush" as it is a popular chewing stick throughout the Indian subcontinent. Nowadays, because of low cost, free availability, unique chemical composition, and spiritual beliefs, miswak is being used worldwide. It also serves as natural toothpaste with antibacterial, anti-caries, anti-periodontal disinfectant having anti-plaque, and anti-fungal properties and it can be used effectively as a natural tool for teeth cleansing and as a natural analgesic for the disturbing toothache. This review gives a bird's eye view mainly on the biological activities of the miswak and plausible medicinal and dental applications.

**Keywords:** Alternative therapy, Dentistry, Miswak, *Salvadora persica*.

### INTRODUCTION

Name of the medicinal plant: *Salvadora persica*

Family: Salvadoraceae

Common name: Miswak [1].

Teeth-cleaning sticks, commonly known as miswak or siwak, are popular oral hygiene aids in India, Pakistan, most of the Arabian countries, and several African countries, whereas toothbrushes with nylon bristles are the most common oral hygiene aid in most of the developed countries. Because of free availability, unique chemical composition and religious beliefs, the use of miswak and other herbal products are increasing at an exponential rate in both developing and developed countries. The World Health Organization (WHO) has also recommended and encouraged the use of miswak as an effective tool for oral hygiene [2].

*Salvadora persica* has many synonyms such as Arak, Galenia asiatica, Meswak, Peelu, Pilu, Mustard tree, *Salvadora indica* or natural toothbrush tree. *S. persica* is a small tree or shrub with a crooked trunk seldom more than one foot in diameter reaching a maximum height of 3 m. The leaves are small oval, thick and succulent with a strong smell of mustard. The fresh leaves are eaten as a salad and are used for cough, asthma, scurvy, rheumatism, and piles. The flowers are small, fragrant and used as stimulant and purgative. The berries are small and eaten both fresh and dried. The miswak tree is generally found in Saudi Arabia, Sudan, Southern Egypt, Chad, Pakistan and Eastern parts of India. Miswak is a popular chewing stick throughout the Indian sub-continent as well as the Muslim countries [1].

### HISTORICAL BACKGROUND

The use of miswak is a pre-Islamic custom, which was adhered to by the ancient Arabs to get their teeth white and shiny. It also contributed to ritual purity. This custom was adopted and Islamized by Prophet Muhammad (PBUH) around 543 AD. This kind of tooth brushing has been used by the Arabs, the Babylonians some 7000 years ago [3], the Japanese called it Koyoji, while the Romans used mastic to rub their teeth and as a toothpick. Ancient Egyptians and the Jews also used it [4]. It is in use throughout the Islamic countries [5].

### Constituents

Miswak contains more than 10 different natural chemical compounds considered essential for good oral and dental hygiene. They are fluorides, silica, tannic acid, resins, alkaloids (salvadorine), volatile oils

(simgrins), sulfur, vitamin C, sodium bicarbonate, chlorides, calcium, benzyloisothiocyanate (BIT), salicylic acids, sterols, trimethylamine, saponins, and flavonoids [1]. El-Mostehy *et al.* [6] found the following chemical substances: Trimethylamine, an alkaloid, chlorides, high amounts of fluoride, silica, sulfur, vitamin C, tannins, saponins, flavonoids, and sterols.

### Functions of different components of miswak

Silica in miswak acts as an abrasive material to remove stains on teeth. Denture bases were treated with tannic acid it reduces *Candida albicans* counts. Miswak exerts an astringent effect on the mucous membrane and reduces the clinically detectable plaque and gingivitis. Resins are amorphous products which are usually hard, transparent or translucent. The alkaloid present in *S. persica* is salvadorine. It exerts a bactericidal effect and stimulatory action on the gingiva. Essential oils have characteristic aroma, carminative, and antiseptic action. The sulfur compounds present in miswak have a bactericidal effect. Sodium bicarbonate is mild abrasive and used as a dentifrice. Calcium saturation of saliva inhibits demineralization and induces the remineralization of tooth enamel. The root of *S. persica* contains steam distillable oil composed of 10% benzyl nitrate and 90% BIT. BIT is classified as chemopreventive agents that prevent carcinogenic and genotoxic compounds from reacting with the target sites on the treated tissue. BIT has virucidal activity (at a concentration of 133.3 mg/ml) against herpes simplex virus. It has a broad-spectrum bactericidal activity which inhibits the growth and acid production of *Streptococcus mutans* [1].

### Commercially available

- Mint fresh herbal toothpaste,
- Himalaya herbal active fresh gel,
- Himalaya herbal sensitive relief toothpaste,
- Himalaya herbal sparkling white toothpaste.
- Himalaya herbal dental cream,
- Complete care herbal toothpaste,
- Hiora mouthwash-regular.

### Medical implications

#### Antibacterial properties

Studies have indicated that *S. persica* contain substances that possess plaque inhibiting and antibacterial properties against several types of cariogenic bacteria which are frequently found in the oral cavity. The growth and acid production of these bacteria are thus inhibited [5].

Al Lafi and Ababneh [31] tested the antibacterial activity of *S. persica* against some oral aerobic and anaerobic bacteria and reported that the extract of these sticks had a drastic effect on the growth of *Staphylococcus aureus*, and a variable effect on other bacterial species. They commented that the chewing sticks they used were harvested 1 month earlier, and suggested that using more fresh sticks will give better result [7].

#### Antimycotic activity

Results of the investigation carried by Al-Bagieh *et al.* [8] suggest that aqueous extracts of miswak could be used to reduce growth of *C. albicans*. Such inhibition lasts for up to 36/hrs at concentrations of 15% and above.

#### Release of calcium and chloride into saliva

Gazi *et al.* [9] investigated the immediate and medium-term effect of miswak on the composition of mixed saliva. They reported that miswak produced significant increases in calcium (22-fold) and chloride (6-fold), and significant decreases in phosphate and pH. Calcium saturation of saliva inhibits demineralization and promotes remineralization of tooth enamel, whereas high concentrations of chloride inhibit calculus formation [5].

#### Analgesic effect

Sulaiman studied the analgesic activity of miswak decoction. Results presented in this study showed that miswak decoction injected intraperitoneally into mice, lower their response to chemical and thermal stimuli in the three analgesic tests. Miswak was more effective against thermal stimuli than against chemical stimuli. It is generally accepted that response to thermal stimuli is mediated via skin pain receptors while the response to chemical stimuli in writhing reflex test is mediated via visceral receptors. Therefore, it was assumed that miswak is a more effective against peripheral pain than visceral pain. This may explain the traditional claim that miswak decoction relieves oral pain by its application to oral mucosa. The underlying mechanism for miswak analgesic action was unclear. However, as the effect of miswak was antagonized by naloxone, it was speculated that the effects could be mediated via interaction with the opiate system [10].

#### Anticonvulsant and sedative effect

The anticonvulsant and sedative effect of *S. persica* L. stem extracts were studied. The effect of *S. persica* L. stem extract on the potentiation of sodium pentobarbital activity and on generalized tonic-clonic seizure, produced by pentylenetetrazole (PTZ) on the rat is reported. The extract of *S. persica* L. extended sleeping time and decreased induction time induced by sodium pentobarbital; in addition, it showed protection against PTZ induced convulsion by increasing the latency period and diminishing the death rate [11].

#### Antiplasmodial activity

Ethnobotanical investigations led to the selection of 19 plant species, used traditionally in Sudan against malaria and similar tropical diseases, for further studies. The antiplasmodial activity of the different extracts of *S. persica* against *Plasmodium falciparum* NF54 strain were found to be 0.6 µg/ml (stems) and 0.7 µg/ml (leaves) [12].

#### Dental implications

Miswak has various therapeutic uses in dentistry such as the juice of the stick extracted on chewing acts as antibacterial extracts as well as a jaw exerciser. Miswak is a good sialogogue. It is used to prevent smoking in adults and thumb sucking in children. It can be used in the development of dentition during eruption. It improves appetite and regulates peristaltic movements of the gastrointestinal tract. Use of miswak in maintaining good oral and dental health as well in general dentistry is as follows [1]:

#### Toothpaste, mouthwashes

Miswak is used in commercial preparation of a number of toothpaste worldwide. Some commercially available toothpaste produced from

*S. persica* plant are as follows: Sarkan toothpaste (UK), quali meswak toothpaste (Switzerland) epidont toothpaste (Egypt), siwak- F toothpaste (Indonesia), Fluoroswak, miswak (Pakistan), and dentacare miswak Plus (Saudi Arabia). Mustafa *et al.* [13] reported a reduction in plaque formation by miswak based mouthwash. But no such preparation presently exists in the market.

#### Role in plaque reduction

Sote [14] found that regular users of miswak show decreased gingival bleeding on probing compared with non-miswak users. A study on Ethiopian schoolchildren comparing miswak with conventional toothbrush found that miswak is as effective as the toothbrush in removing oral deposits. Mustafa *et al.* [13] found 75% plaque reduction after 8 days of miswak use. Rinsing with a slurry of miswak toothpaste reduces gingival inflammation and bleeding on probing. Gazi *et al.* [9] reported that plaque and gingivitis were significantly reduced when miswak was used 5 times a day compared with a conventional toothbrush.

#### Effect on oral micro-organism

Miswak also acts as antibacterial agent. Sofrata *et al.* [15] while studying the effect of miswak pieces on bacteria in periodontitis and dental caries concluded that the antibacterial effect was most pronounced on *Porphyromonas gingivalis*, *Actinobacillus actinomycetemcomitans*, and *Haemophilus influenzae*, less on *S. mutans*, and least on *Lactobacillus acidophilus*. They also reported that the antibacterial effect of miswak suggests the presence of volatile active antibacterial compounds.

#### Endodontic irrigation solution

Although the antimicrobial activity of miswak has been reported, its toxicity must be considered. In addition, no report has been yet made on the utilization of the extract as an irrigant solution in endodontic practice. Samh *et al.* evaluated, *in vitro*, the effect of different concentrations of miswak extract on L929 cell line in tissue culture and compared the results with sodium hypochlorite (NaOCl). They found a concentration-dependent morphologic change of L929 cell line when exposed to miswak extract and NaOCl. They suspect recovery of the cells after a 4-h exposure period to different miswak extract concentrations [16].

#### Gingival recession

A relatively high prevalence of gingival recession among adults in Tanzania has been reported. Gingival recession on buccal surfaces has been ascribed to brushing habits. Since the lingual surfaces in the Tanzanian population exhibit gingival recession to the same extent as the buccal surfaces, as has been reported, then it is doubtful that the miswak is the cause of high prevalence of gingival recession [5].

#### Dental gel

Air-dried powdered stems were extracted with various solvents, and each extract was evaluated for antimicrobial activity against test organisms including dental pathogens by agar diffusion technique. Dichloromethane extract showed significant antimicrobial activity, which was comparable with standards chloramphenicol and clotrimazole. This bioactive extract was formulated into dental gel using a suitable gelling agent. The gel was evaluated for various physicochemical parameters, spreadability, mucoadhesion, dissolution, *in vitro* permeation, and antimicrobial activity. Dichloromethane extract of miswak stems possesses good antimicrobial activity, confirming the traditional claim. A dental gel containing this extract was successively formulated with enhanced penetration and greater activity. This mucoadhesive dental gel has significant potential for treatment of periodontal diseases [17].

#### CONCLUSION

Miswak (*S. persica*) reduces the microbial count in different groups and improves the oral health. The extract possesses antibacterial and antiplaque property and it can be used effectively as a natural tool for teeth cleansing and as a natural analgesic for the disturbing

toothache. The drug is also reported to possess anti-inflammatory, anticonvulsant, sedative. The present review showed that it is useful in a number of diseases. Therefore, it is imperative that more clinical and pharmacological studies should be conducted to investigate unexploited potential of this plant. Nevertheless further investigations are required to isolate and purify novel pharmacologically active.

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