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MISWAK (SALVADORA PERSICA): A NATURAL TOOTH BRUSH OR A MEDICINE AND ITS EFFECTS: A REVIEW ARTICLE

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Abstract

With the increasing incidence of oral diseases attributed to poor oral hygiene, mechanical removal of dental plaque has been regarded as an effective means in the prevention of dental caries and periodontal diseases. The methods for oral hygiene vary from culture to culture and the dimensions regarding the global need for alternative prevention and effective treatment methods have expanded. Evidence-based studies and clinical trials have revealed the use of *Salvadora persica* (miswak) as an effective oral hygiene aid by which different cultures have attached functional value since ancient times. In this review article, the relevant papers to this subjects published in the period 2000-2015 were searched on PubMed Scopus and Google Scholar. These experiences may include such as Miswak, *Salvadora persica*, uses of *Salvadora persica*, oral hygiene etc. Our literature review revealed that the use of *S. persica* miswak as an oral hygiene aid is effective. Descriptive and experimental studies have provided considerable evidence that the *S. persica* plant and its extracts exert beneficial effects on the oral tissues and help to maintain good oral hygiene.

Key words: Miswak, *Salvadora Persica*, Review.

Introduction

The use of a tooth brush in combination with dentifrices is one of the most common methods of cleaning teeth. The evolution of the modern toothbrush may be traced to Chewing sticks that were used by Babylonians as early as 3500 BC, and to toothpicks that were chewed onto help clean the teeth and mouth and were discussed in ancient Greek and Roman literatures (Chewing sticks are prepared from a variety of plant species and are customarily used for cleaning teeth in

described the use of chewing sticks by men and women in the Sahara region and Sudan(5-7).

Scientific classification

Kingdom : Plantae

Division : Magnoliphyta

Class : Magnoliopsida

Order : Brassicales

Family : Salvadoraceae

Genus : *Salvadora*

Species : *persica oleoides*

Binomial name : *Salvadora persica* (Khari Jaal) *Salvadora oleoides* (Meethi Jaal)(8)

Description:

Large shrub with opposite branches,3 m high sometimes growing as dense thickets on and hummock.Leaves leathery, elliptical to broadly lanceolate, entire,acute or obtuse,2-5 cm long, 1-2 cm wide, on petioles 5 mm long.Flowers 3mm long, in paniculate racemes, on 1-2 mm long pedicles.Fruits globular, berry, fleshy, reddish,3-6 mm in diameter(4).

Part Used:

Shoots, Roots and fruits

Traditional & Medicinal Uses:

The plant is mentioned in holy Quran and Sonnah, and the roots and shoot sticks have been used for centuries as oral hygiene tools in many parts of the world .It was reported that fresh and dried leaves, dried fruits and stems are used to treat swellings, ulcers and blisters, scorpion stings, regulating menstruation, gases and worms. In UAE the roots used as toothbrushes and the crushed leaves used with oil to treat joint and knee pains while the fruits also are edible. The plant is used in many countries; fruits edible and used as a carminative, anthelmintic, vulnerary, stomachic, antiseptic and anti-inflammatory and good for spleen, gum, scabies, syphilis, gonorrhoea and the fruit edible as appetizer. Leaves and flowers used for toothache, gum problems, joint pains, skin diseases snake bites, kidney stones, constipation, as antidote carminative and anthelmintic,. The plant broused by sheeps& goats and the leaves used as fodder and a purgative for camels. Also the plant has been incorporated into commercially available toothpaste(4, 9-13).

Microscopic Description:

The leaf is unilateral. Both epidermises compose of small polygonal cells and the upper epidermis is covered with a raised thick striated cuticle. Both epidermises bear many unicellular conical covering trichomes of different sizes and they are easily detachable. The stomata are oval and they are very small in size and of the paracitic type. They are distributed on the lower epidermis. The upper epidermis is underlain by a hypodermis which is composed of large broad cells having thick cell walls. The hypodermis is discontinuous and it is interrupted by one or two layers of palisade tissues of different sizes having wavy cells walls. All cells are fairly rich in chlorophyll and granular structures of various shapes including greenish cluster crystals. The spongy tissues compose of large cells of irregular shapes. They also contain granular structures and they embed a group of adjacent sclereids with angular shapes and thick pitted cell walls. The spongy tissues are also traversed by vascular tissues that contain reticulately and spirally thickened vessels and pitted tracheids(14-16)

The inhabitants of these regions would clean their teeth diligently whenever they had a chance to sit down for social gatherings. Chewing sticks are known by different names in different cultures: “arak” or “miswak” in Arabic, “koyoji” in Japanese, “qesam” in Hebrew, “qisa” in Aramaic, and “mastic” in Latin(17). The availability, low cost, simplicity, and religious and/or traditional associations of chewing sticks have made them popular through modern times. Chewing sticks may play a role in the promotion of oral hygiene, and further evaluation of their effectiveness is warranted, as stated in the 2000 World Health Organization (WHO) Consensus Report on Oral Hygiene(18)

“Miswak” (synonyms in different Arabic dialects and countries include “miswaak,” “miswak,” “miswaki,” “meswak,” “mswaki,” “sewak,” “siwak,” and “siwaki”) is an Arabic word meaning tooth-cleaning stick (17). The spread of Islamic culture had a significant influence on the propagation and use of miswaks, which was a pre-Islamic practice, in different parts of the world (17)). Among at least 182 plant species suitable for preparing toothbrushing sticks, miswak harvested from *Salvadora persica*, are used most extensively (1) The roots, twigs, and stems of this plant have been used for oral hygiene and small *S. persica* sticks have been used as toothpicks . *S. persica* has a wide geographic distribution ranging from Rajasthan (India), Nepal, and Malaysia in the east through Pakistan, Iran, Iraq, Saudi Arabia, and Egypt to Mauritania in the west, and from North Africa through Sudan, Ethiopia, and Central Africa to southwestern Africa. Taking into account the historical importance of the use of *S. persica* miswak in the field of oral hygiene, the present review is an attempt to remind readers of the enormous contributions that this practice has made to dentistry, with

an input from the most recent literature, and to describe the major aspects of its influence on oral health, including its disadvantages(19, 20).

Chemical composition

Chlorhexidine gluconate (CHX), a cationic bisbiguanide, is the best-known and most widely used member of the bisbiguanide class. The efficacy of CHX in significantly reducing plaque and gingivitis (compared with placebos) when used twice daily as a supplement to tooth brushing is well established. The mechanism of action of CHX is due mainly to the rupture of the bacterial cell wall and precipitation of the cytoplasmic content. Early studies used 10 ml of a 0.2% solution for a total of 20 mg CHX per use. There are studies supporting the effectiveness of 0.12% CHX using 15 ml of this solution.^{15,16,17} The total amount of CHX per use was essentially the same, and the clinical findings with the two formulations were similar: plaque reductions in the 50-55% range and reduction in gingivitis of about 45%. The major side effects of CHX are a brown staining of the teeth and tongue, formation of supragingival calculus, taste alteration, and oral desquamation in children.^{18,19,16,20} Allergic reactions have been reported in some patients, especially Asians.²¹ When CHX is used following brushing, one should allow at least 30 minutes after tooth brushing and before rinsing with this chemical because of an interaction (and possible activation) between various positively charged dentifrice detergents and the cationic CHX.²² Also, an antagonistic interaction can occur with the anionic fluoride ion in mouthrinses, toothpastes, and stannous fluoride products. The 30-minute interval is intended to minimize the diminution in activity of CHX.²¹⁽²¹⁾.

The roots and bark of the *S. persica* tree are composed of 27% ash; a high ratio of alkaloids, such as salvadorine and trimethylamine; chlorides and fluorides; moderate concentrations of silica, sulfur, and vitamin C; and small quantities of tannins, saponins, flavonoids, and sterols(²²⁻²⁴) High amounts of sodium chloride and potassium chloride were noted, along with other sulfur-containing organic substances (salvadourea and salvadorine) (²³).

Some phytochemical data of Meswak was presented earlier by Dymock W.¹⁰ According to them, the root-bark contains 27.06% ash and is 'remarkable for the large amount of chlorine present'. The root and stem contain a fairly substantial amount of silica as a desert plant, whereby its mechanical action should provide the teeth a dazzling whiteness. The resin present in the plant parts may be forming a coating over the enamel of the teeth, thus protecting them. Meswak contains the following compounds: lauric, myristic and palmitic acids; polysaccharide and lignin derivatives of phenols and furans; sterols. Five lignin glycosides were isolated by Kamel et al.² as sodium 1-Obenzyl-fi-D-glucopyranoside-2-sulphate

Mehdi KHoshshima Shahraki*et al. /International Journal Of Pharmacy & Technology (salvadoside) and 5,50-dimethoxylariciresinol 4,40-bis-O-b-D-glucopyranoside (salvadoraside), syringin, lirioidendrin and sitosterol 3-Oglucopyranoside. Quercetin and flavonoids rutin were detected in the stems.²⁴ Ashraf Taha Khalil³¹ proved the presence of four benzyl derivatives viz, Benzylamides. N1,N4-bis(phenylmethyl)-2(S)-hydroxy-butanediamide (1), N-benzyl-2-phenylacetamide (2), N benzylbenzamide (3), and benzylurea (4).^(25, 26) It was further investigated that Compound 2 revealed a significant inhibitory effect on human collagen-induced platelet aggregation, and a moderate antibacterial activity. The compound Salvadourea, (m-MeOC₆H₄CH₂NH)₂CO, has been reported in the roots.³ The benzylisothiocyanate isolated from the Meswak showed antiviral activity against HSV-126 and acts as an agent for controlling dental caries. b-sitosterol and ascorbic acid, present in the bark of Meswak show hypocholesterolemic properties. The compounds trimethylamine and salvadorine present in it have shown antiphlogistic, antibacterial and gingiva-stimulating effects. Moreover trimethylamine may have a stimulatory action on the gums. According to studies, chlorine, trimethylamine, alkaloid resin, and sulfur compounds present in meswak have antimycotic effect. Probably, the chlorine present as chloride could act as a dentifrice for removing tartar and other stains from the teeth^(27, 28).

Influence of miswak on oral health

An in vitro study showed that the aqueous extract of *S. persica* miswak had an inhibitory effect on the growth of *Candida albicans* that may be attributed to its high sulfate content ⁽²⁹⁾. AlLafi and Ababneh (1995) investigated the derivatives of *S. persica* miswak using three different laboratory methods, and demonstrated strong antimicrobial effects on the growth of *Streptococcus* sp. and *Staphylococcus aureus*. In addition, Almas et al. (1997) showed that *Enterococcus faecalis* is the most sensitive microorganism affected by the use of *S. persica* miswak, and noted no significant difference in the antimicrobial effects of freshly cut and 1-month-old miswak. A comparison of the alcoholic and aqueous extracts of *S. persica* miswak revealed that the alcoholic extract had more potent antimicrobial activity than did the aqueous extract ⁽³⁰⁾.

Meswak has been scientifically proven to be very useful in the prevention of tooth decay, even when used without any other tooth-cleaning methods.⁴ However the use of meswak extract chewing gum may promote periodontal health by decreasing in plaque, bleeding and gingival indices. Diabetes mellitus and renal transplant patients (usually conditioned with immunosuppressive agents) are known to predispose to oral candidal infection, because these disorders reduce the patient's immune response. Meswak when tested showed a great antimicrobial activity against some. The tannins and resins in meswak have an astringent effect on the mucus membrane and form a layer over the enamel which indeed gives

protection to the teeth. Elvin-Lewis et al. showed that the dental loss in adults is very low in the countries where Meswak is used widely(1, 24, 31).

Dental plaque refers to the diverse microbial community (predominantly bacteria) found on the tooth surface, embedded in a matrix of polymers of bacterial and salivary origin. For its benefit, plaque develops naturally on teeth, and forms part of the defense systems of the host by helping to prevent colonisation of enamel by exogenous microorganisms. Moreover often pathogenic microorganisms are hosted by it which forms the sites for greatest risk of disease. Mutans group of Streptococci were established as the key agents causing dental caries and these are mostly hosted by these sites because of their ability to initiate the plaque formation. Several studies have demonstrated that meswak contains substances that possess dental plaque inhibiting properties against oral microbes. The meswak's mechanical action in plaque removal could have been due to the substantial amount of silica detected in Persica ashes. It may also play a potential role in caries prevention and raises the plaque pH after acidic challenge. This material does not exist in Persica extract. This may explain the disagreement between this study and the findings which showed meswak stick can reduce the plaque accumulation. Moreover the three are no. of reports which sport the anti-plaque property or elongation of the duration for plaque formation(32-34).

The value of *S. persica* miswak is due primarily to its mechanical cleaning action(34). Gazi et al. (1990) reported significantly lower plaque scores following the proper use of miswak as an oral hygiene aid in comparison with the use of conventional toothbrushes(35). Miswak is generally used for a longer period of time than a toothbrush, and the buccal/labial surfaces of the teeth can be reached more easily than can the lingual and proximal surfaces (36). Despite the longer duration of miswak use, Eid et al. (1990a) found no significant difference in buccal/labial plaque scores between miswak and toothbrush users in Saudi Arabia. In many developing countries, chewing sticks are often used as the sole oral cleaning device. Oral hygiene maintenance through the regular removal of dental plaque is an essential factor in the prevention of dental caries and periodontal disease. Several explanations for the cleansing effectiveness of *S. persica* miswak have been put forward, including (a) the mechanical effects of its fibers, (b) the release of favorable chemicals from the chewing stick while in use, or (c) a combination thereof. However, the lack of studies reporting the time, duration, and frequency of *S. persica* miswak use prevents meaningful assessments of its mechanical cleaning effects on oral health(37). In a 2005 survey, the majority of Jordanians believed that using a toothbrush and a miswak was most

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effective for optimal oral health (38). *Salvadora persica* miswak is considered to be an affordable and readily available oral hygiene device that can be used by the vast majority of people (37).

Cultural implications

As the French philosopher Auguste Comte (1798–1857) stated, “demography is destiny”. With world populations becoming more culturally diverse, healthcare providers must practice cultural awareness and sensitivities to achieve trust, and to direct the patient-provider relationship toward the ultimate goal of quality oral health care for all population segments. Unfortunately, ignorance of customs can undermine the establishment of trusting relationship(39). As in the case of the miswak chewing stick; dental professionals should review miswak use with patients to ensure proper use and angulation to maximize bacterial plaque removal One of the ways to meet the challenges presented by multicultural patient populations is to develop a public health and dental workforce that is both culturally and linguistically competent. (40)A study in Jeddah, Saudi Arabia assessing the knowledge, attitude, and behavior among Saudi school students in relation to periodontal health status revealed that regular tooth brushing was the method with the highest frequency (80%) followed immediately by miswak use (40%). The toothbrush was used more frequently among private school subjects, while miswak was used more frequently among governmental school students (41, 42). Consequently, future generation of dentists must be culturally prepared to serve diverse patient populations that utilize miswak as their primary oral hygiene aid According to the National Center for Cultural Competence, critical factors in the provision of culturally competent health care services include understanding of the values, beliefs, traditions, and practices of a culture. Dental schools must strive to prepare their students in such areas of focus. Ideally, future generations of public health practitioners and dentists should be knowledgeable about the cultures they will treat and well-versed in cultural practices. As a result, a study was conducted to examine self-rated knowledge of dental students about the cultures they are likely to encounter in dental practice and students’ belief about the importance of culturally sensitive practices in dental care(38) The authors found that overall students reported low knowledge of the cultures of the patients they were likely to see in practice. The majority of students could not identify a cultural group whom they know well(43)

Disadvantages of chewing sticks

Although *S. persica* miswak is considered to be an essential aid in maintaining oral hygiene, certain disadvantages are associated with its use. Its bristles lie in the long axis of the stick, whereas those of a toothbrush are placed perpendicular to the handle. Thus, it is difficult to reach the lingual surfaces of the dentition with a miswak. Another disadvantage is

related to the habitual use of miswak for a prolonged period (44). Studies reported that chewing-stickusers may excessively scrub the anterior teeth, which are located in the area of primary concern, while ignoring the posterior teeth. Other studies have considered the use of miswak to be one of the possible etiological factors in gingival recession(45). These disadvantages may be overcome with a dentist's provision of precise instructions on the acceptable methods and duration of miswak use. Mohammad and Turner (1983) evaluated the cytotoxic potential of the *S. persica* plant and its diffusible components on oral tissues using the tissue culture agar overlay method. Their results demonstrated no cytotoxic effect of freshly cut *S. persica* miswak, but showed that the same plants contained harmful components if used after 24 h (46). A study of the effect of the direct administration of high doses of *S. persica* miswak extract to mice revealed some minor side effects on male and female reproductive systems and fertility (47). However, an earlier study reported that neither aqueous nor ethanolic *S. persica* miswak extract was toxic to mice at doses of up to 1200 mg/kg (48).

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