Review

**Miswak: The underutilized device and future challenges**

Winarni Yasmin¹, Haslinda Ramli¹ and Aspalilah Alias²

¹Department of Periodontology and Community Oral Health, Faculty of Dentistry, Universiti Sains Islam, Malaysia.  
²Department of Basic Sciences and Oral Biology, Faculty of Dentistry, Universiti Sains Islam, Malaysia.

Received 26 August, 2019: Accepted 14 October, 2019

There have been many studies on the practice of maintaining dental health. Although most people currently use a toothbrush to maintain the cleanliness of mouth, specific populations still use miswak as an alternative tool for oral health care. This study was designed to answer the future challenges of use of miswak as a tool to maintain oral health according to modern sciences. The history, features, function, modernization, and method in miswak were discussed in this article. The effect of miswak on periodontal health and antimicrobial has also been explained thoroughly in this article. Thus, miswak can be said to be a natural source of material that has many benefits in the improvement of oral health. The miswak extract has been modified and added in toothpaste, mouthwash, endodontic irrigation treatment, and for testing DNA. The miswak is used widely as a tool for brushing teeth and is like or better than a standard toothbrush.

**Key words:** Miswak, Salvadora persica, chewing stick, siwak

INTRODUCTION

The use of sticks from the Salvadora persica plant to clean the teeth and mouth is widely known in traditional Arabic culture. This stick is known as Miswak or Siwak. The miswak in Arabic means "stick to brush your teeth" (Hattab, 1997; Arora and Gupta, 2011). Since around seven thousand years ago, the Babylonians have used miswak as a tool in cleaning the teeth. This habit was later followed by countries, such as Greece, Rome, Jews, Egypt, and the Islamic kingdom. Some countries in Africa, South America, Asia, and the Middle East countries such as Saudi Arabia and all other Islamic countries are known to use miswak until now (Chaurasia et al., 2013). However, the well-known benefits of miswak and its use have been recommended by the World Health Organization (WHO, 1987), which is a body in charge of health issues around the globe (Ahmad and Ahamed, 2012). Recently, miswak has been comprehensively reviewed (Ra'ed et al., 1999; Wu et al. 2001; Ahmad and Ahamed, 2012) along with its effectiveness as one of the tools to maintain oral hygiene (FDI, 2000; Ahmad and Ahamed, 2012) where it has been found as effectively and exclusively capable of replacing the toothbrush. However, it was suggested for miswak users to support planning to strengthen the evidence of the current trial, especially in developing countries where oral health care services are limited for ordinary people (Aeeza et al., 2013).
al., 2016) The miswak made from S. persica has been found to contain several medicinal properties, in which almost all parts have an essential role in the pharmaceutical field (Almas, 2002; Almas et al., 2005; Darmani et al., 2006; Arora and Gupta, 2011). Several studies have reported the effectiveness of the use of miswak. The clinical experimental study has been conducted at the Institute of Odontology, Karolinska Institute. They concluded that miswak is as effective as conventional toothbrushes in reducing plaque (Batwa et al., 2006), showing that miswak can effectively and exclusively replace the toothbrush (Aeeza et al., 2016).

Based on this description, the persons can obtain many advantages from the use of miswak. Although many people have abandoned using it because they prefer to use a toothbrush as a tool to maintain their oral hygiene, miswak is still used by certain people in the world, especially among Muslims. Therefore, the review of this study is designed to answer the future challenges of using miswak as a tool to maintain oral health following modern science.

Miswak (chewing stick)

Miswak usually made from roots, twigs, and stems of S. persica plants is used to make chewing sticks (Haque, 2015). S. persica is a small plant or shrub with twisted stems. The stems and roots of the plant are spongy and between the teeth can smash easily. Root cutting is usually flavorful and softened when immersed in water (Almas and Al-Zied, 2004). The bark is light brown, while the inside surface is white. It smells like crescents as well as taste warm and pungent (Ragaii et al., 2017). S. persica contains proven medicinal properties and has found an important role in the pharmaceutical field in almost all parts (Almas, 2002; Almas et al., 2005; Darmani et al., 2006; Arora and Gupta, 2011).

Miswak wood trees are generally still found in East India, Chad, Saudi Arabia, Egypt, southern Sudan, and Pakistan. This stick is famous in all Muslim countries and well known throughout the Indian subcontinent. As mentioned before, miswak has been used by the Babylonians since around seven thousand years ago and later, followed by other nations such as Jews, Greeks, Romans, Egyptians, and Islamic kingdoms. Currently, many have used miswak, especially in South America, the Middle East, including Saudi Arabia, Asia, Africa, and all Islamic countries (Chaurasia et al., 2013). This matter is due to its easy to use and has low price, making it a tool to prevent highly effective plaques in various communities (Bos, 1993; Darout et al., 2000; Wu et al., 2001; Hyson, 2003; Ahmad and Ahamed, 2012).

Chewed wood has various names as it is called siwak and miswak in the Middle East. Meanwhile, in India and Pakistan it is usually called Datun, in Ethiopia it is called Mefaka and in Tanzania Mswaki, respectively (Ra’ed et al., 1999). In Nusantar, this miswak is famous for its name been called sugi wood (Fatin et al., 2012). The most common source of miswak is S. persica (Almas and Al-Zied, 2004), which has many other names, like Salvador indica, Mustard tree, Peelu, Pilu, Galenia Asiatica, Meswak, Arak or natural toothbrush trees all synonymous of S. persica. Besides, miswak belongs to the Salvador species and the Salvadoraceae family (Chaurasia et al., 2013). Countries in the Middle East are famous for using S. persica. It is believed that Prophet Muhammad used this plant, hence Muslim commentators stated that the Prophet’s narrative of miswak rods from the S. persica tree, thus highly recommended it as the most suitable tree for making miswak (Ibn Qayyim, 2003; Fatin et al., 2012).

Features of miswak

Miswak is in the form of small stems, like pencils with a length of 15-20 cm in diameter ranging from 1-1.5 cm and made from roots, stems, twigs or bark of a particular tree or bush (Almas and Alifi, 1995). This stick is called a chewing stick due to its structure. It is a very suitable size, plus having a taste like mint on it makes it fun for one to chew. Sometimes a small portion of a stick is used as a toothpick (Ezoddini-Ardakani, 2009). From one end of the chewing stick, it needs to be sharpened or chewed until it becomes fibers, like brushes (Almas and Alifi, 1995).

Soaking the miswak for a few hours in water will make the fibers softer, and easier to separate when tapering or chewing. Brief chewing will only form the fiber prior to being used as a toothbrush, before proceeding to the oral cleansing, which includes brushing your teeth, gums, and tongue. After finished, the chewing stick is removed from the mouth or can let for some additional time in the mouth. This matter is because if it is in the mouth, miswak can stimulate saliva discharge for the cleansing effect to be better. However, when it does not use miswak, it should be advisable to be stored in a humid place (Almas and Alifi, 1995). After several times, the miswak can replace with a new one or the fur can be cut to obtain a new tip where the new feather is obtained by chewing it again (Wu et al., 2001).

Miswak as oral hygiene device

Recently, miswak has been comprehensively reviewed (Ra’ed et al., 1999; Wu et al., 2001; Ahmad and Ahamed, 2012) and found to be useful as one of the tools to maintain oral hygiene (FDI, 2000; Ahmad and Ahamed, 2012). Hassan et al. (2011) conducted detailed surveys in various regions of Saudi Arabia and concluded that S.
*S. persica* can be used for dental treatment, anti-ulcer, and has anti-inflammatory properties. On the other hand, Olsson (1978) assessed the effectiveness of *miswak* users and found that it was the same as *miswak* plus toothbrush users on oral hygiene. However, there is no valid population data regarding the effects of *miswak* uses on periodontal health. Although, Darout et al. (2000) reported that the Sudanese population has a better periodontal status for *miswak* users compared to those who use toothbrushes to clean their teeth, this study shows that the use of *miswak* is efficient. That is comparable or slightly better for oral health (Ahmad and Ahamed, 2012). Since then, subsequent studies have concluded that using *miswak* is best in dental prevention programs as it is economical and familiar to parents (Ra’ed et al., 1999).

**Use of miswak**

There are few factors that need to be considered in using *miswak* in order to get the optimum effect in cleaning the teeth and mouth. Many researchers found that the time of using *miswak*, cutting the tip of *miswak* every time after use, and the techniques that are used by the person affect the efficiency of the *miswak*.

Before the use of *miswak*, the tip meant for brushing must be washed with water (Almas and Al lafi, 1995). After that, one end of the *miswak* that will be used should be immersed in water for a few minutes (between 2 and 5 min) before using it. Some scholars suggested that for the first use, the person should soak the tip of the *miswak* for several hours, likely about 24 h. However, if the person soaks it for too long, the chemical content will dissolve in the water. This matter will reduce the usefulness, although the mechanical function would still be as usual (Al-Din et al., 1988; Ramli et al., 2017). Afterward, one end of the *miswak* should be chewed until fibrous like feathers appear to form a toothbrush. It is also recommended to bite *miswak* evenly throughout the teeth surface from right to left. As such, it can be a benefit to clean the occlusal surface of teeth (Ramli et al., 2017).

To get the maximum effect, it should be ensured that the tip of the *miswak* is always fresh. For this reason, it is necessary to cut the tip of the *miswak* every time it will be used as *miswak* will release several benzyl isothiocyanate when using it in the mouth. The several times use on the same end piece causes a reduction in the amount of benzyl isothiocyanate which is released gradually (Alabtabain et al., 2017).

Although the Qur'an and Hadith do not mention a proper procedure for brushing teeth using *miswak*, some scholars have stated ways to clean the teeth using *miswak*. Almas and Al lafi (1995) said the two basic techniques of holding *miswak* are: five-finger grip and a three-finger grip. According to them, these can ensure a substantial movement from the tip of the *miswak* brush in the mouth and can get to any part of the oral cavity with relative ease. Just like using a toothbrush, using *miswak* to mechanically clean plaque can be done through vertical and horizontal movements. On the buccal and labial surfaces, this cleansing movement must be from the ginglymal margin of the tooth towards the incisal/occlusal teeth. Meanwhile on the occlusal surface, it can employ scrubbing movements from anterior to posterior (Almas and Al lafi, 1995).

Hirschfeld (1987) proposed the following procedure: must hold the *miswak* with the four fingers (index, middle, ring, and little finger respectively). While placing the thumb along the stem of the *miswak* towards the feathers, brushing starts from the front teeth, then follows the buccal and lingual/palatal surfaces of the back teeth while the chewing surface is the last (Aboul-Enein, 2013).

Ramli et al. (2017) wrote in a book entitled “Rahsia siwak dalam Sunah dan sains pergigian” about how to use *miswak* and proposed that the *miswak* stem can be held in various ways, viz; five finger grip, three finger grips, pen grasp or two fingers lower, and three fingers above. Brushing teeth using *miswak* is a horizontal movement of 5 to 10 times in 2 to 3 teeth at once. This horizontal movement is mainly for molar surfaces and palatal premolars, whereas for palatal teeth and incisors, the motions are vertical. The occlusal surface is brushed with forward and backward horizontal movements, while the whole action always starts from the right.

**Modernization of miswak in oral health care**

Contemporarily, *miswak* is being sold in the market with a variety of packaging that looks cleaner and healthier. It is therefore known to have some amount of chemical content in *S. persica*. Currently, with the development of the era, *S. persica* is not only being used as a toothbrush but also as toothpaste (Haque, 2015); mouthwash (Mustafa et al., 1987); endodontic irrigation solution (Al-Salman et al., 2005; Sukkarwalla et al., 2013); determination of DNA profiling (Alfadaly et al., 2016) and tooth whitening (Halib et al., 2017).

Hattab (1997) said that toothpaste with ingredients containing *S. persica miswak* extract was more effective than Oral-B toothpaste in removing dental plaque. The samples product content of *miswak* to toothpaste in the market are: English (Sarkan toothpaste), Switzerland (Quali-Meswak toothpaste), Egypt (Epident toothpaste), Pakistan (Fluoroswak and *Miswak* toothpaste), Saudi Arabia (Dentacare *Miswak* Plus toothpaste) and Indonesia (Siwak toothpaste) (Ra’ed et al., 1999).

According to Mustafa et al. (1987), the formation of plaque will reduce when rinsing with mouthwash based on *miswak* (Ra’ed et al., 1999). However, Fouad Hussein et al. (2010), in clinical trials, concluded that *S. persica*
extract at a concentration of 10 mg/ml was well tolerated and safe, thereby resulting in excellent antibacterial activity in vitro. As a mouthwash, S. persica extract is less effective than chlorhexidine in preventing the accumulation of dental plaque, but it is more effective than the placebo. The samples product that contain S. persica of mouthwash are: Siwak-F mouthwash and Miswak mouthwash.

There have not been any scientific reports about the use of miswak extract for irrigation in root canal treatment (Ra’ed et al., 1999). However, Al-Salman et al. (2005) and Al-Sabawi et al. (2007) reported miswak as adequate for root canal irrigation because it limits levels of aerobic and anaerobic bacteria during root canal treatment (Sukkarwalla et al., 2013). Also, Al-Sabawi et al. (2007) reported investigated the efficacy of miswak as root canal irrigation through a method of comparing the effects of flooding containing miswak with other root canal irrigation. As such, 15% of miswak extract has been found to have properties similar to chlorhexidine 0.2%, which is very useful for both aerobic and anaerobic bacteria in the necrotic pulp. Besides, miswak extract and chlorhexidine, sodium hypochlorite has also shown the highest anti-microbial effect (Sukkarwalla et al., 2013).

Lastly, miswak contains enough DNA to produce a good DNA profile successfully. Therefore, when compared to a toothbrush, miswak is a source of DNA profiles that can be used to aid forensic identification. It also can be used as a source of identification even after months of usage because up to four months’ storage time has little or no effect on results (Alfadaly et al., 2016).

In another study, researchers found crystal in miswak using Energy-Dispersive X-ray spectroscopy technique. This crystal can act as a natural abrasive. They suggested that the paste from S. persica can be used as an alternative material for teeth whitening that can remove extrinsic staining (Halib et al., 2017).

**EFFECT OF MISWAK ON PERIODONTAL HEALTH**

Many studies have proven that the use of miswak has effects on the health of periodontal tissue, such as antiplaque, gingival recession, periodontal pocket depth and gingival bleeding.

**Antiplaque**

There have been several studies on the effectiveness of using miswak. A cross-sectional survey on adults conducted in Ghana shows the opposite results, where it found that there are more plaque and gingival bleeding in miswak users than toothbrush users. However, there is no difference, as observed in children aged 7-15 years in Tanzania (Almas and Al Iafi, 1995; Ra’ed et al., 1999). In another trial with the children in Ethiopia and adolescents in Nigeria, miswak appears to be as effective as a toothbrush in removing plaque (Olsson, 1978; Almas and Al Iafi, 1995). The results of these studies suggested that teaching and controlling are fundamental as it finds a sample of children that were not familiar with the technique of using miswak. As such, it can be concluded that the maintenance of poor oral hygiene in people who use miswak reflects the inferior method of using miswak (Ra’ed et al., 1999).

Danielson et al. (1989) stated that the reduction of front tooth plaque is better than posterior teeth in miswak users, hence it is recommended for maintaining oral hygiene. Mustafa et al. (1987) derived a 75% reduction in plaque after eight days of miswak usage while Gazi et al. (1990) reported that there was a significant reduction in plaque and gum inflammation when using miswak five times a day compared to the use of a conventional toothbrush (Ra’ed et al., 1999).

Conversely, a clinical experimental study conducted at the Institute of Odontology, Karolinska Institute, concluded that miswak is as effective as a traditional toothbrush in reducing plaque (Batwa et al., 2006). Also, randomized clinical trials among dentistry students from Dow University of Health Sciences, Karachi, Pakistan revealed that miswak has a mechanical and chemical cleansing in the mouth that is stronger than a toothbrush. As such, it has discovered a significant efficacy of antiplaque in the use of miswak. This matter shows that miswak can effectively and exclusively replace toothbrush (Aeeza et al., 2016).

**Gingival recession**

The gingival recession, also known as shrinking gum, is exposure to the tooth root resulting from loss of gum tissue or marginal gingival retraction of the dental crown. The high level of gingival recession and tooth abrasion is associated with the use of miswak (Dahiya et al., 2012). In Saudi, schoolchildren show the relationship between excessive miswak usage and gingival recession (Younes and El-Angbawi, 1983; Halawany, 2012). It was reported that there was relatively high prevalence of gingival recession in Tanzania in the adult population, and that gingival recession on the lingual and buccal surface has the same level (Van Palenstein et al., 1992; Ra’ed et al., 1999). Meanwhile, Eid et al. (1991) reported many cases of gingival recession in miswak users, which may be due to mechanical trauma (Halawany, 2012).

**Periodontal pocket depth and gingival bleeding**

Sote (1987) found no difference in gingival bleeding, plaque, and on miswak and toothbrush users. Similarly,
Eid et al. (1990a) also reported that among users of miswak and modern toothbrush users, there were no significant differences in the gingival index or bleeding score. However, Gazi et al. (1990) stated that the comparison of periodontal status between miswak users and conventional toothbrush users showed that miswak users had lower gingival bleeding and high interproximal bone compared to toothbrush users (Dahiya et al., 2012). Sofrata (2010) reported that miswak users had the same pocket depth as toothbrush users in Saudi Arabia whereas miswak users had deeper pockets on midfacial surfaces than toothbrush users (Almas and Al lafi, 1995). Still, Darout et al. (2000) conducted a study on 213 men of the Sudanese nation, where they evaluated periodontal conditions for miswak users compared to toothbrush users and concluded that Sudanese people who used miswak to maintain their oral hygiene had better periodontal status than those who used toothbrush.

**ANTIMICROBIAL EFFECT OF MISWAK**

Many studies have reported that S. persica contains anti-plaque and antibacterial substances against certain types of cariogenic bacteria in the oral cavity. Materials contained in S. persica can inhibit the growth and production of acidic bacteria (Abo Al-Samh, 1996; Almas et al., 1997; Ra’ed et al., 1999). A study was conducted by Al-Mas and Al-Zeid (2004) to compare the presence of Streptococcus mutans and lactobacilli bacteria in saliva between the toothbrush and miswak users. The results showed that the number of S. mutants in saliva decreased significantly, but there was no significant difference in lactobacilli bacteria (Almas and Al-Zied, 2004; Fatin et al., 2012). Similarly, Wolinsky et al. (1996) also showed that S. persica reduced the strength of specific colonization of Streptococci on tooth surfaces (Ezoddini-Ardakani et al., 2012).

Again, Al-Lafi and Ababneh (1995) reported that using miswak can prevent chemical plaque formation. Besides that, miswak also has antimicrobial effects on several types of microorganisms. Al-Otaibi et al. (2004) observed comparisons of miswak and toothbrush users and found a significant reduction on the amount of Actinomycetemcomitans aggregatibacter in subgingival subagents. Also, it showed that the extracts of S. persica could damage the growth and leukotoxicity processes against bacteria A. actinomycetemcomitans (Dahiya et al., 2012).

Further, Sofrata et al. (2008) studied the effects of fragments of miswak on bacteria in periodontitis as well as tooth decay, concluding that the most prominent antibacterial effects are in A. actinomycetemcomitans, Porphyromonas gingivalis, and Haemophilus influenza. The impact on S. mutants is less while the least effect is on the Lactobacillus acidophilus bacteria.

**CONCLUSION**

Various studies have proven that the use of miswak as a tool for maintaining dental and oral hygiene has the benefit of being antiplaque. Thus, it can prevent dental caries and periodontal problems.

Furthermore, with the presence of modern toothbrushes, the miswak is marginalized, but researches have introduced variations in the use of miswak, such as packaging to make it more beautiful and healthier. Additionally, some form of miswak has also been modernized like a mechanical pencil.

Although many studies have shown that using miswak has a good effect on oral health, however, they must do further research on the technique of using miswak. Also, as a natural material, various innovations have been carried out at this time to maximize its benefits. Thus, to obtain the maximum result, future research must be emphasized through interventions to explore the other benefits of miswak.

**CONFLICT OF INTERESTS**

The authors have not declared any conflict of interests.

**REFERENCES**

Abo Al-Samh D, Al-Bagieh N (1996). A study of antibacterial activity of the miswak extract in vitro. Biomedical Letters 53:225-238.

Aboul-Enein BH (2013). The miswak (Salvadora persica L.) chewing stick: Culture implications in oral health promotion. The Saudi Journal for Dental Research 5(1):9-13.

Aeeza SM, Malik SS, Ambrina AQ, Rasheed A (2016). Comparative effectiveness of chewing stick and toothbrush: a randomized clinical trial. North American Journal of Medical Sciences 6(7):333.

Ahmad H, Ahamed N (2012). Therapeutic properties of meswak chewing sticks: a review. African Journal of Biotechnology 11(83):14850-14857.

Albabtain R, Azeem M, Wondimu Z, Lindberg T, Borg-Karlson AK, Gustafsson A (2017). Investigations of a Possible Chemical Effect of Salvadora persica Chewing Sticks. Evidence-Based Complementary and Alternative Medicine.

Al-Din W, Al-Latif Abd, Al-Baghdadi (1988). Al-Tibb min al Kitab wa al-sunnah. Beirut: Dar al-Ma`rifa pp. 62-63.

Alfadaly N, Kassab A, Al Hedalby F (2016). Determination of DNA profiling of siwak and toothbrush samples used in Kingdom of Saudi Arabia. The Egyptian Journal of Medical Human Genetics 17:383-387.

Al-Lafi, Ababneh H (1995). The effect of the extract of the miswak (chewing sticks) used in Jordan and the Middle East on oral bacteria. International Dental Journal 45:218-222.

Almas K, Al lafi T (1995). The natural toothbrush. World Health Forum 16:206-210.

Almas K, Al-Bagieh N, Akpata ES (1997). In vitro antibacterial effect of freshly cut and 1-month-old miswak extracts. Biomedical Letters 56:145-49.

Almas K, Al-Zied Z (2004). The immediate antimicrobial effect of a toothbrush and miswak on cariogenic bacteria: a clinical study. Journal of Contemporary Dental Practice 5(1):105-114.

Almas K, Skaug N, Ahmad I (2005). In vitro antimicrobial comparison of miswak extract with commercially available non-alcohol mouth rinses.
International Journal of Dental Hygiene 3:18-24.
Almas K (2002). The effect of salvadora persica extract and chlorhexidine gluconate on human dentin. The Journal of Contemporary Dental Practice 3(3):27-35.
Almas K, Al Iafi T (1995). The natural toothbrush. World Health Forum 16:206-210
Al-Otaibi M, Al-Harthy M, Gustafsson A, et al (2004). Subgingival plaque microbiota in Saudi Arabsians after use of miswak chewing stick and toothbrush. Journal of Clinical Periodontology 31:1048-53.
Al-Sabawi NA, Al-Sheikh AK, Taha MY (2007). The antimicrobial activity of Salvadora persica solution (Miswak-siwas) as root canal irrigant (a comparative study) University of Sharjah Journal of Pure and Applied Sciences 4(3):69-91
Al-Saiman TH, Al-Shaekh Ali MG, Al-Nuaimy OM (2005). The antimicrobial effect of water extraction of Salvadora persica (Miswak) as root canal irrigant. Al-Rafidain Dental Journal 5:33-36.
Arora M, Gupta VK (2011). Phytochemical and biological studies on Salvadora persica wall: a review. Pharmacologyonline 1:591-601.
Batwa M, Bertgstrom J, Batwa S, Al-Otaibi MF (2006). The effectiveness of chewing stick miswak on plaque removal. Saudi Dental Journal 18(3):125-133.
Bos G (1993). The miswak, an aspect of dental care in Islam. Medical History 37:68-79.
Chaurasia A, Patil R, Nagar A (2013). Review article miswak in oral cavity—an update. Journal of oral biology and craniofacial Research 3:98-101.
Dahiya P, Kamal R, Luthra RP, Mishra R, Saini G (2012). Miswak: a periodontist’s perspective. Journal of Ayurveda and integrative medicine 3(4):184-87.
Danielson B, Baelum V, Manji F, Fejerskov O (1989). Chewing stick, toothpaste and plaque removal. Acta odontologica Scandinavica 47:121-125.
Darmanto HT, Nusayr AS, Al-Hiyasat (2006). Effects of extracts of miswak and derum on proliferation of bba /C 3T3 fibroblast and viability of cariogenic bacteria. International Dental Hygiene 4:62-66.
Darout IA, Albandoom JM, Skaug N (2000). Periodontal status of adult Sudanese habitual users of miswak chewing sticks or toothbrushes. Acta Odontologica Scandinavica 58:25-30.
Eid MA, Al-Shamyery AR, Selim HA (1999a). The relationship between chewing sticks (miswak) and periodontal health. 2. Relationship to plaque, gingivitis, pocket depth and attachment loss. Quintessence International 21(12).
Eid MA, Selim HA, and Al-Shamyery AR (1991). The relationship between chewing sticks (miswak) and periodontal health. 3. Relationship to gingival recession. Quintessence International 22:61-64.
Ezoddini-ARDakani F (2009). Efficacy of miswak (salvadora persica) in preventing dental caries. Health 2(5):499-503.
Ezoddini-ARDakani F, Shadkam MN, Fotouhi H, et al (2012). Study of the effects of natural toothbrush (salvadora persica) in prevention of dental caries and plaque index. Health 4(9):612-618.
Fatim MN, Siti Rabiulati Adawiyah SM, Sumaiyiah MT, Monika@ Munirah AR (2012). A review on the sunnah of miswak (salvadora persica) and its potentiality to improve oral health. Revelation and science 02(01):33-41.
FDI (2000). The proceeding of the FDI’s second world conference on oral promotion. consensus statement on oral hygiene. International Dental Journal 50:139.
Fouda HA, Aiman HA, Nidhal AWA, Mahmoud AA (2010). Effect of mouth wash extracted from Salvadora persica (Miswak) on dental plaque formation: a clinical trial. Journal of Medicinal Plants Research 4(14):1445-1454.
Gazi M, Saini T, Ashri N, Lambourne A (1990). Miswak chewing stick versus conventional toothbrush as an oral hygiene aid. Clinical Preventive Dentistry 12:19-23.
Halawany HS (2012). A review on miswak (salvadora persica) and its effect on various aspects of oral health. The Saudi Dental Journal 24:63-69.
Halib N, Nuairy N, Ramli H, Ahmad I, Othman NK, Salleh S, Bakarudin SB (2017). Preliminary Assessment of Salvadora persica Whitening Effects on Extracted Stained Teeth. Journal of Applied Pharmaceutical Science 7(12):121-125.
Haque MM (2015). A review of the therapeutic effects of using miswak (Salvadora Persica) on oral health. Saudi Medical Journal 36:5.
Hassan S, Mohammed NA, Leonard W (2011). Ethnobotanical and antibacterial potential of salvadora persica I: A well known medicinal plant in Arab and Unani system of medicine. Journal of Medicinal Plants Research 5(7):1224-1229.
Hassan SFN (1997). Miswak: the natural toothbrush. The Journal of Clinical Dentistry 8:125-129.
Herschfeld JJ (1987). Dentistry in the writings of Al-Baghdad during the golden age of Arabian medicine. Bulletin of The History of Dentistry 35(2):110-114.
Hyson JM (2003). History of the toothbrush. Journal of the history of dentistry 51:73-80.
Ibüty Qayyim al-Jauziyyah (2003). Healing with the medicine of the Prophet. Jalal Alabul Rub (trans) Riyadh: Darussalam.
Mustafa MH, Abd-el AI MM, Abo-el Fadl-KM (1987). Reduced plaque formation by miswak based mouthwash. Egyptian Dental Journal 33:375-384.
Olsson B (1978). Efficiency of traditional chewing sticks in oral hygiene programs among Ethiopian schoolchildren. Community Dental Oral Epidemiology 6:105-109.
Rafiee I, Al Sadhan, Almas K (1999). Miswak (chewing stick): a culture and scientific heritage. Saudi Dental Journal 11(2):80-88.
Ragasi El-Mostehy M, Al-Jassem AA, Al-Yassin IA, El-Gindy and Shoukry E (2017). Siwak. An oral health device (Preliminary chemical and clinical evaluation).
Raml I, Han Abdul Fatlah WI, Halib N, Wan Mohamad Nasir WO (2017). Rahsia siwak dalam sunnah dan sains penggian. University Malaysia Islam Malaysia 51-77.
Sofrata AH, Claesson RL, Lingström PK, Gustafsson AK (2008). Strong antibacterial effect of miswak against oral microorganisms associated with periodontitis and caries. Journal of Periodontology 79:1474-1479.
Sofrata AH (2010). Salvadora persica (miswak) an effective way of killing oral pathogens. Division of Periodontology, Department of Dental Medicine, Karolinska Institutet, Stockholm, Sweden.
Sote EO (1987). The relative effectiveness of chewing sticks and toothbrush on plaque removal. The South African Dental Journal 1(2):48-53.
Sukkarwalla A, Salima MA, Praneel L, Farzene T (2013). Efficacy of Miswak on oral pathogens. Dental Research Journal 10(3):314-320.
Van Pailenstein HWH, Munck L, Mushendwa S, Mrema FG (1992). Cleaning effectiveness of chewing sticks among Tanzanian schoolchildren, Journal Clinical Periodontology 19:460-463.
Health World Organization (WHO) (1987). Prevention of diseases. Geneva: AlMuslim (Ar). AlBoukare and Muslim. Egypt: AlHalabe.
Yasmin et al.          11

Sote EO (1987). The relative effectiveness of chewing sticks and toothbrush on plaque removal. The South African Dental Journal 1(2):48-53.
Sukkarwalla A, Salima MA, Praneel L, Farzene T (2013). Efficacy of Miswak on oral pathogens. Dental Research Journal 10(3):314-320.
Van Pailenstein HWH, Munck L, Mushendwa S, Mrema FG (1992). Cleaning effectiveness of chewing sticks among Tanzanian schoolchildren, Journal Clinical Periodontology 19:460-463.
World Health Organization (WHO) (1987). Prevention of diseases. Geneva: AlMuslim (Ar). AlBoukare and Muslim. Egypt: AlHalabe.

Sote EO (1987). The relative effectiveness of chewing sticks and toothbrush on plaque removal. The South African Dental Journal 1(2):48-53.