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Miswak through the Ages: A Review of Traditional and Modern Usages of the Chewing Stick

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Abstract

Oral health has a major influence on not just individual's general health but also their quality of life. The traditional toothbrush or "miswak" have been used since thousands of years as an oral hygiene aid. Miswak continues to remain popular in modern times, owing to its ease of availability, low costs and simplicity, particularly amongst Muslim population where it holds a religious and cultural impact. Much research has been performed on the phytochemical profile of miswak, revealing anti-plaque, anti-microbial and anti-inflammatory properties, which augment the mechanical cleaning aspects of the twig. A strong inhibitory action against Gram negative bacteria implicated in the initiation and progression of chronic periodontitis has also been reported. Recent investigations have demonstrated an anti-osteoporotic and pro-repair effect on femur bone. The current article presents a review of the pharmacological components, medicinal benefits and modern scientific usages of miswak in various aspects of oral health care.

Keywords: Chewing stick; Miswak; Oral health; Plaque; Salvadora persica

Introduction

The traditional toothbrush or "Miswak" refers to a 15 to 20 cm long pencil-sized stick of an evergreen tree called Salvadora Persica, otherwise known as Arak (in Arabic) and Peelu (in Urdu) [1]. It is the precursor to modern toothbrushes, with usage being traced back to Babylonians some 7000 years ago [2]. In modern times it continues to be a widely popular oral hygiene aid in developing nations like India, Pakistan, most of the Arabian countries, and several African countries [3]. Owing to its strong religious and cultural impact, it is popular amongst the Muslim population [4].

The efficiency of miswak as an oral hygiene aid has been attributed to be due to the mechanical cleansing effects of its fibres, the release of beneficial phytochemicals, or both [5]. Based upon its easy availability, low cost, unique chemical composition and proven efficacy in plaque removal the World Health Organization (WHO) also recommended using miswak as an oral hygiene tool [6, 7].

Discussion

Miswak as an oral hygiene tool

Despite serving a similar function to conventional toothbrushes, miswak differs from them in their design. The bristles are situated along the long axis of the miswak stick (Figure 1), adapting the lingual and interdental spaces relatively difficult compared to the facial surfaces of teeth. Before usage, the miswak sticks have to be chewed at one end, exposing the bristles, which are then used to clean the teeth in a similar manner to a toothbrush [8]. Miswak is held with a pen-like grip with two-fingers or five-fingers [9], and the brush-end is moved along the tooth surface in an up and down or rolling motion [10]. After several usages, the brush-end becomes frayed, making the stick ineffective. This necessitates cutting off the edge and exposure of a fresh end, allowing the stick to be used this way for several weeks.

Studies comparing the efficacy of miswak and modern toothbrushes show that miswak has a superior or comparable oral hygiene effect over toothbrushes [11-14]. An assessment of periodontal status of over 200 adult Sudanese who habitually used either miswak or a toothbrush revealed that miswak users had significantly lesser gingival bleeding, lower dental calculus and signs of periodontal disease [13]. Gazi et al. also reported significantly lower gingival bleeding in miswak users and concluded that five times a day use of miswak is a suitable alternate for tooth brushing [15]. Al-Otaibi et al. concluded that if subjects are professionally instructed on the correct use of miswak [16], it is more effective at plaque removal and reducing the signs of gingivitis than tooth brushing, Malik et al. reported that the mechanical and chemical cleansing properties of toothbrushes were paralleled by miswak, which could potentially replace the former as an oral hygiene tool [17].

The use of miswak is associated with a potentially increased risk of the development of gingival recession and tooth wear. However, these findings have been linked with higher frequency of usage (5 times per day) and an uninstructed manner of application of miswak [18, 19], necessitating the provision of the right instructions.

Figure 1: The traditional chewing stick or miswak. Note how the bristles are situated along the long axis of the stick.

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Chemical composition

Chemical analysis of miswak revealed the presence of a number of biologically active phytochemicals, showing therapeutic benefits in the maintenance of oral hygiene. A list of chemical constituents of miswak and their pharmacological benefits have been recorded in Table 1.

Pharmacological actions of miswak

Antibacterial properties: It has been demonstrated that miswak possesses an antibacterial activity, which led to the recommendation of the use of aqueous solutions of miswak extract in the form of a mouthwash [36]. The antibacterial activity is hypothesized to result from the presence of anionic ions, which exert an inhibitory effect on salivary peroxide thiocyanate and hydrogen peroxidase. In a study assessing the antibacterial action of miswak, Al Lafi and Ababneh reported that miswak was most effective against *Staphylococcus aureus* [37]. An in-vitro study by Sofrata *et al.* demonstrated that miswak exerted stronger antibacterial effects against Gram negative bacteria in comparison to Gram positive bacteria, highlighting a possible role in the prevention and treatment of periodontal diseases [38].

Studies comparing anti-plaque effects miswak and chlorhexidine mouthwash show conflicting results; some indicate that both exert similar effects [39-43], while others favor the use of chlorhexidine mouthwash [44-50]. Two studies reported that the mean plaque score was significantly lower in the miswak group compared to the chlorhexidine group [51, 52]. A meta-analysis indicated that miswak extracts yielded lower mean plaque index scores compared to a placebo it is less effective compared to either 0.12% or 0.2% of chlorhexidine [53].

Anti-cariogenic activity: Numerous clinical and laboratory studies have highlighted the anti-cariogenic activity of miswak, which arises in part from its fluoride content, the inhibitory action against cariogenic bacteria and the salivary stimulatory effect, which in turn improves the buffering capacity of the saliva [54].

A remineralizing effect was observed on white spot lesions when fresh miswak chewing sticks soaked with sodium fluoride was applied [55]. It has also been demonstrated that miswak-containing mouthwashes exert an antibacterial action against cariogenic bacteria, inhibiting their growth and lowering acid production. In a study comparing the antibacterial activity of miswak mouthwash, miswak toothpaste, and regular toothpastes, Al-Dabbagh *et al.* concluded that miswak containing products, particularly the mouthwash, are more effective in reducing the number of cariogenic bacteria than regular toothpaste [66].

Sofrata *et al.* reported that rinsing with miswak extract resulted in a prolonged elevation in plaque pH following an acidic challenge, compared to water rinsing ($p<0.001$) and was associated with a stimulation of parotid gland secretion ($p<0.01$) [57]. This increase in pH could be hypothesized to cause caries prevention.

Anti-mycotic activity: In an investigation conducted by Al- Bagieh *et al.* the authors concluded that aqueous extracts of miswak possessed an antimycotic activity against Candida albicans, which lasts for up to 36 hours at concentrations of 15 or greater [58]. This anti-mycotic activity is hypothesized to originate from one of the root components, including sulphur compounds, chlorine, trimethylamine and alkaloid resins.

Anti-oxidant effects: Anti-oxidants are vital substances that neutralize the effects of free-radical-induced oxidative stress and protect the tissues from the destruction caused by them. The anti-oxidant effects of SP have been ascribed to the presence of two tocopherols (γ-tocopherol and α-tocopherol) as well as the anti-oxidant enzymes catalase, peroxidase, and Polyphenol oxidase [59].Other studies have reported that the presence of hydroxyl-containing furan derivatives could exert anti-oxidant effects [60].

In another study Benzyl isothiocyanate (BITC) was shown to significantly reduce the release of IL-6 and IL-8, suggesting an anti-inflammatory role [61]. It has been documented that BITC is an anti-cancer agent, inhibiting chemically induced cancer, oncogenic-derived cancer formation, and human tumor xenografts in rodent cancer models [62].

Role in bone regeneration and repair: Investigations to assess the bone healing properties of SP revealed an anti-osteoporotic activity of SP [63, 64]. This anti-osteoporotic activity in femur bone maybe attributable to the presence of elevated quantities of phytochemicals, calcium, phosphorus, silica, fluorides, sulphur, sterols and heavy metals; which induce osteoblasts, accelerating bone regeneration and re-modelling [64].

Conclusion

In the current review, empirical shreds of evidence demonstrating the pharmacological properties of miswak and its role in the promotion

Table 1: The various constituents of miswak and their pharmacological actions.

Sl. No.	Compound	Action
1	Sulphur	Antibacterial effects [20-23]
2	Benzyl isothiocyanate (BITC)	Anticariogenic and antibacterial effects [24-26] Antiviral effects [26]
3	Butanediamide	Antibacterial effects [27]
4	N-benzyl-2-phenylacetamide	Antibacterial effects [27]
5	Trimethylamine and Salvadorine	Antiphlogistic, antibacterial and gingiva-stimulating effects [21, 28]
6	Tannins	Astringent actions [29] Anti-plaque and calculus [30] Reduction of clinical signs of gingivitis [31]
7	Fluorides	Enamel repair and remineralization [24, 32, 33]
8	Chloride	Anti-calculus [21, 34]
9	Vitamin C	Assists in gingival tissue healing and repair [20, 35]
10	Silica	An abrasive compound that removes plaque and stains [36]
11	Essential oils	Increased salivary flow and buffering of pH [23]
12	Tocopherols (γ-tocopherol, and α-tocopherol)	anti-oxidant properties [37]

of good oral health have been reported. Based upon the simplicity, low cost, and anti-bacterial, anti-cariogenic, and other protective functions, it can be concluded that miswak is an effective alternative for oral health maintenance particularly in developing countries like Pakistan where it is more convenient and easily obtained. The strong anti-bacterial effect on the periodontopathogenic Gram-negative bacteria paves the way for a potential role for Miswak in the prevention and treatment of chronic periodontal disease.

Author Contribution

The topic selection, literature search and manuscript preparation was carried out by the corresponding author, Dr. Tahira Hyder.

Conflict of Interest

The author declares that there is no Conflict of Interest.

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