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A Review of the Most Important Medicinal Plants for Reducing Dental Plaque in Traditional Iranian Medicine

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A B S T R A C T

Objective: Dental plaque, a flexible white or yellow-gray substance, significantly contributes to periodontal diseases. This study aims to present medicinal plants used in traditional Iranian medicine for controlling and treating dental plaque.

Methods: In this review study, keywords such as medicinal plant, traditional medicine, and dental plaque were utilized to search SID, Google Scholar, Megaran, PubMed, and Scopus databases. The article abstracts were reviewed, irrelevant studies excluded, and relevant ones selected for analysis.

Results: The findings revealed that medicinal plants like coconut, aloe vera, clove, orange, rosemary, black tea, mango, chebulic myrobalan, miswak, turmeric, barberry, licorice, pomegranate, and black mulberry are essential in traditional Iranian medicine for managing dental plaque.

Conclusion: The medicinal plants identified in this study have been suggested that by antioxidant, antimicrobial, and anti-inflammatory activities effectively combat dental plaques.

Keywords: Tooth, Dental plaque, Traditional medicine, Medicinal plants, Iran

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Introduction

Oral and dental hygiene plays an important role in the health and well-being of our bodies. Failure to apply basic measures to maintain oral and dental hygiene not only damages the health of teeth and gums, but can also increase the risk of heart disease, cancer, and diabetes [1]. Dental plaque is a soft and sticky layer of bacteria that is formed on teeth, gums, tongue, and even artificial teeth [2]. Many foods that are consumed produce an envirolment condition for bacteria in the mouth to have colonies and cause acid secretion on the teeth [2]. Sugary foods, starches, and grains are foods that help plaque production on the teeth [2].

Dental plaque, a biofilm composed of bacteria, adheres to the tooth surface, inducing gingival inflammation and increasing susceptibility to bleeding [3]. Progression of plaque accumulation leads to periodontal disease, characterized by the formation of periodontal pockets harboring pathogenic bacteria [3]. A confluence of factors, including inadequate oral

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hygiene practices, dietary choices, genetic predisposition, and limited access to dental care, contributes to plaque formation and subsequent oral health complications [3]. The deleterious effects of dental plaque extend beyond periodontal disease, encompassing dental caries, tooth loss, halitosis, tooth sensitivity, and aesthetic concerns [4].

Consistent daily oral hygiene practices, including tooth brushing and interdental cleaning, are essential for plaque removal. Plaque, when left undisturbed, calcifies to form tartar, a hardened substance that necessitates professional dental intervention for removal [5]. Incorporating fluoride toothpaste into one's oral hygiene regimen provides additional protection against dental caries [6]. Regular use of dental floss and interdental brushes is crucial for maintaining oral health by removing plaque and debris from interdental spaces.

Numerous strategies exist for dental plaque control. These include mechanical methods such as brushing, flossing, and the use of interdental cleaning aids, as well as chemical approaches involving mouthwashes, baking soda, whey, and vinegar [7]. Additionally, advanced technologies like ultrasonic scaling have been employed [8]. Antiseptic mouthwashes can effectively reduce oral bacterial load and mitigate early signs of periodontal disease [7, 8].

Traditional Iranian medicine has a rich history of utilizing medicinal plants for therapeutic purposes [9-12]. Herbal remedies continue to constitute a primary healthcare resource for a significant portion of the global population, including the management of oral diseases [13,14]. Given the prevalent use of medicinal plants for oral health in Iran, this study seeks to identify plant-based therapies traditionally employed for dental plaque control.

Materials and Methods

In this review study, the keywords of medicinal plant, traditional medicine, and dental plaque were used to search SID, Google Scholar, Megaran, PubMed, and Scopus databases. The abstracts of the articles were studied and irrelevant articles were removed and related articles were used to review the texts.

Results

The present study identified coconut, aloe vera, clove, orange, rosemary, black tea, mango, chebulic myrobalan, miswak, turmeric, barberry, licorice, pomegranate, and black mulberry as key medicinal plants employed in traditional Iranian medicine for dental plaque management. Table 1 provides a comprehensive overview of these plants, including their scientific names and reported therapeutic actions against dental plaque.

Table 1. List of Medicinal Plants Effective for Ear Pain in Iranian Traditional Medicine.

Plant	*Scientific Name*	Effect	Ref
Coconut	*Cocos nucifera*	Pure and concentrated coconut oil, rich in lauric acid with anti-inflammatory and antimicrobial properties, is very suitable for removing dental plaque.	[15]
Aloe Vera	*Aloe vera*	Aloe vera is a plant that is used to deal with gum damage caused by dental plaque. The gel of this plant, as an antibiotic, destroys the bacteria that cause dental plaque. Aloe vera has the same effect as chlorhexidine mouthwash on dental plaque.	[16]
Clove	*Syzggiun aromaticum*	Herbal mouthwashes that contain cloves prevent the accumulation of microbial units forming dental plaque and are anti-inflammatory and anti-inflammatory agents for the gums.	[17]

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Rosemary	*Salvia Rosmarinus*	Rosemary essential oil has antimicrobial properties and acts as a disinfectant for oral bacteria, which prevents the formation of plaque and tooth decay. Rosemary extract prevents the growth of oral bacteria, glucosyltransferase activity, glucan production, and dental plaque formation.	[18]
Black tea	*Camellia sinensis*	Black tea is a rich source of fluoride. Black tea has antioxidant and antimicrobial properties so rinsing the mouth with black tea prevents the risk of dental plaque formation to a large extent with its antibacterial properties, especially oral bacteria.	[19]
Mango	*Mangifera indica*	Malvalic acid in mango has therapeutic potential in preventing and treating oral periodontitis and inhibiting oral streptococcus.	[20]
Chebulic myrobalan	*Terminalia chebula*	Chebulic myrobalan extract as an anticaries mouthwash by increasing the pH of saliva inhibits *S. mutans* and lactobacilli.	[20]
Miswak	*Salvadora Persia*	Glucosinolates and benzyl isothiocyanates of the toothbrush plant with acidic properties have antimicrobial properties against *Streptococcus mutans*.	[21]
Turmeric	*Curcuma longa*	Curcumin present in turmeric has anti-inflammatory, antimicrobial, antioxidant, and antiseptic properties. It is an oral antimicrobial and reduces gingivitis and, in this way, it treats dental plaque.	[22]
Barberry	*Berberis Vulgaris*	Barberry mouthwash is effective for dental plaque caused by *A. actinomycetemcomitans* bacteria, lactobacilli, and streptococci. The gel containing berberine reduces dental plaque by 56%.	[23]
Licorice	*Glycyrrhiza glabra*	Licorice root has effects against tooth decay and dental plaque and is a strong inhibitor of streptococcus mutans.	[15]
Black mulberry	*Morinda citrifolia*	Black mulberry fruit has anti-inflammatory effects, antibacterial effects that cause caries and dental plaque and is used as a substitute for sodium hypochlorite.	[20]
Orange	*Citrus sinensis*	Orange peel is a natural teeth whitener and is effective in removing plaque on the teeth. Orange peel contains limonene, and without damaging the tooth enamel, it causes scaling of the teeth. Vitamin C in orange peel has antimicrobial properties and prevents the growth of microbes in the mouth and on the teeth.	[24]
Pomegranate	*Punica granatum*	Pomegranate gel is effective in dental health with antimicrobial effects and reduction of dental plaques.	[25]

Discussion

The oral cavity harbors a diverse microbial ecosystem, with a subset of microorganisms implicated in the pathogenesis of oral infections [26]. Coconut, a plant traditionally recognized for its antimicrobial properties, has been employed in oral hygiene practices. Its oil, rich in saturated and unsaturated fatty acids, vitamin E, phytochemicals, and minerals

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such as manganese, offers potential benefits for oral health [27]. Aloe vera, another plant with established anti-inflammatory properties, contains a variety of bioactive compounds, including oxidase, amylase, catalase, folic acid, aloin, and isobarbaloin [28].

Clove, a plant with established anti-inflammatory properties, has been traditionally used for toothache management. Its bioactive compounds, including eugenol, eugenol acetate, and heptacosane, contribute to its therapeutic effects [29]. Rosemary, another plant with anti-inflammatory properties, contains a range of bioactive molecules, such as rosmarinic acid, camphor, caffeic acid, ursolic acid, betulinic acid, carnosic acid, and carnosol [30]. Black tea, rich in polyphenols including flavonoids and catechins, exhibits anti-inflammatory effects [31]. Mango essential oil contains mangiferin, benzyl acetate, linalool, geraniol, limonene, and myrcene [32]. Black nightshade, traditionally recognized for its antioxidant and anti-inflammatory properties, is characterized by the presence of ellagic acid, gallic acid, chebulic acid, and flavonol glycoside. Miswak, a plant widely used in oral hygiene practices, contains isothiocyanide and sangrin [33, 34].

Curcumin, the principal bioactive compound in turmeric, has been traditionally employed for oral hygiene practices, including teeth whitening [35]. Barberry is rich in polyphenols, anthocyanins, and citric acid, while licorice root primarily contains glycyrrhizin, a compound with anti-inflammatory and gastrointestinal benefits [36-38]. Orange is a significant source of limonene and vitamin C, both possessing antioxidant and anti-inflammatory properties [39, 40]. Pomegranate fruit is characterized by the presence of tocopherols, sterols, terpenoids, and alkaloids [41, 42].

As it was mentioned, the main cause of dental plaque is the growth and colony of microorganisms, which cause inflammation and oxidative stress. Bacterial plaque is not removed easily, the gums can become inflamed within just a few days, and plaque can harden and develop into tartar [43]. Therefore, we should have preventive strategies to prevent dental plaques. Other than brushing the teeth and using floss, the use of plants with anti-bacterial, anti-oxidant and anti-inflammatory activities might be beneficial in dental plaques prevention. There are a lot of these plants [44-46].

Dental plaque, a biofilm composed of microorganisms, initiates an inflammatory response and oxidative stress within the oral cavity. This tenacious biofilm rapidly mineralizes into calculus, exacerbating oral health challenges [43]. Effective plaque control is essential to prevent the development of periodontal diseases. While mechanical methods such as brushing and flossing are fundamental, the incorporation of plant-derived agents with antibacterial, antioxidant, and anti-inflammatory properties offers promising adjunctive strategies for plaque management [44- 46].

Conclusion

Dental plaque remains a primary contributor to periodontal diseases. The results of this review highlight the significant role of various medicinal plants in traditional Iranian medicine (TIM) for controlling and treating dental plaque. These plants are valued not only for their historical use but also for their effectiveness demonstrated in scientific research. Their antioxidant, antimicrobial, and anti-inflammatory properties offer a multifaceted approach to managing dental plaque. The convergence of traditional knowledge with contemporary scientific validation opens new pathways for integrating these medicinal plants into modern dental care. Further clinical studies and trials are essential to fully elucidate their efficacy and safety. Nonetheless, the traditional knowledge preserved in TIM provides valuable insights into natural and effective strategies for plaque control. In conclusion, the medicinal plants identified in this study represent a promising repertoire for managing dental plaque, combining centuries-old traditional practices with modern scientific validation. Incorporating these plants into preventive and therapeutic dental care could enhance oral health outcomes and offer a comprehensive approach to plaque management.

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This study was performed in line with the principles of the Declaration of Helsinki.

Consent to participate:

Informed consent was obtained from all individual participants included in the study.

Author contributions:

MKN: Conceptualization, the original draft writing, investigation, writing including reviewing and editing and investigation and formal analysis; MKN : Conceptualization, supervision, and project administration; AGH and MKN Conceptualization, the original draft writing, investigation, writing including reviewing and editing.

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