# The Most Important Native Iranian Medicinal Plants Affecting The Bacteria that Cause Tooth Decay; A Systematic Review

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## Abstract

**Background:** Tooth decay is an infectious disease that is caused by various microorganisms. Chemical drugs used to control and treat tooth decay mainly have side effects. On the other hand, many plants have antimicrobial effect against microbes that cause tooth decay. Therefore, the aim of this study was to introduce Iranian medicinal plants with antimicrobial properties in tooth decay.

**Method:** To reach this purpose, we searched keywords containing Iranian medicinal plants, medicinal plants, Tooth decay, essential oils, and extracts in Pub Med, Web of Science Direct, Scopus, Scientific Information Databases, and Google scholar.

**Results:** The results of our study led to the achievement of 17 articles that intensive on the study of Iranian medicinal plants affecting the bacteria that cause tooth decay.

**Conclusion:** This article introduces a number of plants that have been introduced in different regions of Iran for the treatment of tooth decay, which based on the knowledge of traditional and ethnobotanical medicine of Iran, we believe that they can be used as a drug against tooth decay.

***Keywords:*** *Treatment, Tooth decay, medicinal plants, Systematic review*

## Introduction

Tooth decay is one of the most common microbial infections in humans in various societies, especially in underdeveloped countries [(1)]. Tooth decay is a multifactorial complication, the most important of which is oral microbes. Oral streptococci, especially *streptococcus mutants* and lactic acid-producing bacteria, play an important role in causing tooth decay [(2)]. Factors such as physical, biological, environmental, behavioral and lifestyle conditions are among the factors contributing to tooth decay [(3)].

The most important way to deal with tooth decay is prevention by observing oral hygiene, proper nutrition, and the use of groove blockers. Treatment of tooth decay also leads to heavy costs, in addition to antibiotic treatment reduces the body's resistance to pathogenetic factors [(4)]. For centuries, the use of herbs for the traditional treatment of many infectious diseases, including tooth decay, has been widely accepted. So that their stems, leaves and roots have been used [(5)]. Studies have shown that many native plants of Iran such as Salvia

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officinalis, Satureja have anti-tooth decay capabilities [6-8]. It has also been shown to have antimicrobial activity against oral microbes due to the presence of a wide range of metabolites such as flavonoids, polyphenols, terpenes, alkaloids and alcoholic sugars such as xylitol, which are then used in the treatment and control of tooth decay[9]. Therefore, due to the emergence of antibiotic-resistant microbial isolates due to the indiscriminate use of antibiotics, the gradual replacement of plants and their compounds, including essential oils and extracts instead of chemicals with side effects has increased in recent years in the treatment of diseases. So that today it is planned for mass production of medicinal plants at the industrial level [10]. Therefore, the aim of present systematic review study was to evaluate the effective Iranian medicinal plants on the control and treatment of tooth decay.

## Methodology

### Database study

A complete Pub Med, Web of Science Direct, Scopus, Scientific Information Databases, and Google scholar search was done for articles published that included the search term containing Iranian medicinal plants, medicinal plants, Tooth decay, essential oils, and extracts, Dental caries, Prevention of dental caries in their title. This study focused on published articles papers from 2000 to 2019.Seventeen articles were selected in total. The chosen papers were published from 2009 to 2019.

## Results

### Data derivation

In current study was evaluated a perspective on the Origin of native Iranian medicinal plants affecting the bacteria that cause tooth decay. Details of native Iranian medicinal plants affecting the bacteria that cause tooth decay and the major results has been shown in the below:

***Salvia officinalis:***

Minimum inhibitory concentration (MIC) against of *Streptococcus mutans* and *Lactobacillusrhamnosus* were 6.25 , 1.56 µg/ml [6].

***Pimpinellaanisum:***

MIC against of *streptococcusmutans* and *Lactobacillusrhamnosus* was 12.5 µg/ml[6].

***SaturejaKhuzestanica*Jamzad:**

MIC Flowers, leaves, stems, roots for streptococcus mutans were 750,500,1500,750µg/ml respectively [7].

***SaturejaKhuzestanica*Jamzad:**

MIC of *SaturejaKhuzestanica*Jamzad against of Biofilm *Streptococcusmutans*≥1500 µg/ml [7].

***Satureja* spp.:**

For *Enterococcusfaecalis*, *Streptococcussanguis*, *Eikenellacorrodens*, *Actinomycesviscose* were 562.1, 562.1, 39.0, 562.1 µg/ml respectively [8].

Saffron:

Alcoholic extract of saffron was more successful in eliminating *Candidaalbicans* and *StreptococcusMutans*, compared to aqueous extract of saffron ($P$<0.001) [11].

***Pimpinellaanisum*:**

MIC against of *streptococcusmutans*, *Lactobacillusrhamnosus*, *Actinomycesviscosus* were 6.25, 1.56, and 12.5 µg/ml, respectively [12].

***Menthalongifolia*:**

MIC against of *Streptococcusmutans*, *Lactobacillusrhamnosus*, *Actinomycesviscosus* were 12.5 ,3.12 , 100µg/ml respectively [12].

***Achilleamillefolium*:**

MIC against of streptococcus mutans , Lactobacillus rhamnosus , Actinomycesviscosus were 50 , 12.5, 50µg/ml respectively [12].

***Aloevera*:**

MIC for *Streptococcus mutans, Streptococcus salivarius, Streptococcus sanguinis*, *Actinomycesviscosus*, were 4, 0.5 ,1 , 1 mg/ml, respectively [13].

***Glycyrrhizaglabra*:**

MIC for *Streptococcusmutans*, *Streptococcussalivarius*, *Streptococcussanguinis*, *Actinomycesviscosus*, were 0.5 ,0.25 , 0.125, ,0.25 mg/ml, respectively[13,14].

Myrtus:

The widest inhibition zone (IZ) was presented in concentration of 2.5% for *S.Sanguis*,*S.Mutans* and diphteroid and in concentration of 1% for lactobacillus .The narrowest IZ was presented in concentration of 5% for Lactobacillus [15].

***Teucriumchamaedrys*:**

MIC for *Streptococcusmutans* was 128 mg/ml [16].

***MenthaPiperita*:**

*MenthaPiperita* no antibacterial effect on *S. mutans*[17].

***Salvadorapersica* L.:**

The mean of inhibition zone diameter around the discs of miswak tree extract in all concentration was significantly less than chlorhexidine 0.2%.(P<0.0001) [18].

***QuercusInfectoria*Oliv:**

In the plate containing the bacterium Streptococcus sanguis, a halo with a diameter of 75.4 mm was formed around each disc after 24 hours and a halo with a diameter of 50.4 mm was formed after 48 hours. In the plate containing Streptococcus mutans, the halos were 90.2 and 62.2 mm in diameter, respectively [19].

***Rosadamascene*:**

The Minimum inhibitory concentration (MIS) values for these bacteria were 5.7, 5.7, 51 and minimum bactericidal concentration (MBC) for these bacteria were 15, 7.5 and 15, respectively [20].

TeucriumChamaedrys:

The MIC of *T. chamaedrys* was obtained 128 and 32 µg/L against *S. mutans* and *L. rhamnosis*, respectively. The MBC of T.chamaedrys was obtained 256 and 64 µg/L against *S. mutans* and *L. rhamnosis*, respectively [21].

TrachyspermumAmmi:

The MICs (minimum inhibitory concentration) of the essential oil for *C. albicans*, Aa and *S. mutans* were 0.312%, 3.75% and 1.875%, respectively. The inhibitory effect of the extracts (especially more polar extracts) were weak, comparatively (MICs were between 10 g/L to 300 g/L) [22].

***Menthapiperita*and*Cuminumcyminum*:**

Antibacterial and in vivo biofilm preventive efficacies of all the concentrations of *M. piperita* oil were significantly (p<0.001) higher. The biofilm inhibitory properties in planktonic cultures were in *M. piperita*>chlorhexidine>*C. cyminum* order. In vivo experiments conducted on male and female volunteers who brushed with essential oil blended toothpastes indicated that lower concentrations of the oils, in particular the *M. piperita* oil, were significantly higher (p<0.001) [23].

***Camelliasinensis*:**

The Iranian green and black tea had an antibacterial effect on 100 to 400 mg/ml concentrations. The MIC of green and black tea was 150 and 50 mg/ml, respectively. The mean diameter of inhibition zone were 9.5 mm and 10.9 mm for methanolic extract of green and black tea, respectively [24].

## Discussion

Tooth decay is one of the most important public health challenges worldwide. Due to the high costs and the lack of a definitive treatment or preventive solution for this problem, research on controlling or controlling tooth decay is one of the research priorities in the field of public health in different countries [25]. On the other hand, due to the increasing antibiotic resistance in bacteria that cause tooth decay and the side effects of chemical compounds effective in controlling and treating tooth decay, plant compounds with antibacterial properties against tooth decay agents and fewer side effects have replaced chemical compounds today. They are of special importance. As various researches have

been done in this field. The present study was conducted to introduce different native plants of Iran that are effective on bacterial agents of tooth decay [26].

This article introduces a number of plants that have been introduced in different regions of Iran for the treatment of tooth decay, which based on the knowledge of traditional and ethnobotanical medicine of Iran, we believe that they can be used as a drug against tooth decay. Knowledge of this science in different Iranian ethnic groups has led to the use of herbs, herbal medicines effective on the microbial causes of tooth decay.

Among the native plants of Iran that have antimicrobial effect against tooth decay agents such as *Streptococcus mutans*, *Lactobacillus* and have been studied, we can mention *Salviaofficinalis*, *SaturejaKhuzestanica*, *Menthalongifolia*, *Aloevera*, *Pimpinellaanisum*, Saffron, *Achilleamillefolium*, *Glycyrrhizaglabra*, Myrtus, *Teucriumchamaedrys* , *Salvadorapersica* L, [6, 7, 11-18]. The results of studies showed that the native medicinal plants of each region are effective for controlling and treating tooth decay, which is derived from medicinal cultures and experimental knowledge of different regions.

## Conclusion

The results of this study showed that native plants of Iran have the ability of antibacterial effect due to having a wide range of plant metabolites that are thus effective in controlling and treating the causes of tooth decay bacteria.

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**Authors' contribution**

All authors contributed equally to the manuscript.

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