



Anti-halitosis plants in Iranian Traditional Medicine

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Abstract

Halitosis is an oral health condition characterized by unpleasant odors emanating constantly from oral cavity. Almost 22-50% of the population experiences such a condition during lifespan and about half of them suffer from personal discomfort and social embarrassment. Based on the literature survey, it seems that the oral cavity is the most important origin of halitosis; therefore, this area could be considered as the best target for the treatment. Halitosis is a well-known disorder in Iranian Traditional Medicine (ITM); Avicenna and some other famous Iranian traditional physicians have described this condition in their manuscripts precisely. Herbal therapy was the major treatment suggested by Iranian scholars in which mixtures of medicinal plants were used in the form of mouthwashes and other oral formulations. In the present study, six Iranian ancient medical texts were screened for the herbs with anti-halitosis effects. Subsequent to this study, the medicinal herbs were listed and scored based on the frequency of their repetition. Moreover, the effort has been taken to provide the best scientific name for each plant as well as searching modern studies about their biological effects. In our investigation fourteen plants were obtained as the most frequent herbs for treatment of halitosis in ITM. Previous studies revealed that some of these plants have shown biological activities relating to anti-halitosis effect. The present study introduces some more plants for future studies about anti-halitosis property.

Keywords: halitosis, herbal medicine, Iranian Traditional Medicine, oral malodor

Introduction

Halitosis is an unpleasant or offensive odor emanating from the oral cavity regardless of its origin. It is common in people of all ages with the prevalence of 22% to more than 50% [1-3]. It is an important factor in social communication which may lead to social and personal isolation. At least 50% of the population suffer from chronic oral malodor and approximately half of these individuals experience a severe problem

that creates personal discomfort and social embarrassment [2,3]. Halitosis is a multifactorial disorder. The source of oral malodor is located in the oral cavity in up to 90% of people with the condition and only a small percentage of cases may be due to non-oral causes. A serious underlying medical condition may warrant immediate referral to a physician [2]. The most likely cause of oral malodor is the accumulation

of food debris and dental bacterial plaque on the teeth and tongue, resulting from poor oral hygiene and resultant gingival and periodontal inflammation. Decreased salivary flow rate, disturbances of the upper and lower respiratory tract, disorders of gastrointestinal tract, some of systemic diseases, metabolic disorders, medications and carcinoma could be considered as the other causes of halitosis [1-3]. *Helicobacter pylori* infection has been suggested to cause a subjective change in oral odor [3]. The oral microorganisms most likely to cause oral malodor are Gram-negative bacteria, however, no obvious association exists between oral malodor and any specific bacterial infection, suggesting that halitosis reflects complex interactions between several oral bacterial species. Volatile sulfide compounds (VSC) are the principal components of bad breath resulting from the proteolytic degradation of various sulfur-containing substrates in food debris, saliva, blood, and epithelial cells by predominantly anaerobic Gram negative oral microorganisms [2,3]. At present, there are three methods for measuring halitosis: organoleptic measurement, gas chromatography and sulfide monitoring [2]. Due to the fact that the majority of breath malodor cases originate from the oral cavity, the treatment of oral malodor can therefore be focused on the reduction of the intraoral bacterial load and/or the conversion of VSC to nonvolatile substrates [2]. Toothpastes and mouthrinses with chemical ingredients such as chlorhexidine (CHX), triclosan and cetylpyridinium chloride (CPC) or essential oils can reduce oral malodor by decreasing either the number of microorganisms or by chemically neutralizing odor compounds, including VSCs [1,2]. Botanical extracts have demonstrated to be active against halitosis. In addition to antimicrobial efficacy in these plant extracts, their aromatic effects are appreciable for bad breath neutralization and flavoring the treatment products as well [4].

Nowadays, many of drugs with natural sources have been retrieved from traditional medical

systems. In Iranian Traditional Medicine (ITM), plants have been used to combat various diseases and pathological conditions. Halitosis is a well-known disorder in ITM. "Bakhar ul-fam" was the term used for oral malodor by Iranian physicians and the traditional definition of halitosis is similar to its conventional description. Etiology of halitosis has been mentioned in ITM manuscripts precisely indicating the similarity between conventional and traditional beliefs in this context. According to ITM references, gingivitis, the fragile gum, root infection which leads to tooth damage, hot and non humid intemparement of the gums, accumulation of rotten bilious or phlegmatic humor in the cardia of the stomach, lung infection such as tuberculosis and falling of rotten humidity from head to the gums, are the most important factors involved in oral malodor [5-7]. So, tooth cleaning, removing the infection, evacuation and cupping (in the case of phlegmatic humor) were considered as the main therapeutic approaches for halitosis as well as herbal therapy in ITM. Combinational prescriptions including several herbal plants in the form of mouthwash, tooth powder, mucoadhesive, chewable and oral dosage forms were applied by Iranian scholars for treatment of halitosis [5,7].

Due to the prevalence of halitosis, finding new and safe remedies for oral malodor is favorable. The aim of the present study was to introduce the most frequent medicinal plants used in ITM for treatment of halitosis.

Methods

Six ITM texts including *al-Qanun fi al-Tibb* (Avicenna) [5], *Al Havi* (Rhazes) [8], *Al-abnihah An Haghayegh el-adviah* (Heravi) [9], *Ekhtiarat-e-Badiee* (Ansari) [10], *Tohfah-ul-momenin* (Momen tonekaboni) [11] and *Makhzan-ul-Adviah* (Aghili Shirazi) [12] were studied. The traditional word of "bakhar ul fam" was considered as the search term for extracting the plants with healing effect on oral malodor. First *al-Qanun fi al-Tibb*, the main text of ITM, was screened using the key word and the anti-halitosis

property of the selected plants has been checked in the rest of ITM texts to find the most frequently used plants. In addition to the used part, the temperament of the plants has been studied. Afterwards, traditional names of the selected plants were matched to scientific names using botanical text books [13-15]. On the next step, a substantial search has been performed in scientific databases such as "Google Scholar" and "pubmed" to find the anti-halitosis or biological activities of the plants corresponding to oral malodor. For this purpose, "halitosis" and "oral malodor" in combination with the scientific plant names were used as the keywords.

Results and Discussion

Searching ITM references revealed fourteen plants as the most frequently used herbs for halitosis which have been listed in table 1 and ordered according to their repetition in the references along with their scientific name, family, temperament and used part. The plant parts used for halitosis consisted of oleo gum resins, leaves, barks, fruits, peels, roots and woods while leaves appeared to be the most used parts. According to table 1, most of the herbs have hot and dry temperament (>92%) while dryness is the prominent characteristic of all anti halitosis plants introduced by Iranian scholars. In addition to the summarized results in table 1, the plants which have shown anti-halitosis or biological activities related to oral malodor in modern researches, have been discussed as follow:

Commiphora myrrha (Nees) Engl.

In an *in vitro* study, a toothpaste with natural extracts ingredients including *C. myrrha* demonstrated to be effective against Gram-positive bacteria and yeasts. Moreover, the product was able to inhibit the growth of *Pseudomonas aeruginosa* [16]. It has been found that mouthwashes containing hydroalcohol extract of Yemeni myrrh (oleo-gum-resin obtained from the stem of *C. myrrha*) have exhibited antimicrobial activity against common pathogens of the oral cavity [17].

Symplocos racemosa Roxb.

Oral rinses and toothpaste manufacturers have incorporated plant-derived antimicrobials into their formulations; In India, HiOra, has been formulated which contains extracts of *Symplocos racemosa*, *Vitis vinifera*, *Cinnamomum zeylanicum* and *Carica papaya* [18].

Syzygium aromaticum (L.) Merr. & L.M.Perry Caryophilli Flos (*Syzygium aromaticum*) has demonstrated the ability to inhibit malodor *in vitro* using malodor modeling of the salivary sediment system; the results have shown that the plant significantly reduced VSC, organoleptic odor and indole/skatole formation ($p < 0.05$) [19]. Shi *et al.* (2003) have developed compositions of herbs and methods of using these compositions for the treatment and prevention of microbial infections, especially for dental caries or periodontal diseases. The composition consisted of mixture of two or more herbs such as *S. aromaticum* and medicinal rhubarb root. Evaluation of the herbal formula using human cell lines and Ames's DNA mutagenesis tests have confirmed the safety of the formula [20]. It has been revealed that the methanol extract of *S. aromaticum* is able to inhibit of *S. aureus*, *S. pyogenes*, *Providencia* sp., *P. mirabilis*, *S. sonnei*, *S. typhi* and *S. typhimurium*. Moreover, volatile components of the plant have been found to possess antibacterial activities [21]. Rosas-Piñón *et al.* (2012) have shown that water extract of *S. aromaticum* (10.5–78.0 µg/mL) had high inhibitory effect against *Streptococcus mutans* and *Porphyromonas gingivalis* [22].

Myristica fragrans Houtt.

Chung J.Y. *et al.* (2006) have demonstrated that the extract of *Myristica fragrans*, possessed strong inhibitory activity against *S. mutans* (MIC 3.9 µg/mL). Moreover, they have revealed that Macelignan (nutmeg extract) has preferential activity against other oral microorganisms such as *Streptococcus sobrinus*, *S. salivarius*, *S. sanguis*, *Lactobacillus acidophilus* and *L. casei* with the MIC range of 2–31.3 µg/mL [23].

Table 1. The most frequent herbs in ITM for halitosis

| No. | Traditional name | Phonetics | Scientific name | Family | Temperament | Used part |
|-----|------------------|------------------|--|---------------------------|--------------|---------------|
| 1 | Otroj | /otrodʒ/ | <i>Citrus medica</i> L. | Rutaceae | Hot and dry | Yellow Peel |
| 2 | Soed | /soʊʔd/ | <i>Cyperus longus</i> L. | Cyperaceae | Hot and dry | Root |
| 3 | Morr | /moor/ | <i>Commiphora myrrha</i> (Nees) Engl. | Burseraceae | Hot and dry | Oleogum resin |
| 4 | Badranjbooye | /ba:drændʒbu:je/ | <i>Asperugo procumbens</i> L. <i>Melissa officinalis</i> L. | Boraginaceae Lamiaceae | Hot and dry | Leaves |
| 5 | Armal | /ærma:l/ | <i>Symplocos racemosa</i> Roxb. | Symplocaceae | Hot and dry | Bark |
| 6 | Khoolanjan | /xu:lændʒp:n/ | <i>Alpinia officinarum</i> Hance | Zingiberaceae | Hot and dry | Root |
| 7 | Sazej | /sa:zedʒ/ | <i>Cinnamomum citriodorum</i> Thwaites | Lauraceae | Hot and dry | Leaves |
| 8 | Karafs | /kæræfs/ | <i>Apium graveolens</i> L. | Apiaceae | Hot and dry | Whole part |
| 9 | Qaranfol | /gærænfol/ | <i>Syzygium aromaticum</i> (L.) Merr. & L.M.Perry | Myrtaceae | Hot and dry | Fruit |
| 10 | Jos e bavva | /dʒoʊzebæva:/ | <i>Myristica fragrans</i> Hoult. | Myristicaceae | Hot and dry | Fruit |
| 11 | Tanbool | /tænbu:l/ | <i>Piper betle</i> L. | Piperaceae | Hot and dry | Leaves |
| 12 | ood | /u:d/ | <i>Aquilaria sinensis</i> (Lour.) Spreng. | Thymelaeaceae | Hot and dry | Wood |
| 13 | Foofel | /fu:fel/ | <i>Areca catechu</i> L. | Arecaceae | Cold and dry | Fruit |
| 14 | Sodab | /soda:b/ | <i>Ruta graveolens</i> L. | Rutaceae | Hot and dry | Leaves |

Susceptibility of certain clinically important pathogens to organic extracts of *M. fragrans* have been examined by Cherian and Mathew (2010) and the results have shown that in addition to the methanol and acetone extracts, the volatile components of the plant exhibited antibacterial effect [21].

Piper betle L.

The biological studies have revealed that allylpyrocatechol (APC), the major active component of *P. betle* leaves, had the potential to reduce methylmercaptan and hydrogen sulfide. This potential was mainly due to its antibacterial activity against obligate oral anaerobes responsible for halitosis as established using dynamic *in vitro* models [24].

Areca catechu L.

It has been established that catechin and resveratrol, two phenolic compounds extracted from *A. catechu*, could inhibit oral microorganisms and reduce bad breath [4].

Conclusion

Nowadays, botanical extracts have been considered as favorable remedies for halitosis

due to their antimicrobial efficacies as well as aromatic effects [4]. In the present investigation, fourteen plants have been extracted from ITM references which are supposed to be the most frequent herbs for treatment of halitosis in ITM. The biological effects of some of these plants, relating to halitosis, have been established in modern studies. The present study provides a list of several plants which could be considered for further studies regarding halitosis. *Citrus medica*, *Cyperus longus*, *Asperugo procumbens*, *Melissa officinalis*, *Alpinia officinarum*, *Cinnamomum citriodorum*, *Apium graveolens*, *Aquilaria sinensis* and *Ruta graveolens* are introduced candidates for future researches in the field of halitosis treatment.

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Declaration of interest

The authors declare that there is no conflict of interest. The authors alone are responsible for the content of the paper.

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