Original Article

Effect of Mouthwash Containing Citrus Fruit Extract on Oral Malodor

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Abstract

Background: The aim of the study was to assess the efficacy of mouthwash containing citrus fruit extract on oral malodor, to use portable sulfide, monitor as a motivational tool to encourage patients towards better oral hygiene, and to compare the oral malodor scores before and after using mouthwash containing citrus fruit extract. **Materials and Methods:** Twenty individuals working in Malabar Dental College and research center were divided into two Groups A and B, and the breath checker scores of all the patients were recorded. All individuals in Group A were asked to use 10 ml mouthwash containing citrus fruit extract (2%) twice daily for 14 days those in Group B with placebo mouthwash, 10 ml twice daily for 14 days. All the patients were recalled after 14 days, and the breath scores were again recorded. **Results:** Mean breath checker scores in Group A at baseline was 3 ± 0.66, which was reduced to 1.6 ± 0.51 after 14 days. And the placebo mouthwash, on the other hand, showed no significant difference in oral malodor compared with baseline scores. Mean breath checker scores in Group B at baseline was 2.9 ± 0.87, which was reduced to 2.7 ± 0.67 after 14 days. **Conclusion:** An intensity of the oral malodor was reduced after the use of mouthwash containing citrus fruit extract when compared to the placebo group. The portable sulfide monitor was efficacious in motivating the patients toward better oral hygiene.

Keywords: Mouthwash, Malodor, Halitosis.

Introduction

The oral cavity contains hundreds of bacterial species that produce several fetid substances as a result of protein degradation.[1] Oral malodor, or halitosis or bad breath, is a general term used to describe an offensive odor emanating from the oral cavity. It can be caused by several factors.[2] While certain extra oral disorders (nasal infection, diabetes mellitus, uremia, etc.) have been proposed as causes of oral malodor, clinical trials have indicated that the key origins of the disease are intraoral causes such as gingivitis, periodontitis, and tongue coating.[3,4] A number of products resulting from bacterial amino acid metabolism can be linked to oral malodor. These metabolites include many volatile sulfur compounds (VSCs) such as hydrogen peroxide, methyl mercaptan, dimethyl sulfide, and compounds such as skatole and indole.[5] These gases mainly originate from the breakdown of sulfur containing amino acids such as cystine, methionine cysteine, or and peptides by microbial putrefaction within the oral cavity,[6,7] mainly on the dorsum of the tongue.[8,9] These compounds are produced primarily by anaerobic Gram-negative periodontal pathogens.[10] Studies have also demonstrated that these compounds are toxic at low concentrations. Therefore, VSCs may be associated not only with oral malodor but may also contribute to the etiology of both gingivitis and periodontitis.[11,12] *Porphyromonas gingivalis*, *Prevotella intermedia*, *Fusobacterium nucleatum*, and *Treponema denticola*, among the Gram-negative bacteria, the so-called periopathogens, are significant contributors to volatile sulfur compounds.[13,14]

Non-oral etiology of halitosis includes gastrointestinal tract disorders, upper and lower respiratory infections, neurological conditions, various systemic diseases, and use of certain drugs.[15] The organoleptic rating is known to be the gold standard for the diagnosis of oral malodor. Rosenberg and McCulloh had suggested a ranking of 0–5.[16] The drawbacks of gas chromatography and saliva incubation test are cumbersome, high cost, and lack of portability, the time taken

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for detection and measuring and not being used on the side of the chair. Recently, a small, very handy, and portable sulfide monitor has been introduced in the market, which is capable of detecting the VSCs in the breath. Due to the lack of education and awareness about the value of oral hygiene, oral hygiene is often ignored in the Indian community. As a preventive for halitosis, people usually use mouthwash after brushing their teeth. In this experiment, an herbal ingredient called citrus orange extract is the main ingredient in the mouthwash. Some of the advantages of herbal medicine are: Cheaper; easily available with no side effects.

In various medical and dental diseases, different trials have demonstrated outstanding therapeutic properties of different herbal products. There is a long era of use and strong patient tolerance for herbal medicines, as well as greater public recognition. In developing countries like India, which have rich agro-climatic, cultural, and ethnic biodiversity, the availability of medicinal plants is easy. Herbal medicine has supplied contemporary medicinal research with much of the useful and wide array of medicines in the world.

In the present study, we have tried to evaluate the effect of an herbal decoction in oral halitosis. This research was carried out by co-relating the oral hygiene status of patients with breath checker scores and comparing the breath checker scores before and after the use of mouthwash, thereby encouraging the patient to improved oral hygiene, using a portable breath checker as a motivational tool to motivate patients to enhance oral hygiene.

Aims and objectives

The objectives are as follows:

1. To assess the efficacy of mouthwash containing citrus fruit extract on oral malodor
2. To use portable sulfide monitor as a motivational tool to encourage patients toward a better oral hygiene
3. To compare the oral malodor scores before and after using mouthwash containing citrus fruit extract.

Materials and Methods

Twenty individuals working in Malabar Dental College and research center were selected for the study.

Inclusion criteria

The following criteria were included in the study:

1. Individuals who have not undergone clinical oral prophylaxis procedure for at least 1 year or 6 months
2. Those who are not under any other clinical trial
3. Subjects not using any commercial mouthwash, antibacterial toothpaste, and dental floss.

The subjects received verbal and written information about the study and signed consent forms to participate and were divided into two Groups A and B (Figure 1). An overall oral examination was conducted to assess the oral status of the subjects before the experiment, and the breath checker scores of all the patients were recorded using a portable sulfide monitor (Figure 2). A breath checker is capable of detecting volatile sulfur compounds. As the monitor of the breath checker is turned on, it emits a beep. When the second beep is heard, the patient is asked to blow air into the sensor. Odor levels are displayed on the screen of the monitor after the third beep. Those with scores ≥of 2 were included in the study.

Breath checker scores and its interpretation

- 0 – very good (No odor)
- 1 – normal (Slight odor)
- 2 – not so good (Moderate odor)
- 3 – bad (Strong odor)
- 4 – very bad (Very strong odor).

If no reading is displayed on the monitor, then it is considered as an error, and the procedure is repeated again. The patient was asked to pinch the nose with the finger, stop his or her breathing for a moment with the lips sealed and then exhale gently by opening the mouth to ensure that the odor is from the oral cavity. The odor detected thus was from the local factors of the oropharyngeal cavity. The patients were grouped by lot method. All patients in Group A were asked to use 10 ml

Figure 1: Mouthwash containing citrus fruit extract (A) and placebo mouthwash(B)

Figure 2: Portable sulfide monitor

mouthwash containing citrus fruit extract (2%) twice daily for 14 days. Patients in Group B were given placebo mouthwash, 10 ml twice daily for 14 days. All the patients were recalled after 14 days, and the breath scores were again recorded.

Results

Mean breath checker scores in Group A at baseline was 3 ± 0.66, which was reduced to 1.6 ± 0.51 after 14 days (Table 1). And the mean breath checker scores in Group B at baseline was 2.9 ± 0.87, which was reduced to 2.7±0.67 after 14 days (Table 2).

Mean breath checker scores in Group A at baseline were 3 ± 0.66, which were reduced to 1.6 ± 0.51 after 14 days.

Mean breath checker scores in Group B at baseline were 2.9±0.87, which were reduced to 2.7 ± 0.67 after 14 days.

There is an 88% reduction in the breath checker scores in Group A and a 13% reduction in Group B, respectively.

Discussion

Volatile sulfur compounds have been shown to result from the bacterial putrefaction of proteins with sulfur-containing amino acids.[1] These proteins are derived from white blood cell debris and tongue epithelial cells.[14] Bacteria such as *P. gingivalis*, *P. intermedia*, *F. nucletum*, and *T. denticola*, *Tenerella forsythus* and several species of other oral bacteria associated with gingivitis and/or periodontitis are known to produce large amounts of VSCs, which are malodorous. Periodontal disease also causes high concentrations of VSCs in mouth air.

The present study was designed to evaluate the effect of an herbal mouthwash containing citrus fruit extract on halitosis. A number of antimicrobial mouthwashes are widely available and have been proven to be clinically useful in oral disease control. However, the search for new and more powerful antimicrobial agents continues for a number of reasons. It is possible to describe natural antimicrobial agents as bioactive compounds obtained from biological sources. Natural agents that have antimicrobial; activity and the effectiveness of plant extracts, such as bacteriocins defense peptide and phenolics, have been demonstrated.[17-19] Natural agents could be more suitable to patients, in addition to greater antimicrobial activity and better safety profiles. Herbal medicine, including herbs, herbal components, herbal formulations, finished herbal products containing parts of plants or other plant materials as active ingredients, has been used for over 2000 years, and various medicinal plants have been used, individually or in combination for maintaining oral hygiene.

In the present study, we have used a mouth wash containing citrus fruit extract. The citrus plant is native to tropical Asia but can be found in all tropical and subtropical country. It has a wide range of uses in the treatment of various diseases and is easily available. The major active biological ingredients in Citrus herbs are flavonoids, especially hesperidin, naringin

Table 1: Mean breath checker scores in Group A at baseline and after 14 days

Mean at baseline	Mean after 14 days	Percentage reduction
3	1.6	88%

Table 2: Mean breath checker scores in Group B at baseline and after 14 days

Mean at baseline	Mean after 14 days	Percentage reduction
2.9	2.7	13%

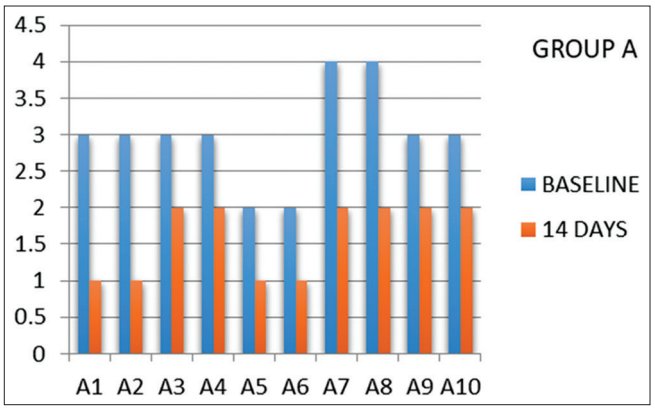

Figure 3: Breath checker scores of Group A

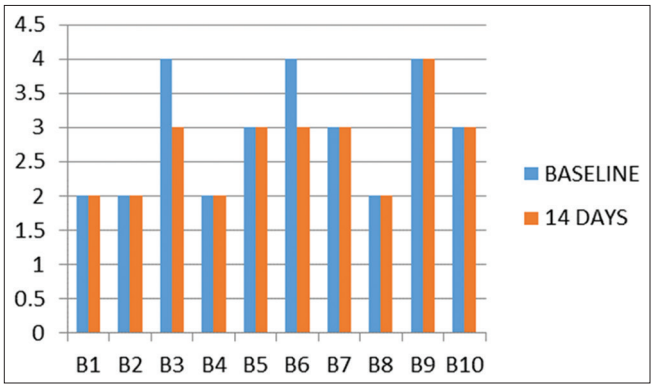

Figure 4: Breath checker scores of Group B

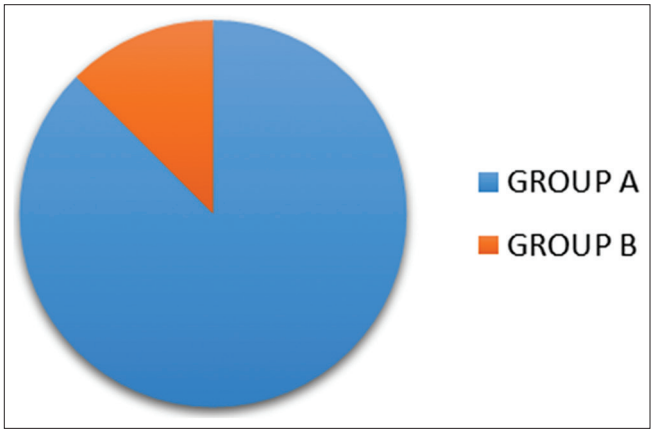

Figure 5: Percentage reduction in breath checker scores between Groups A and B

and alkaloids, mainly synephrine, with have beneficial medical effects on human health.[20] The flavonoids have several useful properties, being anti-inflammatory, antibacterial, and antifungal. The composition of the volatile oils in the leaves, flowers, and peel differ significantly.

Studies revealed sufficient information to conclude that the major cause of bad breath is oral microflora that produces volatile odoriferous molecules. As a motivational aid, we have used a compact handheld sulfide monitor to enable patients to maintain proper oral hygiene and thereby avoid periodontal disease and bad breath. The sulfide monitor provided an objective reading that indicates the intensity of the volatile sulfur compounds.

The composition of mouth wash includes extract (bio-flavonoid complex) of Citrus reticulata, Citrus sinensis, vegetable glycerine, ascorbic acid, citric acid, lactic acid, and purified water. Bioflavonoid is hydroxylated phenolic structures synthesized by plants and have shown to have bactericidal, fungicidal, and virucidal properties. Natural bioflavonoids are non-toxic and have good antimicrobial properties.[21] Studies by Tsai *et al*. and sheesha Prasad *et al*. have evaluated the antimicrobial property of citrus polyphenols.[22,23] They concluded that these compounds have the potential to control oral microflora. The antibacterial activity of orange extract is due to the synergistic activity of citrus fruit bioflavonoid complex and certain other organic acids.[23] The bioflavonoid complex kills bacteria (both Gram-negative and Gram-positive), virus, fungus, and other multi-resistant strains.[23]

Plants are rich in a wide variety of antimicrobial phytochemicals such as flavonoids, tannins, alkaloids, terpenoids, and phenolic compounds.[24] The active ingredients act by destroying the cellular membrane of the microorganisms.[25] The bioflavonoid complex kills bacteria, virus (RNA and DNA), mold and fungus – including MRSA, VRE, SARS, GRGNB, H1N1, Clostridium Perfringens, Salmonella, E.Coli, Pseudomonas, Listeria Monocytogenes, and other multi-resistant strains. The kill rate is 99.999%. A 20% solution destroys even the spores. The hydrophobicity of plant extracts and their components is one of their most essential characteristics, as it allows them to partition the lipids of the bacterial cell membrane and mitochondria, disrupting cell structures and making them more permeable. Death will result from extensive bacterial cell leakage or the loss of essential molecules and ions.[23]

In a study, Blom *et al*. found that almost all mouthwashes containing active ingredients reduced oral malodor in both long- and short-term studies. The most compelling evidence was provided for chlorhexidine mouthwashes and mouthwashes containing a combination of cetyl pyridinium chloride and zinc on oral malodor.[26] Aleman *et al*. conducted a study to determine the effectiveness and sustainability of three commercial types of mouthwash against halitosis and concluded that a decrease in VSC and organoleptic levels after use of mouthwashes for 1st and 3rd h. Results obtained in that study indicate that mouth rinsing with essential oils, cetylpirydine chloride, and triclosan represents a positive option for the treatment of halitosis.[27]

In our study, it was found that after the use of mouth wash containing citrus fruit extract, there was a reduction in the breath checker scores. The mean value of the breath checker scores for Group A at baseline was 3 ± 0.66, which was reduced to 1.6 ± 0.51 after 14 days (Figure 3). And the mean breath checker scores in Group B at baseline were 2.9 ± 0.87, which were reduced to 2.7 ± 0.67 after 14 days (Figure 4). It was interesting to notice that the reduction in the levels of breath checker scores after patient motivation. There was a reduction of 88% in Group A, whereas in Group B only 13% reduction was noticed (Figure 5).

We now work in an era in which patients are more concerned about their dental health as well as their general medical well-being. Thus, in the midst of increasing proof of the connection between oral health and whole-body health, herbal medicines with their "naturally occurring" active ingredients provide the most trustworthy and least dangerous way to restore health in a gentle and lasting manner. One of the major strength of these natural herbs is that their use has not been reported with any side effects to date.

Conclusion

Mouthwashes are effective and safe delivery systems for microbial reduction and for the treatment of halitosis. Out of the currently available antiplaque agents, chlorhexidine is considered the gold standard in chemical plaque control. However, it also has a number of side effects such as tooth discoloration, and discoloration of restorative to overcome the mucosal ulcerations. Hence, to overcome the side effects, the WHO advise researchers to investigate the possible use of natural products such as herbs and plant extracts. Various herbal products and their extracts, such as Guava, Pomegranate, orange, Neem, Cranberry, Grapefruit, Propolis, Tulsi, and Green Tea have shown significant advantages over the chemical ones. Natural mouthwashes have significant advantages over chemical mouthwashes. If such mouthwashes can be formulated, they can be conveniently processed and safely used by people at home using natural ingredients. It can lead to change in the population's overall dental health. As these are relatively economical compared with chlorhexidine, they can be used as an alternative to chemical mouthwashes for effective plaque control, gingivitis control, and halitosis.

Oral malodor is a subject of considerable public interest. With the introduction of a portable breath checker, the chair side assessment of oral malodor is made possible in no time, and the variations in the oral malodor intensity before and after the use of mouthwashes can be shown to the patients. Thus, they can be easily motivated towards better oral hygiene by putting an emphasis on the role of poor oral hygiene in halitosis and periodontitis. Limitations of our study included small sample size and short duration. Further studies are needed to understand the possible drug interactions if any.

Conflicts of Interest

The authors declare that they have no potential conflict of interests regarding this article.

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