

## Are herbal mouthwash efficacious over chlorhexidine on the dental plaque?

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### Abstract

#### Aim:

To compare the effect of herbal extract mouthwash and chlorhexidine mouthwash on the dental plaque level.

#### Materials and Methods:

The subjects (60 healthy medical students aged ranges between 20 and 25 years) were randomly divided into two groups, that is, the herbal group and the chlorhexidine gluconate mouthwash group. The data were collected at the baseline and 3 days. The plaque was disclosed using erythrosine disclosing agent and their scores were recorded using the Quigley and Hein plaque index modified by Turesky-Gilmore-Glickman. Statistical analysis was carried out later to compare the effect of all the two groups.

#### Results:

Our result showed that the chlorhexidine group shows a greater decrease in plaque score followed by herbal extract, but the result was statistically insignificant.

#### Conclusion:

The results indicate that herbal mouthwash may prove to be an effective agent owing to its ability to reduce plaque level, especially in low socioeconomic strata.

**Keywords:** Chlorhexidine, herbal mouthwash, holistic dentistry, plaque index

### INTRODUCTION

Oral diseases have a strong history of treating by natural remedies. Dental caries and periodontal diseases are essentially caused by the micro-organisms present in dental plaque. Research has linked these micro-organisms, particularly those with adherent biofilm properties, to clinically specific oral conditions, such

as caries, periodontal disease and halitosis.[1] Individual's susceptibility to dental and periodontal disease is dependent on a complex combination of risk factors; including genetics, systemic factors, diet and oral hygiene. Clinical control of these diseases can most readily be achieved by reducing the oral microbial load of the plaque biofilm. Plaque reduction has been the hallmark of preventive dentistry since the advent of antibiotics and the realization that bacteria are possible causative agents of the major dental diseases, caries and periodontal disease.[2]

Both chemical and mechanical oral hygiene aids are used for removal and prevention of plaque. Mechanical plaque control measures, such as toothbrushes, dental floss, toothpicks, and interdental brushes are very popular and are mostly used in conjunction with chemical plaque control aids. Even though, the toothbrush is the most widely used oral hygiene aid, a majority of the population is not able to perform mechanical plaque removal effectively. Hence, there is the need for chemical plaque control. Chemical methods of reducing plaque, such as mouthwashes, are therefore appealing as they can provide significant benefits to patients who cannot maintain adequate mechanical plaque control. They can be considered a less technically demanding adjuvant to mechanical control.

From the earliest times, plants have not only provided food, cosmetics and embalming ointments, but also a plethora of easily available remedies for the maladies of humanity.[3] Plants have been exploited by humans for many centuries as sources of medicinal drugs, due to the presence of various bioactive compounds. As the popularity of these herbal products continues to rise, dental professionals are expected to provide information to patients about these products' safety and efficacy. This can be difficult, however, owing to a lack of professional consensus on the subject. Until today, an insufficient amount of clinical research on herb-based mouthrinses and dentifrices has been reported in Asia, especially in India and other southeast Asian countries (where these products are most popular and widely used).

Various mouth rinses are available in the market, amongst which Chlorhexidine is the most popular. It is recognized as the primary agent for chemical plaque control, its clinical efficacy being well known to the profession. It has also been recognized by the pharmaceutical industry as the positive control against which the efficacy of alternative antiplaque agents should be measured, and has earned its eponym of gold standard. But it cannot be used on a long term basis because of various side effects like brown discoloration, taste perturbation, oral mucosal lesions, parotid swelling, enhanced supragingival plaque formation and sometimes unacceptable taste.[4,5] An effective alternative to Chlorhexidine with all the good qualities and sans its unpleasant effects is highly desirable and has been long awaited. Herbal mouthwash may act as a good and cost-effective oral hygiene product.

The history of drug development has its foundation firmly set in the study of natural remedies used to treat human disease over centuries. Many studies have found that *Cinnamon* and *Terminalia chebula* have antibacterial and antifungal properties.[6,7] However, no study had been conducted to check the antiplaque properties of *Cinnamon* and *T. chebula* extract in combination. Hence, the present study has been conducted to check the effect of this combination on the clinical level of dental plaque.

## **MATERIALS AND METHODS**

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This double-blind randomized control trial was conducted in the department of public health dentistry on volunteered university students of Teerthankar Mahaveer University. All subjects signed an Institutional Review Board approved consent form.

### **Inclusion and exclusion criteria**

The students with no history of any dental treatment, antibiotic or anti-inflammatory drug therapy for the past 3 months were included in the study. Those volunteers who had used antibiotics or mouthwash for 5 consecutive days or corticosteroids in the past 30 days were excluded from the study. Furthermore, those who had undergone professional measures to remove plaque and calculus in the past 15 days, and did not give consent for the clinical trial were excluded.

### **Sample size and randomization**

A sampling frame ( $n = 60$ ) was prepared from the students of Teerthankar Mahaveer University of those who fulfilled the inclusion and exclusion criteria. A total of 60 volunteers were randomly allocated into the

two study groups through computer-generated random numbers. Random allocation of mouth rinses using the lottery method was done.

Group 1 ( $n = 30$ ) was given herbal mouthwash (combination of *Cinnamon* and *T. chebula* extract mouthwash) and instructed to use 10 ml twice a day for 3 days.

Group 2 ( $n = 30$ ) was given chlorhexidine (.12%) and instructed to use 10 ml twice a day for 3 days.

Herbal mouthwash composed of 50% concentration of *T. chebula* and remaining 50% was the *Cinnamon* extract. All the students were subjected to scaling and polishing to get the baseline score to nil. All the two groups followed same oral hygiene instructions, except for the use of allocated mouthrinse. Both the mouthrinse were made identical. This was done with the help of Department of Pharmacy, TMU. Students in all the two groups were instructed to rinse their mouth with 10 ml of mouthwash twice daily after breakfast and other after lunch for 3 days for 1 min and not to rinse with water thereafter.

The data were collected at the end of 3<sup>rd</sup> day. The plaque was disclosed using erythrosine disclosing agent and their scores were recorded per tooth using the Quigley and Hein plaque index modified by Turesky-Gilmore-Glickman.[8]

A single examiner, who was trained and calibrated to record the plaque and gingival scores, recorded the findings at all two intervals and for both the groups. The recorder was blinded to the type of the mouthwash used by participants.

### Statistical analysis

The data were analyzed using SPSS version 17. ANOVA followed by *post-hoc* least significant difference (LSD) were used for analysis.  $P$  value of 0.05 was taken to be significant.

## RESULTS

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There were no reports of adverse reactions to any of the mouth rinses used. ANOVA was used to analyze the reduction in plaque in the two groups. A significant decrease was noted in the plaque in both the herbal and chlorhexidine groups at 3 days ( $P < 0.05$ ). There was a progressive decrease in the plaque at 5% level of significance. Chlorhexidine group showed maximum decrease when compared to the herbal group, but it was not statistically significant. Multiple comparisons were obtained by *post-hoc* LSD. The difference in the decrease in plaque ( $P = 0.309$  at 3 days) between herbal group and chlorhexidine group was not statistically significant. Data show that there was no significant difference between herbal-based mouth rinse and chlorhexidine for any clinical parameters throughout the study.

## DISCUSSION

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It is generally accepted that the formation of dental plaque at the tooth/gingiva interface is one of the major causes of gingival inflammation and caries. The single best way to remove harmful plaque from teeth is to brush teeth regularly and appropriately. Brushing teeth with toothpaste helps to remove plaque, resist decay, promote remineralization, polish and remove stains, etc. There is an increase in the use of mechanical and chemical plaque control agents to prevent dental caries and periodontal disease. Some of the methods are proper and regular tooth-brushing, flossing and rinsing with mouthwashes. Various chemical mouthwashes are available in the market, but are associated with side-effects such as immediate hypersensitivity reactions, toxicity, tooth staining, etc., Alternative medicines may be developed from medicinal plants as these plants contain natural phytochemicals, and hence, can replace synthetic drugs.

*T. chebula* is rightly called the 'King of Medicines' in Tibet and is always listed first in Ayurvedic Materia Medica in India. *T. chebula* fruit has been used as a traditional medicine against various human ailments since antiquity. It exerts a wide range of pharmacological effects. Animal studies have also shown that it exerts anticarcinogenic and antimutagenic effects. In addition, it exerts cardioprotective, hepatoprotective and radioprotective effects.[9] Cinnamon (*Cinnamomum zeylanicum*) is one of the herb which has been used extensively for treatment of several conditions including general and oral health. In traditional medicine cinnamon is used for colds, flatulence, nausea and diarrhea. It's also believed to improve energy, vitality, and circulation. Studies have found that cinnamon may have antibacterial and antifungal properties.

Two studies have claimed *T. chebula* as an antiplaque agent.[9,10] However, until date, a comparison of the clinical antiplaque effectiveness of the combination of *T. chebula* with *Cinnamon* and 0.12% chlorhexidine has not been reported in controlled trials. As far as we know, this is the first published trial that directly compared the antiplaque efficacy of combination of *T. chebula* and *Cinnamon* extract mouthwash and chlorhexidine rinses, which limits the possibility of comparison with the literature.

*Terminalia chebula* extracts exerts antibacterial, antiviral effect against *Helicobacter pylori*, *Xanthomonas campestris* pv. citri and *Salmonella typhi*, herpes simplex virus type-1, human immunodeficiency virus-1 and *Cytomegalovirus*. *T. chebula* contains almost 30% tannins and other minor constituents are polyphenols such as corilagin, galloyl glucose, punicalagin, terflavin A and maslinic acid. Tannins are a group of polymeric phenolic substances of pyrogallol (hydrolysable) types, releasing gallic acid as a main component, which is well recognized for its antimicrobial and astringent property.[9]

According to Ooi *et al.*[7] *Cinnamon* is active on Gram-positive and Gram-negative bacteria. Cinnamaldehyde is the major and active component in *Cinnamon*.[11]

The *in vitro* study conducted by Fani, Kohanteb showed that *Cinnamon* oil showed strong, promising inhibitory activity on all the *Streptococcus mutans* isolates at a concentration of as low as 3.12%.[12] *T. chebula* alone may also act as an antiplaque agent.[10]

Mechanisms where by cinnamon extract inhibit growth of bacteria especially against oral bacteria are still unclear, most explanations concerning the antibacterial effect of cinnamon in general related the inhibitory effect of cinnamon to its essential oils. An important characteristic of essential oils and their components is their hydrophobicity, which enable them to partition the lipids of the bacterial cell membrane, disturbing the cell structures and rendering them more permeable. Extensive leakage from bacterial cells or the exit of critical molecules and ions will lead to death.[13]

Most of the studies on *Cinnamon* oil suggest that it is not harmful and may be used as an agent to inhibit the growth of bacteria, fungi, and yeast. However, some cases of contact dermatitis and stomatitis associated with *Cinnamon* oil have been reported.[14] *Cinnamon* is rarely associated with allergic reactions with symptoms like localized burning sensation, sloughing, erythema.[14]

In the present study, combination of *T. chebula* and *Cinnamon* was used. 50% *T. chebula* extract and 50% *Cinnamon* was used to make the mouthwash, which acted as antiplaque agent.

The efficacy of combination of *cinnamon* and *T. chebula* has never been tested on the dental plaque level. No studies had been conducted to show the effect of combination of *Cinnamon* and *T. chebula* extract on plaque which is the main precursor of periodontal diseases.

In the present study, there was a significant difference on the clinical level of dental plaque in both herbal and chlorhexidine mouthwash group before and after the experimental period. Chlorhexidine shows more reduction in dental plaque than herbal extract, but the result was statistically insignificant. The results of these two groups on plaque could not be compared with other studies as no studies have been reported in the literature, which has tried to assess the same effect. Thus it can be said that the holistic or complementary medicine has a great potential which can be utilized for the better oral and general health. [15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30]

## Limitations

Present study was a short term study employing a crude extract of *T. chebula* and *Cinnamon* as mouthrinse. Though significant results were obtained at 3 days in the herbal groups, long term clinical efficacy (6 months -as prescribed by ADA)[31] and adverse effects associated with long term usage could not be assessed. Microbiological assessment on plaque or saliva of the participants was not performed and hence this study could not provide any evidence regarding the effects of these mouthwashes on oral microbial flora.

## CONCLUSION

Within the limitation of this trial, herbal mouthwash has been shown to demonstrate similar effects on a plaque as compared to the standard drug chlorhexidine. Further, long term research needs to be done to

check the efficacy and effectiveness of herbal products over standard drug regime. Given the increasing trend in Ayurveda use in day today life and the enormous power to two contemporary approaches – evidence-based clinical practice and modern dentistry – the time is ripe to reformulate our approach to the practice, research and training in Ayurveda and holistic dentistry. Natural compounds can again become central players in the treatment of disease and in the understanding of disease mechanisms.

## Footnotes

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**Conflict of Interest:** None declared.

## REFERENCES

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1. Marsh PD. Dental plaque as a biofilm: The significance of pH in health and caries. *Compend Contin Educ Dent*. 2009;30:76–8, 80, 83. [PubMed: 19301526]
2. Barnett ML. The rationale for the daily use of an antimicrobial mouth rinse. *J Am Dent Assoc*. 2006;137:16S–21. [PubMed: 17035671]
3. Smith G. Herbs in Medicine [review] *Triple Helix*. 2004. [Last accessed on 2 Jan 2015]. pp. 12–13. Available from: <http://www.admin.cmf.org.uk/pdf/helix/aut04/29herbs.pdf>.
4. Ceylane A, Daniel Y. Antimicrobial activity of spices. *J Rapid Methods Autom Microbiol*. 2004;12:1–55.
5. Rashad JM. Effect of water cinnamon extract on mutans streptococci, in comparison to chlorhexidine gluconate and zac (*in vitro* and *in vivo* study) *Mustansiria Dent J*. 2008;5:250–60.
6. Rani P, Khullar N. Antimicrobial evaluation of some medicinal plants for their anti-enteric potential against multi-drug resistant *Salmonella typhi*. *Phytother Res*. 2004;18:670–3. [PubMed: 15476301]
7. Ooi LS, Li Y, Kam SL, Wang H, Wong EY, Ooi VE. Antimicrobial activities of cinnamon oil and cinnamaldehyde from the Chinese medicinal herb *Cinnamomum cassia* Blume. *Am J Chin Med*. 2006;34:511–22. [PubMed: 16710900]
8. Turesky S, Gilmore ND, Glickman I. Reduced plaque formation by the chloromethyl analogue of vitamin C. *J Periodontol*. 1970;41:41–3. [PubMed: 5264376]
9. Gupta D, Bhaskar DJ, Gupta RK, Karim B, Gupta V, Punia H, et al. Effect of *Terminalia chebula* extract and chlorhexidine on salivary pH and periodontal health: 2 weeks randomized control trial. *Phytother Res*. 2014;28:992–8. [PubMed: 24123617]
10. Gupta D, Gupta RK, Bhaskar DJ, Gupta V. Comparative Evaluation of *Terminalia chebula* Extract Mouthwash and chlorhexidine Mouthwash on Plaque and Gingival Inflammation — 4-week Randomised Control Trial. *Oral Health Prev Dent*. 2015;13:5–12. [PubMed: 25386630]
11. Burt S. Essential oils: Their antibacterial properties and potential applications in foods — A review. *Int J Food Microbiol*. 2004;94:223–53. [PubMed: 15246235]
12. Fani MM, Kohanteb J. Inhibitory activity of *Cinnamomum zeylanicum* and *Eucalyptus globulus* oils on *Streptococcus Mutans*, *Staphylococcus aureus*, and *Candida* species isolated from patients with oral infections. *Shiraz Univ Dent J*. 2011;11:14–22.
13. Kwon J, Yu A, Park H. Bactericidal effects and inhibition of cell separation of cinnamic aldehyde on *Bacillus cereus*. *Lett. Appl. Microbiol*. 2003;37:61–65. [PubMed: 12803558]
14. Gupta C, Kumari A, Garg AP, Catanzaro R, Marotta F. Comparative study of cinnamon oil and clove oil on some oral microbiota. *Acta Biomed*. 2011;82:197–9. [PubMed: 22783715]
15. Gupta D, Dalai DR, Swapnadeep, Mehta P, Indra BN, Rastogi S, Jain A, et al. Acupuncture (zhēn jiǔ) — an emerging adjunct in routine oral care. *J Tradit Complement Med*. 2014;4:218–23. [PMCID: PMC4220498] [PubMed: 25379462]



16. Gupta RK, Gupta D, Bhaskar DJ, Yadav A, Obaid K, Mishra S. Preliminary antiplaque efficacy of aloe vera mouthwash on 4 day plaque re-growth model: randomized control trial. *Ethiop J Health Sci.* 2014;24:139–44. [PMCID: PMC4006208] [PubMed: 24795515]
17. Gupta D, Bhaskar DJ, Gupta KR, Karim B, Kanwar A, Jain A, et al. Use of complementary and alternative medicine for work related musculoskeletal disorders associated with job contentment in dental professionals: Indian outlook. *Ethiop J Health Sci.* 2014;24:117–24. [PMCID: PMC4006205] [PubMed: 24795512]
18. Gupta D, Bhaskar DJ, Gupta RK, Jain A, Yadav P, Dalai DR, et al. Is complementary and alternative medicine effective in job satisfaction among dentists with musculoskeletal disorders. A cross sectional study? *Med Pr.* 2014;65:317–23. [PubMed: 25230560]
19. Gupta D, Batra R, Mahajan S, Bhaskar DJ, Jain A, Shiju M, et al. Comparative Evaluation of the Complementary and Alternative Medicine Therapy and Conventional Therapy Use for Musculoskeletal Disorders Management and Its Association with Job Satisfaction among Dentists of West India. *J Tradit Complement Med.* 2014;4:218–23. [PMCID: PMC4220505] [PubMed: 25379469]
20. Ravneet Kaur Randhawa, Nidhi Gupta, Vikram Arora, Preety Gupta. Antioxidants in oral health. *Int J Contemp Med Res.* 2015;2:53–8.
21. Saloni Sood, Manish Bhargava, Pallvi Rathore. Diabetes Mellitus Leading Expiry of Oral Health. *Int J Contemp Med Res.* 2015;2:100–4.
22. Pradeep Raghav, Swati Jain, Munish Reedy, Shishir Singh, Tarun S Phull, Raj K Verma. Evaluation of nasal form in average, pleasing and attractive looking individuals. *Int J Contemp Med Res.* 2015;2:12–9.
23. Megalaa N, Kayalvizhi G, Silas AJ, Sajeev R, Saravana Kumar MS. Role of herbal leaf extracts in caries prevention. *Int J Contemp Med Res.* 2014;1:71–8.
24. Gupta D, Gupta RK. Investigation of antibacterial efficacy of *Acacia nilotica* against salivary mutans streptococci: A randomized control trial. *Gen Dent.* 2015;63:23–7. [PubMed: 25574715]
25. Gupta D, Nagar P, Karim B, Khan IM, Naveen B, Chaturvedi M, Verma R, Purwar P, Gupta RK. Tobacco abuse amongst the school going students of 15 to 18 years of Almora district, Uttarakhand: A cross sectional study. *Oral Health Dent Manag.* 2014;13:680–6. [PubMed: 25284536]
26. Gupta D, Bhaskar DJ, Gupta RK, Karim B, Jain A, Singh R, et al. A randomized controlled clinical trial of *Ocimum sanctum* and chlorhexidine mouthwash on dental plaque and gingival inflammation. *J Ayurveda Integr Med.* 2014;5:109–16. [PMCID: PMC4061585] [PubMed: 24948862]
27. Gupta D, Bhaskar D J, Gupta RK. Contemporary and alternative dentistry: Ayurveda in dentistry. Saarbrücken: Lap Lambert Academic Publishing; 2013. pp. 28–30.
28. Jain A, Bhaskar DJ, Gupta D, Agali C, Gupta V, Gupta RK, Yadav P, Lavate AB, Chaturvedi M. Comparative evaluation of honey, chlorhexidine gluconate (0.2%) and combination of xylitol and chlorhexidine mouthwash (0.2%) on the clinical level of dental plaque: A 30 days randomized control trial. *Perspect Clin Res.* 2015;6:53–7. [PMCID: PMC4314848] [PubMed: 25657903]
29. Jain A, Bhaskar DJ, Gupta D, Agali C, Gupta V, Gupta RK, Yadav P, Lavate AB, Chaturvedi M. Comparative evaluation of honey, chlorhexidine gluconate (0.2%) and combination of xylitol and chlorhexidine mouthwash (0.2%) on the clinical level of dental plaque: A 30 days randomized control trial. *Perspect Clin Res.* 2015;6:53–7. [PMCID: PMC4314848] [PubMed: 25657903]
30. Oral Piercings - Pain or Pleasure? Puneet Sharma, Sanjeev Kumar Salaria, Ravi Kiran N, Shilpa Kamra, Deepak Kumar Bansal. *Int J Contemp Med Res.* 2015;2:93–99.
31. Council on scientific Affairs. Acceptance Program Guidelines - Chemotherapeutic Products for Control of Gingivitis. [Internet]: ADA. [Last accessed on 2015 Jan 6; cited 2011 25th september]. Available from: [http://www.ada.org/sections/scienceAndResearch/pdfs/guide\\_chemo\\_ging.pdf](http://www.ada.org/sections/scienceAndResearch/pdfs/guide_chemo_ging.pdf).

