The antiplaque efficacy of white tea extract mouthrinse

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Abstract:
Objective: This study was conducted to assess the antiplaque efficacy of a mouthwash containing white tea. It also assessed the antibacterial properties of white tea against Prevotella intermedia (Pi), Porphyromonas gingivalis (Pg), and Aggregatibacter actinomycetemcomitans (Aa) in vitro. Materials and Methods: Forty-five subjects with healthy periodontium were randomly chosen and were divided into three groups and advised to use mouthwashes A, B, and C (Group A, white tea; Group B, distilled water [placebo]; Group C, chlorhexidine) for 4 days. They were advised to refrain from any kind of mechanical oral hygiene techniques. Plaque index (PI) was checked on day 1 and 5. In vitro testing for against Pi, Pg, and Aa against white tea extract was undertaken. Results: PI significantly increased from day 1 to day 5 (P < 0.01) in Groups A, B, and C. In inter-group comparison, there was a statistical significant difference between white tea mouthwash and placebo group, chlorhexidine group and placebo group and also chlorhexidine group and white tea mouthwash group. However, chlorhexidine showed superior antiplaque activity. In vitro test, white tea showed effective inhibition against all three bacterial strains Pi, Pg, and Aa at 1% concentration. Conclusion: White tea mouthwash potently inhibits plaque formation although not as comparable to chlorhexidine mouthwash. Hence, for those preferring herbal products, white tea mouthwash is a good option.

Key words:
Antiplaque, mouthrinse, white tea

INTRODUCTION

Periodontal disease is a chronic inflammatory condition occurs due to the complex interaction between the periodontopathogens bacteria and the host’s immune response.[1,2] Mechanical and chemical plaque control techniques are proven methods for plaque control.[3] Essential oils, enzymes, bisbiguanides, and lately even herbal extracts have been researched as potent plaque inhibitors.

Chlorhexidine, considered to be the gold standard,[4] cannot be advised for long periods because of its adverse effects.[5] So also essential oils rinse, which have been extensively researched, have side effects.[6] Therefore, the search for other agents with equal efficacy and fewer side effects is essential.

Tea has been reported to be a very popular beverage among a wide range of populations. It has shown to have many beneficial effects on our oral health. Different types of teas are manufactured, and each has shown to have a positive effect on the teeth. White tea goes well with healthy white teeth and gums.[7]

White tea, green tea, and black tea originate from the plant Camellia sinensis.[8] White tea has a light taste and color. The origin of white tea is mostly from Fujian Province of China and is the least processed form of tea with least amount of caffeine as compared to black and green tea.[9]

White tea retains its nutrients since the processing temperature is low compared to processing temperature of other two teas. The ingredients of white tea are alanine, histidine, aspartic acid, threonine, glutamic acid, and amino acids.[10] The most important ingredients in white tea are rich in polyphenols, which is a natural antioxidant.[10,11]

There have been studies in the past which have shown that white tea has a major health benefit, it can kill bacteria, fungi, and viruses in the body with more success than other teas.[12] White tea contains a number of polyphenolic compounds which have a wide spectrum of activity on bacteria, fungi, and viruses. Although not as comparable to chlorhexidine, it can be used as a good alternative.

How to cite this article: Mitra DK, Shah PM, Shah HH, Rodrigues SV, Mehta CJ. The antiplaque efficacy of white tea extract mouthrinse. J Indian Soc Periodontol 2018;20:514-7.
of antioxidant, antiviral, anticancer, antitoxoplasmal, antithelmintic properties (Almajano, Carbo and Gordon 2008).\textsuperscript{[13]}

It lowers cholesterol, reduces blood pressure, and fights fatigue.\textsuperscript{[13]} White tea also contains fluoride, tannins, and flavonoids.\textsuperscript{[15]} Fluorides help to reduce caries.

Not much research has been done on the efficacy of white tea as an antiplaque agent. Therefore, this study was undertaken to evaluate the effectiveness of white tea as mouthwash in comparison with the gold standard, i.e., chlorhexidine.

**MATERIALS AND METHODS**

**In vivo study design**

The current clinical trial was a double-blinded, randomized, parallel, longitudinal study. Forty-five periodontally healthy subjects (11 males and 34 females) between the age group of 21 to 23 years (mean age 22 years) were enrolled in the 4-day rinsing study. Mouthwashes were labeled as A, B, and C by one examiner and another examiner (blinded) conducted the study.

Mouthwash A (test) was a white tea extract mouthwash; mouthwash B (placebo control) was a placebo that constituted distilled water, and mouthwash C (positive control) was a commercially available 0.2% chlorhexidine mouthwash (ICPA Health Care Products, Ankleshwar, Gujarat).

For mouthwash A, white tea extract powder (Changsha Nutra-Y Biotechnology, Hunan, China) was used. The solubility of the mouthwash was 1 mg/100 ml of water. It was dissolved in distilled water for an effective concentration of 1%.

Subjects with good systemic health with at least 24 scorable teeth (not including third molars or crowned teeth) were included in the study. Subjects who consumed a high polyphenolic diet (including green tea or soya diet), wore appliances, or prostheses (fixed or removable) were prescribed antibiotics or other medications in the previous 3 months or had undergone treatment for periodontal problems were excluded from the study. Subjects having diseases that would increase oxidative stress such as diabetics and subjects not cooperating with the study protocol were excluded from the study.

Forty-five students, studying in Terna Dental College, Nerul, Navi Mumbai, India, who complied inclusion criteria, were selected. This study was approved by the Ethical Committee of the same institution and was conducted in accordance with the Declaration of Helsinki and principles of good clinical practice.

The subjects were randomly assigned into three equal groups Group A, B, and C (15 subjects per group).

At baseline, thorough oral prophylaxis was done for all the subjects by the investigator. Plaque was disclosed using Two Tone Plaque Disclosing Agent (Dento Plac, India) to ensure that all deposits had been removed. Subjects were told not to use toothbrushes, toothpaste, or any other interdental cleaning aid or chewing gum for the next 4 days. Instead, subjects were asked to use one of the assigned mouthwash two times a day.

At a particular specified time during the day, all subjects were instructed to rinse two times a day for 1 min with 10 mL of the randomly allocated rinse. At each rinsing, 10 mL of the solution was swished around the mouth for about 60 s and then expectorated. On day 5, the subjects were recalled; plaque index (PI; Turesky et al. modification of Quigley PI) was recorded, and subjects were allowed to resume their routine oral hygiene regimens.

**Data collection**

The amount of plaque was checked on days 0 and day 5. Adverse effects such as burning sensation, altered taste, and desquamation of gingival epithelium if any were also evaluated on the 5th day.

**In vitro study design**

The white tea extract was tested against three organisms: *Porphyromonas gingivalis* (Pg), *Porphyromonas intermedia* (Pi) and *Aggregatibacter actinomycetemcomitans* (Aa).

**Media used**

The brain heart infusion (BHI) agar was used; agar plates were brought to room temperature before use.

**Inoculum preparation**

Nine dilutions of each drug (white tea extract mouthwash, chlorhexidine mouthwash, and distilled water) were done with BHI for minimal inhibitory concentration. In the first tube, 20 µl of the drug was added into the 380 µl of BHI broth. For dilutions, 200 µl of BHI broth was put in the other 9 tubes separately. Then, from the first tube, 200 µl was put into the first tube containing 200 µl of BHI broth. This was said to be as 10:1 dilution.

From 10:1 diluted tube 200 µl was put to the second tube to make 10:2 dilution. The serial dilution was repeated up to 10:9 dilution for each drug. From the maintained stock cultures of required organisms, 5 µl was taken and was put into 2 ml of BHI broth. In each serially diluted tube, 200 µl of above culture suspension was added. The tubes were incubated for 24 h and observed for turbidity.

**Statistical analysis**

After the indices were calculated and the mouthwash order was decoded, further testing was done with SPSS version 17 software (SPSS Inc., Chicago, IL, USA). The mean was calculated for each mouthwash. The analysis of variance (ANOVA) was done. Differences between the mouthwash solutions and distilled water were determined via the Bonferroni multiple comparison test.

**RESULTS**

Forty-five subjects, 11 males, and 34 females, completed the study. In all groups, PI showed significant ($P < 0.01$) increase from the baseline to the 5th day. The *in vivo* results demonstrated that the mean PI values were the highest for the distilled water mouthwash (2.55) and the least for...
chlorhexidine mouthwash (1.94). The mean PI value for distilled water (2.55) was higher than the white tea group (2.21). ANOVA showed a statistically significant difference between the PI scores \( (P = 0.001) \).

Differences between the individual mouthwashes and distilled water, determined through the Bonferroni multiple comparison test, showed significantly less plaque regrowth in case of both chlorhexidine \( (P = 1.94) \) and white tea \( (P = 2.21) \) as compared to distilled water.

The results of the ANOVA test are given in Table 1 while those of the Bonferroni multiple comparison test are given in Table 2. There was no burning sensation or taste alteration reported by any of the subjects at the end of the study period. In addition, there was no evidence of gingival epithelial desquamation on intraoral examination in any of the subjects.

The in vitro study showed that Pg, Pi, and Aa was inhibited at the concentration of 1%.

**DISCUSSION**

This present study evaluated the antiplaque effects of a new white tea mouthwash and also aimed to evaluate whether the mouthwash had any adverse effects. White tea mouthwash was compared with distilled water and 0.2% chlorhexidine solution. The study design (4-day plaque regrowth study) has been used in many studies and is a standard method for testing the plaque-reducing effect.\[16,17\] The advantage of a 4-day plaque regrowth study design is that it eliminates the effect of the adjunctive mechanical oral hygiene techniques because they are not permitted during the trial period.\[16\]

In all the groups, PI showed statistically significant \( (P < 0.01) \) increase from baseline to day 5. The present study showed significant and comparable reduction in PI in the white tea and chlorhexidine group as compared to the distilled water \( (P = 0.001) \). White tea mouthrinse was found to be a potent antiplaque agent, though less efficacious than chlorhexidine mouthrinse. Postoperative mouthrinse of white tea and chlorhexidine are shown in Figures 1 and 2, respectively.

Probably, it can serve as a long-term herbal antiplaque agent in maintenance phase or as an alternative for the patients looking for herbal products mouthrinse, or for the patients who complaint of side-effects due to chlorhexidine mouthrinse.

One of the shortcomings of this study is the smaller sample size. At the end of the study, no adverse effects of the white tea mouthwash were seen in any of the subjects. The duration of the study was short (4 days) as the plaque regrowth model was used. Therefore, the antigingivitis efficacy of the white tea extract mouthwash was not tested. More studies using a longer duration, larger sample size and a cross-over model can be performed for further research.

**CONCLUSION**

White tea mouthrinse was found to be a potent antiplaque agent although less efficacious than chlorhexidine mouthrinse. It can serve as a good alternative for the patients who prefer herbal products, which have practically no side effects.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

**Table 1: Results of plaque index and comparison between groups using one-way analysis of variance**

| Sample       | Mean | SD    | \( P \) |
|--------------|------|-------|--------|
| White tea    | 2.2133 | 0.12459 | 0.001* |
| Distilled water | 2.5520 | 0.23902 |       |
| Chlorhexidine | 1.9400 | 0.16818 |       |

\*Statistically significant at \( P \leq 0.05 \). SD – Standard deviation

**Table 2: Comparison between groups using Bonferroni multiple comparison test**

| Sample compared           | \( P \) |
|---------------------------|--------|
| Chlorhexidine versus white tea | 0.001* |
| Distilled water versus chlorhexidine | 0.001* |
| White tea versus distilled water | 0.001* |

\*Statistically significant at \( P \leq 0.05 \)
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