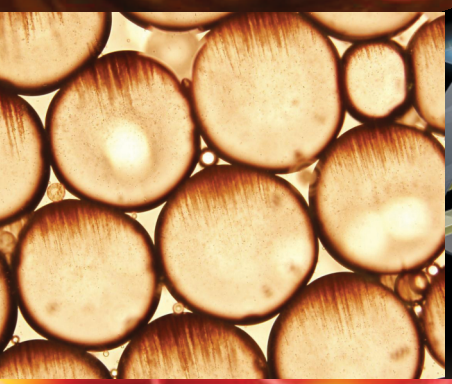
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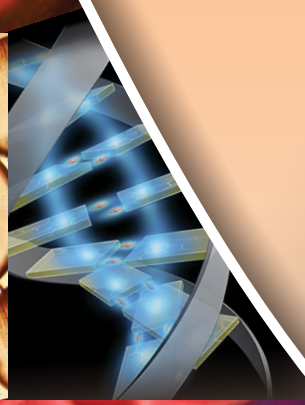
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Original Article

Comparative Evaluation of the Effect of 0.2% Chlorhexidine, 2% LemonGrass Oil, and 2% Tea Tree Oil Mouth rinse on Salivary pH: An *In vivo* Study

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ABSTRACT

Background: Mouthwashes containing essential oils are used in the prevention and treatment of periodontal diseases. Lemongrass oil (LGO) belongs to a section of andropogen called cymbogam of the family germineae and from it, the LGO is extracted. Tea tree oil (TTO) is extracted from *Melaleuca alternifolia* leaves (*Myrtaceae* family). **Aim and Objective:** The aim of the study is to evaluate the pH of saliva before and after using LGO and TTO mouth rinse and to determine its relevance to the oral health status. **Materials and Methods:** A purposive sample of 90 participants aged between 26 and 38 years were included in the study. The PH before and after the use of the chlorhexidine, LGO, and TTO mouthwashes are noted using the GC PH strips and a comparative study was made. Statistical analysis was performed using paired *t*-test. $P < 0.05$ was considered statistically significant. **Results:** Comparative analysis was made with Wilcoxon signed-ranks test and found that the TTO gives a greater increase in salivary pH with a $P = 0.001^{**}$ ($P < 0.05$) which is found to be statistically significant. **Conclusion:** The study conducted shows beneficial effects of TTO and LGO mouth rinse. Further studies with larger samples may produce more reliable values.

Keywords: *Chlorhexidine, lemongrass oil, mouth rinse, salivary pH, tea tree oil*

Introduction

Dental health problems such as dental caries, periodontitis, and oral malordor are always initiated at the interface between the microbial ecosystem and host tissue.[1] Saliva being an effective antimicrobial agent in the oral cavity maintains the oral pH at near neutral (pH 6.7–7.3). Lower salivary pH promotes the growth of harmful organisms creating a favorable environment for the initiation of dental caries and periodontitis.[2]

Compelling reasons exist to use saliva as a diagnostic fluid. It meets the demand for being inexpensive, noninvasive and easy to use diagnostic methods.

Essential oils are ideal for the use in oral care products because they are both antibacterial and nontoxic a rare combination. Mouthwashes containing essential oils are used in the prevention and treatment of periodontal diseases.[3]

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Lemongrass oil (LGO) belongs to a section of andropogen called cymbogam of the family germineae and from it, the LGO is extracted. Tea tree oil (TTO) is extracted from *Melaleuca alternifolia* leaves (*Myrtaceae* family).[4] This oil is effective against a high number of gram-positive and gram-negative bacteria as well as fungi.[5]

This study is aimed at the evaluation of the pH of saliva before and after using LGO and TTO mouth rinse and to determine its relevance to the oral health status.

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Materials and Methods

A purposive sample of 90 participants aged between 26 and 38 years were included in the study. The study was conducted over a period of 1 month and was carried out at a private hospital in Dharmapuri, Tamil Nadu, India. Informed oral and written consent was obtained from all the participants participating in the study.

Inclusive criteria

- Healthy participants aged between 26 and 38 years without any known systemic condition
- Participants with informed written consent
- Participants with no active carious lesions
- No history of use of antimicrobial agents or any other drugs (up to within 4 weeks).

Exclusive criteria

- Participants with a known history of allergy to any mouth rinse or drug
- Participants with any systemic illness
- Participants using any other commercially available mouth rinse products
- Participantss using any other oral hygiene aids other than routine teeth brushing.

The participants who fulfilled the inclusion criteria were selected and randomly divided into three groups with 30 participants in each group.

- Group A: Chlorhexidine (CH) group
- Group B: LGO group
- Group C: TTO group.

The groups are trailed with different mouthwashes containing CH, LGO and TTO, mouthwashes, respectively. Constituents of the mouthwashes include,

TTO - 1, 8 - cineole, terpinen-4-ol, alpha-terpineol, and gamma-terpinen.

LGO - Geranial, neral and myrcene.

CH - CH gluconate, 11.6% alcohol, glycerin, PEG-40 sorbitan diisostearate, sodium saccharin, and flavor.

Preparation of lemongrass oil mouth rinse

Fresh LGO (packing date < 1 month) was procured from the local market. Two percent of LGO was prepared with 2 g of LGO diluted in 100 mL warm water for 5 min (10 mL for each participant).

Preparation of tea tree oil mouthrinse

Fresh TTO (packing date <1 month) was procured from the local market. Two percent TTO was prepared with 2 g of TTO diluted in 100 mL warm water for 5 min (10 mL for each participant).

Salivary pH measurements

A volume of 2 mL saliva samples was collected before the commencement of mouth rinsing, baseline, and after 1 h rinsing. Unstimulated whole saliva samples were collected using Navazesh[6] spitting method by pooling saliva for 60 s and then spitting in a disposable container sitting in an upright position in a well-lit room with good ventilation. Saliva was collected in the morning between 10.00 am and 10.30 am to prevent any bias in the concentration of saliva due to circadian rhythm. Participants were also informed not to eat or drink anything (except water) 1 h before saliva collection to minimize possible food debris and stimulation of saliva. Salivary pH was measured using GC pH strips. A single sheet was dipped into the saliva till it is fully wet and removed immediately. After 30 s, the acid produced reacts to these pH indicators, thus leading to colorimetric change, which was compared with color code chart, and the pH value was noted.

After the baseline recording of salivary pH, the designated mouth rinse was dispensed to the respective groups. Group A received TTO, Group B received LGO mouth rinse, and Group C received CH mouth rinse. The PH before and after the use of the mouthwashes are note using the GC pH strips and a comparative study was made. Statistical analysis was done using a paired *t*-test. $P < 0.05$ was considered statistically significant.

Results

Tables 1, 2, and Graph 1, 2 show the demographic distribution among the participants, which was statistically not significant ($P > 0.001$). Table 3 and Graph 3 show the comparison of mean pH scores for all the three groups (CH, LGO, and TTO), which revealed that the pH of saliva was increased in the participants after rinsing with all the three mouth rinses (CH, LGO, and TTO). The statistical analysis shows that the treatment with TTO, LGO, and CH are effective. Similarly, when pre- and post-mean pH was compared in the CH, LGO, and TTO groups, it was found that pH was higher in the TTO group as shown in Table 3 and Graph 3. The results were statistically significant. Comparative analysis was made and found that the

Table 1: Gender distribution among the participants

Mouthwash	Gender, *n* (%)		Total, *n* (%)	χ^2	*P*
	Male	Female			
Chlorohexidine	10 (27.03)	20 (37.74)	30 (33.33)	1.74	0.418
Lemon grass oil	12 (32.43)	18 (33.96)	30 (33.33)		
Tea tree oil	15 (40.54)	15 (28.30)	30 (33.33)		
Total	37 (100.00)	53 (100.00)	90 (100.00)		

Table 2: Age distribution among the participants

Mouthwash	Age (years), *n* (%)				Total	χ^2	*P*
	20-30	31-40	41-50	51-60			
Chlorohexidine	6 (20.00)	13 (43.33)	11 (36.67)		30	2.80	0.834
Lemongrass oil	6 (20.00)	9 (30.00)	14 (46.67)	1 (3.33)	30		
Tea tree oil	5 (16.67)	9 (30.00)	15 (50.00)	1 (3.33)	30		
Total	17 (18.89)	31 (34.44)	40 (44.44)	2 (2.22)	90		

Table 3: Comparision of salivary pH among the three groups (Wilcoxon Signed Ranks Test)

Mouthwash	PH of saliva	*n*	Mean	SD	*Z*	*P*
Chlorohexidine	PH before	30	6.87	1.11	1.13	0.258
	PH after	30	7.13	0.63		
Lemongrass oil	PH before	30	6.80	0.71	4.08	0.001**
	PH after	30	7.93	0.98		
Tea tree oil	PH before	30	7.40	1.07	4.33	0.001**
	PH after	30	8.67	0.92		

**Highly significant. SD: Standard deviation

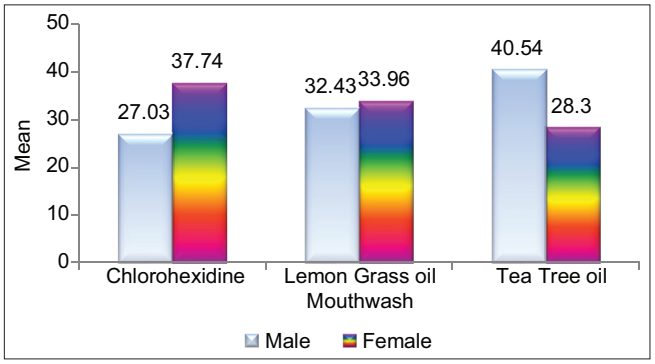
TTO gives a greater increase in salivary pH with a $P = 0.001^{**}$ ($P < 0.05$) which is found to be statistically significant.

Discussion

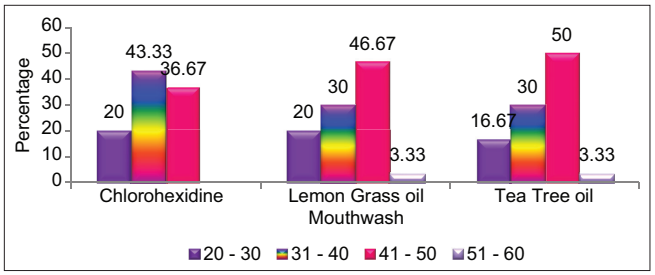
Mechanical plaque control by tooth brushing methods and interdental aids may not completely remove the plaque from the surface of the tooth.[7] Antimicrobial mouthwashes may help to improve plaque control and gingival health by reducing dental plaque from even difficult to reach areas. Because of the long-term effectiveness of CH, it has been considered as the gold standard among the mouthwashes.[8] This clinical trial was made to check the efficacy of gold standard CH mouthwash with the essential oils LGO and TTO as control groups. *M. alternifolia*, more commonly known as TTO has antimicrobial effects against the biofilms.[9] LGO can be used as an adjunct to the nonsurgical periodontal therapy for plaque control.

The results of the present study showed that there is a statistically significant increase in the postmouth rinses salivary pH in all three groups. Intergroup comparison for the effectiveness of CH, LGO, and TTO showed varied results in the salivary pH in each group. The clinical trial was conducted to check the PH of the oral cavity after using LGO and TTO as mouthwash and comparisons were made with the gold standard 0.2% CH mouthwash. There has been marked inter-individual variability detected regarding the salivary pH. Given that the tested pH strips, these vital GC PH strips are the suitable method for this type of study.

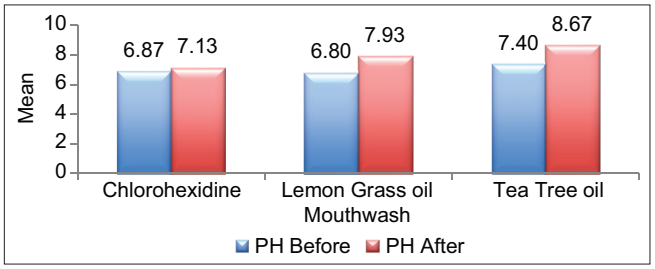
TTO has demonstrated remarkable antimicrobial activity which was more efficient than LGO and CH.[10]



Graph 1: Gender distribution among the participants



Graph 2: Age distribution among the participants



Graph 3: Comparision of salivary pH among the three groups

Whereas, both essential oils and CH were effective against reducing the plaque build-up on the teeth surface. It should be mentioned that in the multiple literature reviews it has been concluded that performing daily mouthwashes with TTO and LGO produces increased antiplaque effect to that of CH.[11] Concerning the effectiveness of the essential oils and CH on salivary pH, our study founded that the TTO mouthwash showed higher pH difference in the oral cavity than the other control groups providing an alkaline environment which is conducive to oral health care.

Conclusion

The study conducted shows beneficial effects of TTO and LGO mouth rinse in providing an alkaline environment, which is conducive to oral health of children. It is high time to find an alternate remedy from natural sources to avoid the side effects associated with the commercially available products.[12]

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Nil.

Conflicts of interest

There are no conflicts of interest.

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