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Article in *Indian journal of dental research: official publication of Indian Society for Dental Research* · January 2017

DOI: 10.4103/0970-9290.203622

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## Efficacy of Triphala Extract and Chlorhexidine Mouth Rinse Against Plaque Accumulation and Gingival Inflammation Among Female Undergraduates: A Randomized Controlled Trial

### Abstract

**Aim:** To know the efficacy of Triphala extract and Chlorhexidine mouth rinse against plaque and gingival inflammation. **Materials and Methods:** A double blinded parallel arm randomised control trial was done among 60 participants aged 18-24 years. Participants were randomly allotted to three groups with 20 participants in each group of 0.6% triphala, 0.12% chlorhexidine and control group. Study was done in 2 phases of 21 days duration. During the experimental period, participants rinsed with the allocated mouth rinse 10ml twice daily for 30 seconds without any supervision. The plaque and gingival status were assessed using Silness and Loe and Loe and Silness at baseline and end of the phase. **Statistical Analysis Used:** The results were analysed using ANOVA (Analysis of Variance), Wilcoxon sign rank test and post hoc test with significant level at  $P$  value  $< 0.05$ . **Results:** Triphala and Chlorhexidine showed significant reduction in plaque and gingival scores as compared to Control group ( $P < 0.001$ ). No significant difference was found between the plaque and gingival scores obtained with triphala extract and chlorhexidine mouth rinse. **Conclusion:** Triphala extract mouth rinse was effective in reducing plaque accumulation and gingival inflammation with reported no side effects.

**Keywords:** Chlorhexidine, dental plaque, gingival inflammation, triphala

Sahana Umesh  
Baratakke,  
Rekha Raju,  
Sushi  
Kadanakuppe,  
Nagashree R  
Savanur,  
Radha Gubbihal,  
Pallavi Swamy  
Kousalaya

Department of Public Health  
Dentistry, V S Dental College  
and Hospital, Bengaluru,  
Karnataka, India

### Introduction

Mouthwash has been used for centuries for medicinal and cosmetic purposes, but in recent years, the rationale behind the use of chemical ingredients has been subjected to scientific research and clinical trials.<sup>[1]</sup> Ayurveda is considered as the "science of life." The ancient Indian system of health care focused on views of man and his illness.<sup>[2]</sup> Long before the advent of modern medicine, herbs were the mainstream remedies for nearly all ailments. Herbal medicines were in great demand in the developed as well as in developing countries for primary health care because of their wide biological and medicinal activities, higher safety margin, and lower costs.<sup>[3]</sup>

The World Health Organization estimates that about 80% of the populations living in the developing countries rely almost exclusively on traditional medicine for their primary health-care needs. Conventional drugs usually provide effective antibiotic therapy for bacterial infections, but there is an increasing

problem of antibiotic resistance and a continuing need for new solutions. Hence, nowadays, herbal drugs are preferred to synthetic antibiotics.<sup>[4]</sup>

Natural herbs such as triphala, tulsi patra, jyestiamadh, neem, clove oil, pudina, ajwain, and many more used either as whole single herb or in combination have been scientifically proven to be safe and effective medicine against various oral health problems such as bleeding gums, halitosis, mouth ulcers, and preventing tooth decay.<sup>[5]</sup>

Triphala' is a well-known powdered preparation in the Indian System of Medicine, being used in Ayurveda since ancient time. Triphala consists of equal parts of the *Emblica officinalis* (Amalaki), *Terminalia chebula* (Haritaki), and *Terminalia bellerica* (Bibhitaki).<sup>[6]</sup>

*T. chebula* is valuable in the prevention and treatment of several diseases of the mouth such as dental caries, spongy and bleeding gums, gingivitis, and stomatitis. The extract could successfully prevent

### Address for correspondence:

Dr. Sahana Umesh Baratakke,  
Department of Public Health  
Dentistry, V S Dental College  
and Hospital, Bengaluru,  
Karnataka, India.  
E-mail: sahanabaratakke@  
gmail.com

### Access this article online

Website: [www.ijdr.in](http://www.ijdr.in)

DOI: 10.4103/0970-9290.203622

### Quick Response Code:



**How to cite this article:** Baratakke SU, Raju R, Kadanakuppe S, Savanur NR, Gubbihal R, Kousalaya PS. Efficacy of triphala extract and chlorhexidine mouth rinse against plaque accumulation and gingival inflammation among female undergraduates: A randomized controlled trial. Indian J Dent Res 2017;28:49-54.

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plaque formation on the surface of the tooth, as it inhibited the sucrose-induced adherence and the glucan-induced aggregation, the two processes which foster the colonization of the organism on the surface of the tooth. Thus, the extract of *T. chebula* may be an effective agent in the treatment of carious teeth, owing to its ability to inhibit the growth and accumulation of *Streptococcus mutans* on the surface of the tooth. This would prevent the accumulation of acids on the surface of the tooth and thus the further demineralization and the breakdown of the tooth enamel.<sup>[7]</sup>

Antimicrobial and antioxidant effect of triphala has been proven *in vitro* as it has been shown to inhibit *S. mutans* at concentrations as low as 50 µg/ml. This antiplaque effect probably may be due to the tannic acid in triphala, which is adsorbed well to the groups on the surface of the bacterial cells, which result in protein denaturation and ultimately to bacterial cell death.<sup>[8]</sup>

Triphala presented an antiplaque efficacy similar to that of chlorhexidine (CHX) and was more effective in inhibiting plaque formation with lesser or no side effects.<sup>[9]</sup>

CHX is a dicationic bisbiguanide which is effective against an array of microorganisms including Gram-positive and Gram-negative bacteria, fungi, yeast, and viruses. It is regarded as the “gold standard” antiplaque treatment and is particularly effective against gingivitis. It is generally used at a concentration of 0.2% (0.12%).<sup>[10]</sup> However, most practitioners do not recommend the long-term and daily use of CHX as mouthwash. This is mainly because of its side effects such as objectionable taste, tooth discoloration, desquamation, and soreness of oral mucosa.<sup>[11]</sup>

To overcome the disadvantages of CHX, other agents may have to be used as mouthwash. Triphala extract mouthwash may be an alternative in such a scenario with no reported adverse effects.

Hence, this study was undertaken to evaluate the effect of 0.6% triphala extract mouth rinse and to compare the effect with 0.12% CHX mouth rinse against plaque accumulation and gingival inflammation among 18–24 years study participants.

## Materials and Methods

A double-blinded parallel arm randomized controlled trial was conducted to assess the effect of 0.6% triphala and 0.12% CHX on oral health and to compare the effect of triphala with CHX and control group regarding plaque accumulation and gingival inflammation.

Ethical clearance was obtained from the Institutional Review Board, and Informed consent was obtained from the study participants.

Data were collected from 18 to 24 years age female undergraduates residing at V. S Dental College Ladies Hostel, Bengaluru, based on inclusion and exclusion criteria.

## Inclusion criteria

- Participants with the age group of 18–24 years female undergraduates with minimum of 20 teeth
- Participants with gingival and plaque index (PI) score of  $\geq 1$  in 10% of the sites
- Participants who are willing to comply with the appointment schedule.

## Exclusion criteria

- Participants with any systemic conditions
- Participants with any allergy or infectious diseases
- Participants receiving antibiotic therapy or any medication within the past 6 months
- Participants already using any mouth rinse
- Participants wearing an orthodontic appliance or removable partial denture.

All the female undergraduate students of the womens hostel were screened. The selected sixty participants were randomly allotted to three groups of twenty participants in each group using lottery method. Group 1 - Triphala, Group 2 - CHX, and Group 3 - Control group.

## Sample size determination

Simple random sampling method was followed. Based on the secondary data,<sup>[12]</sup> the sample size was estimated to be 60.

Sample size calculation using the formula:

$$n = \frac{(Z_D + Z_\beta)^2 2S^2}{\Delta^2}$$

$$n = \frac{(1.96 + 0.84)^2 \times 2 \times 1}{(0.9)^2}$$

$$n = \frac{7.84 \times 2}{0.81}$$

$$n = \frac{15.68}{0.81}$$

$$n = 19.35$$

$\Delta$  Confidence interval - 95% (0.95),

Power = 80% (0.80),  $Z_D = Z_{0.95} = 1.96$ ,  $Z_\beta = Z_{0.80} = 0.84$ ,  $\Delta^2 = 0.9$  (expected difference).

The estimated sample size was 19 and this was rounded off to 20 for each group, and total sample size was 60.

## Preparation of the mouth rinse

Commercially available triphala powder was taken. An alcoholic extract of triphala was obtained using cold maceration technique with 97% ethanol as the solvent. Ten percent triphala mouth rinse was prepared by adding 100 g of the extract to 1 L of sterile distilled water. Commercially available 0.2% CHX solution (Hexidine

ICPA Health products; Mumbai, Maharashtra, India) was diluted to a 1:1 concentration. Sterile distilled water with coloring agent was used as the control. All the mouth rinses were freshly prepared every week at Visveswarapura Institute of Pharmaceutical Sciences College, Bengaluru. Solutions were made of identical color and taste to eliminate bias. The contents of the solutions were known to the person who prepared the solution and were disclosed to the investigator at the end of the study.

### Method of data collection

The study was conducted during the period of June 2015 for a period of 21 days.

Demographic information and oral examination were done to record the gingival index (GI)<sup>[13]</sup> and PI,<sup>[14]</sup> according to Loe and Silness and Silness and Loe criteria to assess the plaque accumulation and gingival inflammation at baseline.

The mouth rinse was given to the participants, and instructions were given about the procedure to use 10 ml twice daily for 30 s for 21 days and refrain from eating or drinking for 30 min after using the mouth rinse. Mouth rinsing was performed daily without any direct supervision.

During the entire study period, the participants continued to exercise their routine self-performed oral hygiene measures. No instructions were given to any of the participants regarding the oral hygiene practices, so as to prevent any associated bias in any of the groups. Participants were reexamined after 21 days, and oral examination was done to record the gingival and plaque scores by the same examiner [Figure 1].

Data collected during the study were entered into excel sheets and were subjected to data analysis. Statistical analysis

was done by Statistical Package for Social Sciences (SPSS) version 16(Chicago, USA SPSS Inc.) for descriptive data analysis. Descriptive statistics was done for demographic data. The Analysis of Variance (ANOVA) test was used to find the significant differences between the means of the study groups with  $P < 0.05$  and Wilcoxon signed-rank test was used for the comparison of baseline and postrinsing within each group.

## RESULTS

All the study participants ( $n = 60$ ) who completed the study were females with a mean age of 20.23 years. Mean PI score according to Silness and Loe index for each group was recorded at the baseline. The mean score for triphala group was 1.231 (standard deviation [SD]: 0.21), CHX 1.2215 (SD: 0.188), and control 1.229 (SD: 0.19). There was no statistically significant difference [Table 1].

Mean gingival score according to Loe and Silness index for each group was recorded at the baseline. The mean score for triphala group was 1.248 (SD: 0.27), CHX 1.236 (SD: 0.29), and control 1.2365 (SD: 0.185). There was no statistically significant difference [Table 2].

The mean plaque score for each group was recorded after 21 days. There was statistically significant difference among scores of the three groups ( $P < 0.001$ ). Mean gingival score for each group was recorded after 21 days. There was statistically significant difference among scores of the three groups ( $P < 0.001$ ) [Tables 3 and 4].

Plaque and gingival scores of triphala and CHX group at baseline and after 21 days using Wilcoxon signed-rank test showed statistically significant reduction in within triphala and CHX groups. Plaque and gingival scores of the control group at baseline and after 21 days using Wilcoxon-signed rank test showed no significant reduction.

**Table 1: Distribution of study participants based on plaque scores at baseline**

Groups	n	Mean	SD	Plaque scores		H	P
				95% CI			
				Lower bound	Upper bound		
Triphala Group 1	20	1.2310	0.21258	1.1315	1.3305	0.05 <sup>a</sup>	0.97 (NS)
Chlorhexidine Group 2	20	1.2215	0.18891	1.1331	1.3099		
Control Group 3	20	1.2290	0.19172	1.1393	1.3187		

<sup>a</sup>Kruswallis ANOVA was used for all three groups. There was no statistically significant difference at baseline. CI=Confidence interval, SD=Standard deviation, NS=Non significance, ANOVA=Analysis of variance

**Table 2: Distribution of study participants based on gingival scores at baseline**

Groups	n	Mean	SD	Gingival scores		H	P
				95% CI			
				Lower bound	Upper bound		
Triphala Group 1	20	1.2480	0.27372	1.1199	1.3761	0.05 <sup>a</sup>	0.81 (NS)
Chlorhexidine Group 2	20	1.2395	0.29841	1.0998	1.3792		
Control Group 3	20	1.2365	0.18511	1.1499	1.3231		

<sup>a</sup>Kruskal-wallis ANOVA was used for all three groups. There was no statistically significant difference at baseline. CI=Confidence interval, SD=Standard deviation, NS=Non significance, ANOVA=Analysis of variance

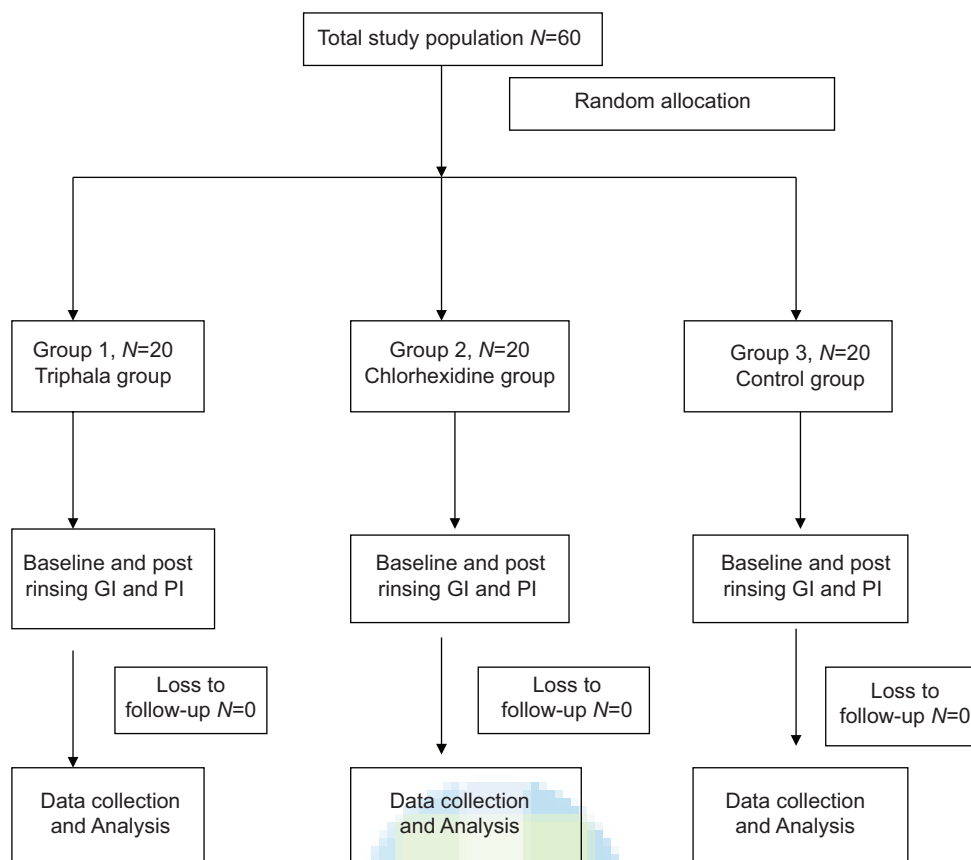


Figure 1: Flow chart showing procedure

Table 3: Distribution of study participants based on plaque scores after 21 days (postrinsing) and comparison between groups

Groups	Plaque scores						Post hoc test <sup>§</sup>	
	n	Mean	SD	95% CI for mean		H		P
				Lower bound	Upper bound			
Triphala Group 1	20	0.9070	0.24405	0.7928	1.0212	21.45	<0.001 (S)	1 versus 2 (NS)
Chlorhexidine Group 2	20	0.9265	0.26751	0.8013	1.0517			2 versus 3 - <0.001* (S)
Control Group 3	20	1.2725	0.24553	1.1576	1.3874			1 versus 3 - <0.001* (S)

<sup>§</sup>Post hoc test, \*significance= $P < 0.05$ , nonsignificance= $P > 0.05$ . CI=Confidence interval, SD=Standard deviation

The percentage mean reduction for plaque scores and gingival scores from baseline to post rinsing is higher compared to CHX and Control group [Tables 5 and 6].

There was statistically significant reduction observed from baseline to post rinsing for plaque scores and gingival scores among triphala and CHX groups. No significant result was observed from baseline to post rinsing for plaque and gingival scores among control group [Tables 7 and 8].

## DISCUSSION

A randomized controlled trial was done to evaluate the effect of 0.6% triphala extract and compare with 0.12% CHX

mouth rinse on dental plaque accumulation and gingival inflammation. Study participants were randomly allocated into three groups. Clinical examination was done to record plaque and gingival scores at baseline and postrinsing. This is in accordance with the study conducted by Bajaj *et al.*<sup>[15]</sup>

The purpose of recording was to observe any soft tissue changes such as increase or decrease in inflammation occurring due to the use of agent. Plaque and gingival scores were recorded for all participants on day 0 and 21 by trained examiner. The effect of triphala extract mouth rinse was intended to be studied in a real life situation and hence no oral prophylaxis was performed. This is in accordance with the study conducted by Chainani *et al.*<sup>[12]</sup>



**Table 4: Distribution of study participants based on gingival scores after 21 days (postrinsing) and comparison between groups**

Groups	Gingival scores					H	P	Post hoc test <sup>§</sup>
	n	Mean	SD	95% CI for Mean				
				Lower bound	Upper bound			
Triphala Group 1	20	0.9065	0.32640	0.7537	1.0593	15.78	<0.001 (S)	1 versus 2 (NS)
Chlorhexidine Group 2	20	0.9490	0.37815	0.7720	1.1260			2 versus 3 - 0.006* (S)
Control Group 3	20	1.2705	0.16494	1.1933	1.3477			1 versus 3 - <0.001* (S)

<sup>§</sup>Post hoc test, \*significance= $P < 0.05$ , nonsignificance= $P > 0.05$ . CI=Confidence interval, SD=Standard deviation

**Table 5: Distribution of study participants based on percentage mean reduction for plaque scores from baseline to postrinsing**

Groups	n	Mean difference	Percentage
Triphala Group 1	20	0.324	26
Chlorhexidine Group 2	20	0.295	24
Control Group 3	20	-0.0435	-3.5

**Table 6: Distribution of study participants based on percentage mean reduction for gingival scores from baseline to postrinsing**

Groups	n	Mean difference	Percentage
Triphala Group 1	20	0.3415	27.36
Chlorhexidine Group 2	20	0.2905	23.43
Control Group 3	20	-0.034	-3.4

**Table 7: Comparison of baseline and postrinsing within each group for plaque scores**

Groups	Plaque index	n	Mean	SD	Z	P
Triphala Group 1	Baseline	20	1.2310	0.21258	3.45 <sup>§</sup>	0.001 (S)
	Postrinsing		0.9070	0.24405		
Chlorhexidine Group 2	Baseline	20	1.2215	0.18891	3.65 <sup>§</sup>	<0.001 (S)
	Postrinsing		0.9265	0.26751		
Control Group 3	Baseline	20	1.2290	0.19172	1.42 <sup>§</sup>	0.16 (NS)
	Postrinsing		1.2725	0.24553		

<sup>§</sup>Wilcoxon-signed rank test, significance= $P < 0.05$ , nonsignificance= $P > 0.05$ . SD=Standard deviation

**Table 8: Comparison of baseline and postrinsing within each group for gingival scores**

Groups	Gingival scores	n	Mean	SD	Z	P
Triphala Group 1	Baseline	20	1.2480	0.27372	3.28 <sup>§</sup>	0.001 (S)
	Postrinsing		0.9065	0.32640		
Chlorhexidine Group 2	Baseline	20	1.2395	0.29841	2.68 <sup>§</sup>	0.009 (S)
	Postrinsing		0.9490	0.37815		
Control Group 3	Baseline	20	1.2365	0.18511	0.79 <sup>§</sup>	0.42 (NS)
	Postrinsing		1.2705	0.16494		

<sup>§</sup>Wilcoxon-signed rank test, significance= $P < 0.05$ , nonsignificance= $P > 0.05$ . SD=Standard deviation

Several authors have used triphala as a mouth rinse in healthy gingivitis and periodontitis patients.<sup>[8,11]</sup> Triphala presented an antiplaque efficacy similar to that of CHX and was more effective in inhibiting plaque formation with lesser or no side effects.<sup>[9]</sup>

Sushruta Samhita has emphasized that triphala has hemostatic, anti-inflammatory, analgesic, and wound-healing properties. Haritaki is the most efficacious for bleeding gums and gingival ulcers as well as carious teeth. On the other hand, Amalaki contains a large amount of Vitamin C, which is the most effective in preventing bleeding from gums.<sup>[16]</sup>

Jagadish *et al.*<sup>[8]</sup> conducted a study to determine the effect of triphala on dental biofilms and concluded that triphala had potent antioxidant and antimicrobial activity and inhibited the growth of *S. mutans* and Gram-positive cocci involved in plaque formation when it was adsorbed on the tooth surface.

Bhattacharjee *et al.*<sup>[17]</sup> conducted a study to evaluate the efficacy of triphala mouth rinse (aqueous) in the reduction of plaque and gingivitis among children and concluded both CHX and triphala groups showed significantly lower mean gingival and PI scores at follow-up than baseline ( $P < 0.001$ ), and no significant difference in the percentage change in the mean GI between the two groups ( $P = 0.826$ ). The percentage change in the mean PI was significantly higher in the CHX group compared to the triphala group ( $P = 0.048$ ).

Tandon *et al.*<sup>[18]</sup> suggested the use of triphala mouthwash for preventing the development of incipient lesions and reported that triphala mouthwash is cheaper than the commercially available CHX mouthwash. Being an ayurvedic product, it has no side effects and hence is safer for long-term use.

Effectiveness of CHX can be attributed to its bactericidal and bacteriostatic effects and its substantivity within the oral cavity (8 h after rinsing) CHX has often been used as a positive control. Hence, 0.12% concentration was used in this study as there were fewer side effects compared to 0.2%. In CHX group, mean plaque and gingival scores are  $1.22 \pm 0.18$  and  $1.23 \pm 0.298$  at baseline and  $0.92 \pm 0.26$  and  $0.94 \pm 0.37$  at postrinsing. There was a significant reduction

in the scores with  $P < 0.009$  at baseline and postrinsing. This is in accordance with the study conducted by Moran *et al.*<sup>[19]</sup> and Quiren *et al.*,<sup>[20]</sup> in which CHX was found to be effective in reducing plaque and gingival scores.

In the triphala group, patients did not complain about any side effects and had no adverse effects and was readily available at affordable prices in this geographical location for future use. CHX has been considered the best antiplaque and antigingivitis agent, but now, it is time to acknowledge the value of natural herbs such as triphala, known to have many useful properties and no side effects.

### Limitations

The present study was conducted among dental students (girls) of relatively younger age group. However, their selection was based on the relevant inclusion and exclusion criteria to keep bias at the minimum.

### Recommendations

The study should include both the genders.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

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