

“Effectiveness of Natural Lozenges on Plaque Formation, Gingival Health and Levels of Salivary Streptococcus Mutans”

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Abstract:

Background: Plaque formation, gingival health, salivary microorganisms (mainly *Streptococcus mutans*) plays a critical role in the maintenance of oral health. The frequent use and misuse of the current chemical therapeutic agents has led to adverse effects. This paper will discuss the potential use of curcumin as an anti-plaque, anti-inflammatory and antimicrobial agent in the maintenance of oral health.

Aim: To clinically evaluate the effectiveness of Curcumin lozenges on plaque formation, gingival health and levels of salivary *Streptococcus mutans*.

Methods and Material: School children of age group 9-12 years were selected for the study after satisfying the inclusion and exclusion criteria. They were allocated in the following 2 sub groups after determining baseline plaque index, gingival index and salivary streptococcus mutans level:

Group 1 (curcumin lozenge group): children advised to follow routine oral hygiene measures and consume one curcumin lozenge for a period of 7 days and Group 2 (control group). Plaque index, Gingival index, Salivary streptococcus mutans level were assessed at periodic intervals that is at 1 hr, 24 hr and on 7th day.

Statistical analysis: Mann Whitney & Wilcoxon signed rank test.

Results: Study and Control groups showed reduction in plaque index and gingival index but highly significant reduction was seen in study group. Study group showed drastic reduction of microbial colonies from 24 hrs to 7th day.

Conclusion: Curcumin lozenge decreases plaque formation, gingival inflammation and salivary *Streptococcus mutans* level. Thus it can be used as an effective chemical therapeutic aid in the management of dental caries and to improve overall oral health. Creating awareness on this easily available herbal medicine will help to minimize and treat oral health problems.

Keywords: Curcumin lozenge, plaque, gingival health, salivary *Streptococcus mutans*.

I. Introduction

Oral health is of prime importance to all individuals irrespective of age. Plaque formation, gingival health, salivary microorganisms (mainly *Streptococcus mutans*) plays a critical role in the maintenance of oral health.¹

Recently, a number of chemical agents have been advocated for the maintenance of oral health which are either available in the form of toothpastes/dentifrices or as a mouthwash. The frequent use of the current chemical therapeutic agents like chlorhexidine has led to adverse effects such as tooth/tongue staining, mouth/throat irritation, dry mouth, unpleasant/changed taste sensation.¹ Hence there is a need for alternative such as products from natural phytochemicals that is enmeshed within traditional Indian system which is safe and economical.

Medicinal plants have been used as traditional treatment agents since ancient times.² Turmeric, more commonly known as “HALDI” in “AYURVEDA” (Ayu-life and Veda-science) system of Indian medicine has been used successfully for treating various systemic ailments. This auspicious element is available in various forms and is widely used as a household spice for various cuisines of the country.

Curcumin is a polyphenol derived from *Curcuma longa* plant/ turmeric. Curcumin has been used extensively in ayurvedic medicine for centuries, as it is nontoxic and possesses anti-inflammatory, anti-oxidant, and anti-microbial properties along with its hepatoprotective, immunostimulant, antiseptic, antimutagenic, and anticarcinogenic activity.³ It is for this concern that potential use of turmeric in dentistry is being explored.

Curcumin lozenge (turmpure-lupin) is an available preparation used as remedies for sore throat and cough, which contains the purest form of Turmeric extract that contains the main constituent Curcumin.

There have been very few studies on knowing the possible impact of curcumin on oral health. However, there are no reported studies on curcumin lozenges in dental practice.

Considering all above claims and facts, this study was carried out with the aim to clinically evaluate the effectiveness of Curcumin lozenges on plaque formation, gingival health and levels of salivary Streptococcus mutans in 9-12 years old school children.

II. Materials And Methods

Study population

Ethical clearance was obtained prior to the start of study from the ethical committee of Yenepoya University and informed consent was obtained from the parents.

School Children aged 9-12 years of rural areas in Mangalore were allocated in the study. An initial screening was done for all the children aged between 9-12 years and DMFT was recorded.

58 Children met with the following Inclusion criterias: DMFT \geq 4 Practiced routine tooth brushing once daily, No history of antibiotic usage and Preventive dental treatment.

Using lottery method 20 children were randomly selected and allocated in the following 2 sub groups: Group 1 (curcumin lozenge group), children advised to follow routine oral hygiene measures and consume one curcumin lozenge for 5 minutes daily, 30 minutes after brushing in the morning, for a period of 7 days and Group 2 (control group) who were instructed to follow routine oral hygiene measures only, that is to brush with tooth brush and paste twice daily.

Study Design and Clinical Measurements

Assessment of Plaque Accumulation and Gingival Health

The subjects were assessed for baseline data of plaque accumulation and gingival inflammation by recording Plaque index given by Sillness and Loe and Gingival index given by Loe and on 7th day, Subjects were assessed again for plaque accumulation and gingivitis.

Saliva Collection And Microbial Evaluation

The Stimulated saliva samples from respective groups were collected after chewing a piece of paraffin wax between 8 to 9 am.

Microbial levels were assessed at periodical interval of 0, 1 hour, 24 hours and final value on the 7th day, during which children belonging to group 1 were asked to consume one curcumin lozenge for 5 minutes daily, 30 minutes after brushing in the morning, for a period of 7 days.

The baseline salivary S. mutans level were recorded using simple, rapid, chair side method-GC Saliva Check Mutans and further confirmation was done by chair side CRT bacteria test and inoculating samples on the Mitis salivarius bacitracin agar media ,which was incubated at 37°C for 48 hrs and 24 hrs respectively.

Curcumin lozenges were evaluated for side effects by assessing subjective and objective criteria after 7th day. Subjective criteria included: (1) Taste disturbance; (2) burning sensation; (3) dryness/soreness; (4) pruritis/itchiness; marked as 0 - absent; 1 - present. Objective criteria included (1) ulcer; (2) staining of teeth; (3) staining of tongue; (4) allergy; marked as 0 - absent; 1 - present.¹

Statistical analysis

Changes from baseline to different time intervals in various clinical parameters (inter group comparison) of both plaque and gingival indices were analysed using paired Mann Whitney test. Intra group comparison was analysed using Wilcoxon signed rank test. P<0.05 were considered as statistically significant.

III. Results

At baseline, there was no statistically significant difference between the two groups with regards to plaque index and gingival index.

Plaque Index

The Plaque index (PI) was reduced during the study in both groups,

Curcumin lozenge group (Group 1-case)

The mean PI was 1.753 at day 0 and .636 on 7th day. [Table 1].

The difference of mean plaque index between 0 and 7th day was P=0.005(statistically highly significant).

Control group (group 2)

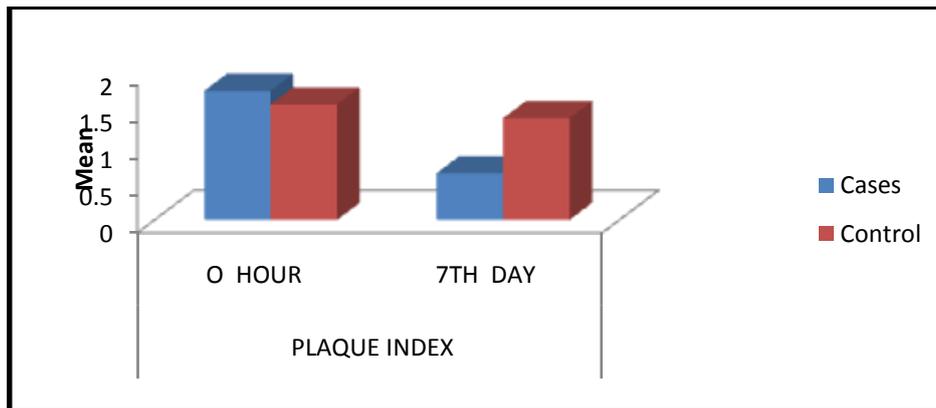
The mean PI was 1.568 at day 0 and 1.380 on 7th day. [Table 1].

The difference of mean plaque index between 0 and 7th day was statistically significant P<0.001. (Figure 1)

Parameter: PLAQUE INDEX

Group	N	Mean	Std. Deviation	Median(IQR)	Wilcoxon signed rank test	
					Z value	p value
Cases O HOUR	10	1.753	.268	1.715(1.575-2)	2.81	.005
7TH DAY	10	.636	.431	0.665(0.247-1.02)		
Control O HOUR	10	1.568	.387	1.66(1.09-1.87)	2.53	.012
7TH DAY	10	1.380	.416	1.5(1-1.65)		

Table 1



Percentage reduction of plaque index **Figure 1**

Gingival Index

Gingival index was reduced during the study in both groups, but statistically significant difference was found in the study group.

Curcumin lozenge group (Group 1-case)

Mean GI was 1.430 at day 0, 0.431 at day 7 [Table 2].

The difference of mean gingival index between 0 and 7th day was statistically highly significant, P=.005.

Control group (group 2)

The mean GI value was 1.379 at day 0, 1.332 at day 7 [Table 2].

The difference of mean plaque index between 0 and 7th day was statistically not significant, P>0.001. (Figure 2)

Parameter: GINGIVAL INDEX

Group	N	Mean	Std. Deviation	Median(IQR)	Wilcoxon signed rank test	
					Z value	p value
Cases O HOUR	10	1.430	.298	1.5(1.22-1.6)	2.81	.005
7TH DAY	10	.431	.297	0.33(0.28-0.582)		
Control O HOUR	10	1.379	.378	1.315(1-1.62)	.55	.581
7TH DAY	10	1.332	.351	1.33(1-1.54)		

Table 2

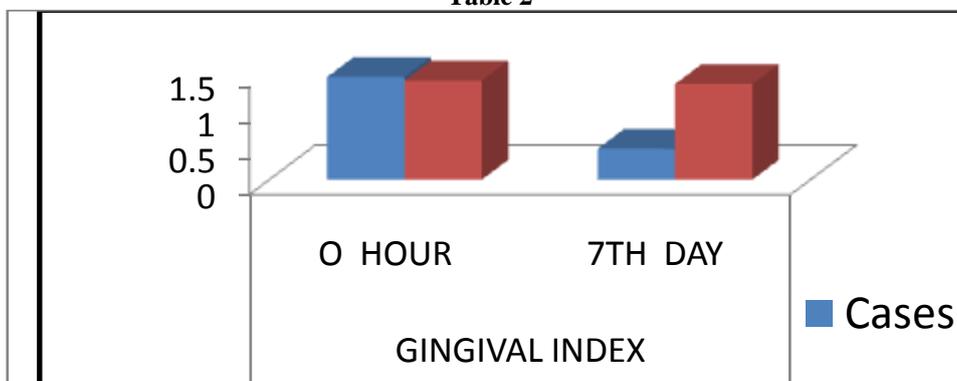


Figure 2

Gingival index (GI) over the period; comparison between the groups

Microbial evaluation

Gc Saliva-Check Test: Saliva-check mutans uses a very specific immunochromatography process and accurate results were available in just 15 minutes. At baseline, in both the groups, Test window showed positive results- a red line is shown on the Test (T) line; meaning the subjects had a level of *S. mutans* equal to or above 500 000 colony forming units per ml (cfu/ml) saliva. Whereas on the 7th day, in the study group T window showed negative result - thin red line disappeared, meaning there were less than 500,000 cfu/ml of *S. mutans*. (Figure 3)



Figure 3 Gc Saliva-Check Test

CRT Bacteria Test

In the study group, *S. mutans* occurred as small, rough blue colonies with a diameter of < 1 mm on the blue agar, suggestive of >10⁵ colonies at baseline. Whereas on 7th day, the agar surface were smooth suggestive of <10⁵ colonies. (Figure 4)



Figure 4 CRT Bacteria Test

Mitis Salivarius Bacitracin Agar Media

Both study and control groups showed significant reduction of streptococcus mutans count from day 0 to 7th day, study group showed drastic reduction of microbial colonies from 24 hrs to 7th day with <10⁵ colonies. (Figure 5) (P<0.05) statistically highly significant.

Table 3 and figure 6 presents the results at days 0, 1 hour, 24 hrs and 7th day.

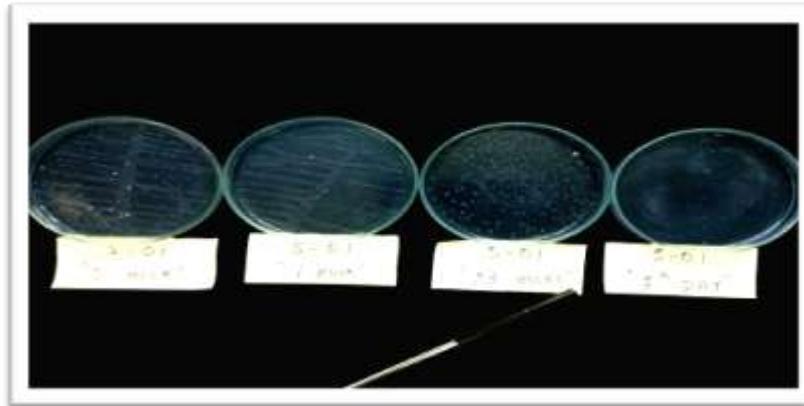


Figure 5 Mitis Salivarius Bacitracin agar media

Group	N	Mean	Std. Deviation	Median(QR)	Mannwhitney test	
					Z value	p value
0 HOUR Cases	10	205200	276989	120000(96500-150000)	1.16	.103
Control	10	93900	10546	99000(88750-102000)		
1 HOUR Cases	10	154500	199096	93000(82500-106250)	.87	.382
Control	10	91220	10313	92000(86750-101500)		
24 HOUR Cases	10	88720	105019	72500(39500-78000)	2.54	.011
Control	10	87000	12220	86500(83500-99250)		
7TH DAY Cases	10	12400	8168	9500(6000-16250)	3.78	p<0.001
Control	10	75500	14191	72000(68000-87500)		

Table 3 presents the results at days 0, 1 hour, 24 hrs and 7th day.

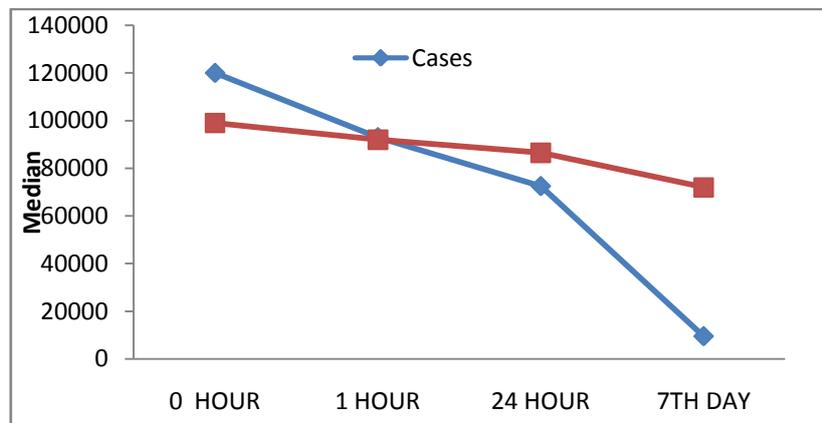


Figure 6 Percentage reductions of microbial colonies at different time intervals for both study and control groups

IV. Discussion

The use of plant products to improve dental health and to promote oral hygiene is in existence since ancient times. Undoubtedly, the natural products are the source for most of the pharmaceuticals. The best-researched active constituent is curcumin, which comprises of 0.3-5.4% of raw turmeric.

This yellow pigmented polyphenol is considered safe and nontoxic even up to 8,000 mg /day. Curcumin known as a prebiotic, is an effective alternative for many conventional drugs due to its distinguished therapeutic properties and multiple effects on various systems of the body and has diversified effects in various oral diseases.²

Oral hygiene measures using chemomechanical procedures helps in the maintenance of oral health by decreasing the plaque accumulation, gingival inflammation and microbial levels. There is no scientific literature on the use of curcumin lozenges for improving oral health to our knowledge. This study aimed at checking the effectiveness of curcumin lozenge as chemical therapeutic aid in reducing the plaque formation, gingival inflammation and levels of salivary *Streptococcus mutans*.

In the present study, Plaque index by Silness and Loe and Modified gingival index were used for clinical assessment as they are the most widely used indices in trials for therapeutic agents.

Study group showed definitive reduction ($p < 0.05$) in Plaque index, Gingival index and in the levels of S.Mutans, compared with the baseline, and 7th day after consuming curcumin lozenge. These effects of curcumin observed was due to its anti-plaque effect, anti-inflammatory action and antibacterial action.¹

The mechanism by which curcumin causes reduction in S.Mutans is by inhibiting the sucrose dependent adherence of these bacteria on enamel.⁵

Our results related to curcumin causing plaque reduction are in accordance with a study carried out by Bhandari et al, where an experimental mouthwash i.e., combination of four ayurvedic drugs (Beriberi Aristata, curcuma longa, Curcuma Amda, and Glycerrhiza) was prescribed along with routine oral hygiene measures. Reduction in mean plaque index was observed from 0 to 21st day.⁶

Considering the anti-inflammatory effect of curcumin lozenge, our results for the gingival Index are consistent with the results of the study carried out by Nilofer Farjana, where clinical efficacy of oral curcuma gel in gingivitis was evaluated, and concluded that, gel containing curcuma longa extract was efficient in treating gingivitis by reducing its inflammatory components.⁷

The findings of this study are consistent with studies conducted by Waghmare et al⁴ and Amitha et al¹, where in 100 subjects were randomly selected. Both gingival index and plaque index were recorded at 0, 14, and 21 days and it was found that turmeric mouthwash is equally effective to chlorhexidine gluconate solution in the prevention of plaque and gingivitis.

Mulikar S et al studied the efficacy of curcumin mouth wash as an adjunct to scaling and root planning in the treatment of chronic gingivitis and compared with chlorhexidine in terms of its anti-inflammatory and anti-microbial properties. They concluded that curcumin is equally effective to chlorhexidine as an anti-inflammatory mouth wash and can be used as an effective adjunct to mechanical periodontal therapy.⁸

Microbiological evaluation of salivary S.mutans level proved the antimicrobial properties of curcumin lozenge, which was in accordance with the study conducted by Najah et al, Where inhibitory effect of curcumin on Strept. mutans and Strept.pyogenes growth was evaluated and compared with the antibiotic Ciprofloxacin using well diffusion method. It was concluded that the curcumin can be useful for controlling dental biofilms, subsequently dental caries formation due to its antimicrobial activity on Strept. mutans and Strept. pyogenes growth.⁵

This study used chair side Gc Saliva-Check Mutans And Crt Bacteria tests which are simple and reliable methods in S.mutans evaluation⁹ and it was further confirmed by inoculating samples on Mitis salivarius bacitracin agar media.

In this study, control group also showed reduction in the mean plaque, gingival index and salivary S.Mutans score. This little reduction in the control group may be attributed to the mechanical dislodging of loose supragingival plaque, which occurred due to the oral hygiene instructions given to the children i.e., brushing twice daily with tooth brush and tooth paste.

Lozenge has other benefits such as, it increases saliva and its substantivity in the oral cavity. Moreover the only constituent in this lozenge is curcumin which is a polyphenol derivative and bioactive component of turmeric. It was observed from subjective and objective criteria that, lozenges were palatable and well accepted by children with no undesirable effects during the course of study, except for staining of tongue which was observed in 3 subjects using curcumin, however it was transient and insignificant.

V. Conclusion

Based on the observations of this study, curcumin lozenge decrease plaque formation, gingival inflammation and salivary Streptococcus mutans level. Thus it can be used as an effective chemical therapeutic aid to improve overall oral health. Creating awareness on this easily available herbal medicine will help to minimize and treat oral health problems. However, there is scarcity of information and research in this field. Therefore, long term research is required to determine the optimal dosage, bioavailability, and bio-efficacy of curcumin-based drugs.

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