

## Effects of Fluoridated Toothpaste and Mouth rinse on Salivary pH in Children- An *In Vivo* Study

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### Abstract

#### Background, aims and objective

The protective function of saliva against dental caries achieved through its physico-chemical properties. The purpose of this comparative study was to estimate and to compare the pH of saliva before and after brushing and mouthrinsing with fluoridated toothpaste and Mouthwash.

#### Materials and method

40 study subjects were divided into two groups with 20 children each. Group A (combination of toothpaste and mouthrinse) and Group B (Toothpaste). Both the groups were told to perform oral hygiene practice and salivary pH estimation was done before and after brushing and mouthrinsing on day 1, 1<sup>st</sup> week, 2<sup>nd</sup> week, 3<sup>rd</sup> week and 4<sup>th</sup> week. The salivary pH was directly estimated using the digital pH meter calibrated using buffers of pH 4, 7 and 9. Intra group comparison was done by paired t test where as repeated measure ANOVA and Turkey's test were used in intergroup comparison.

#### Results

Intra group comparison showed increase in mean salivary pH in both the groups and found to be statistically significant. In intergroup comparison showed increase in the mean difference in salivary pH in group A than Group-B and found to be statistically not significant.

#### Conclusion

The pH of saliva increases more after brushing and rinsing with fluoridated toothpaste and mouthrinse rather than toothpaste alone.

**Keywords:** Dentifrice; Mouthrinse; pH; Saliva; Tooth brushing

### Introduction

Dental caries is the most prevalent dental disease affecting human race although the prevalence of dental caries has significantly reduced but it is still a major problem (Beck et al., 1988) [1]. Saliva is a complex fluid consisting of 99% of the water and remaining 1% of organic and inorganic molecules. It plays a major role in the demineralization and remineralization processes of the teeth. The diverse functions of the oral tissues such as the mastication, deglutition, taste sensation, speech and initial digestion of the carbohydrates would be impossible without the salivary secretions [2].

When the pH in the oral cavity decreases, the thermodynamic conditions become unfavorable, there is a driving force for hydroxyapatite dissolution or demineralization. When normal oral pH returns, the thermodynamic conditions become favorable and there is a driving force for hydroxyapatite precipitation or remineralization. The pH at which any particular saliva ceases to be saturated is referred to as 'critical pH' and below this value; the inorganic material of teeth may dissolve in it [2-4].

Dentifrices are considered agents with antibacterial potential which could have a beneficial effect on plaque control and disease prevention [2,5]. The attributes of the dentifrices which may affect their cosmetic or therapeutic effect are their physical form, chemical composition, their pH, their solubility. A mouth rinse is a chemotherapeutic agent used as an effective home care remedy to enhance oral hygiene and prevent dental caries by targeting the cariogenic bacteria. A variety of synthetic antimicrobial mouthwashes are available to prevent dental caries. It was

shown to inhibit plaque formation, also reduce gingival inflammation and prevent dental caries [6-9]. There is evidence indicating that the ingredients in the formula of triclosan-containing mouthwashes, including vehicle and other active substances, may influence its antimicrobial activity, and consequently its clinical efficiency [10].

Keeping the above mentioned points in view, a clinical trial was undertaken with the objectives to estimate the pH of saliva before and after brushing with commercially available Fluoridated Toothpaste and Mouthrinse.

### Materials and Methods

40 subjects based on modified Moller's [11] criteria satisfying the inclusion criteria were selected for the study from J.S.S Residential School from the age group of 6 years to 12 years. Children free from systemic disease and are in a moderate to high caries risk group were

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selected for the study and children suffering from any form of systemic illness, oral infections, hospitalizations and pharmacological treatment are excluded from the study.

Before carrying out the present study the ethical clearance was obtained from the institutional ethical clearance committee. The purpose and methodology of the study was explained to each of the subject and informed consent was obtained from the Head of the institution.

On the first day of study Toothpaste, Mouth washes were distributed to the respective groups and toothbrush to all the subjects. Demonstration of brushing technique [12] was given on Day1 of the study. Pocket-sized (HANNA) digital pH meter was used in the study. The salivary pH was directly estimated using the digital pH meter calibrated using buffers of pH 4, 7 and 9.

### Estimation of pH of fluoridated tooth paste

Measured 2 grams of dentifrice by using digital weighing machine and add it to the labeled beaker then added 80 ml of distilled water to this beaker and stirred the dentifrice/water mixture with a stirring rod until a suspension is formed. To measure the pH of dentifrice, pH sensitive electrode was dipped into the beaker, the digital reading was allowed to stabilize for a few seconds and the pH reading was recorded.

### Estimation of pH of fluoridated mouth rinse

Measured 5 ml of mouth rinse and to it added 5ml of tap water in a beaker and then stirred with a glass stirrer. To measure the pH of Mouth rinse, pH sensitive electrode was dipped into the beaker then the digital reading was allowed to stabilize for a few seconds and the pH reading was recorded.

### Collection of salivary samples

Salivary samples were collected on 1<sup>st</sup> day, at the end of 1<sup>st</sup> week, 2<sup>nd</sup> week, 3<sup>rd</sup> week and 4<sup>th</sup> week. The baseline unstimulated salivary samples were collected in sterile container from the subjects in the morning before brushing and pH was assessed using digital pH meter. Then the subjects were asked to brush and rinse with the given toothpaste and mouth rinse. The saliva was collected and salivary pH estimated again at 15, 30, 60 minutes with digital pH meter and salivary pH was estimated. The accuracy of pH meter was checked at regular intervals to ensure that readings were correct. Cleansing of sensing electrode is done with distilled water after every sample of pH estimation (Figures 1-3).

## Results

### Intragroup comparison of Group-A (combination of Toothpaste and Mouth rinse)

**Day 1:** The mean pH difference from Baseline to 15 minute, baseline to 30 minute and baseline to 60 minute are  $0.70 \pm 0.1$ ,  $0.85 \pm 1$  and  $0.86 \pm 2$

**1<sup>st</sup> week:** the mean pH difference from Baseline to 15 minute, baseline to 30 minute and baseline to 60 minute are  $0.16 \pm 0.09$ ,  $0.25 \pm .09$  and  $0.24 \pm 0.1$

**2<sup>nd</sup> week:** The mean pH difference from Baseline to 15 minute, baseline to 30 minute and baseline to 60 minute are  $0.19 \pm 0.09$ ,  $0.27 \pm 0.1$  and  $0.29 \pm 0.1$ .  $p < 0.001$ .

**3<sup>rd</sup> week:** The mean pH difference from Baseline to 15 minute, baseline to 30 minute and baseline to 60 minute are  $0.18 \pm 0.1$ ,  $0.22 \pm$



Figure 1: Collection of saliva after Oral hygiene practice.



Figure 2: salivary pH estimation

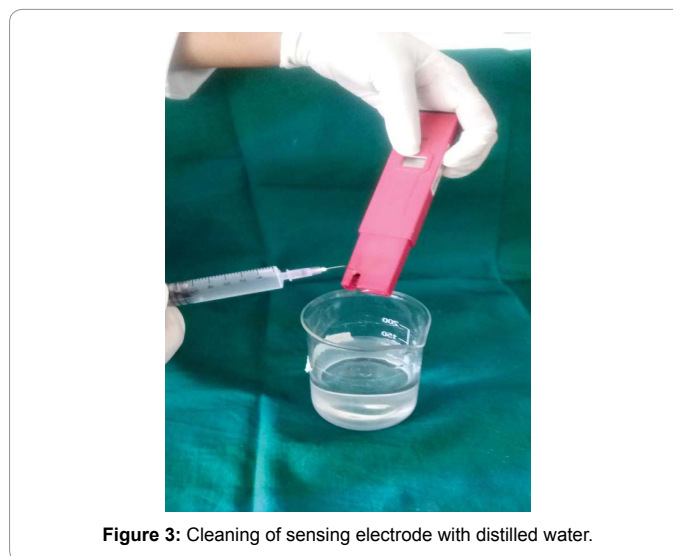


Figure 3: Cleaning of sensing electrode with distilled water.

$0.1$  and  $0.22 \pm 0.1$ .

**4<sup>th</sup> week:** The mean pH difference from Baseline to 15 minute, baseline to 30 minute and baseline to 60 minute are  $0.2 \pm 0.97$ ,  $0.23 \pm 0.1$  and  $0.26 \pm 0.1$ .

P <0.005 in Group-A which is statistically significant (Table 1, Graph 1).

### Intragroup comparison of Group-B (Toothpaste)

**Day 1:** the mean pH difference from Baseline to 15 minute, baseline to 30 minute and baseline to 60 minute are

$$0.68 \pm 0.1, 0.72 \pm 1 \text{ and } 0.79 \pm 2$$

**1<sup>st</sup> week:** The mean pH difference from Baseline to 15 minute, baseline to 30 minute and baseline to 60 minute are  $0.10 \pm 0.1$ ,  $0.21 \pm 1$  and  $0.29 \pm 1$ .

**2<sup>nd</sup> week:** The mean pH difference from Baseline to 15 minute, baseline to 30 minute and baseline to 60 minute are  $0.20 \pm 0.1$ ,  $0.22 \pm 1$  and  $0.26 \pm 1$ .

**3<sup>rd</sup> week:** the mean pH difference from Baseline to 15 minute, baseline to 30 minute and baseline to 60 minute are  $0.12 \pm 0.1$ ,  $0.13 \pm 1$  and  $0.20 \pm 1$ .

**4<sup>th</sup> week:** The mean pH difference from Baseline to 15 minute, baseline to 30 minute and baseline to 60 minute are  $0.13 \pm 0.1$ ,  $0.15 \pm 1$  and  $0.22 \pm 1$ .

P<0.005 in Group-B which is statistically significant (Table 2, Graph 1).

### Inter Group comparison of mean difference in salivary pH at Baseline in Group-A and Group-B at Day1, end of 1<sup>st</sup> week, 2<sup>nd</sup> week, 3<sup>rd</sup> week, 4<sup>th</sup> week

The Mean difference in Group –A from baseline to day 1, baseline to 1 week, baseline to 2<sup>nd</sup> week, baseline to 3<sup>rd</sup> week and baseline to 4<sup>th</sup> week is found to be 0.8, 0.78, 0.85 and 0.9 respectively.

Pair	Duration	Paired Differences		t	df	p
		Mean	SD			
Pair 1	baseline - min 15	-.70500	.16051	-19.643	19	.000
Pair 2	baseline - min 30	-.85000	.17622	-21.572	19	.000
Pair 3	baseline - min 60	-.86500	.22308	-17.341	19	.000
Pair 4	baseline1stweek - w1_min15	-.16000	.09947	-7.193	19	.000
Pair 5	baseline1stweek - w1_min 30	-.25500	.09987	-11.419	19	.000
Pair 6	baseline1stweek - w1_min 60	-.24500	.16694	-6.563	19	.000
Pair 7	baseline2ndweek - w2_min15	-.19500	.09987	-8.732	19	.000
Pair 8	baseline2ndweek - w2_min 30	-.27000	.14903	-8.102	19	.000
Pair 9	baseline2ndweek - w2_min 60	-.29500	.16694	-7.903	19	.000
Pair 10	baseline3rdweek - w3_min 15	-.18000	.11517	-6.990	19	.000
Pair 11	baseline3rdweek - w3_min 30	-.22500	.13328	-7.550	19	.000
Pair 12	baseline3rdweek - w3_min 60	-.22000	.13992	-7.031	19	.000
Pair 13	baseline4thweek - w4_min15	-.20000	.09733	-9.189	19	.000
Pair 14	baseline4thweek - w4_min 30	-.23500	.10894	-9.647	19	.000
Pair 15	baseline4thweek - W4_min 60	-.26500	.12680	-9.346	19	.000

**Table 1:** Intra Group comparison of Group-A. Paired Samples Test, p <0.001. SD: Standard Deviation; df: Degree of Freedom.

The Mean difference in Group –B from baseline to day 1, baseline to 1 week, baseline to 2<sup>nd</sup> week, baseline to 3<sup>rd</sup> week and baseline to 4<sup>th</sup> week is found to be 0.66, 0.61, 0.75 and 0.79.

The values showed there is a rise in pH as the duration increases and pH increase is more in Group-A than that of Group-B and the difference between the groups found to be statistically not significant(p-value = 0.09) (Table 3, Graph 1)

### Inter Group comparison of mean difference in salivary pH at 15 min in Group-A and Group-B between at Day1, end of 1<sup>st</sup> week, 2<sup>nd</sup> week, 3<sup>rd</sup> week, 4<sup>th</sup> week

The Mean difference in pH in Group –A from 15 minutes at day 1 with 15 minutes at 1 week, 15 minutes at 2 week, 15 minutes at 3<sup>rd</sup> week and 15 minutes at 4<sup>th</sup> week was found to be 0.2, 0.25, 0.33 and 0.4 respectively.

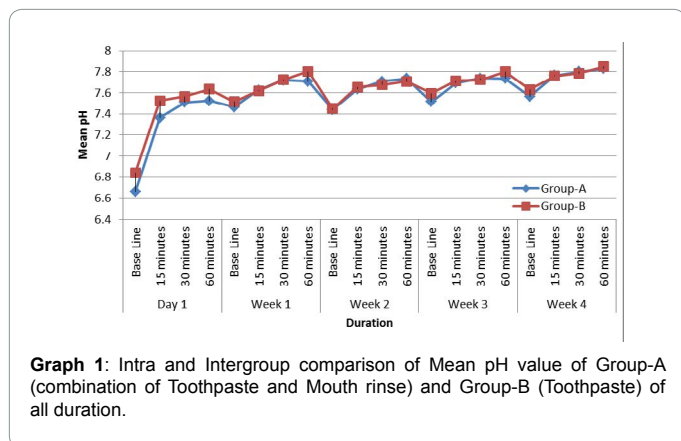
The Mean difference in pH in Group –B from 15 minutes at day 1 with 15 minutes at 1 week, 15 minutes at 2<sup>nd</sup> week, 15 minutes at 3<sup>rd</sup> week and 15 minutes at 4<sup>th</sup> week was found to be 0.09, 0.13, 0.19 and 0.23 respectively. The values showed there is a rise in pH as the duration increases and pH increase is more in Group-A than that of Group-B and the difference between the groups found to be statistically not significant (p-value = 0.06) (Table 4, Graph 1).

### Inter Group comparison of mean difference in salivary pH at 30 min in Group-A and Group-B at Day1, end of 1<sup>st</sup> week, 2<sup>nd</sup> week, 3<sup>rd</sup> week, 4<sup>th</sup> week

The Mean difference in pH in Group-A from 30 minutes at day 1 with 30 minutes at 1 week, 30 minutes at 2<sup>nd</sup> week, 30 minutes at 3<sup>rd</sup> week and 30 minutes at 4<sup>th</sup> week was found to be 0.21, 0.2, 0.23 and 0.23 respectively.

Pair	Duration	Paired Differences		t	df	p
		Mean	SD			
Pair 1	baseline - min 15	-.68500	.18994	-16.128	19	.000
Pair 2	baseline - min 30	-.72500	.21244	-15.262	19	.000
Pair 3	baseline - min 60	-.79500	.25021	-14.209	19	.000
Pair 4	baseline1stweek - w1_min 15	-.10500	.10501	-4.472	19	.000
Pair 5	baseline1stweek - w1_min 30	-.21000	.12096	-7.764	19	.000
Pair 6	baseline1stweek - w1_min 60	-.29000	.16827	-7.707	19	.000
Pair 7	baseline2ndweek - w2_min 15	-.20500	.10501	-8.731	19	.000
Pair 8	baseline2ndweek - w2_min 30	-.22500	.12513	-8.041	19	.000
Pair 9	baseline2ndweek - w2_min 60	-.26000	.15009	-7.747	19	.000
Pair 10	baseline3rdweek - w3_min 15	-.12000	.13992	-3.835	19	.001
Pair 11	baseline3rdweek - w3_min 30	-.13000	.10809	-5.378	19	.000
Pair 12	baseline3rdweek - w3_min 60	-.20500	.16051	-5.712	19	.000
Pair 13	baseline4thweek - w4_min 15	-.13000	.14903	-3.901	19	.001
Pair 14	baseline4thweek - w4_min 30	-.15500	.13169	-5.264	19	.000
Pair 15	baseline4thweek - W4_min 60	-.22000	.17045	-5.772	19	.000

**Table 2:** Intra group comparison of Group-B. Paired Samples Test, p <0.001.



The Mean difference in pH in Group-B from 30 minutes at day 1 with 30 minutes at 1 week, 30 minutes at 2<sup>nd</sup> week, 30 minutes at 3<sup>rd</sup> week and 30 minutes at 4<sup>th</sup> week was found to be 0.16, 0.11, 0.16 and 0.22 respectively.

The values showed there is a rise in pH as the duration increases and pH increase is more in Group-A than that of Group-B and the difference between the groups found to be statistically not significant (p-value = 0.733) (Table 5, Graph 1).

### Inter Group comparison of mean difference in salivary pH at 60 min in Group-A and Group-B at Day1, end of 1<sup>st</sup> week, 2<sup>nd</sup> week, 3<sup>rd</sup> week, 4<sup>th</sup> week

The Mean difference in pH in Group A from 60 minutes at day 1 with 60 minutes at 1 week, 60 minutes at 2<sup>nd</sup> week, 60 minutes at 3<sup>rd</sup> week and 60 minutes at 4<sup>th</sup> week was found to be 0.18, 0.21, 0.01 and 0.30 respectively.

The Mean difference in pH in Group-B from 60 minutes at day 1 with 60 minutes at 1 week, 60 minutes at 2<sup>nd</sup> week, 60 minutes at 3<sup>rd</sup> week and 60 minutes at 4<sup>th</sup> week was found to be 0.17, 0.07, 0.16 and 0.21 respectively. The values showed there is a rise in pH as the duration increases and pH increase is more in Group-A than that of Group-B and the difference between the groups found to be statistically not significant (p-value = 0.275) (Table 6, Graph 1).

## Discussion

The present study was conducted to estimate and compare the pH of saliva in 6 years to 12 years children before and after brushing and mouth rinsing with commercially available toothpaste and mouth rinse.

The salivary pH is an important biomarker for dental caries. The dentifrice and mouth rinse pH range might influence the salivary pH. In the present study we found that the pH of the dentifrice was 8.2, which is basic for given toothpaste if compared with the result obtained by Chand et al. [2]. Similar results were obtained in study by Bardal et al., who reported the pH of dentifrices to be in the range of 6.8 – 9.9 [13]. Chunhye Kim Lee also reported in his study that if mouth rinse has low pH the surface of the tooth leads to a net loss of enamel and mineral structure at the tooth's surface [14].

The study done by Pontefract et al. reported that low pH mouth rinses cause dental erosion [15]. Similar result reported by Ankita et al. that many commercially available mouthrinse are acidic in nature and cause dental erosion [16].

Duration	Groups	Mean	SD	N
baseline	mouthwash	6.6600	.17290	20
	toothpaste	6.8400	.11425	20
	Total	6.7500	.17097	40
baseline1stweek	mouthwash	7.4650	.17852	20
	toothpaste	7.5150	.20333	20
	Total	7.4900	.19055	40
baseline2ndweek	mouthwash	7.4400	.16670	20
	toothpaste	7.4500	.19331	20
	Total	7.4450	.17824	40
baseline3rdweek	mouthwash	7.5150	.18994	20
	toothpaste	7.5950	.16376	20
	Total	7.5550	.17967	40
baseline4thweek	mouthwash	7.5650	.16631	20
	toothpaste	7.6300	.15927	20
	Total	7.5975	.16406	40

Tests of Within-Subjects Effects					
P=.093					
Source	Type III Sum of Squares	df	Mean Square	F	p
change	19.615	4	4.904	249.021	.000
change * groups	.160	4	.040	2.029	.093
Error(change)	2.993	152	.020		

**Table 3:** Inter Group comparison with relation to all baseline values. Descriptive Statistics p>0.005

Descriptive Statistics				
p>0.005				
Duration	Groups	Mean	SD	N
min15	mouthwash	7.3650	.29429	20
	toothpaste	7.5250	.21491	20
	Total	7.4450	.26694	40
w1_min15	mouthwash	7.6250	.20743	20
	toothpaste	7.6200	.20417	20
	Total	7.6225	.20316	40
w2_min15	mouthwash	7.6350	.15652	20
	toothpaste	7.6550	.16051	20
	Total	7.6450	.15681	40
w3_min15	mouthwash	7.6950	.19595	20
	toothpaste	7.7150	.22775	20
	Total	7.7050	.20995	40
w4_min15	mouthwash	7.7650	.16311	20
	toothpaste	7.7600	.18468	20
	Total	7.7625	.17200	40

Tests of Within-Subjects Effects					
P=0.62					
Source	Type III Sum of Squares	df	Mean Square	F	p
change	2.300	4	.575	27.390	.000
change * groups	.192	4	.048	2.290	.062
Error(change)	3.191	152	.021		

**Table 4:** Inter Group comparison with relation to all 15 minutes values.

In our study we estimated pH of toothpaste and mouth rinse to be 8.2 and 7.8 respectively which is alkaline and therefore the risk of erosion on teeth is eliminated as children has less thickness of enamel which erodes easily in acidic environment.

The intra group comparison of our study on day 1, end of 1<sup>st</sup> week, 2<sup>nd</sup> week, 3<sup>rd</sup> week and 4<sup>th</sup> week with respect to all baselines, at 15 minutes, 30 minutes and 60 minutes values showed an increase in pH

Descriptive Statistics					
					p>0.005
Duration	Groups	Mean	SD	N	
min 30	mouthwash	7.5100	.21250	20	
	toothpaste	7.5650	.23232	20	
	Total	7.5375	.22152	40	
w1_min 30	mouthwash	7.7200	.21176	20	
	toothpaste	7.7250	.19702	20	
	Total	7.7225	.20190	40	
w2_min 30	mouthwash	7.7100	.18325	20	
	toothpaste	7.6750	.17733	20	
	Total	7.6925	.17887	40	
w3_min 30	mouthwash	7.7400	.23486	20	
	toothpaste	7.7250	.20487	20	
	Total	7.7325	.21767	40	
w4_min 30	mouthwash	7.8000	.17168	20	
	toothpaste	7.7850	.18144	20	
	Total	7.7925	.17451	40	
Tests of Within-Subjects Effects					
					P=0.733
Source	Type III Sum of Squares	df	Mean Square	F	p
change	1.459	4	.365	15.586	.000
change * groups	.047	4	.012	.504	.733
Error(change)	3.558	152	.023		

Table 5: Inter Group comparison with relation to all 30 minutes values.

Descriptive Statistics					
					p>0.005
Duration	Groups	Mean	SD	N	
min 60	mouthwash	7.5250	.18028	20	
	toothpaste	7.6350	.27391	20	
	Total	7.5800	.23556	40	
w1_min 60	mouthwash	7.7100	.26735	20	
	toothpaste	7.8050	.22821	20	
	Total	7.7575	.25001	40	
w2_min 60	mouthwash	7.7350	.18715	20	
	toothpaste	7.7100	.21981	20	
	Total	7.7225	.20190	40	
w3_min 60	mouthwash	7.7350	.23005	20	
	toothpaste	7.8000	.25955	20	
	Total	7.7675	.24431	40	
W4_min 60	mouthwash	7.8300	.19222	20	
	toothpaste	7.8500	.22361	20	
	Total	7.8400	.20606	40	
Tests of Within-Subjects Effects					
					P=0.275
Source	Type III Sum of Squares	df	Mean Square	F	p
change	1.470	4	.368	15.441	.000
change * groups	.123	4	.031	1.295	.275
Error(change)	3.618	152	.024		

Table 6: Inter Group comparison with relation to all 60 minutes values.

of saliva and that the changes in mean pH difference was statistically significant i.e.  $p < 0.001$  (Table 1-2, Graph 1).

Similar result were obtained in the study done by Chand S et al. where he conclude that the pH of saliva increases after brushing in each commercially available dentifrice group [3]. Another study done by Advani et al., where they conclude that the pH of saliva increases after brushing with Kidodent Toothpaste [17]. Similar result obtained by Olivia Lim where she concludes that the pH of saliva increases after

mouth rinsing [18].

The rise in pH could be due to the contents of Toothpaste and Mouth rinse. In our study we used Kidodent Toothpaste which contains sodium monofluorophosphate and Xylitol, its fluoride content is 500 ppm. The mouth rinse we used in our study was Kidodent Mouthwash which contains sodium fluoride, xylitol and triclosan, its fluoride content is 225 ppm.

Xylitol is a non-nutritive sweetener that has demonstrated effectiveness for preventing caries. Xylitol is not fermented by plaque. The nonspecific effect of xylitol is due its non-fermentability, and thus does not encourage bacterial growth.

The presence of fluoride in this mouth rinse and Toothpaste could have also contributed to the reduction of *S. mutans* in plaque. The effects of fluoride on streptococcal cells are partly ascribed to the inhibition of enolase, one of the series of glycolytic enzymes. This inhibition decreases the intracellular level of phosphoenolpyruvate (PEP), and thus decreases bacterial sugar uptake via PEP-dependent phosphotransferase system (PEP-PTS) [19-21].

The other ingredient present is triclosan, a broad-spectrum antimicrobial, having an anti-plaque potential. Triclosan (2,4,4'-trichloro 2'-hydroxydiphenyl ether) is used to increase the ability of mouth washes and Toothpaste to bind to the oral mucosa, and thus be available for longer periods of time [19-20] Jenkins et al. compared the magnitude and duration of salivary bacterial count reductions produced by a single rinse of 0.2% triclosan, 1% sodium lauryl sulfate (SLS) and 0.2% chlorhexidine mouthwashes. They found considerable reductions in bacterial counts which remained significant for 3 hours with triclosan and for 7 hours with SLS and chlorhexidine. The use of 0.3% triclosan mouth rinse showed significant reduction in salivary mutans streptococci count.

Hence, the significant rise in salivary pH in our study could be due to the reduction in *S. mutans* could be attributed to the synergistic effect of all three constituents, viz., xylitol, sodium fluoride/sodium monofluorophosphate and triclosan.

The inter group comparison in our study on day 1, end of 1<sup>st</sup> week, 2<sup>nd</sup> week, 3<sup>rd</sup> week and 4<sup>th</sup> week with respect to all baselines, at 15 minutes, 30 minutes and 60 minutes. The values show there is a rise in salivary pH as the duration increases and pH of saliva increase is more in Group-A than that of Group-B and the difference between the groups found to be statistically not significant. The result are in accordance with the Daniela Correia Cavalcante Souza et al. that three time oral hygiene practice in a day with Fluoride dentifrice did not differ from two time oral hygiene practice with two time Fluoride dentifrice and onetime Fluoride Mouth rinse, however it enhanced demineralization control when compared two time oral hygiene practice with dentifrice alone [21].

Salivary pH is the important salivary parameter affecting the carious process. Demineralization and remineralization processes of the teeth, occurring in the oral cavity are dependent on the pH of the saliva. The saliva is rich in the calcium and phosphates and is nearly always supersaturated with respect to enamel minerals and other biological apatites. The alkaline pH of the saliva neutralizes the acid produced by the plaque bacteria Further the more basic is the pH of the saliva more is the remineralization of tooth surface by the precipitation of bicarbonate ions.

## Limitations and recommendations

- More measure and advancement can be done for better result.
- As the study population was a captive population restricted to children from hostel of the school institute, the results obtained were specific.
- Hence, the results cannot be generalized to the whole population for which further studies are recommended taking more advancement with wider geographical representation.

## Conclusion

Oral hygiene practice with commercially available Fluoridated toothpaste followed by Fluoridated mouth rinse for children two times a day can be recommended in moderate to high caries group.

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