Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(3), 2566-2571 | ISSN:2251-6727



The Effect of an Oral Spray Containing an Extract of Pineapple (Bromelain) on Dental Plaque and Gingival Inflammation in Children: A Crossover Randomized Controlled Study

Dr. Faiz Ansari¹, Dr. Shweta Chaudhary², Dr. Varsha Pokharkar³, Dr. Preeti Tamane⁴, Dr. Krishna Patil⁵, Dr.Preetam Shah⁶

¹Post-graduate student, Department of Pediatric and Preventive Dentistry, Bharati Vidyapeeth (Deemed to be university) Dental College and Hospital, Pune, India

² Associate professor, Department of Pediatric and Preventive Dentistry, Bharati Vidyapeeth (Deemed to be university) Dental College and Hospital, Pune, India

³ Vice principal Dean, Faculty of Pharmaceutical sciences, Bharati Vidyapeeth Poona College of Pharmacy, Pune, India
 ⁴Assistant professor, Bharati Vidyapeeth Poona College of Pharmacy, Pune, India

⁵Assistant professor, Department of Pediatric and Preventive Dentistry, Bharati Vidyapeeth (Deemed to be university) Dental College and Hospital, Pune, India

⁶ Professor, Department of Pediatric and Preventive Dentistry, Bharati Vidyapeeth (Deemed to be university) Dental College and Hospital, Pune, India

Corresponding author:

Dr. Faiz Ansari,

Post-graduate student,

Bharati Vidyapeeth (Deemed to be university)

Dental College and Hospital, Pune, India

(Received: 04 February 2024

Revised: 11 March 2024

Accepted: 08 April 2024)

KEVWODDS	ABSTRACT:					
KE I WORDS	Background : To investigate if daily use of an oral spray containing an extract of pineapple (bromelain).					
Bromelain	associated with supervised toothbrushing may improve gingival health in children with mixed dentition.					
fluoridated,	Method: 22 healthy children aged 6-12 years were included in the study where 2 groups where they					
gingival	were given bromelain spray and an unidentifiable placebo spray. Following an oral prophylaxis the study commenced; use of spray for 14 days after which the parameters (plaque index and gingival inflammation index) were recorded, followed by a washout period (8 days) and then crossover of another 14 days. Parameters were recorded again and compared. Results : Plaque index and gingival inflammation index were significantly lower in bromelain group as compared to placebo groups after 14 days p <0.001. Conclusions: Study indicates the correlation of active bromelain with reducing the gingival inflammation significantly. Bromelain spray can serve as a potential adjunct in maintain the oral hygiene of children especially who are physically incapable of expectorating mouthwashes as well as fluoridated dentifrices while brushing their teeth					

Introduction

Plaque-induced gingivitis is the most common form of periodontal disease in childhood and adolescence; its prevalence and severity increase with age.¹ Based on the

direct correlation between plaque accumulation and development of gingival inflammation, effective control of gingivitis could be achieved through primary and secondary prevention measures involving health education, oral hygiene instruction and motivation,

Journal of Chemical Health Risks www.jchr.org JCHR (2024) 14(3), 2566-2571 | ISSN:2251-6727



supervised daily toothbrushing and professional plaque removal.² This is even more relevant in children suffering from systemic diseases in which the impaired host's immune and inflammatory response may render an individual more susceptible to the effects of bacterial products.³

Despite the commitment of parents, children do not consistently perform home care procedures at an acceptable level.⁴ Dental health interventions have demonstrated positive but temporary effects on plaque accumulation and transient improvement of gingival health.⁵ Mixed dentition may further augment biofilm retention by creating more ecological niche and contribute to gingival inflammation.⁶ In this context, the use of chemical adjuncts in addition to toothbrushing and flossing for routine home care may better control plaque accumulation and prevent gingival and oral diseases from initiating or progressing.⁷

Several antimicrobial agents, such as chlorhexidine digluconate (CHX), have been successfully used in prevention and treatment of gingivitis in mouthwash formulations.⁷ However, unwanted side effects, such as unpleasant taste and tooth discolouration, limit their long-term use and acceptability by patients.⁸ Moreover, according to American Dental Association the use of mouthwashes is not recommended in children below 6 years of age.

Pineapple or ananas comosus belongs to the family of bromeliacea.⁹ It has been widely used as a therapeutic plant in several resident cultures and these therapeutic qualities of pineapple are accredited to bromelain, which is an elementary extract from pineapple that contains, along with other compounds, various proteinases. Bromelain has shown to exhibit various fibrinolytic, antiedematous, antithrombotic, and anti-inflammatory activities both in vitro and in vivo.⁹ Ever since bromelain was known chemically, it has been used as a phytomedical agent.¹⁰

There is evidence that states bromelain exerts an antibacterial effect against potent periodontal pathogens; hence it may be used as an antibacterial agent.¹¹ Furthermore, a study is indicated to evaluate the efficacy of active bromelain enzyme on gingival health in children.

Aim of study is to investigate if daily use of an oral spray containing an extract of pineapple (bromelain), associated with supervised toothbrushing may improve gingival health in children with mixed dentition.

Material and Methods

Inclusion and exclusion criteria of study participants

Inclusion criteria:

- Children of the age group 7-12 years
- Teeth in mixed dentition
- Presence of first permanent molars and incisors.

Exclusion criteria:

- Children using any medication.
- Children with orthodontic appliances or space maintainers.
- Children with systemic diseases.
- Children allergic to pineapple.

Ingredients	Quantity
Bromelain (35%)	35 mg
Mannitol	50 mg
Glycerine	100mg
Pineapple incense (Q.S)	q.s 1%
Distilled water (Q.S)	Upto 100 ml

• Children with any oral ulcer/lesion.

Study groups

- 22 healthy children aged 6-12 years will be included in the study after parents of the children consent their participation post verbal and written information
- The study will be carried out as a randomized, controlled, single centre, examiner blind, crossover clinical trial in two parallel groups.
- The children will be given roll numbers by their staff in charge. And two groups will be formed where odd roll numbers (1,3,5..21) will be the group 1 and the even numbers (2,4,6..22) will be group 2. Followed by a crossover.

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(3), 2566-2571 | ISSN:2251-6727



Materials:

- 1. Bromelain spray
- 2. Mouth mirror and straight probe
- 3. Soft bristle toothbrush.
- 4. Fluoridated toothpaste
- 5. Ultrasonic scaling unit

Bromelain spray formulation-

Bromelain spray was formulated at Pune College of Pharmacy, Pune.

Placebo spray-

- Similar composition minus the active ingredient-bromelain
- Identical color



Identical smell

Methodology:

- i. Children will initially receive a professional plaque removal Day 0
- ii. Group 1- bromelain spray & Group 2- placebo spray
- iii. Spray and hygiene instructions will be given in presence of parents
- iv. Parents will be instructed to use the spray two times a day for two weeks.

{A squirt will be applied to the right/left side of the mouth on the buccal aspect and a squirt on the lingual aspect (4 squirts in total in one application)}

- v. Parents will be asked to apply the spray and to supervise children during oral hygiene procedures.
- vi.Parameters will be checked on day 4.
- vii.Toothbrushing with a non-fluoridated toothpaste and spray continued for another 10 days.

{Parameters Checked (day 14)}

viii.Washout period - 8 days.

- ix. 22nd day- Oral prophylaxis for both the groups
- Interchange the groups Group 1- Placebo spray & group
 2- bromelain spray
- xi. Parameters checked after 4 days -26^{th} day
- xii.Toothbrushing with a non-fluoridated toothpaste and spray continued for another 10 days.
- xiii.Parameters checked day 36

Results

- Gingival inflammation was recorded using GI according to Löe and Silness [1963] on the facial and lingual surfaces of four index teeth (16, 11, 36 and 31).
- Plaque index was recorded according to Silness and Löe [1964] on the facial and lingual surfaces of six index teeth (16, 11, 26, 36, 31 and 46).

There was a significant reduction in plaque index and gingival inflammation index from baseline to 14 days before crossover in bromelain group; however, there was an increase in plaque index and gingival inflammation index from baseline to 14 days before crossover in the placebo group which was non-significant

Group	Variable	Baseline		After 14 days			
		Mean	SD	Mean	SD	Difference	p value
Bromelain	PI	0.93	0.12	0.34	0.26	0.59	<0.001*
	GI	0.59	0.32	0.23	0.24	0.36	<0.001*
Placebo	PI	0.93	0.16	1.45	1.21	-0.52	0.183
	GI	0.68	0.37	0.84	0.20	-0.16	0.152

Paired t test; * indicates significant difference at p≤0.05



Comparison of plaque index and gingival inflammation index at baseline and after 14 days before crossover in each group.







Comparison of plaque index and gingival inflammation index at baseline and after 14 days before crossover in each group.

There was a significant reduction in plaque index and gingival inflammation index from baseline to 14 days after crossover in bromelain group; however, there was an increase in plaque index and reduction in gingival inflammation index from baseline to 14 days after crossover in placebo group which was non-significant.



Intergroup comparison of plaque index and gingival inflammation before crossover index between two groups.

Phase-1

Intergroup comparison of plaque index and gingival inflammation before crossover index between two groups showed that there was no difference in plaque index and gingival inflammation index between two groups at baseline; however, plaque index and gingival inflammation index were significantly lower in bromelain group as compared to placebo groups after 14 days.

Intergroup comparison of plaque index and gingival inflammation after crossover index between two groups showed that there was a difference in plaque index and gingival inflammation index between two groups at baseline with placebo group showing lesser scores as compared to bromelain group and there was no difference in plaque index and gingival inflammation index between two groups groups after 14 days.





Phase- 2

Discussion

Uhlig in 1981 compared the anti-inflammatory effect of several commonly used drugs on experimentally induced edemas in rats and found that bromelain was the most potent among all nine tested drugs, including aspirin. Concluding a direct relationship between bromelain dose and inhibition of biosynthesis of prostaglandin E2.¹²

Research conducted by Embisa et al (2016) showed that there was a significant difference in the decrease in

Journal of Chemical Health Risks www.jchr.org JCHR (2024) 14(3), 2566-2571 | ISSN:2251-6727



plaque index between before and after consuming pineapple fruit. And according to Rakhmanda (2008) from the results of his research, pineapple fruit has an antibacterial effect both inhibiting (bacteriostatic) and killing (bactericidal) bacteria that causes caries.¹⁴

The sensitivity of periodontal pathogens at low concentration of bromelain was laid forward by an invitro study conducted by Praveen et al.¹¹

A recent systematic review reported that oral sprays are an acceptable delivery method for chemotherapeutic agents and can be effective against dental biofilm and gingival inflammation, for managing gingivitis and for prevention of dental caries, when used in addition to daily oral hygiene measures.¹⁵

Moreover oral spray are advantageous over mouthwashes in young children as the latter requires to be squished and expectorated properly.

As each spray delivers tiny droplets into the soft tissue of the mouth, these are easily and readily absorbed at the local site thus increasing the bioavailability and effectivness of the solution.¹⁶

On the basis of the said evidences we formulated an aqueous spray containing active bromelain enzyme to evaluate its effect on gingival health of children.

In the results we found that there was a significant reduction in plaque and gingival inflammation index at end of 14 days in bromelain group whereas in placebo group the index score increased which was nonsignificant.

After the crossover, in the bromelain group there was significant reduction in plaque and gingival index at the end of 14 days. Increase in PI and reduction in GI in placebo group which was non significant.

Intergroup comparison of PI and GI before crossovershowed no difference at baseline. After 14 days PI and GI were significantly low in bromelain as compared to placebo

Intergroup comparison of PI and GI after crossover showed lower scores of PI GI in placebo group which could potentially be because of the earlier use of bromelain spray and no difference was seen in PI and GI between 2 groups after 14 days.

Strengths of the study -

- Examiner blind
- Parallel group crossover study.
- Use of an indistinguishable placebo

Limitations

- Gingival inflammation due to erupting teeth.
- Not refraining the basic oral hygiene measures.
- No diet control.

Conclusion

- The study indicates the correlation of active bromelain with reducing the gingival inflammation significantly.
- It can serve as a potential adjunct in maintaing the oral hygiene of children especially who are physically incapable of expectorating mouthwashes as well as fluoridated dentifrices while brushing their teeth.
- Considering the fact that the active ingredient is a naturally occuring enzyme in pineapple fruit with no evident side effects, it was readily acceptable by both parents and children.

References:

- Albandar JM, Tinoco EM. Global epidemiology of periodontal diseases in children and young persons. Periodontol 2000 2002;29:153–76.
- [2] Kwan SY, Petersen PE, Pine CM, Borutta A. Healthpromoting schools: an opportunity for oral health promotion. Bull World Health Organ 2005;83:677–685.
- [3] Meyle J, Gonzales JR. Influences of systemic diseases on periodontitis in children and adolescents. Periodontol 2000 2001;26:92–112.
- [4] Kolawole KA, Oziegbe EO, Bamise CT. Oral hygiene measures and the periodontal status of school children Int J Dent Hyg 2011;9:143–148
- [5] Stein C, Santos NML, Hilgert JB, Hugo FN. Effectiveness of oral health education on oral hygiene and dental caries in schoolchildren: systematic review



and metaanalysis. Community Dent Oral Epidemiol 2018;46:30-37

- [6] Agarwal A, Rehani U, Adlakha V, Kaushik M, Kaushik N. Comparative analysis of the amount of plaque formation and associated gingival inflammation in deciduous, mixed and permanent dentition. Int J Clin Pediatr Dent 2009;2:23–26
- [7] Cortelli SC, Cortelli JR, Shang H, McGuire JA, Charles CA. Long-term management of plaque and gingivitis using an alcohol-free essential oil containing mouthrinse: A 6-month randomized clinical trial. Am J Dent 2013;26:149–155.
- [8] Brecx M, Macdonald LL, Legary K, Cheang M, Forgay MG. Long-term effects of Meridol and chlorhexidine mouthrinses on plaque, gingivitis, staining, and bacterial vitality. J Dent Res 1993;72:1194–1197
- [9] Pavan R, Jain S, Shraddha, Kumar A. Properties and therapeutic application of bromelain: Areview. Biotechnol Res Int 2012;2012:976203.
- [10] Taussig SJ, Batkin S. Bromelain, the enzyme complex of pineapple (Ananas comosus) and its clinical application. An update. J Ethnopharmacol 1988;22(2):191-203
- [11] Praveen NC, Rajesh A, Manish Madan, Vishwajit RC, Neel VH, Akanksha MS. In vitro evaluation of antibacterial efficacy of pineapple extract (Bromelain) on periodontal pathogens. J Int Oral Health 2014;6(5):96-8.
- [12] Uhlig, G. Schwellungsprophylaxe nach Exogenem Trauma. Zeitschrift fuer Allgemeine Medizin 1981;57, 127 - 131.
- [13] Yurnila A. Embisa, Lydia Tendean, Kustina Zuliari. "The effect of consumption of pineapple (Ananas comosus L. Merr) on index decline plaque in children aged 10-12 years at SD Inpres 4/82 Guide", e-GIGI, 2016
- [14] Rakhmanda AP. 2008. Comparison Antibacterial Effects of Pineapple Juice (Ananas comosus L. Merr) on Various Concentration on Streptococcus mutans. H. 1. Available at http://eprints.undip.ac.id/24278/1/Adi_Pu tra. pdf. Accessed March 18, 2015
- [15] Zhang J, Ab Malik N, McGrath C, Lam OLT. The effect of antiseptic oral sprays on dental plaque and gingival inflammation: A systematic review and meta-analysis. Int J Dent Hyg 2019;17:16–26.
- [16] Francetti L, del Fabbro M, Testori T, Weinstein RL. Chlorhexidine spray versus chlorhexidine mouthwash in

the control of dental plaque after periodontal surgery. J Clin Periodontol 2000;27:425-430.