J Dent Mater Tech 2024; 13 (3): 110-115
https://doi.org/10.22038/jdmt.2024.79441.1627

J Dent Mater Tech

Original Article Open Access

Effect of xylitol and casein phosphate amorphous calcium phosphate gums on saliva: A randomized clinical trial

Zahra Bahrololoomi [1], Golnaz Malihi [1], Mohammad Mazloum Ardakani [2], Arezoo Ghotbzadeh [3*], Maryam Irannezhad [1]

Abstract

Objective: This study aimed to investigate the effects of two types of gum, containing xylitol or casein phosphopeptide-amorphous calcium phosphate (CPP-ACP), on saliva properties.

Methods: In this single-blind clinical trial, 60 dental students were randomly divided into three groups (n=20). Each group was instructed to chew one of the following substances: paraffin (control), xylitol gum, or CPP-ACP gum. Saliva samples were collected before and five minutes after chewing. Saliva volume was measured using a pipette, and saliva pH was evaluated with a digital pH meter. The calcium concentration was determined using the photometric method, while phosphorus concentration was measured via spectrophotometry. Statistical analysis was performed using the chi-square test, ANOVA, Tukey HSD post hoc test, and paired t-test ($\alpha = 0.05$).

Results: Chewing all three substances significantly increased saliva volume and pH while reducing phosphorus ion concentration ($P < 0.05$). The calcium ion level increased significantly after five minutes of chewing the CPP-ACP gum ($P = 0.002$). After the intervention, between-group comparisons revealed no significant difference in saliva volume and pH ($P > 0.05$). However, the calcium level in the CPP-ACP group was significantly higher than the control group ($P = 0.01$). Additionally, the phosphorus ion level was significantly lower in the xylitol gum group than in the control and the CPP-ACP groups ($P < 0.05$).

Conclusions: Chewing CPP-ACP gum may promote oral health more effectively than xylitol gum by increasing salivary calcium levels and less affecting phosphorus levels.

Keywords: CPP-ACP, xylitol, gum, saliva, calcium, phosphorus

Introduction

Dental caries is the most common disease worldwide (1). Saliva contains antimicrobial compounds, growth factors, and essential minerals like calcium, phosphate, and bicarbonate, which are released through chewing. Saliva stimulation prevents dental caries by influencing flow rate, pH, and buffering capacity (2). One method to stimulate saliva production is chewing sugar-free gum.

Casein phosphopeptide–amorphous calcium phosphate (CPP-ACP) is derived from milk and aids in preventing enamel demineralization and promoting remineralization (3). Casein phosphopeptides regulate calcium phosphate bioavailability and maintain a stable amorphous calcium phosphate structure, essential for remineralizing hydroxyapatite crystals (4). It can be a viable alternative to fluoride in daily-use toothpaste for enamel remineralization and can effectively reduce dental hypersensitivity (5, 6). Evidence suggests that gums containing CPP-ACP are more effective than other sugar-free gums in remineralizing carious lesions (7). One study found that chewing gum containing CPP-ACP could enhance salivary properties and support remineralization in children with enamel hypomineralization (8).

Non-cariogenic sugar substitutes in chewing gum also help prevent caries (9). Xylitol is one of the most common polyols in sugar-free gums and can not be fermented by oral bacteria (9). It promotes remineralization by increasing saliva flow and thus reducing the overall count and adhesion of *Streptococcus mutans* (10). The American Academy of

[1]Department of Pediatric Dentistry, Faculty of Dentistry, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.
[2]Department of Analytical Chemistry, Yazd University, Yazd, Iran.
[3]Private Practice, Yazd, Iran.

*Corresponding Author: Arezoo Ghotbzadeh
Email: arezooghotbzade2@gmail.com

Accepted: 16 July 2024. Submitted: 22 April 2024.

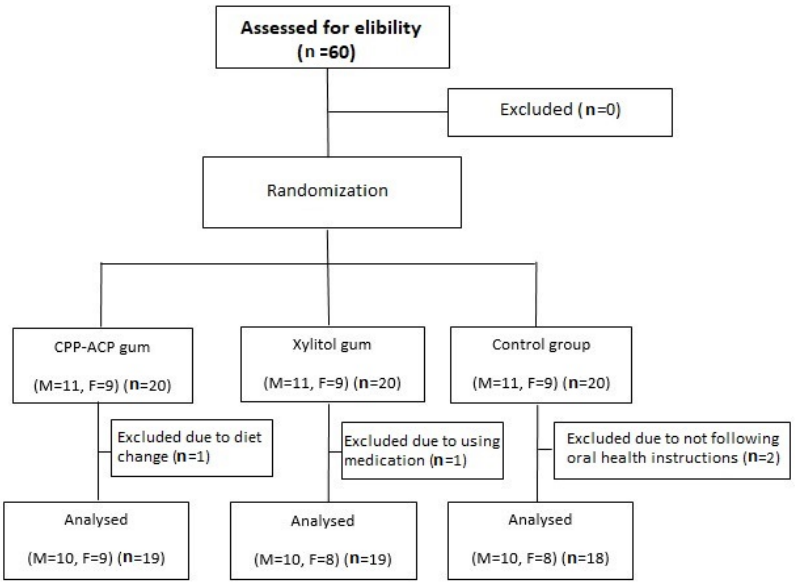

Figure 1. CONSORT flow diagram for patient selection

Pediatric Dentistry (A.A.P.D.) recommends using xylitoll as a caries prevention strategy, particularly for suppressing caries pathogens and thus reducing dental decay (11). Previous studies have revealed that xylitol improves periodontal health and prevents caries (12-14). Emamieh et al. (15) reported that regular consumption of chewing gum containing CPP-ACP or xylitol reduced salivary *S. mutans* levels, but CPP-ACP gum showed greater efficacy than xylitol in lowering bacterial counts. A recent study suggested that xylitol gum may serve as a viable alternative to chlorhexidine mouthwash for reducing *S. mutans* levels in saliva (12).

Despite these benefits, few studies have examined the effect of CPP-ACP or xylitol-containing gums on calcium and phosphorus levels of saliva. This study aimed to compare the effects of xylitol and CPP-ACP gums with those of a control group on salivary volume, pH, and calcium and phosphorus levels.

Materials and methods

The protocol for this randomized, single-blind clinical trial was approved by the ethics committee of Shahid Sadoughi University of Medical Sciences, Yazd, Iran (IR.SSU.REC.1398.096). It was also registered in the Iranian Clinical Trial Registration Centre under code IRCT20140601017935N8. Participants were selected through a simple random sampling method, and the study's CONSORT diagram is presented in Figure 1.

Sample size calculation

The sample size was calculated based on Santosh et al.'s (16) findings, with a confidence level of 95% and a power of 80%, resulting in 20 participants per group.

Participants

Sixty healthy dental students from Shahid Sadoughi Faculty of Dentistry in Yazd were randomly selected, and written informed consent was obtained from all participants. The exclusion criteria were as follows:

- Being on a special diet
- Having an allergy to milk protein (including casein)
- Taking antibiotics or anti-acid drugs during the two weeks before the intervention
- Having orthodontic appliances or fixed or removable prostheses
- The presence of dry mouth
- Having a smoking habit
- Pregnancy
- Having periodontal disease or active caries
- Using mouthwashes or medicaments during the study

Intervention

Before the intervention, participants were instructed not to change their dietary habits and to refrain from eating anything except water for at least two hours before the trial. Toothbrushes with soft bristles (Kala Kooda k Toos, Mashhad, Iran) and toothpaste (Nasim toothpaste with mint flavor, Goltash Corp., Isfahan, Iran) were provided for each participant, and they were asked to brush their teeth twice daily for three weeks before the intervention. During this period, they were also instructed not to use fluoride-containing products. After three weeks, the participants were called back. They were then randomly divided into three groups, each consisting of 20 participants according to the gum that they received:

Table 1: The composition of materials used in this study

	Materials	Brands	Ingredients
Toothpaste	Nasim (mint flavored)	Paksan Co., Iran	Dicalcium phosphate dihydrate, water, sorbitol, glycerin, sodium lauryl sulfate, CMC, monofluorophosphate, edible essential oil, T.S.P.P, methylparaben, and sodium saccharin.
Group 1	CPP-ACP gum	Trident Recaldent, Thailand	Synthetic sweetener, flavors, CPP-ACP aspartame, acesulfame potassium, sorbitol, mannitol, maltitol, gum base, citric acid
Group 2	xylitol gum	Trident, Mondelez Internatinal	Sorbitol, chewing gum base, xylitol, glycerin, natural and synthetic lubricants, acesulfame potassium, aspartame, BHT, mannitol, soy lecithin

1) CPP-ACP gum (Trident Recaldent, Thailand) with mint flavor

2) Xylitol gum (Trident Recaldent, Thailand) with mint flavor

3) A 1 x 1 cm piece of paraffin

The compositions of the materials used in this study are presented in Table 1.

The participants were asked to collect their saliva into Falcon tubes before chewing. The samples were collected between 10 a.m. and 12 p.m. (19).

No specific instructions were provided regarding how to chew, including the number or duration of chewing strokes. Each student chewed the gum based on their habit while sitting. They were asked to keep their eyes open (except for blinking), bend their head and neck forward, and rest their arms easily on their knees. This is known as the "Coachman's position" (17). After five minutes of chewing, they were asked to collect their saliva again into another Falcon tube. Samples were labeled, transferred to the laboratory, and stored in a refrigerator at 1°C.

Evaluating saliva properties

The volume of saliva was determined using Mohr pipettes. Calcium levels were analyzed through a photometric method involving cresolphthalein complexone (SIGMA ALDRICH Co., Bandai, Fukushima, Japan). In this method, calcium ions react with cresolphthalein in an alkaline environment, forming a purple complex, and the intensity of the color is directly proportional to the calcium concentration in the sample (16). Serum kits (Pars Azmoon, Alborz, Iran) were also employed to measure calcium concentration.

The inorganic phosphate concentration in saliva was measured using the Low Range (LR) phosphorous kit. (Gesan Production, Campobello di Mazara, Italy). This spectrophotometric method relies on the reaction between inorganic phosphate and ammonium molybdate, which produces a phosphomolybdate complex in an acidic medium, exhibiting an absorbance peak at 340 nm. After a 5-minute incubation at 37°C, the absorbance of the samples was recorded at 340 nm (LAMBDA 365, PerkinElmer, USA), with the blank reagent serving as the standard absorbance. The average saliva reference value was used for the standard concentration, which ranges from 2.4 to 4.9 mg/dL in adults. Phosphate levels (mg/dL) were calculated using the formula (18, 19):

$$\text{Phosphorus level} = \frac{\text{sample absorbance}}{\text{standard absorbance}} \times \text{standard concentration}$$

Statistical analysis

Data was analyzed using SPSS 22.0 software (SPSS Inc., IL, USA). The gender and age of participants were compared using the chi-square test and ANOVA, respectively. Saliva properties before and after intervention were compared using the paired-sample t-test. The one-way ANOVA and Tukey HSD post-hoc tests were used to compare saliva properties among the groups. Values less than 0.05 were considered statistically significant.

Results

Four students were excluded from the study due to changes in diet, medication use, and failure to adhere to the oral hygiene instructions. Table 2 presents the baseline characteristics of the participants in the study groups. The mean age of the patients was 22.67 ± 3.35 years. Overall, 31 males (55.35%) and 25 females (44.65%) participated in the study. No significant differences were found in age and gender distribution among the study groups (P > 0.5; Table 2)

Table 2: The age and gender distribution of the participants in the study groups

	Control (18)	Xylitol gum (19)	ACP-CPP gum (19)	P- value
Gender				0.95
Male N (%)	10 (55.6)	11 (57.9)	10 (52.6)	
Female N (%)	8 (44.4)	8 (42.1)	9 (47.4)	
Age (Mean ± SD)	22.1 ± 5.61	22.74 ± 2.33	23.16 ± 2.24	0.63

Table 3: Mean ± standard deviation of saliva volume (ml) and pH among the groups before and after intervention

Groups	volume			pH		
	Before	After	P- value**	Before	After	P-value**
Control	3.35 ± 1.07	4.54 ± 2.32	0.046	7.74 ± 3.07	8.11 ± 0.37	0.001
Xylitol gum	3.25 ± 1.23	4.24 ± 1.46	0.004	7.7 ± 0.54	8.06 ± 0.08	0.033
ACP-CPP gum	3.05 ± 1.04	4.00 ± 1.45	0.006	7.79 ± 0.31	8.01 ± 0.26	0.005
P-value*	0.72	0.65		0.67	0.87	

* Values less than 0.05 represent a significant difference between groups according to the ANOVA test (p<0.05).
**Values less than 0.05 represent a significant difference between time points according to the paired t-test (p<0.05).
Different lower-case letters represent a significant difference among the groups according to the Tukey HSD test (p<0.05).

Table 3 presents the mean values for salivary volume and pH among the groups before and after the intervention. Results from the paired t-test indicated that in all groups, the pH and volume of the post-intervention saliva significantly increased (P < 0.05; Table 3).

Table 4 presents the salivary ion concentration before and after the intervention. The phosphorus level significantly decreased after chewing in all groups (P < 0.05; Table 4), whereas the calcium level showed a significant increase in only the CPP-ACP group (P = 0.002) with no significant changes in other groups (P>0.05; Table 4).

Baseline saliva properties were comparable across all groups (P > 0.05; Tables 3 and 4). After the intervention, saliva pH and volume remained comparable among the groups (P > 0.05, Table 3). However, based on the one-way ANOVA test, the groups had significant differences in calcium (P = 0.025) and phosphorus ion concentrations (P = 0.002). Pairwise comparisons using the Tukey HSD test showed that the CPP-ACP gum group had significantly higher salivary calcium levels than the control group (P < 0.05; Table 4). In addition, the xylitol gum group had significantly lower phosphorus ion levels than the control group and the CPP-ACP group (P < 0.05; Table 4).

Discussion

Chewing sugar-free gum is widely accepted as a beneficial oral health supplement and is often included in caries prevention programs. In addition to stimulating saliva, gum can also serve as a delivery system for substances like fluoride, chlorhexidine, calcium, and phosphorus, which help to maintain dental health (16). This RCT study examined the effects of xylitol, CPP-ACP chewing gums, and a paraffin block (as a control) on salivary volume, pH, and ion concentrations. Previous studies have shown that taste can influence salivary flow rate and pH (20). Therefore, this study used gums with identical mint flavor, taste, and shape.

This study showed a significant increase in saliva volume across all groups, with no significant differences. These findings are consistent with the results reported by Pereira et al. (21), Hegde and Thakkar (20), and Vantipalli et al. (2). In contrast, Polland et al. (22) observed a significant increase in saliva flow after 55 minutes of chewing sugar-free gum, while in the present study, saliva flow increased after just five minutes of chewing.

Both xylitol and CPP-ACP gums led to a significant increase in salivary pH after five minutes of chewing. This increase in pH is likely due to the rise in bicarbonate concentration in both gums. The results align with studies by Sultan et al. (1) and Hegde and Thakkar (20), who also reported increased saliva pH after five minutes of chewing. Similarly, Kumar et al. (23) found that chewing xylitol gum or sugared chewing gum (Happydent White Chewing Gum) raised salivary pH after 10 and 30 minutes, compared to baseline. Vantipalli et al. (2) also reported a significant increase in pH due to gum chewing. In their study, both gums increased pH after 2 minutes and gradually decreased after 30 minutes, with no significant difference between them.

Table 4: Mean ± standard deviation of saliva ions (mg/dl) among the groups before and after intervention

Groups	Phosphorus			Calcium		
	Before	After	P-value**	Before	After	P-value**
Control	18.95 ± 6.2	13.30 ± 3.8^{b}	<0.001	4.27 ± 1.35	3.81 ± 1.00^{a}	0.086
Xylitol gum	17.67 ± 7.91	9.25 ± 3.96^{a}	<0.001	5.08 ± 1.79	5.03 ± 2.8^{a,b}	0.946
ACP-CPP gum	20.81 ± 7.28	12.46 ± 2.97^{b}	<0.001	3.87 ± 1.27	6.07 ± 2.95^{b}	0.002
P-value*	0.41	0.002		0.051	0.025	

* Values less than 0.05 represent a significant difference between groups according to the ANOVA test (p<0.05).
**Values less than 0.05 represent a significant difference between time points according to the paired t-test (p<0.05).
Different lower-case letters represent a significant difference among the groups according to the Tukey HSD test (p<0.05).

In the present study, no statistically significant difference was observed between the three groups regarding pH after the intervention. In contrast, Padminee et al. (14) found that chewing CPP-ACP gum increased salivary pH more than the xylitol gum. The discrepancy between these findings may be due to differences in the study design. In Padminee's study, participants chewed gum three times daily, and pH was measured after two weeks. Similarly, Banava et al. (24) used CPP-ACP paste with fluoride as a toothpaste for chemotherapy patients and compared it with a control group that did not receive the toothpaste. The pH measured after 21 and 42 days was not significantly different among the groups. However, in both studies, salivary pH was assessed over a more extended period than in the present study.

In this study, salivary calcium level was not changed in the control and xylitol groups after chewing. However, chewing CPP-ACP gum led to a significant increase in salivary calcium levels. After chewing, the calcium ion level was greater in the CPP-ACP group than in the other groups, but the difference was only significant in the control group. These findings are consistent with Poureslami et al. (25), who found that both CPP-ACPF and CPP-ACP pastes significantly increased calcium levels in saliva. Sultan et al. (1) similarly found that chewing CPP-ACP gum significantly raised salivary pH and calcium levels. Santhosh et al. (16) also reported that chewing CPP-ACP gum for 20 minutes increased calcium ion concentration from approximately 7 mg/dL to 12 mg/dL.

All three substances in this study significantly decreased phosphorus concentration in saliva. After chewing, the phosphorous ion level in the xylitol gum group was significantly lower than in the control and CPP-ACP groups. Similarly, Santhosh et al. (16) reported a significant decrease in phosphorus ion levels after chewing CPP-ACP gum. It has been suggested that an increased salivary flow rate can lower the magnesium and phosphate levels of saliva (26). In contrast to the outcomes of this study, Poureslami et al. (25) discovered that applying CPP-ACPF and CPP-ACP toothpaste led to higher phosphate levels in saliva and plaque. However, their study utilized toothpaste, whereas the current research used gum.

A limitation of this study is that the xylitol and CPP-ACP gums had a similar smell, taste, and shape, while the paraffin pieces had a different shape and color and did not have a taste. Therefore, the blinding of the participants may have been compromised. However, the experiments were conducted in separate rooms, and the participants were unaware of the other study groups. Although taste might be effective in saliva secretion, it might not cause an intervening effect in the present study because the pH level and volume were comparable among the groups after the intervention. Another limitation was that this study only measured salivary parameters after five minutes of chewing. A more comprehensive evaluation could be made by measuring salivary properties at multiple time intervals, which would help determine the optimal chewing duration and provide more precise patient recommendations. Future clinical studies should also investigate the long-term effects of chewing gums to confirm the findings.

Conclusions

Chewing all three substances significantly increased saliva volume and pH while decreasing phosphorus concentration. The salivary calcium level in the CPP-ACP group was significantly higher than in the control group. Moreover, the phosphorus ion level in the xylitol group was lower than in the other groups. Therefore, chewing CPP-ACP gum may support oral health by boosting salivary flow rate, pH, and calcium levels.

Acknowledgments

We want to thank the students who participated in this study.

Conflict of interest

The authors declare no conflict of interest.

Authors' contributions

ZB contributed to the manuscript's study management, supervision, and editing. GM contributed to data collection. MMA contributed to data collection, chemical analysis, and interpretation. AGH contributed to the project conception, research inception, participant recruitment, data collection, and analysis. MI contributed to the manuscript's data gathering, writing, and editing. All the authors read and approved the final manuscript.

Ethical approval

This study was approved by the ethics committee of Shahid Sadoughi University of Medical Sciences, Yazd (code: IR.SSU.REC.1398.096) and registered in the Iranian Clinical Trial Registration Centre (code: IRCT20140601017935N8).

Funding

Not applicable.

References

1. Sultan S, Telgi CR, Chaudhary S, Manuja N, Kaur H, Amit SA, Lingesha RT. Effect of ACP-CPP Chewing Gum and Natural Chewable Products on Plaque pH, Calcium and Phosphate Concentration. J Clin Diagn Res 2016;10(4):13-17.
2. Vantipalli UK, Avula SSJ, Enuganti S, Bandi S, Kakarla P, Kuravadi RV. Effect of three commercially available chewing gums on salivary flow rate and pH in caries-active and caries-free children: An in vivo study. J Indian Soc Pedod Prev Dent 2017;35(3):254-259.
3. Nemati-Karimooy A, Hosseinpour Sabet R, Khorshid M, Shahri A, Mohammadipour HS. Effect of casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) on bond strength of a universal adhesive to demineralized dentin. J Dent Mater Tech 2024;13(2):52-59.
4. Asadi M, Majidinia S, Bagheri H, Hoseinzadeh M. The Effect of Formulated Dentin Remineralizing Gel Containing Hydroxyapatite, Fluoride, and Bioactive Glass on Dentin Microhardness: An In Vitro Study. Int J Dent 2024;2024(1):4788668.
5. Mohammadipour HS, Bagheri H, Babazadeh S, Khorshid M, Shooshtari Z, Shahri A. Evaluation and comparison of the effects of a new paste containing 8% L-Arginine and CaCO3 plus KNO3 on dentinal tubules occlusion and dental sensitivity: a randomized, triple blinded clinical trial study. BMC Oral Health 2024;24(1):507.
6. Rafiei S, Bagheri H, Gholizadeh M, Garmroodi AF, Montazeri AH, Rangrazi A. Effect of adding CPP-ACP into a daily-use toothpaste on remineralization of enamel white spot lesions. J Dent Mater Tech 2024;13(1):2-7.
7. Alkarad L, Alkhouli M, Dashash M. Remineralization of teeth with casein phosphopeptide-amorphous calcium phosphate: analysis of salivary pH and the rate of salivary flow. BDJ Open 2023;9(1):16.
8. Prathima GS, Narmatha M, Selvabalaji A, Adimoulame S, Ezhumalai G. Effects of Xylitol and CPP-ACP Chewing Gum on Salivary Properties of Children with Molar Incisor Hypomineralization. Int J Clin Pediatr Dent 2021;14(3):412-415.
9. Pienihäkkinen K, Hietala-Lenkkeri A, Arpalahti I, Söderling E. The effect of xylitol chewing gums and candies on caries occurrence in children: a systematic review with special reference to caries level at study baseline. Eur Arch Paediatr Dent 2024;25(2):145-160.
10. Janakiram C, Deepan Kumar CV, Joseph J. Xylitol in preventing dental caries: A systematic review and meta-analyses. J Nat Sci Biol Med 2017;8(1):16-21.
11. American Academy on Pediatric Dentistry Council on Clinical Affairs. Policy on the use of xylitol in caries prevention. Pediatr Dent 2008;30(7 Suppl):36-37.
12. Tafti SD, Parisay I, Mehrabkhani M, Sabbagh S, Seddigh S, Ghazvini K, et al. Effects of probiotic yogurt, casein phosphopeptide-amorphous calcium phosphate, and xylitol chewing gums on the salivary count of Streptococcus mutans: A single-blinded randomized controlled clinical trial. Dent Res J (Isfahan) 2023;20:115.
13. Mehrabkhani M, Parisay I, Mastoory N, Barati Doghai V. Effect of Casein Phosphopeptide Amorphous Calcium Phosphate and Xylitol Chewing Gums, and Probiotic Yogurt on Periodontal Parameters: A Randomized Clinical Trial. Front Dent 2021;18:35.
14. Padminee K, Poorni S, Diana D, Duraivel D, Srinivasan MR. Effectiveness of casein phosphopeptide-amorphous calcium phosphate and xylitol chewing gums on salivary pH, buffer capacity, and Streptococcus mutans levels: An interventional study. Indian J Dent Res 2018;29(5):616-621.
15. Emamieh S, Khaterizadeh Y, Goudarzi H, Ghasemi A, Baghban AA, Torabzadeh H. The effect of two types chewing gum containing casein phosphopeptide-amorphous calcium phosphate and xylitol on salivary Streptococcus mutans. J Conserv Dent 2015;18(3):192-195.
16. Santhosh BP, Jethmalani P, Shashibhushan KK, Subba Reddy VV. Effect of casein phosphopeptide-amorphous calcium phosphate containing chewing gum on salivary concentration of calcium and phosphorus: an in-vivo study. J Indian Soc Pedod Prev Dent 2012;30(2):146-150.
17. Shah TJ, Manju R, Joshi AB, Reenayai N. Evaluation of the cariogenic potential and total antioxidant capacity of saliva after the consumption of candies and paneer: an in vivo study. JHAS 2022;12(04):427-440.
18. Benedetti S, Primiterra M, Finco A, Canestrari F, Cornelli U. Validation of a patented method to determine the antioxidant capacity of human saliva based on the reduction of iron: The SAT test. Clin Lab 2014;60(3):475-482.
19. Razzaque MS. Salivary phosphate as a biomarker for human diseases. FASEB Bioadv 2022;4(2):102-108.
20. Hegde RJ, Thakkar JB. Comparative evaluation of the effects of casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) and xylitol-containing chewing gum on salivary flow rate, pH and buffering capacity in children: An in vivo study. J Indian Soc Pedod Prev Dent 2017;35(4):332-337.
21. Pereira JV, Maciel RP, Monteiro MJF, de Oliveira Conde NC, Vieira JMR, Rebelo MAB. Effect of chewing gum containing CPP-ACP on salivary flow and buffer capacity: An in vivo study. Pesqui Bras Odontopediatria Clin Integr 2016;16(1).
22. Polland KE, Higgins F, Orchardson R. Salivary flow rate and pH during prolonged gum chewing in humans. J Oral Rehabil 2003;30(9):861-865.
23. Kumar S, Sogi SH, Indushekar KR. Comparative evaluation of the effects of xylitol and sugar-free chewing gums on salivary and dental plaque pH in children. J Indian Soc Pedod Prev Dent 2013;31(4):240-244.
24. Banava S, Houshyari M, Safaie T. The effect of casein phosphopeptide amorphous calcium phosphate fluoride paste (CPP-ACPF) on oral and salivary conditions of patients undergoing chemotherapy: A randomized controlled clinical trial. Electron Physician 2015;7(7):1535-1541.
25. Poureslami H, Hoseinifar R, Khazaeli P, Hoseinifar R, Sharifi H, Poureslami P. Changes in the Concentration of Ions in Saliva and Dental Plaque after Application of CPP-ACP with and without Fluoride among 6-9 Year Old Children. J Dent Biomater 2017;4(1):361-366.
26. Işık HY. Effect of Chewing Gums with Different Contents on Salivary Flow Rate, pH and Ion Exchange. Selcuk Dent J 2024;11(1):43-48.