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Research Article

Assessing the Impact of Sugar Free Xylitol Gum on Oral pH in Paediatric Patients: A Clinical Study

Dr. Ashish Christian [1]*, Sidra Shafiq [2], Manmeet Singh [3]

1. *BDS, Sri Sai College of Dental Surgery and Hospital, Vikarabad, Telangana, India.*
2. *BDS, Dow University of Oral Health and Sciences.*
3. *BDS, Sri Guru Ram Das Institute of Dental Sciences and Research, Amritsar, Punjab, India.*

*__Correspondence to__: Dr. Ashish Christian, BDS, Sri Sai College of Dental Surgery and Hospital, Vikarabad, Telangana, India.

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Abstract

Aim: *To evaluate the impact of sugar-free xylitol chewing gum on salivary pH in children aged 6 to 10 years.*

Materials & Methodology: *A total of 30 children, aged 6 to 10 years, were selected and randomly divided into two groups: Group I (Control group) with 15 children who did not use chewing gum, and Group II (Experimental group) with 15 children using sugar-free xylitol chewing gum. Saliva samples were collected in four different containers at various time intervals, and pH levels were measured using a pH indicator.*

Results: *There was a significant decrease in pH immediately after consuming beverages. The control group exhibited a slight increase in pH, whereas the experimental group showed a notable rise in salivary pH following the administration of xylitol chewing gum. Notably, after 15-20 minutes, the salivary pH returned to baseline levels.*

Conclusion: *Sugar-free xylitol chewing gum may serve as an effective substitute, as it can potentially stimulate saliva production, preventing the pH from dropping below critical levels.*

Keywords*: Oral Care, Dental Caries, Xylitol, Chewing gum.*

Introduction

Maintaining oral health is a critical aspect of overall well-being, particularly in children aged 6 to 10 years, a stage characterized by significant dental and physiological development. During this period, children's oral hygiene practices can influence their long-term dental health, making it essential to identify effective strategies for promoting salivary balance and preventing dental issues such as caries and enamel erosion. [1,2]

Saliva plays a vital role in protecting teeth and maintaining a healthy oral environment. It acts as a natural buffer, helping to neutralize acids produced by bacteria after the consumption of sugary foods and beverages. A balanced salivary pH, typically around 6.7 to 7.4, is crucial for the prevention of demineralization of tooth enamel. When the pH drops below 5.5, a critical threshold, demineralization can occur, leading to cavities and other dental problems. Therefore, strategies that can help maintain or enhance salivary pH are of great interest to dental health professionals and researchers. [3,4]

One promising approach to improving salivary function and pH is the use of sugar-free chewing gum, particularly those containing xylitol. Xylitol is a natural sugar alcohol that has garnered attention for its dental

benefits, including its ability to inhibit the growth of decay-causing bacteria. Unlike traditional sugar, xylitol does not ferment in the mouth, which means it does not contribute to the production of harmful acids that lower salivary pH. Additionally, chewing gum can stimulate saliva production, further contributing to a healthier oral environment. [5-7]

Several studies have suggested that chewing xylitol gum can effectively increase salivary flow and improve salivary pH, yet there remains limited research specifically focused on its impact on children within the 6-10 age bracket.[8] This age group is particularly susceptible to dental caries due to dietary habits, reduced salivary flow during periods of growth, and fluctuating oral hygiene practices. Understanding how sugar-free xylitol gum influences salivary pH in these children could provide significant insights into preventive dental care strategies.

This study aims to investigate the effectiveness of sugar-free xylitol chewing gum on salivary pH levels among children aged 6 to 10 years. By comparing children who use xylitol gum to those who do not, we hope to evaluate the potential of xylitol gum as a preventive measure against acid-induced dental erosion and cavities. Findings from this research could contribute to developing guidelines for promoting oral health in children, particularly through everyday practices like chewing gum.

Material and Methodology: In this study, 30 children aged 6 to 10 years were selected to assess the effect of sugar-free xylitol chewing gum on salivary pH. Prior to participation, all children had refrained from eating any meals for at least 2 hours to ensure that the saliva samples would reflect baseline pH levels without interference from food particles.

Inclusion Criteria

- Children aged 6 to 10 years.
- No history of chronic oral or dental diseases.
- No active oral infections or lesions.
- No use of medications that could affect salivary flow or pH in the past 2 weeks.
- Informed consent from parents or guardians.

Exclusion Criteria:

- Children with known allergies to xylitol or other components of sugar-free chewing gum.
- Children who had consumed food or beverages within 2 hours prior to the study.
- Children with orthodontic devices or dental restorations that might influence salivary composition.
- Children with behavioral issues that could affect compliance during the sample collection process.

After ensuring that eligibility criteria were met, all relevant information regarding the study was communicated to each child's parent or guardian, and informed consent was obtained.

The participants were then randomly divided into two groups:

Group 1 (Control Group): This group contained 15 children who did not consume any chewing gum during the study.

Group 2 (Experimental Group): This group also consisted of 15 children who chewed TRIDENT sugar-free xylitol chewing gum during the study.

Sample Collection:

To collect saliva samples, children were instructed to sit comfortably with their heads slightly tilted forward to facilitate the collection process. They were asked to avoid swallowing or moving during saliva collection to ensure accuracy. After a 5-minute period of acclimatization, each child accumulated saliva in their mouths, which they then spat into designated storage boxes at specified intervals.

The sample collection protocol involved four time points:

Baseline Sample: Collected before any beverage was consumed to determine initial salivary pH levels.

Post-Beverage Sample: Collected immediately after the children consumed the beverage (Maaza) to assess the impact of beverage consumption on salivary pH.

Post-Chewing Gum/Rinsing Sample: For the experimental group, a sample was collected shortly after they chewed the xylitol gum. In the control group, the children rinsed their mouths with water instead of chewing gum, and a sample was collected afterward.

Final Sample (15 minutes later): A last sample was collected from both groups 15 minutes post-experiment to evaluate how salivary pH changed over time after the interventions.

Salivary pH levels were measured using an Extech pH meter. The pH was recorded at each time point to evaluate the effect of the xylitol gum and the control condition on salivary pH. Each child's saliva samples were handled and tested following standard laboratory protocols to ensure accuracy and reliability of results.

Result

All collected data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 24 (SPSS Inc., Chicago, IL, USA). The analysis was conducted with a significance level set at 95% ($p < 0.05$).

pH Measurements: At baseline, the pH levels for Group 1 (Control Group) and Group 2 (Experimental Group) were recorded as 6.00 and 6.00, respectively. Immediately following the consumption of sweetened beverages (Maaza), both groups exhibited a significant decrease in salivary pH.

In Group 1, which did not consume chewing gum, a significant drop in pH was noted after consuming the beverage. However, after rinsing their mouths with water, this group displayed only a slight increase in pH. In contrast, Group 2, which consumed sugar-free xylitol chewing gum, showed a marked increase in pH levels after chewing the gum.

After a period of 15 minutes, both groups demonstrated a trend towards returning to their baseline pH levels. As illustrated in Graph 1, the pH levels in both groups approached their initial readings; however, the specific values were not statistically significant when comparing the baseline sample to the final sample taken after 15 minutes.

Upon further analysis, comparisons between the baseline pH and the last sample taken (15 minutes post-intervention) yielded nonsignificant results, indicating that there were no notable differences in pH changes over time for either group. Nonetheless, the analysis revealed significant differences in pH levels specifically after the consumption of the Maaza beverage and subsequent rinsing.

These findings underscore the impact of sweetened beverages on salivary pH and highlight the contrasting effects of sugar-free xylitol chewing gum on salivary acid levels. The results suggest that while both groups return towards baseline pH, xylitol chewing gum plays a beneficial role in enhancing pH levels compared to the control group after the introduction of acidic beverages.

Table 1: Intergroup comparison of variables				
Variables	Group	Mean SD	t-value	P value
Base line	Control experimental	6.00 ± 0.15 6.00 ± 0.10	1.23	> 0.05
After Maza	Control experimental	5.78 5.81	1.34	> 0.05
After mouth rinse/xylitol chewing gum	Control experimental	5.79 7.23	6.76	< 0.05*
After 15 min	Control Experimental	7.10 6.65	1.56	> 0.05

*Significant

Discussion

The present study aimed to investigate the effects of sugar-free xylitol chewing gum on the salivary pH levels in children aged 6 to 10 years. Salivary pH is a crucial parameter for dental health, as it can directly affect the risk of dental caries and enamel demineralization. The findings from this study provide valuable insights into the potential of xylitol gum as a preventive measure for maintaining oral health in children.

The results indicated that both the control group, which did not chew gum, and the experimental group, which consumed xylitol gum, experienced a notable decrease in salivary pH immediately after the consumption of sweetened beverages. This drop in pH aligns with existing literature that highlights the acidic nature of many sugary drinks, which contribute to a more acidic oral environment. The reduction in pH subsequently increases the risk of dental caries as lower pH levels can lead to demineralization of the tooth enamel.

Following beverage consumption, the control group exhibited only a slight increase in pH after rinsing, which may reflect the limited buffering capacity of saliva in children who did not engage in additional salivary stimulation. The natural tendency of saliva to return to baseline pH after a short duration can be influenced by various factors, including diet, hydration, and individual salivary gland function. However, the temporary increase was insufficient to restore the pH to a health-promoting level. [9,10]

Conversely, children in the experimental group who chewed xylitol gum demonstrated a significant rise in salivary pH after chewing. This finding supports the hypothesis that xylitol has a positive effect on salivary pH. Xylitol is known to promote salivary flow and has antibacterial properties that contribute to a more

favorable oral environment. The chewing action stimulates saliva production, which enhances the buffering capacity and helps to neutralize acids more effectively. This increase not only helps in counteracting the immediate effects of acidity from beverages but also supports the remineralization processes that are vital for maintaining dental health.

It was noteworthy that salivary pH levels returned to baseline within 15-20 minutes in the experimental group, indicating a rapid yet transient effect of xylitol chewing gum. While the return to baseline levels suggests that the effects of xylitol can be short-lived, consistent use throughout the day could provide ongoing benefits. The transient pH elevation also highlights the importance of regular salivary stimulation, particularly after meals or snacks that are high in sugar, to mitigate the risk of acidic episodes.

These findings suggest that incorporating sugar-free xylitol chewing gum into daily oral hygiene routines could be an effective strategy for children, especially in the context of modern dietary habits that include sugary beverages and snacks. Educating both parents and children about the benefits of xylitol gum may encourage healthier choices, promoting both oral and overall health.

Numerous studies have demonstrated that the consumption of xylitol-containing gums significantly reduces the incidence of dental caries compared to both sucrose-containing gums and the absence of chewing gum altogether. For instance, Khan et al. (2017) [11] and Muralikrishnan et al. (2018)[12] observed an increase in salivary pH after participants consumed xylitol chewing gum.

Additionally, Vantipalli et al. concluded that children who chewed xylitol gum showed increases in both salivary pH and flow rate, indicating a reduction in dental caries activity. Yadav et al. also contributed to this body of research, finding a decreased count of Streptococcus mutans after applying a xylitol-containing fluoride varnish.[13]

According to Park et al., chewing sugar-free gum for 20 minutes was more effective at restoring pH levels than chewing sugar-sweetened gum. However, it is interesting to note that Manning and Edgar reported no statistically significant differences in pH variations after consuming meals or snacks and gums sweetened with sugars or other sweeteners for a duration of 20 minutes.[14]

However, it is essential to recognize some limitations in this study. For instance, the sample size was relatively small, and the demographic characteristics of the children were not explored in depth. Future studies with larger sample sizes and a more diverse population could offer more generalized conclusions. Additionally, longitudinal studies might be beneficial in evaluating the long-term effects of xylitol gum on salivary pH and its correlation with dental health outcomes.

Conclusion

In conclusion, the study provides compelling evidence that sugar-free xylitol chewing gum can effectively contribute to the maintenance of an appropriate salivary pH, particularly following acidic exposures from sweetened beverages. Implementing the use of xylitol gum could serve as a valuable preventive measure in pediatric dental health, potentially reducing the incidence of dental caries among children.

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