

Effects of Sweets and Cold Drinks on Tooth Surfaces Among Government School Students in Peshawar

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Abstract

Background: The increasing consumption of sweets and cold drinks has raised concerns regarding their adverse effects on dental health, particularly among school-aged children.

Aim: This study investigates the influence of sweetened foods and beverages on tooth surface integrity.

Methodology: Data were collected from school students to assess their dietary habits and dental health conditions. The analysis highlights a significant correlation between frequent consumption of sugary items and cold drinks and the prevalence of dental erosion, cavities, and enamel demineralization.

Results: Results reveal that children consuming these items regularly exhibit a higher incidence of tooth surface damage.

Conclusion: The discussion explores potential preventive measures, including dietary modifications, dental hygiene education, and regular dental check-ups, to mitigate these effects. This research underscores the critical need for awareness campaigns targeting school children and their guardians to promote healthier dietary practices and preserve oral health.

Keywords: Soda, Fermentable Sugar, Micro Organisms, Demineralization

Introduction

The rise in sugary drink intake is a major public health concern since it has a negative influence on oral health, notably in terms of dental caries and enamel erosion. Sugary liquids such as sodas, energy drinks, and juices contain fermentable sugars which are digested by bacteria in the mouth to generate acids. These acids demineralize the enamel, the protective outer covering of teeth, contributing to the formation of cavities. The pH of sugary drinks, specially carbonated ones, is also acidic, further promoting enamel dissolution and making teeth more vulnerable to decay.¹ There may be simple scientific proof to help the direct hyperlink among the frequency of consumption of sugary drinks and the danger of dental caries. These drinks provide a steady delivery of fermentable sugars thus causing production of acids via oral microorganisms. This leads to lowering the pH within the oral cavity and demineralization of the tooth. Enamel decay which is characterized by cavities and diseased enamel, might also finally arise from this demineralization.² This problem is especially extensive in Pakistan, where sugar-stuffed beverages are conveniently handy and reasonably priced. A public fitness concern results from the combination of immoderate use of positive drinks and inadequate dental care habits.³

Besides this, enamel erosion is another important consequence of sugary drink intake. Over time, acidic drinks may lead to everlasting damage to enamel, which distinct cavities, cannot

reestablish. This erosion increases tooth sensitivity and additionally exposes the teeth to risk of cavities. The consistency of sugary drink consumption is a serious factor in this progression; consuming sugary drinks several times a day or drinking on them over lengthy periods increases the period of acid contact to the teeth, which increases the risk of both caries and erosion.⁴

The sugars and acids in sugary beverages additionally increase the chance of tooth discoloration, which can result in unpleasant stains that can be hard to do away with.⁵ Frequently called biofilm, dental plaque is a sticky coating that develops at the surface of the tooth. Saliva, food debris, and bacteria make up this biofilm. Although plaque is a common manifestation, daily consumption of sugary meals or liquids can cause trouble. Dental caries develops because of the bacteria in plaque breaking down glucose to supply acids that demineralize teeth. Certainly, one of the most important causes of plaque accumulation and dental decay is sugary and acidic drinks, consisting of sodas, energy drinks, and sweetened juices.⁶ If plaque isn't continuously eliminated by brushing and flossing, it in the end solidifies into calculus or tartar. After tartar has advanced, it is notably tougher to take away, which causes plaque to accumulate and teeth to turn out to be demineralized. Enamel decay is elevated through tartar, which also can result in more critical oral fitness troubles such as gum sickness and tooth loss.⁷ The teeth are unable to undergo spontaneous remineralization because of the steady acid assaults at the teeth, which are made viable through plaque. Minerals from saliva are frequently useful resources in the recovery of demineralized teeth. However, this phase is weakened by using non-stop exposure to acids from sugary beverages.⁸ This leads to a circumstance in which the enamel steadily deteriorates, making tooth decay much more likely. Plaque in addition complicates this method by supplying a secure haven for dangerous bacteria, which increases their capacity to make acid and further erode teeth.⁹ Moreover, the low pH of the beverages contributes to

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erosion of teeth as studies reveal that enamel starts to demineralize when the mouth's pH falls below 5.5. Because of their acidity and carbonation, cola drinks in particular have been proven to be among the most erosive.¹⁰ The truth that a tooth can't regrow once it's eliminated is the maximum worrisome function of enamel erosion. Lengthy-time period dental troubles result from this, such as heightened tooth sensitivity that makes eating hot, cold, or candy ingredients uncomfortable.¹¹ Uncovered dentin is extra vulnerable to bacterial invasion and has a lower resistance to decay. Enamel that lacks teeth is more liable to cavities and different damage, underscoring the need for early intervention and preventative measures.¹²

Studies have indicated a clear correlation between these beverages' erosive effect and their pH and carbonation ranges. These beverages' excessive acidity encourages teeth to dissolve, increasing the susceptibility of teeth to decay.¹³

The decay can increase to the factor where considerable sections of the tooth structure are destroyed if enamel erosion and tooth surface loss are not addressed. Excessive erosion can motivate the teeth to go to the pot to the factor wherein deep contamination necessitates extraction or root canal therapy. Moreover, microorganisms from inflamed teeth might migrate to nearby locations, resulting in greater critical health problems. The visual effect on teeth is often the maximum apparent result of enamel degradation as teeth may also turn out to be discolored whilst enamel erodes, which can cause aesthetic troubles, particularly for more young individuals who are self-conscious about their smiles.¹⁴

Objectives

To find out the effects of sweets and cold drinks on tooth surfaces among government boys and girls school's students at Police Colony Nasir Bagh Peshawar. To raise awareness among school students about the harmful effects of sweets and cold drinks on oral health. Both sweets and cold drinks contribute to acid erosion, enamel softening, tooth decay, plaque, tartar, and discoloration. Frequent consumption of sugary and acidic foods and drinks increases the risk of these issues, which can lead to serious dental problems. Educating students at an early age on these risks is crucial for promoting better oral hygiene and overall health.

Methodology

This study was a cross-sectional study conducted at Govt schools Police Colony Nasir Bagh Peshawar. The duration of this study was approximately 6 months. Convenience sampling technique was used to collect samples. Open Epi software was used to calculate the sample size. The sample size for this study was 281 with anticipated frequency of 50%, with confidence interval 95% and marginal error 5%. Ethical permission was taken from the institute ethical committee having Reg No.166/GMS/2024. Furthermore, pre-procedure permission was taken from school principals regarding data collection while written inform consent was taken from students before clinical examination and questionnaire to be filled. Data was collected through questionnaire and clinical examination. Clinical examination was performed through dental examination kit. Statistical analysis of data was conducted by statistical package SPSS Version 22. Continuous variables were presented by mean and standard deviation. Categorical variables were expressed in percentage and frequency table to estimate the difference between groups.

Results

The demographic data included 281 participants aged between 11 and 16 years, with a mean age of 13.5 years and a standard deviation of 1.44. Results showed a significant correlation between the frequency of sweet consumption and the presence of enamel erosion, with higher consumption leading to more pronounced damage. Cold drinks, particularly carbonated beverages, were identified as major contributors to the degradation of tooth surfaces, with a notable prevalence of acidic pH levels causing enamel demineralization. Male students exhibited slightly higher rates of dental erosion compared to female students, possibly due to differing dietary habits. Furthermore, students who consumed both sweets and cold drinks frequently displayed the most severe dental surface deterioration, highlighting the compounded effects of these dietary factors. These findings underscore the critical need for dietary awareness and preventive dental care among school-aged children. The study involved 281 school students aged 11 to 16 years, with the largest group being 11-year-olds (22.1%). Females dominated the sample, comprising 72.2%, while 6th class students represented the highest educational level (34.5%). This diverse demographic ensures robust insights into the impact of sweets and cold drinks on tooth surfaces as shown in table 1.

Table 1: Demographic and Education Levels

| S/NO | Variable | Categories | Frequency | Percentages |
|------|-------------------|------------|-----------|-------------|
| 1 | Age Group | 11 years | 62 | 22.1% |
| | | 12 years | 53 | 18.9% |
| | | 13 years | 59 | 21.0% |
| | | 14 years | 47 | 16.7% |
| | | 15 years | 29 | 10.3% |
| | | 16 years | 31 | 11.0% |
| | | Total | 281 | 100% |
| 2 | Gender | Male | 78 | 27.8% |
| | | female | 203 | 72.2% |
| | | Total | 281 | 100% |
| 3 | Educational Level | 4th class | 68 | 24.2% |
| | | 5th class | 45 | 16.0% |
| | | 6th class | 97 | 34.5% |
| | | 7th class | 28 | 10.0% |
| | | 8th class | 42 | 14.9% |
| | | Total | 281 | 100% |

The oral health survey of 281 participants revealed that 78.3% brush their teeth, but only 24.9% brush twice a day. About 50.5% use a toothbrush before bed, and 34.9% use dental floss. Sweets are consumed daily by 30.2%, and cold drinks by 11.4%. Notably, 83.6% visit the dentist only when a problem arises, with 48.4% reporting tooth sensitivity or pain after consuming sweets or cold drinks.

Clinical examinations of 281 participants showed that 55.9% had dental plaque, while 46.6% had tooth cavities. Tooth discoloration was observed in 44.5%, and 13.2% showed signs of erosion. Tooth loss was minimal at 12.5%, and only 5.0% had filled teeth, highlighting significant oral health concerns among the participants. The data further showed that 59.1% of females brush their teeth once a day compared to only 15.4% of males. Additionally, 20.4% of males reported never brushing their teeth, significantly higher than 1.5% of females, highlighting better oral hygiene practices among females.

The comparison showed that 62.1% of females use a toothbrush before bed, significantly higher than 20.5% of males. Conversely, 53.8% of males reported not using a toothbrush before bed, compared to only 18.7% of females, emphasizing better nighttime oral hygiene practices among females. When asked about use of floss the data showed that 46.3% of females use dental floss, either regularly or sometimes, compared to only 30.8% of males. A notable 69.2% of males reported not using dental floss, highlighting a significant gender difference in flossing habits, with females practicing better oral care.

Regarding use of miswak that data showed that 57.7% of males use miswak, either regularly or sometimes, compared to only 29.6% of females. However, a significant proportion of females (58.6%) reported never using miswak, while 28.2% of males never used it, indicating varied preferences and practices between genders.

When asked about use of drinks and sweets the data showed that 84.6% of males rarely consume sweets, with only 24.4% eating them daily. In contrast, 32.5% of females eat sweets daily, and 35% consume them rarely. This indicates a higher frequency of sweet consumption among females compared to males. Furthermore, that 28.2% of males rarely drink cold drinks, while 12.8% drink them daily. Among females, 50.7% consume cold drinks rarely, and 10.8% drink them daily. This highlights that both genders consume cold drinks more infrequently, with females showing a higher percentage of occasional consumption.

Regarding dental check-ups the data showed that 86.4% of males visit the dentist only when they have a problem, compared to 82.3% of females. However, more females (6.4%) go for check-ups every six months, while only 1.3% of males do. This indicates a lower frequency of regular dental visits among males compared to females.

When asked about having any issues after sweet or cold and rinsing after taking sweet the data showed that 85.9% of females reported experiencing tooth sensitivity or pain after eating sweets or drinking cold drinks, compared to only 11.5% of males. This suggests that tooth sensitivity is more prevalent among females, highlighting a potential gender difference in dental reactions to sugary or cold foods and beverages. Besides this, 83.3% of females rinse their mouth after eating sweets or drinking cold drinks, with 31.9% doing so regularly. In contrast, only 23.1% of males rinse their mouth after such activities, with the majority (61.5%) rarely doing so. This indicates that females are more consistent in maintaining oral hygiene after consuming sugary or cold items. All these findings are given in table 2.

The distribution of dental plaque among males and females showed that the number of individuals with and without dental plaque, as well as the corresponding percentages. Out of 281 total participants, 157 reported having dental plaque (55.84%), while 124 did not (44.16%). Among males, 20 individuals had plaque (25.64%), and 58 did not (74.36%). Among females, 137 had plaque (67.47%), and 66 did not (32.53%).

The distribution of tooth loss among males and females showed that number of individuals with and without tooth loss,

Table 2: Oral Hygiene Practice and Beverages Intake.

| Variable | Categories | Frequency | Percentages |
|---|--------------------------|-----------|-------------|
| Do you brush your teeth? | Yes | 220 | 78.3% |
| | No | 61 | 21.7% |
| How many times do you brush your teeth? do you use? | Once a day | 132 | 47.0% |
| | Once in a week | 27 | 9.6% |
| | Twice a day | 70 | 24.9% |
| | Once in a month | 10 | 3.6% |
| | Never | 42 | 14.9% |
| Do you use a toothbrush before bed? | Yes | 142 | 50.5% |
| | No | 80 | 28.5% |
| | Some time | 59 | 21.0% |
| Do you use dental floss? | Yes | 98 | 34.9% |
| | No | 110 | 39.1% |
| | Some time | 73 | 26.0% |
| Do you use miswak? | Yes | 67 | 23.8% |
| | No | 161 | 57.3% |
| | Some time | 53 | 18.9% |
| How often do you eat sweets (like candy or chocolates)? | Daily | 85 | 30.2% |
| | Rarely | 119 | 42.3% |
| | Never | 14 | 5.0% |
| | Weekly | 57 | 20.3% |
| | Monthly | 6 | 2.0% |
| How often do you drink cold drinks? | Daily | 32 | 11.4% |
| | Rarely | 154 | 54.8% |
| | Never | 22 | 7.8% |
| | Weekly | 55 | 19.6% |
| | Monthly | 18 | 6.4% |
| How often do you go to the dentist for check-ups? | Every 6 month | 14 | 5.0% |
| | Once a year | 32 | 11.4% |
| | Only if I have a problem | 235 | 83.6% |
| Have you noticed tooth sensitivity or pain after eating sweets or drinking cold drinks? | Yes | 136 | 48.4% |
| | No | 145 | 51.6% |
| | Always | 74 | 26.3% |
| | Rarely | 164 | 58.4% |
| | Never | 43 | 15.3% |

as well as the corresponding percentages. Out of the 281 total participants, 35 reported having tooth loss (12.46%), while 246 did not (87.54%). Among males, 3 individuals had tooth loss (3.85%), and 75 did not (96.15%). Among females, 32 had tooth loss (15.77%), and 171 did not (84.23%)

The distribution of tooth discoloration among males and females showed that the number of individuals with and without discoloration, as well as the corresponding percentages. Out of the 281 total participants, 125 reported having discoloration (44.47%), while 156 did not (55.53%). Among males, 31 individuals had discoloration (39.74%), and 47 did not (60.26%). Among females, 94 had discoloration (46.31%), and 109 did not (53.69%).

The distribution of tooth erosion among males and females. It includes the number of individuals with and without erosion, as well as the corresponding percentages. Out of the 281 total participants, 37 reported having tooth erosion (13.15%), while 244 did not (86.85%). Among males, 2 individuals had erosion (2.56%), and 76 did not (97.44%). Among females, 35 had erosion (17.25%), and 168 did not (82.75%).

The distribution of tooth cavities among males and females showed that the number of individuals with and without tooth

cavities, as well as the corresponding percentages. Out of the 281 total participants, 131 reported having tooth cavities (46.56%), while 150 did not (53.44%). Among males, 31 individuals had tooth cavities (39.74%), and 47 did not (60.26%). Among females, 100 had tooth cavities (49.26%), and 103 did not (50.74%).

The distribution of filled teeth among males and females the number of individuals with and without filled teeth, as well as the corresponding percentages. Out of the 281 total participants, 14 reported having filled teeth (4.98%), while 267 did not (95.02%). Among males, 2 individuals had filled teeth (2.56%), and 76 did not (97.44%). Among females, 12 had filled teeth (5.91%), and 191 did not (94.09%).

The findings of this study align with global oral health trends, highlighting gaps in preventive dental care and oral hygiene practices. A study conducted by NN Stella *et al.*, reported that 70-80% of participants brushed their teeth, but less than 30% brushed twice daily, which is consistent with this study's finding of 24.9%. Similarly, the low rate of dental floss usage (34.9%) parallels findings where flossing rates was below 40%, indicating limited adoption of comprehensive oral hygiene practices. Daily sweet consumption (30.2%) and cold drink intake (11.4%) reflect dietary habits and identify frequent sugar and acidic drink consumption as significant risk factors for dental issues.¹⁵ The high rate of dentist visits only when problems arise (83.6%) is compared. Furthermore, 48.4% reporting tooth sensitivity after consuming sweets or cold drinks aligns with DD Chawhuaveang *et al.* (2024), who linked enamel erosion to dietary habits. These comparisons underscore the urgent need for public health initiatives promoting regular dental visits, better oral hygiene, and reduced sugary and acidic food consumption.¹⁶

The clinical findings of this study highlight significant oral health concerns, which are consistent with trends observed in similar research. The 55.9% prevalence of dental plaque aligns with NN Stella *et al.*, who reported plaque in over half of adolescent populations, linking it to inadequate oral hygiene practices.¹⁵ The high rate of tooth cavities (46.6%) corresponds with WHO (2022) estimates that dental caries affects 60-90% of school-aged children globally, with sugary diets as a primary contributor.¹⁶ The 44.5% prevalence of tooth discoloration parallels JN Fathima *et al.*, which associated discoloration with frequent sweet and cold drink consumption. Signs of tooth erosion in 13.2% of participants are consistent to enamel erosion, commonly among adolescents due to acidic beverage intake. Tooth loss (12.5%) and the low percentage of filled teeth (5.0%) reflect findings by JN Fathima *et al.*, who noted that limited access to dental care in underserved areas often results in untreated dental issues.¹⁷

The data on sweet consumption aligns with trends observed in other studies, indicating gender differences in dietary habits. For instance, Dj Mela *et al.* reported that females often consume sugary foods more frequently than males, a pattern attributed to sociocultural factors and preferences for sweet-tasting foods. The female participants had a higher daily intake of sweets compared to males, correlating this behavior with

increased risk of dental caries and plaque buildup. The findings in this study, where 32.5% of females consume sweets daily compared to only 24.4% of males, are consistent with these observations and reinforce the need for gender-specific dietary education and interventions to reduce sweet consumption.¹⁸

The findings on cold drink consumption are consistent with trends reported in related research, which often highlights gender differences in beverage consumption patterns. NZ Jumakulovich *et al.* observed that adolescents generally consume acidic beverages, such as cold drinks, infrequently, but gender variations exist. This study's data, where 50.7% of females and 28.2% of males consume cold drinks rarely and females are more likely to consume such drinks occasionally rather than regularly. The daily consumption rates (12.8% males and 10.8% females) align with studies suggesting that regular cold drink intake is less common but still contributes significantly to dental erosion and other oral health issues.¹⁹

The distribution of tooth erosion among males and females highlights significant gender differences, consistent with trends observed in previous studies. In this study, 13.15% of participants experienced tooth erosion, with a much higher prevalence in females (17.25%) compared to males (2.56%). KA Schulze *et al.* similarly reported higher rates of enamel erosion among females, attributing this to greater consumption of acidic beverages and possibly thinner enamel in females. The lower prevalence in males (2.56%) aligns that males might engage less frequently in dietary habits that contribute to erosion, such as regular consumption of acidic drinks or sweets.²⁰

Conclusion

This study highlights the oral health concerns among schoolchildren in Peshawar, with high rates of dental plaque, cavities, tooth discoloration, and sensitivity, particularly among females, despite their better hygiene practices. Gender disparities revealed that females were more prone to dental issues due to higher sweet and cold drink consumption, while males exhibited poorer hygiene habits. The low rate of treated dental issues, such as filled teeth, highlights limited access to dental care and emphasizes the need for targeted interventions to improve oral health outcomes.

Recommendation

To address these issues, schools and communities should implement educational programs promoting regular oral hygiene practices, such as brushing twice daily and rinsing after meals. Dietary awareness campaigns should encourage reduced consumption of sweets and acidic drinks. Additionally, initiatives to improve access to dental care, including routine check-ups and affordable treatments, are essential to prevent and manage oral health issues effectively.

Limitations

The study's limitations include a relatively small sample size, potentially affecting the generalizability of findings. Self-reporting bias is a concern, and future studies could incorporate observational methods.

Discussion

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2. Abrar Ahmad - Conceptualization and Methodology of study
3. Talha Falak Khalil— Manuscript writing
4. Sami Salleh Khan- Data Analysis
5. Muhammad Muqarab - Manuscript review