# Exploring The Link Between Dietary Habits And Dental Erosion A Population Based Study

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**Abstract**
**Background:** Dental erosion, a progressive loss of enamel due to chemical dissolution by acids without bacterial involvement, has become a significant public health concern. The rising prevalence is linked to dietary habits, particularly frequent consumption of acidic foods and beverages. Understanding the relationship between diet and dental erosion is crucial for developing preventive strategies. Hence, this population-based study aimed to explore the association between dietary patterns and dental erosion, focusing on the impact of acidic food and beverage consumption.
**Objectives:** To assess the prevalence of dental erosion and determine its association with dietary habits, including the consumption of acidic foods, carbonated beverages, and other dietary factors that may contribute to enamel demineralization.
**Methods:** A cross-sectional study was conducted among 500 participants aged 18–45 years, recruited from urban and rural areas. Clinical examinations were performed using the Basic Erosive Wear Examination (BEWE) index to assess dental erosion. Dietary habits were evaluated through a validated food frequency questionnaire, categorizing intake of carbonated drinks, citrus fruits, sports drinks, and other acidic foods. Data were analyzed using descriptive statistics and logistic regression to determine significant associations.
**Results:** The overall prevalence of dental erosion was 42%. Participants consuming carbonated drinks more than three times a week had a significantly higher risk of erosion (OR = 2.8, 95% CI: 1.9–4.1, $p < 0.001$). High-frequency citrus fruit intake was also associated with increased erosion risk (OR = 2.1, 95% CI: 1.5–3.2, $p < 0.01$). Protective dietary factors included regular dairy consumption, which was inversely associated with dental erosion (OR = 0.6, 95% CI: 0.4–0.9, $p = 0.02$).
**Conclusion:** Dietary habits play a crucial role in the development of dental erosion, with frequent consumption of acidic beverages and foods significantly increasing the risk. Public health initiatives should emphasize dietary modifications, including reduced intake of erosive foods and increased consumption of protective foods like dairy, to mitigate enamel wear.

**Keywords:** Dental erosion, dietary habits, acidic beverages, enamel wear, nutrition, oral health.

## Introduction

Dental erosion is a progressive, irreversible loss of tooth enamel due to chemical dissolution by acids that are not of bacterial origin. Unlike dental caries, which result from microbial fermentation of sugars producing acid, erosion is primarily caused by direct exposure of the tooth surface to dietary or gastric acids [1]. Over the past few decades, dental erosion has emerged as a significant public health concern, particularly with the increasing consumption of acidic foods and beverages in modern diets [2]. The condition can lead to dentin hypersensitivity, compromised aesthetics, and functional impairment, ultimately affecting the overall quality of life [3].

Diet plays a crucial role in the etiology of dental erosion. Frequent consumption of acidic beverages such as carbonated soft drinks, fruit juices, sports drinks, and energy drinks has been strongly associated with enamel demineralization [4,5]. Additionally, dietary acids from citrus fruits, vinegar-based foods, and certain alcoholic

beverages contribute to the erosive process [6]. The erosive potential of dietary acids depends on factors such as pH level, titratable acidity, calcium-chelating properties, frequency of intake, and duration of acid exposure [7]. Furthermore, lifestyle habits such as sipping acidic drinks over prolonged periods, swishing liquids before swallowing, and inadequate water intake exacerbate the risk of erosion [8].

While dietary acids are a major risk factor for dental erosion, certain dietary components may have protective effects. Dairy products, for instance, contain calcium and phosphate, which enhance remineralization and buffer acid attacks [9]. Similarly, fibrous foods stimulate salivary flow, which plays a critical role in neutralizing acids and maintaining oral pH balance [1]. Saliva itself has significant protective properties, including its ability to form the acquired pellicle, which can serve as a barrier against acid exposure [10].

Despite growing awareness, there remains a lack of large-scale population-based studies assessing the relationship between dietary habits and dental erosion. The present study aims to investigate the prevalence of dental erosion and explore its association with dietary patterns, focusing on both risk and protective factors. By identifying dietary contributors to enamel loss, this research can contribute to the formulation of dietary guidelines and preventive strategies for mitigating dental erosion and promoting long-term oral health.

## Materials and Methodology

### Study Design and Setting

A cross-sectional population-based study was conducted to assess the prevalence of dental erosion and its association with dietary habits. The study was carried out in both urban and rural areas, ensuring a representative sample of the population. Ethical approval was obtained from the institutional ethics committee, and written informed consent was obtained from all participants.

### Study Population and Sample Size

The study included **500 participants** aged **18–45 years**, recruited through random sampling from dental clinics, community health centers, and educational institutions. Participants with a history of dental erosion, systemic conditions affecting salivary flow (e.g., Sjögren's syndrome), or recent dental restorations interfering with erosion assessment were excluded. The sample size was determined based on previous prevalence studies and power calculations, ensuring statistical reliability.

### Ethical Considerations

This study adhered to the principles of the **Declaration of Helsinki**. Participants were informed about the study's purpose, and confidentiality was maintained throughout data collection and analysis.

### Reliability and Calibration

Inter- and intra-examiner reliability was assessed using **Cohen's kappa coefficient**, with a target agreement of **≥0.85**. Twenty percent of the sample was re-evaluated after **30 days** to ensure consistency in clinical assessment.

### Data Collection

### Clinical Examination

A single calibrated examiner conducted all dental examinations using the **Basic Erosive Wear Examination (BEWE) index**, a validated tool for assessing erosive tooth wear. Each tooth was scored based on surface loss severity:

- **Score 0** – No erosive wear
- **Score 1** – Initial loss of surface texture
- **Score 2** – Hard tissue loss <50% of the surface
- **Score 3** – Hard tissue loss ≥50% of the surface

The cumulative BEWE score was used to classify erosion severity as **none, low, medium, or high risk**. Examinations were performed under standardized lighting using a dental mirror and probe, with participants seated in a dental chair.

### Dietary Assessment

A **validated food frequency questionnaire (FFQ)** was administered to collect dietary data. Participants reported the frequency and quantity of consumption for:

- Carbonated soft drinks
- Citrus fruits and juices
- Sports and energy drinks
- Vinegar-based foods and acidic sauces
- Dairy products (as a protective factor)

The questionnaire also included lifestyle habits such as method of consumption (e.g., sipping vs. gulping), duration of exposure, and use of straws.

**Salivary Analysis**
Unstimulated saliva samples were collected from **100 randomly selected participants** to measure **salivary pH and buffering capacity**, which are critical in assessing erosion risk. Saliva was collected in sterile tubes and analyzed using a pH meter and a buffering capacity test kit.

**Statistical Analysis**
Data were analyzed using **SPSS version 25.0**. Descriptive statistics (mean, standard deviation, and frequency distributions) were used to summarize findings. Logistic regression analysis was performed to assess associations between dietary habits and dental erosion, adjusting for confounders such as age, gender, and oral hygiene practices. A **p-value < 0.05** was considered statistically significant.

**Results**
**Table 1** summarizes the demographic distribution. A total of 500 participants (240 males, 260 females) aged 18–45 years (Mean: 29.4 ± 6.8 years) were included in the study.
**Table 2** showed the severity distribution based on BEWE scores in which Dental erosion was observed in **285 (57%)** participants.

**Association Between Dietary Habits and Dental Erosion**
Frequent consumption of **carbonated soft drinks, citrus fruits, and sports drinks** was significantly associated with higher BEWE scores (**p < 0.05**).
Dairy consumption was observed to have a protective effect, as participants consuming dairy products ≥5 times per week had a **lower prevalence** of dental erosion (**p = 0.001**).

**Salivary Analysis**
Unstimulated salivary pH and buffering capacity were significantly lower in individuals with moderate to severe dental erosion.

**Tables:**

**Table 1: Demographic Characteristics of Study Participants**

| Variable | Frequency (n) | Percentage (%) |
|---|---|---|
| **Gender** | | |
| Male | 240 | 48.0 |
| Female | 260 | 52.0 |
| **Age Group (years)** | | |
| 18–25 | 160 | 32.0 |
| 26–35 | 200 | 40.0 |
| 36–45 | 140 | 28.0 |
| **Urban/Rural** | | |
| Urban | 280 | 56.0 |
| Rural | 220 | 44.0 |

**Table 2: Distribution of Dental Erosion by BEWE Scores**

| BEWE Score | Severity Level | Frequency (n) | Percentage (%) |
|---|---|---|---|
| 0 | No erosion | 215 | 43.0 |
| 1 | Low risk | 130 | 26.0 |
| 2 | Moderate risk | 95 | 19.0 |
| 3 | High risk | 60 | 12.0 |

**Table 3: Dietary Factors and Dental Erosion**

| Dietary Factor | No Erosion (n = 215) | Erosion Present (n = 285) | p-value |
|---|---|---|---|
| Carbonated drinks (≥3/week) | 50 (23.3%) | 180 (63.2%) | **<0.001**** |
| Citrus fruits (≥4/week) | 60 (27.9%) | 150 (52.6%) | **0.002**** |
| Sports/energy drinks (≥2/week) | 30 (14.0%) | 110 (38.6%) | **<0.001**** |
| Dairy intake (≥5/week) | 120 (55.8%) | 70 (24.6%) | **0.001**** |

***Significance Level: p < 0.05**

**Table 4: Salivary Parameters and Dental Erosion Severity**

| Parameter | No Erosion (n = 50) | Mild Erosion (n = 30) | Severe Erosion (n = 20) | p-value |
|---|---|---|---|---|
| Mean Salivary pH | 7.2 ± 0.3 | 6.8 ± 0.4 | 6.3 ± 0.5 | **<0.01**** |
| Buffering Capacity (mEq/L) | 6.5 ± 0.7 | 5.8 ± 0.6 | 4.9 ± 0.5 | **<0.01**** |

## Discussion

The present study discovered a high prevalence of dental erosion, with 57% of participants exhibiting signs of erosion and 12% classified as high-risk cases. These findings highlighted the growing concern of erosive tooth wear in contemporary populations, likely driven by dietary and lifestyle factors.

Dietary acids emerged as a significant risk factor for dental erosion, with frequent intake of carbonated beverages, citrus fruits, and sports drinks being strongly associated with increased erosion risk ($p < 0.001$). These findings were consistent with prior research by Pereira et al. [6], who demonstrated that individuals consuming acidic beverages more than three times per week exhibited significantly higher erosion scores compared to those with lower consumption. The erosive potential of these beverages was largely attributed to their low pH (often below 3.0), high titratable acidity, and the presence of chelating agents such as citric acid, which enhanced enamel demineralization. Moreover, behavioral factors such as prolonged sipping or swishing acidic drinks exacerbated enamel exposure, further accelerating erosion progression.

Conversely, the study identified a significant protective effect of dairy consumption, with individuals consuming dairy products at least five times per week demonstrating a lower prevalence of dental erosion ($p = 0.001$). This aligned with the findings of Huysmans et al. [9], who highlighted the remineralizing properties of dairy products due to their high calcium and phosphate content. These minerals contributed to buffering oral acidity and facilitating the formation of a protective pellicle over the enamel. Additionally, casein, a key protein in dairy, was implicated in reducing enamel demineralization (11). However, some discrepancies existed in the literature, as Shellis et al. [10] found no significant protective effect of dairy intake against erosion. These inconsistencies may have stemmed from differences in study populations, dietary habits, and the influence of confounding factors such as oral hygiene practices and fluoride exposure. Furthermore, while dairy products may have conferred a protective effect, their efficacy may have been compromised when consumed in conjunction with acidic foods or beverages.

Salivary parameters also played a crucial role in erosion severity within the study population. Participants with lower salivary pH and reduced buffering capacity exhibited significantly higher erosion severity ($p < 0.01$), reinforcing the role of saliva as a critical defense mechanism against erosive tooth wear. These findings corroborated previous research by Lussi & Ganss [12], who emphasized the protective functions of saliva, including acid neutralization, remineralization, and acquired pellicle formation. Consequently, individuals with reduced salivary flow or compromised buffering capacity were more vulnerable to dental erosion, particularly when exposed to dietary acids.

The variation in findings across different studies may have been partially attributed to methodological differences. While some studies relied on self-reported dietary data, which may have introduced recall bias, the present study employed a validated food frequency questionnaire (FFQ), minimizing inconsistencies in dietary reporting. Additionally, the use of the Basic Erosive Wear Examination (BEWE) index ensured standardized clinical assessment of erosion severity, enhancing the reliability of the findings. Another key consideration was the potential impact of fluoride exposure, which was not explicitly accounted for in this study. Prior research suggested that regions with higher fluoride exposure, such as those with fluoridated drinking water or frequent fluoride toothpaste use, reported lower prevalence of dental erosion due to fluoride's role in enhancing enamel resistance to acid attacks [13]. Future research should incorporate salivary fluoride analysis or assess participants' oral hygiene regimens to provide a more comprehensive understanding of protective factors influencing dental erosion.

The findings of this study underscored the multifactorial nature of dental erosion, emphasizing the significant role of dietary acids while highlighting the protective influence of salivary defenses and dietary components. Given the increasing prevalence of erosive tooth wear, public health interventions should focus on dietary modifications, educational initiatives, and preventive strategies such as fluoride use and behavioral counseling. Targeted interventions for high-risk populations, including individuals with frequent acidic beverage consumption and those with compromised salivary function, are essential to mitigate the risk of dental erosion and promote long-term oral health.

## Conclusion

This study highlighted a significant association between dietary habits and dental erosion, emphasizing that frequent consumption of acidic foods and beverages contributed to enamel erosion. Carbonated drinks, citrus fruits, and sports drinks increased the risk, whereas dairy intake demonstrated a protective effect due to its buffering and remineralization properties. Salivary factors, such as lower pH and buffering capacity, further influenced erosion susceptibility, while regional dietary patterns, urbanization, and fluoride exposure contributed to variations in findings.

Given the multifactorial nature of dental erosion, preventive strategies focused on dietary modifications, public awareness, and early clinical interventions. Limiting acidic beverage intake, promoting dairy consumption, maintaining optimal oral hygiene, and utilizing fluoride-based measures helped mitigate erosion risk, particularly in high-risk populations. A multidisciplinary approach involving dentists, nutritionists, and public health professionals remained essential for developing comprehensive, evidence-based strategies for the prevention and management of dental erosion.

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