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The influence of dietary and lifestyle factors on GERD-related dental erosion: A literature review

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Abstract

Background: Gastroesophageal reflux disease (GERD) is a chronic gastrointestinal disorder commonly associated with dental erosion. GERD-related dental erosion is influenced by various factors, including dietary habits and lifestyle choices.

Purpose: This article aims to review the influence of dietary and lifestyle factors on GERD-related dental erosion based on a literature review.

Methods: This study employed a literature review methodology, analyzing articles published between 2019 and 2024. Data sources were obtained from databases such as PubMed, Google Scholar, ScienceDirect, and Elsevier. A total of 8 articles met the inclusion criteria and were analyzed further.

Results: Studies indicate that the consumption of acidic foods and beverages, such as citrus fruits and carbonated drinks, exacerbates dental erosion in GERD patients. Lifestyle factors, such as late-night eating and caffeine consumption, were also found to increase the risk of dental erosion. Conversely, the consumption of milk was associated with a reduction in the severity of erosion. GERD also affects the salivary profile, including lowering the pH and buffering capacity of saliva, thereby increasing the risk of enamel demineralization.

Conclusion: Dietary and lifestyle factors play a significant role in increasing the risk of GERD-related dental erosion. A holistic management approach, including dietary modifications, lifestyle changes, and regular dental health monitoring, is necessary to reduce the impact of GERD on dental health.

Keywords: Dietary; Lifestyle; GERD; Dental Erosion

1. Introduction

Gastroesophageal reflux disease (GERD) is a chronic disease characterized by the main clinical manifestations of heartburn and regurgitation. In addition, esophageal and pulmonary symptoms may also occur. The primary pathological mechanisms of GERD involve the invasion of gastric contents and dysfunction of the esophageal anti-reflux barrier. The invasion of gastric contents is primarily caused by the formation of a gastric acid pocket and delayed gastric emptying. Dysfunction of the anti-reflux barrier typically arises from lower esophageal sphincter (LES) dysfunction [9]. Epidemiological data indicate that the prevalence of this disease varies across different regions of the world. GERD symptoms are found in approximately one in five individuals in North and South America, and one in seven individuals in Australia. The lowest prevalence is recorded in Asian countries (<10%). In Europe, GERD may affect 15-21% of the population, depending on the region. In Poland, the disease is estimated to affect up to 35.5% of adults reporting gastric

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complaints. A global prevalence study, combining data from various countries, suggests that approximately 14% of the global population experiences reflux symptoms at least once a week [13].

Factors such as age, sex, ethnicity, genetic predisposition, and lifestyle habits, including diet, obesity, and smoking are known to influence the occurrence of GERD. Both dietary and lifestyle factors play a significant role in the management and risk of gastroesophageal reflux disease (GERD) [10]. Several types of food and beverages have long been linked to GERD symptoms, including acidic foods (such as tomatoes and citrus fruits), fatty foods, soft drinks or carbonated beverages, chocolate, and caffeine. Studies indicate that the consumption of these items can reduce pressure on the lower esophageal sphincter (LES), which is responsible for preventing gastric acid reflux into the esophagus. Furthermore, these foods and drinks can prolong acid exposure to the esophagus and stimulate excessive gastric acid production, exacerbating GERD symptoms [12]. High-fat foods, late-night eating, smoking, and the consumption of alcohol and caffeine have also been found to worsen GERD symptoms [11].

Erosive tooth wear (ETW) is defined as the loss of hard dental tissue resulting from the interaction between repeated acid exposure and mechanical forces. Over recent decades, the term "dental erosion" has often been used to describe the overall process of tooth wear, which includes the softening of tooth surfaces due to acid and subsequent mechanical wear. Several studies have shown that GERD can contribute to ETW, as gastric acid ascending into the esophagus and mouth may damage tooth enamel, increasing the risk of oral diseases in individuals with GERD [14]. This article aims to explore the influence of dietary and lifestyle factors on GERD-related dental erosion.

2. Methods

This study utilized various sources, including databases, national and international research findings, and online searches. The research design employed was a literature review, which included publications from 2019 to 2024. The search strategy involved the use of keywords such as "dietary," "lifestyle," "GERD," and "dental erosion," and was conducted through databases such as PubMed, Google Scholar, ScienceDirect, and Elsevier. The primary focus of the search was articles examining the influence of dietary and lifestyle factors on GERD-related dental erosion. Several exclusion criteria were applied to ensure the relevance and quality of the studies reviewed. The studies excluded included: (1) duplicate research, (2) studies with irrelevant titles or abstracts, (3) studies that were not experimental in nature, and (4) studies that did not explicitly discuss the impact of diet and lifestyle on GERD-related dental erosion. Following the screening process, only 8 studies met all the inclusion criteria and were incorporated into this review.

3. Results

Table 1 results of a review of research articles regarding the influence of dietary and lifestyle factors on GERD-related dental erosion.

No.	Author and Title	Subject	Research Purposes	Research Methods	Results
1.	(Chauhan *et al.,* 2022) Dietary Practices as a Potential Predictor for Dental Erosion among Patients Having Gastroesophageal Reflux Disease: An Analytical Cross-sectional Study [1].	330 patients (aged ≥18) with a clinical and endoscopic diagnosis of GERD for at least six months.	To evaluate the correlation between dietary habits and the presence of dental erosion in GERD patients. To assess the relationship between dietary practices and the severity of dental erosion in GERD patients.	Design: Analytical cross-sectional study. Data Collection: Clinical oral examinations using the Basic Erosive Wear Examination (BEWE) index. A structured questionnaire capturing dietary habits, medical history, and sociodemographic details. Analysis: Data were analyzed using descriptive and inferential statistics (e.g.,	Dental erosion was present in 84.8% of GERD patients. A significant inverse association was found between the consumption of acidic foods, soft drinks, and dental erosion severity. Milk consumption was negatively correlated with dental erosion severity ($r = -0.2$, $P < 0.001$). While GERD was a significant risk

				chi-square tests, Pearson and Spearman correlation) via SPSS software.	factor for dental erosion, most cases were of low severity.
2.	(Picos *et al.,* 2019) Factors associated with dental erosions in gastroesophageal reflux disease: a cross-sectional study in patients with heartburn [2].	263 patients (141 with GERD and 122 control patients without GERD).	To assess the prevalence of dental erosion in GERD patients and explore the correlation between intrinsic (e.g., GERD) and extrinsic (e.g., diet, lifestyle) factors of DE. To compare the occurrence of dental erosion and its severity between GERD patients and non-GERD controls.	Design: Cross-sectional study. Data Collection: Dental Erosion Assessment: Basic Erosive Wear Examination (BEWE) index. Questionnaire: Collects data on GERD symptoms, medications, lifestyle, and dietary habits. Salivary Parameters: pH and buffering capacity were assessed using specific tests. Analysis: Descriptive and inferential statistics using SPSS. Comparisons were made using chi-square tests and Mann-Whitney U tests.	The study revealed a significantly higher prevalence of dental erosion (DE) in GERD patients (92.9%) compared to controls (72.1%), with GERD being strongly associated with more severe cases ($P < 0.001$). GERD patients exhibited lower salivary pH levels, correlating with increased DE severity ($P = 0.03$), while salivary buffering capacity did not show a significant relationship with DE. Dietary habits, particularly the consumption of citrus fruits and soda drinks, were linked to higher DE prevalence in GERD patients,
3.	(Lim *et al.,* 2022) Prevalence and risk factors of erosive tooth wear among young adults in the Singapore military [3].	1,296 young adults aged 18–25 years from the Singapore Armed Forces.	To assess the prevalence of ETW and evaluate medical, dental, dietary, and lifestyle factors contributing to its development among young military personnel in Singapore.	Design: Cross-sectional study. Data Collection: Clinical assessments using the Basic Erosive Wear Examination (BEWE) index to evaluate ETW. Questionnaires capturing demographics, medical history (e.g., GERD), dental history, lifestyle habits, and dietary factors. Analysis: Multivariable logistic regression and univariable analysis were performed to determine significant risk factors, with results expressed as odds ratios (OR).	The study revealed that 21.8% of young military personnel in Singapore exhibited erosive tooth wear (ETW), with most cases classified as low to moderate risk. Key risk factors included gastroesophageal reflux disease (GERD), which increased the likelihood of ETW ($OR = 2.83$, $P = 0.041$). Erosive tooth wear (ETW) is correlated with: frequent consumption of acidic foods and

					drinks, high caries susceptibility, and the use of hard-bristled toothbrushes significantly contribute to the multifactorial nature of ETW, emphasizing the role of dietary and oral hygiene practices in its prevalence and severity.
4.	(Chen *et al.,* 2023) Differences in Dietary and Lifestyle Triggers between Non-Erosive Reflux Disease and Reflux Esophagitis - A Multicenter Cross-Sectional Survey in China [4].	396 GERD patients with typical gastroesophageal reflux symptoms who received upper endoscopy in the previous month.	To compare the dietary and lifestyle triggers between non-erosive reflux disease (NERD) and reflux esophagitis (RE) in Chinese patients. To provide evidence for development of practical dietary modifications for GERD.	Design: Analytical cross-sectional study. Data Collection: Questionnaires including demographic data, reflux symptoms, previous management, dietary and lifestyle habits, triggers of reflux symptoms, psychological status, and quality of life. Analysis: Data were analyzed using Student's t-test or Mann–Whitney U test, Pearson's test and Spearman's test via SPSS 25 Software.	There were no significant differences in general GERD symptom scores and the scores of heartburn, acid reflux, food regurgitation, and retrosternal chest pain between NERD and RE patients. There were no significant differences in the proportions of the above management strategies and effective rates between NERD and RE patients. There were some differences in terms of dietary habits, dietary and lifestyle triggers, and related quality of life between NERD and RE patients.
5.	(Milani *et al*., 2022) Gastroesophageal reflux disease and dental erosion: The role of bile acids [5].	26 GERD patients and 40 healthy controls, recruited based on endoscopic confirmation of GERD and dental health status.	To identify the presence and concentration of bile acids in the saliva of GERD patients and healthy controls. To evaluate the effects of bile acids on tooth enamel, including	Design: A two-phase study combining clinical and in vitro research. Clinical Data Collection: Saliva analysis using liquid chromatography for taurocholic and glycocholic acid detection. Dental erosion assessment using the	Dental erosion was more prevalent in GERD patients (27%) compared to controls (7%), with most cases in GERD patients being moderate to severe. Taurocholic acid was the predominant bile acid in saliva, but glycocholic acid

			microhardness, calcium release, and surface topography.	Basic Erosive Wear Examination (BEWE). Questionnaires assessing dietary habits and oral health-related quality of life. In Vitro Study: Enamel specimens exposed to bile acids (taurocholic and glycocholic acids) at various concentrations. Analysis of enamel microhardness, calcium release, and surface characteristics using scanning electron microscopy. Statistical Analysis: Descriptive and inferential statistics with significance set at $p < 0.05$.	levels were significantly higher in GERD patients with dental erosion. In vitro, taurocholic acid at higher concentrations increased enamel microhardness and induced calcium release, suggesting enamel alteration without affecting surface topography.
6.	(Basha *et al.,* 2020) Association between soft drink consumption, gastric reflux, dental erosion, and obesity among special care children [6].	350 special care children aged 6–16 years from Taif City, Saudi Arabia.	To evaluate the association between soft drink consumption, gastric reflux, dental erosion, and obesity in special care children, while identifying key demographic, dietary, and health-related risk factors.	Design: Cross-sectional study. Data Collection: Dental erosion assessed using WHO guidelines. Body mass index (BMI) measured and categorized. Sociodemographic, dietary, and health-related data collected via a structured questionnaire completed by parents/guardians. Analysis: Descriptive statistics, bivariate analysis, and multivariable logistic regression were used to evaluate associations between variables.	Dental erosion was prevalent in 36% of special care children, with males (44.2%) more affected than females (31.1%, $p = 0.04$), and permanent lower anterior teeth most frequently impacted. Significant risk factors included soft drink consumption (adjusted OR = 1.83, $p = 0.001$), gastric reflux (OR = 2.24, $p = 0.0001$), and chronic vomiting or bulimia (OR = 2.27, $p < 0.001$). Obese children had a higher prevalence of dental erosion (44.4%) compared to those with normal weight (33.3%, $p = 0.04$), though no significant association was found in regression analysis.

7.	(Masud *et al.,* 2022) Dental Erosions: A Manifest of Gastroesophageal Reflux Disease (GERD) [7].	A total of 100 patients who had been diagnosed with gastro esophageal reflux disease and were between the ages of 30 and 60 in the Madinah teaching hospital Faisalabad.	To record the frequency of dental erosion (DE) in patients with Gastro esophageal Reflux Disease (GERD).	Design: Analytic observational study. Data Collection: The receipt of the patients' informed permission, Comprehensive history of Gastroesophageal Reflux Disease (GERD) Analysis: SPSS version 21 was used for the analysis of the data.	There were 46 (46%) cases between 30-45 years of age while 54 (n=54) were between 46-60 years of age, mean age was calculated as 46.14+11.85 years. Gender distribution shows that 51 (51%) were male while 49 (49%) were females. DE was recorded in 34 (34%) while 66 (66%) had no findings of the morbidity. There was no significant difference in age and gender.
8.	(Rajab *et al.,* 2023) Evaluation of Salivary Pepsin Levels and Dental Erosion in Patients With Gastroesophageal Reflux Disease [8].	Total 40 patients with GERD, diagnosed with an endoscope and 35 healthy subjects	To evaluate pepsin levels in the saliva of GERD patients and assess the prevalence of dental erosion (DE) in patients with GERD.	Design: Case-control study Data Collection: Patients and healthy individuals were subjected to the GERD questionnaire (GerdQ) A dental assessment was performed using the Basic Erosive Wear Examination (BEWE) The salivary pepsin levels examined using the enzyme-linked immunosorbent assay were recorded for both groups. Analysis: SPSS software version 28	DE was significantly more frequent in GERD patients compared to healthy subjects. The mean salivary pepsin was 43.60 ± 10.61 ng/mL in the GERD group and 20.60 ± 9.27 ng/mL in the healthy group A statistically significant difference was found in pepsin levels between the two groups ($p < 0.001$)

4. Discussions

Gastroesophageal reflux disease (GERD) significantly contributes to dental erosion (DE), with its multifactorial etiology encompassing dietary behaviors, intrinsic gastric factors, and systemic conditions, as highlighted in this comprehensive review. This literature review provides a comprehensive evaluation of the influence of dietary and lifestyle factors on GERD-related dental erosion (DE), synthesizing findings from eight pivotal studies. GERD patients consistently exhibited a higher prevalence of DE compared to control groups, with rates ranging from 34% to 92.9%. The primary risk factors included frequent consumption of acidic foods and beverages, such as citrus fruits and carbonated drinks, which exacerbate enamel erosion by reducing salivary pH and exposing teeth to prolonged acid contact [1, 2, 6]. Intrinsic acids, such as gastric reflux associated with GERD, were also strongly implicated in the pathogenesis of DE. Conditions like chronic vomiting and bulimia further compounded the risk, highlighting the dual role of intrinsic and extrinsic acids

in enamel degradation [5, 6, 7]. Interestingly, milk consumption showed a protective effect, correlating negatively with the severity and emphasizing the potential role of dietary interventions in mitigating its impact [1].

Dietary behaviors played a significant role, with GERD patients consuming soft drinks 2–6 times per week having a 1.83-fold higher likelihood of developing DE compared to those with lower consumption levels [3, 6]. Furthermore, GERD patients exhibited altered salivary profiles, characterized by reduced pH and buffering capacities, which impaired the natural protective mechanisms of saliva and facilitated enamel demineralization. In vitro studies revealed that bile acids, particularly glycocholic acid, exacerbated enamel microhardness loss and calcium release, further illustrating the biochemical underpinnings of GERD-related DE [3, 5].

The severity of DE in GERD patients is not solely a result of gastric acid exposure but also its frequency and interaction with other lifestyle factors. Nighttime reflux episodes, common in GERD patients, are particularly damaging due to reduced saliva production during sleep, which limits its natural buffering capacity. This prolongs the exposure of tooth enamel to acidic conditions, thereby exacerbating the erosive process. Additionally, behaviors such as inadequate hydration and the habitual intake of caffeine or alcohol, both of which can reduce saliva production, further diminish the protective effect of saliva. These findings highlight the intricate interplay between behavioral and physiological factors in amplifying the risk of DE in GERD patients [4, 5].

Specific populations were found to be more vulnerable. Among special care children, 36% exhibited DE, with males showing a significantly higher prevalence than females (44.2% vs. 31.1%, respectively). Obese children also displayed an elevated prevalence of DE (44.4% compared to 33.3% in normal-weight children). However, multivariable analyses indicated that obesity's link to DE is multifactorial rather than direct, reflecting the complexity of interactions between dietary habits, systemic conditions, and oral health [3, 6].

Subtypes of GERD, such as non-erosive reflux disease (NERD) and reflux esophagitis (RE), demonstrated variability in dietary and lifestyle triggers, emphasizing the need for personalized management approaches tailored to the specific GERD subtype [4]. Diagnostic advancements, such as the assessment of salivary pepsin levels, emerged as promising tools for early detection of GERD-related DE. GERD patients exhibited significantly higher salivary pepsin levels than healthy controls, underscoring its diagnostic potential in identifying patients at greater risk for DE [8]. These findings underscore the multifactorial etiology of GERD-related DE, driven by a combination of dietary behaviors, intrinsic gastric factors, and systemic conditions. The evidence highlights the need for integrated management strategies that address dietary modifications, lifestyle interventions, and regular oral health monitoring to mitigate the burden of DE in GERD patients.

5. Conclusion

Gastroesophageal reflux contributes significantly to dental erosion through multifactorial mechanisms, including gastric acid exposure, consumption of acidic foods, and alterations in salivary profile. The intake of acidic foods and beverages, such as citrus fruits and sodas, as well as late-night eating habits, exacerbate this condition by lowering the pH of saliva and damaging tooth enamel. Conversely, the consumption of milk has been shown to have a protective effect against dental erosion. Effective management of GERD-related dental erosion requires a holistic approach, which includes dietary modifications, lifestyle changes, and regular oral health monitoring to mitigate the impact of GERD on dental health.

Compliance with ethical standards

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Disclosure of conflict of interest

I declare no conflict of interest.

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