

# Dietary Practices as a Potential Predictor for Dental Erosion among Patients Having Gastroesophageal Reflux Disease: An Analytical Cross-sectional Study

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## ABSTRACT

**Aim:** The aim of this study was to assess how dietary practices impact gastroesophageal reflux disease (GERD) patients in Haryana state, India, from the perspective of either preventing or promoting dental erosion. **Objectives:** The primary objective of this study was to find a correlation between the presence of dental erosion and dietary practices among patients with GERD.

The secondary objective of this study was to assess the correlation between GERD patients' dietary practices and dental erosion severity. **Materials and Methods:** Three hundred and thirty study participants, who've been 18 years of age or older with the diagnosis of GERD for at least six months or more were included. Evaluation of dental erosion was performed with basic erosive wear examination (BEWE) index. On age, gender, medical history, medication history, and dietary habits, a pretested structured questionnaire was used. Statistical analysis software SPSS (Statistical Package for the Social Sciences) variant 20.0 was used to conduct the statistical analysis. Analytic statistics and descriptive statistics were used in the data analysis. **Results:** Dental erosion was present in 84.8% of the study participants. The majority of study participants, 122 (37%), had no risk of dental erosion. The occurrence of dental erosion was shown to be substantially adversely associated to the intake of acidic meals and soft drinks in the present investigation (odds ratio [OR] = 0.5,  $P < 0.05$ ). There has not been any proven link between the severity of dental erosion and the frequency of consuming acidic meals, fruit juice, and soft drinks. Milk consumption frequency and dental erosion severity were observed to be considerably inversely associated ( $r = -0.1$ ,  $P = 0.001$ ). **Conclusion:** Patients with GERD frequently experienced dental erosion. One probable risk factor for the development of erosive dental lesions can be considered GERD. Most of the patients had dental erosion with a low degree of severity. When dental erosion occurs, the mineral quantity that dissolves from enamel is influenced by several factors, including the buffering action of the acids, pH, and duration of exposure. Whereas if the food and drinks contain adequate amounts of fluoride, calcium, and phosphate, the dissolution can be prevented. The intake of fruit juice, acidic foods, as well as soft drinks was not consumed to be a risk factor in the current study for directly

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causing or for promoting the severity of dental erosion since they were consumed less frequently. A higher frequency of milk ingestion was found to reduce the severity of dental erosion. Regular milk consumption could be regarded as an alternative dietary practice to stop dental erosion. As dental erosion is a complex condition, it's essential to have an early diagnosis and implement the proper preventive measures. It is vital to inform people about dental erosion and how it is interrelated to GERD and dietary practices.

**KEYWORDS:** *Acid reflux disease, dental erosion, dietary practices, people's health*

## INTRODUCTION

Millions of individuals worldwide suffer from gastroesophageal reflux disease (GERD), which is defined by common signs and symptoms as well as difficulties brought on by the reflux of stomach contents into the esophagus, under the Montreal definition.<sup>[1]</sup>

GERD is largely caused by a disruption of the lower esophageal sphincter (LES), despite the various contributing factors. GERD is impacted by pathologic and physiological variables. The LES's intermittent relaxations are the primary factor (TLESRs).<sup>[2]</sup> Smoking, advanced age, a high body mass index (BMI), depression or anxiety, and a lack of physical exercise at the workplace are risk indicators for GERD.<sup>[1,3,4]</sup> Dietary practices, including food acidity, meal quantity, and time, can all influence the onset of GERD.<sup>[5]</sup>

Dental erosion, also referred to as “erosio dentium,” is a pathologic, localized, chronic, and painless dental hard tissue loss that, in the absence of bacterial involvement, is chemically eroded off the tooth's surface by acid or chelation. The intraoral flora does not synthesize the acids that induce erosion; instead, they derive from dietary, occupational, or endogenous sources.<sup>[6]</sup>

Hydroxyapatite crystals in enamel may be dissolved by regurgitated intrinsic acids since their pH is less than 2, much below the crucial pH threshold of 5.5.<sup>[7]</sup> There is strong evidence that individuals who often are exposed to gastric fluids hold a significant risk of having dental erosion.<sup>[8-10]</sup>

Acidic drinks and foods such as those in pickles, vinegar sauces, preserves, citrus and other fruits, fruit juices (which contain citric acid), soft drinks, wine, and other carbonated beverages (acetic acid) can promote dietary erosion.<sup>[6]</sup> The saturation degree with regard to the tooth mineral, which establishes the driving force for dissolution, is influenced by the buffering capacity, titratable acidity, pH value, calcium, oral clearance rate, fluoride, and phosphate content of a drink or food.<sup>[11]</sup>

Regularly having acidic gastric contents in the oral cavity increases the likelihood of developing dental erosion by creating a persistently acidic environment. Few studies have been performed to examine the contribution of dietary practices to prevent or cause of dental erosion among GERD subjects; as a result, the goal of this study was to examine dietary practices in Haryana state, India as a possible predictor of dental erosion.

## MATERIALS AND METHODS

The gastroenterology department of Rohtak's tertiary care hospital conducted a cross-sectional study. For four months, from January 2021 to April 2021, twice weekly patient recruitment was carried out to collect the needed three hundred thirty samples. The Post Graduate Institute of Dental Sciences, Rohtak Institution Ethics Committee granted ethical clearance vide letter no. PGIDS/IEC/2019/39 after understanding the study's objectives and significance.

Subjects who had been clinically and endoscopically diagnosed to have GERD for more than six months or who signed the informed consent form and available on the day when the data were collected. This research excluded individuals who had a history of orthodontic treatment were pregnant or breastfeeding was recalcitrant, had intellectual difficulties, or had any additional disorders like bulimia nervosa or a hiatus hernia.

The size of the sample was determined to evaluate serious erosion. In 30% of participants, a pilot study found severe teeth erosion. This prevalence was estimated using a sample size of 30, with a 5% absolute margin of error. Three hundred thirty was the final calculated sample size.

One examiner who has been trained and calibrated examined the subjects. A questionnaire was used to collect the data, following which there were clinical oral examinations. For the study, a structured questionnaire in Hindi was prepared.

**Table 1: Distribution of dental erosion based on GERD symptoms and sociodemographic parameters**

Characteristics	Dental erosion		P Value for (chi-square)	Odds (95% CI)
	Absent(n = 50)	Present(n = 280)		
Age (years)				
18–28	33 (66.0%)	116 (41.4%)	<0.001	1
29–58	16 (32.0%)	117 (41.8%)		0.7 (0.3–1.5)
59–78	1 (2.0%)	47 (16.8%)		0.18 (0.08–4.2)
Gender*			0.03	
Male	29 (58.8%)	117 (41.8%)		1
Female	21 (42.0%)	163 (58.2%)		1.4*(0.8–2.4)
Location			0.18	
City	18 (36.0%)	106 (37.9%)		1
Village	32 (64.0%)	174 (62.1%)		0.8(0.8–2.7)
Stages of GERD*			<0.001	
Stage 1	7 (14.0%)	14 (5.0%)		0.1*(0.04–0.4)
Stage 2	35 (70.0%)	156 (55.7%)		0.3*(0.1–0.7)
Stage 3	8 (16.0%)	110 (39.3%)		1

P Values were based on the chi-square test

\*P < 0.05 considered significant for odds ratio

Dietary habits: Acidic drinks and acidic foods were divided into two categories. Fruit juices (natural and diluted), fruit-flavored beverages (cocktail drinks and diluted cordials), non-sugared carbonated beverages, sugared carbonated beverages (sparkling water and carbonated drinks), sports beverages (often called isotonic beverages), honey drinks, and alcoholic beverages were among the acidic beverages. Milk was a drink that was not corrosive. Pickles, ketchup, dishes contained vinegar, citrus fruit-flavored ice cream, fruit jam, baked beans, dried fruits, sour candies, and yogurt and fruits were types of acidic foods. ADA Type III classification was used for the dental examination. Using the basic erosive wear examination (BEWE) index, the location, severity, as well as area of dental erosion were all examined.<sup>[12]</sup>

Using Statistical Package for the Social Sciences (SPSS) software program, version 20.0, the data were coded, tabulated, and subjected to the necessary statistical analysis. Analytic statistics and descriptive statistics (frequency distribution) were applied to the data analysis. To assess the relationship between independent variables and dental erosion, the chi-squared test was conducted. Dental erosion severity and dietary practices were correlated using Pearson and Spearman's correlation. The correlation between diet and the probability of developing dental erosion was investigated using binary logistic regression. The statistical significance threshold was determined to be 5% with a 95% confidence interval (CI).

## RESULTS

This trial had 330 patients with GERD, 184 (55.8%) of whom were female, and 146 (44.2%) of which were male. The most of participants in the study,

**Table 2: Distribution of dental erosion severity in GERD patients**

Severity of dental erosion	No. of GERD patients	%
No	122	37.0
Low	109	33.0
Medium	84	25.5
High	15	4.5
Total	330	100.0

that is, 149 (45.2%), were between the ages of 18 and 28, then 133 (40.3%) between the ages of 29 and 58, and 48 (14.5%) between the ages of 59 and 78. In the study, 280 (84.8%) participants reported having dental erosion, whereas 50(15.2%) participants did not. The findings show a significant positive association between the occurrence of erosive lesions and female gender (odds ratio [OR] = 1.4, P < 0.05). The study's findings revealed that stage 1 and stage 2 patients with GERD had considerably reduced probabilities of having dental erosion than those who had stage 3 GERD (OR = 0.1, P < 0.05 and OR = 0.3, P < 0.05, respectively) [Table 1].

Most of the respondents, or 122 (37.0%), had no risk of dental erosion. This was followed by 109 (33.0%), 84 (25.5%), and 15 (4.5%), who each had a low, medium, and high risk of erosion [Table 2].

The current examination found a substantial negative correlation between the prevalence of dental erosion and the use of acidic meals and drinks (OR= 0.5, P < 0.05) [Table 3].

In the current investigation, the great majority of people who regularly consume milk, or 38.7%, had no erosion risk, followed by 35.5%, who had a moderate risk, and 0.0%, who had a high risk. With increased

**Table 3: Dental erosion distribution according to patterns of acidic and non-acidic drinks consumption**

Parameters	Dental erosion		P Value for (chi-square)	Odds (95% CI)
	Absent (n = 50)	Present (n = 280)		
Food habits: fruit juice (yes)	24 (48.0%)	133 (47.5%)	0.835	0.9(0.5–1.7)
No	26(52.0%)	147(52.5%)		1
Food habits: soft drink (yes)	28 (56.0%)	86 (30.7%)	<0.001	0.5*(0.3–0.9)
No	22(44.0%)	194(69.3%)		1
Food habits: acidic food (yes)	40 (80.0%)	134 (47.9%)	<0.001	0.5*(0.2–0.9)
No	10(20.0%)	146(52.1%)		1
Food habits: milk (yes)	41 (82.0%)	251 (89.6%)	0.119	1.9(0.8–4.3)
No	9(18.0%)	29(10.4%)		1
Food habits: yoghurt (yes)	42 (84.0%)	246 (87.9%)	0.451	1.3(0.3–3.1)
No	8(16.0%)	34(12.1%)		1

P Values were based on the chi-square test

\*P < 0.05 considered significant

**Table 4: Distribution of dental erosion severity in GERD patients according to the frequency of dietary patterns**

Frequency of dietary patterns		Risk level of dental erosion				Total	P Value for (chi-square)
		No	Low	Medium	High		
Fruit Juice	Many times, a day	1(33.3%)	2(55.7%)	0(0.0%)	0(0.0%)	3 (100.0%)	0.03*
	Once a day	6 (31.6%)	9 (47.4%)	4 (21.1%)	0 (0.0%)	19(100.0%)	
	Three to five times a week	1 (100.0%)	0(0.0%)	0 (0.0%)	0(0.0%)	1 (100.0%)	
	One to two times a week	46 (41.8%)	40 (36.3%)	23 (20.9%)	1 (0.9%)	110(100.0%)	
	Less than once a week	14 (58.3%)	6(25.0%)	4(16.7%)	0 (0.0%)	24(100.0%)	
	Never	54 (31.2%)	52(30.0%)	53 (30.6%)	14 (8.1%)	173 (52.4%)	
Soft Drinks	Many times, a day	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	0 (0.0%)	0.000*
	Once a day	3 (25.0%)	3 (25.0%)	4(33.3%)	2 (16.6%)	12(100.0%)	
	Three to five times a week	1 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100.0%)	
	One to two times a week	36 (55.4%)	19 (29.2%)	10(15.4%)	0(0.0%)	65 (100.0%)	
	Less than once a week	20 (47.6%)	9(21.4%)	5(11.9%)	2(4.7%)	42(100.0%)	
	Never	62 (28.7%)	78(36.1%)	65(30.1%)	11(5.1%)	216(100.0%)	
Acidic Food	Many times, a day	1(14.3%)	4 (57.1%)	2 (28.6%)	0(0.0%)	7(100.0%)	0.000*
	Once a day	8 (80.0%)	2 (20.0%)	0 (0.0%)	0 (0.0%)	10 (100.0%)	
	Three to five times a week	6 (100.0%)	0(0.0%)	0 (0.0%)	0 (0.0%)	6(100.0%)	
	One to two times a week	61 (61.0%)	26 (26.0%)	11 (11.0%)	2 (2.0%)	100 (100.0%)	
	Less than once a week	22 (43.1%)	20 (39.2%)	6 (11.7%)	3 (5.8%)	51(100.0%)	
	Never	24 (15.3%)	57 (36.5%)	65 (41.6%)	10 (6.4%)	156 (100.0%)	
Milk	Many times, a day	12(38.7%)	11 (35.5%)	8 (25.8%)	0 (0.0%)	31 (100.0%)	0.01*
	Once a day	86(38.0%)	64 (28.3%)	61(26.9%)	15(6.6%)	226(100.0%)	
	Three to five times a week	0(0.0%)	0(0.0%)	0(0.0%)	0 (0.0%)	0(0.0%)	
	One to two times a week	10 (28.6%)	16(45.7%)	9(25.7%)	0(0.0%)	35(100.0%)	
	Less than once a week	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0(0.0%)	
	Never	14(36.8%)	18 (47.3%)	6(15.8%)	0 (0.0%)	38 (100.0%)	
Yogurt	Many times, a day	8(53.3%)	2 (13.3%)	5(33.3%)	0(0.0%)	15 (100.0%)	0.04*
	Once a day	87 (40.7%)	66 (30.8%)	47 (22.0%)	14 (6.5%)	214(100.0%)	
	Three to five times a week	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	0(0.0%)	
	One to two times a week	16 (32.0%)	21 (42.0%)	12 (24.0%)	1(2.0%)	50(100.0%)	
	Less than once a week	4(44.4%)	1 (20.0%)	4 (11.1%)	0(0.0%)	9 (100.0%)	
	Never	7(16.6%)	19 (45.2%)	12(28.5%)	0(0.0%)	42(100.0%)	

P Values were based on a chi-square test

\*P < 0.05 considered significant

milk consumption, it was observed that dental erosion was significantly less severe ( $P = 0.01$ ). [Table 4]. It was shown that milk consumption significantly decreased dental erosion severity ( $r = -0.2$ ,  $P < 0.001$ ) [Table 5].

## DISCUSSION

Dental erosion was seen in 84.8% of patients in the current study who had GERD. There have not been several studies done to determine how food may prevent

**Table 5: Correlation of dietary patterns and the severity of dental erosion in GERD patients**

	<i>r</i> –	<i>P</i> Value
Dietary patterns		
Fruit juice	.139	0.07
Soft drinks	.125	0.08
Spicy food	.452	0.07
Sour food	.465	0.06
Alcohol	–.085	1.22
Milk	–.202*	<0.001
Yogurt	.069	0.208
Frequency of diet		
Fruit juice	.195	0.09
Soft drinks	.279	0.07
Spicy food	.446	0.08
Sour food	.458	0.09
Alcohol	.028	0.614
Milk	–.113	0.40
Yogurt	.106	0.06

\*Correlation is significant at the 0.01 level (two tailed)

or contribute to dental erosion in patients with GERD in Haryana. Dental erosion is more likely to occur in GERD subjects due to the constant existence of acidic gastric contents in the oral cavity, which may create a chronically acidic state. As a result, this study aims to analyze dietary practices among patients with GERD in the Indian state of Haryana as a potential predictor of dental erosion.

Dental erosion was observed to be substantially adversely correlated with the use of soft drinks and acidic meals in the present research (OR = 0.5,  $P = 0.001$  and OR = 0.5,  $P = 0.002$ , respectively). This study contradicts that of Reddy *et al.*,<sup>[13]</sup> who presented a positive correlation between dietary practices such as drinking carbonated beverages, eating fruit, and drinking tea or coffee and dental erosion. They concluded that soft drinks, which include carbonated drinks and fruit juices, are mostly acidic (pH 4) and would cause the pH at the tooth surface to go under the significance level of 5.5 for enamel demineralization when they come into contact with teeth.

The frequency of consuming drinks and acidic food and the intensity of dental erosion were not significantly correlated in the present research. Similar to the current investigation, Manaf *et al.*<sup>[14]</sup> found no link between dental erosion and the rate of ingesting fruit juice and other acidic foods as the majority of their participants reported ingesting less of these items.

Although a study by Al-Dlaigan *et al.*<sup>[15]</sup> found that participants' reports of dental erosion being correlated with acidic beverages were more frequent when their intake was high. In a report by Lussi *et al.*,<sup>[11]</sup> eating

four or more portions of acidic meals a day was correlated to dental erosion. Enamel can dissolve even if it includes a significant amount of minerals if it is exposed to acid repeatedly or for a long time.<sup>[16]</sup> Likewise, when teeth are exposed to sugary drinks on a frequent basis, dental caries and erosion are caused by bacteria produced by acids that remain in the oral cavity for a long time.<sup>[17]</sup> Liquid carbohydrates often do not remain in the mouth for very long, and the majority of individuals in the present research reported ingesting acidic food and consume no more than four times each day, which may explain why eating acidic foods and drinking soft drinks were not shown to elevate the dental erosion risk in the current study or to cause it directly.

In the present analysis, there was no relationship between the incidence of dental erosion and the regularity of yogurt and milk intake. Our results are in line with those of Aguiar *et al.*,<sup>[18]</sup> who discovered no relationship between the frequency of milk and yogurt intake and the incidence of dental erosion. They came to the conclusion that the lack of a connection between diet and the incidence of dental erosion reported in their report may be explained by individual modifying factors, including the buffering and protective properties of saliva and the intrinsic and extrinsic multifactorial characteristics of acids included in the etiology of dental erosion. In this trial, the great majority of people who regularly consume milk, or 38.7%, had no erosion risk, followed by 35.5%, who had a moderate risk, and 0.0%, who had a high risk. With higher milk consumption, it was observed that dental erosion was significantly less severe ( $P = 0.01$ ). The research by Manaf *et al.*<sup>[14]</sup> indicated that when other confounding variables were taken into account, the link between milk-drinking frequency and the dental erosion incidence was not substantial. The dental erosion risk was shown to be considerably inversely correlated with milk drinking in this investigation ( $r = -0.1$ ,  $P = 0.001$ ). The individuals' lesser milk consumption might be the explanation for this. According to the findings of the current study, drinking milk frequently serves as a preventive factor and prevents the onset of severe dental erosion. In lab studies, it was discovered that milk's high calcium content prevents teeth erosion. Foods rich in phosphate and calcium may aid in preventing the erosion of dental enamel. As calcium contributes to the mineral teeth composition throughout the processes of remineralization and demineralization, which are reliant on dietary variables, pH, and the oral state, calcium is important for dental health.<sup>[19]</sup> Milk consumption on a

routine basis could be referred to as an effective diet approach to prevent dental degradation.<sup>[20]</sup>

The study's strengths include its large sample size (three hundred thirty participants), the inclusion of all variables that may affect dental erosion severity and presence, as well as the analysis of the effect of the common dietary practices of the Haryana population on dental erosion development. The study's shortcomings, which are a result of its cross-sectional design, include the inability to make any conclusive statements concerning the onset of dental erosion in the participants of trial. Since the onset of tooth erosion is multifactorial and affected by tooth structure and composition as well as saliva content, these factors were not evaluated.

#### SCOPE FOR FURTHER RESEARCH

Further investigation utilizing a case-control study design will be required to establish temporality and biologic plausibility between disease and risk factors.

#### CONCLUSION

The quantity of mineral that dissolves from enamel during dental erosion relies on a variety of factors, including pH, the buffering action or acid content, and the duration of exposure. If the beverage contains enough amounts of fluoride, calcium, and phosphate, the dissolution may be prevented. Consumption of fruit juice, soft drinks, and acidic foods was not shown to be a risk factor in the current study for directly producing dental erosion or for promoting dental erosion since they were consumed less frequently. Milk consumption frequency and dental erosion severity were shown to be strongly adversely associated. This indicates that milk, a good source of calcium, was protecting teeth by reducing the dental erosion severity. Regular milk consumption can be viewed as an alternative dietary approach to avoid dental erosion. It is imperative to inform the public about dental erosion and the ways it is interrelated to GERD and dietary practices.

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#### CONFLICTS OF INTEREST

Not present.

#### AUTHOR CONTRIBUTIONS

Not applicable.

#### ETHICAL POLICY AND INSTITUTIONAL REVIEW BOARD STATEMENT

Mentioned.

#### PATIENT DECLARATION OF CONSENT

Present.

#### DATA AVAILABILITY STATEMENT

Not applicable.

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