A survey on the prevalence and risk indicators of dental erosion among 18-22 years old students of Diyala university

Eman D. Salman[1*], Aisha A. Qasim[2]
[1]Diyala Health Directorate, Diyala, Iraq; eman.22dep13@student.uomosul.edu.iq (E.D.S.).
[2]College of Dentistry, University of Mosul, Iraq; dr.aisha6757@uomosul.edu.iq (A.A.Q.).

Abstract: The aims of the study were to investigate prevalence and severity of dental erosion, and its related etiological risk factors and habits among students of university of Diyala. A cross-sectional survey of 404 university of Diyala undergraduate students, ages 18 to 22, was carried out. The participants were split into four groups: First Academic Stage (96), Second Academic Stage (133), Third Academic Stage (91), and Fourth Academic Stage (84). Before the exam began, general information and questions were captured in a unique form designed for data recording. Students also signed an informed permission form indicating their willingness to participate in research before the exam began. The prevalence and severity of dental erosion were classified for each tooth using the basic erosive wear examination (BEWE). The erosive wear criterion for each surface, tooth, and sexton ranges from 0 to 3. In this recent study females were higher percentage of dental erosion 56.9% than males 43.1% in score 0 of BEWE, also females were higher percentage of dental erosion in score 1, score 2 and score 3. Age 18 has a larger percentage of erosion (7.8%) in score 1 and no erosion in score 3, however age 19 has the highest score (18.2%) compared to the other age groups. Higher percentages in score 2 were 28.4% and 33.3%, respectively, for those aged 20 and 21. The percentage of degradation was higher in score 1 42.7% at age 22. Severe erosion was found in females than males, the enamel layer appears to be more impacted by tooth erosion as indicated by scores 1 and 2, which were determined by the BEWE index.

Keywords: Dental erosion, Dental wear, Eroded, BEWE.

1. Introduction

Erosive tooth wear, also known as dental erosion, is a disease of the hard tissues of the mouth that causes progressive loss of dental tissue as a result of chemo-physical or physical processes, with a focus on the involvement of chemical acid(1). The etiological factors of dental erosion can be divided to 'external' and 'internal' causes. External causes include circumstances relating to the workplace, certain drugs, and dietary consumption that can affect acidity. The primary exogenous causes of DE in today's children are lifestyle choices that include eating a diet richer in fruits and vegetables, drinking energy drinks during physical activity, but especially consuming more fruit juices and soft drinks. Both healthy and unhealthy lifestyle choices can increase a person's susceptibility to erosive wear (2,3). The first signs of dental erosive wear that patients typically report include pain and sensitivity issues, worsening aesthetic appearance indicated by tooth discoloration or shortening, loss of physiological contacts due to morphological changes in the teeth that may cause an unbalanced occlusion, and in severe cases effects on the temporomandibular joint's physiology(4,5).

2. Materials and Methods

The study was carried out in the University of Diyala City Center/Baquba between 2023 and 2024 with approval from the relevant university authorities. It was consisted of a cross-sectional survey of undergraduate first, second, third and fourth academic stage students attending university of Diyala - Iraqi. The total sample size was (404 from both gender) students. Calculate the sample size of a survey

based on the population size (which is 20226 total number of students in university of Diyala), margin of error 5% and confidence level 95%. Before the exam, each student's name, gender, age, college, residence (rural or urban), mother's and father's educational backgrounds (illiterate, primary, secondary, senior secondary, graduation, post-graduation) and medical history were all recorded on a separate form. They were also asked about their medical history. The teeth were categorized according to the degree and kind of dental erosion using the basic erosive wear examination (BEWE) (6). The maximum value for any surface, tooth or sextant in the grading system is (3), and the total of the BEWE score, which ranges from 0 to 18. Scores and criteria for BEWE index (Table 1).

Table 1.
Basic erosive wear examination index by (6).

Score	Criteria
0	No erosive tooth wears.
1	Initial loss of surface texture (Brightness loss, opaque surface or 'frosted glass' appearance).
2	Distinct defect, hard tissue loss, less than 50% of the surface area. Dentin could be involved.
3	Hard tissue loss in more than 50% of the surface area. Dentin could be involved.

Note: Prior to a clinical examination, the teeth should ideally be cleaned. Six sextants, representing the oral cavity and dentition, were visually inspected. It was 17-14, 13-23, 24-27, 37-34, 33-43, 44-47(6). SPSS (version 19, USA) was used for data entry and analysis, descriptive statistics and chi square test.

3. Results

The Prevalence of Dental Erosion: This research includes a total of 404 (174 males and 230 females) colleges students whose participate in this study from university of Diyala city center / Baquba which divided into four groups: First academic stage students (96), Second stage academic students (133), Third stage academic students (91) and Fourth stage academic students (84).

A total of 11.312 teeth (33.936 tooth surfaces) were examined in this study. The prevalence of dental erosion about the survey of 404 subjects and minimum one tooth or one surface with dental erosion was (19.83%).

The Severity of Dental Erosion, BEWE According to Gender: Females were higher percentage of dental erosion 56.9% than males 43.1% in score 0 of BEWE, also females were higher percentage of dental erosion in score 1, score 2 and score 3 (57.9%, 51.9% and 80.6%) respectively as showed in table (2).

Table 2.
The severity of dental erosion (Basic erosive wear examination index) score according to gender.

Gender	BEWE %	Score 0 (%)	Score 1 (%)	Score 2 (%)	Score 3 (%)
Male	% of studied sample	43.2%	42.6%	49.3%	20%
	Mean	1.56	5.1	10.53	16
	Std. deviation	0.542	1.713	1.376	1.732
	Erosion%	43.1%	42.1%	48.1%	19.4%
Female	% of studied sample	56.8%	57.4%	50.7%	80%
	Mean	1.57	5.21	11.03	16.58
	Std. deviation	0.499	1.639	2.007	3.825
	Erosion%	56.9%	57.9%	51.9%	80.6%
Total	% of studied sample	100%	100%	100%	100%
	Mean	1.57	5.16	10.78	16.47
	Std. deviation	0.516	1.668	1.731	3.461
	Erosion%	100%	100%	100%	100%

The Severity of Dental Erosion, BEWE Score According to Age: In age 18 years the percent of erosion was higher in score 1 of BEWE index 7.8% and absent in score 3, while in age 19 years score 3 was highest 18.2% than other. In age 20 years and 21 years, higher percent in score 2 were 28.4% and 33.3% respectively. In age 22 years the percent of erosion was higher in score 1 42.7%, (Table 3).

Table 3.
The severity of dental erosion, Basic Erosive Wear Examination Index score according to age.

Age (Years)		BEWE %			
		Score 0 (%)	Score 1 (%)	Score 2 (%)	Score 3 (%)
18	% of studied sample	3.6%	8.6%	1.4%	---
	Mean	2	4.67	9	---
	Std. deviation	0.0001	1.572	---	---
	Erosion%	4.6%	7.8%	1.2%	---
19	% of studied sample	11.7%	12.0%	11.6%	20%
	Mean	1.54	4.56	11	15
	Std. deviation	0.519	1.417	1.773	0.0001
	Erosion%	11.5%	10.6%	11.8%	18.2%
20	% of studied sample	27%	19.6%	27.5%	26.7%
	Mean	1.43	5.07	11.11	15.25
	Std. deviation	0.504	1.649	1.487	1.258
	Erosion%	24.7%	19.3%	28.4%	24.7%
21	% of studied sample	16.2%	17.7%	33.3%	20%
	Mean	1.61	5.73	10.78	19
	Std. deviation	0.502	1.726	2.255	6.928
	Erosion%	16.7%	19.6%	33.3%	23.1%
22	% of studied sample	41.4%	42.1%	26.1%	33.3%
	Mean	1.61	5.24	10.44	16.8
	Std. deviation	0.537	1.682	1.149	2.95
	Erosion%	42.5%	42.7%	25.3%	34%
Total	% of studied sample	100%	100%	100%	100%
	Mean	1.57	5.16	10.78	16.47
	Std. deviation	0.516	1.668	1.731	3.461
	Erosion%	100%	100%	100%	100%

The Severity of Dental Erosion, BEWE Score According to Academic Stage: In first stage, the percent of erosion was higher in score 1 (27.7%) and lower percentage in score 3 (6.1%). In second stage, the percentage of erosion was higher in score 2 (48.3%). Score 3 was the higher percentage of dental erosion in third and fourth stage (33.2% and 23.9%) respectively, (Table 4).

Table 4.
The severity of dental erosion basic erosive wear examination index score according to academic stage.

		Score 0 (%)	Score 1 (%)	Score 2 (%)	Score 3 (%)
First	% of studied sample	27%	28.7%	10.1%	6.7%
	Mean	1.6	4.98	10.71	15
	Std. deviation	0.498	1.682	1.704	----
	Erosion%	27.6%	27.7%	10.1%	6.1%
Second	% of studied sample	41.4%	33.5%	49.3%	40.0%
	Mean	1.59	5.13	10.56	15.17
	Std. deviation	0.541	1.623	1.307	0.983
	Erosion%	42%	33.3%	48.3%	36.8%
Third	% of studied sample	17.1%	22%	30.4%	33.3%
	Mean	1.42	5.43	11.14	16.4
	Std. deviation	0.507	1.695	2.308	3.05
	Erosion%	15.5%	23.2%	31.5%	33.2%
Fourth	% of studied sample	14.4%	15.8%	10.1%	20%
	Mean	1.62	5.18	10.86	19.67
	Std. deviation	0.500	1.722	1.773	6.429
	Erosion%	14.9%	15.8%	10.2%	23.9%
Total	% of studied sample	100%	100%	100%	100%
	Mean	1.57	5.16	10.78	16.47
	Std. deviation	0.516	1.668	1.731	3.461
	Erosion%	100%	100%	100%	100%

Answers to BEWE Index Questioner Items: There were insignificant difference in answers of first question about teeth sensitivity, but there were a significant difference in question nine about vomiting at ($p \leq 0.05$) and in question 21 about drink water before going to sleep at ($p \leq 0.01$), (Table 5).

Table 5.
Descriptive analysis of YES-answers to BEWE index questioner items by colleges of Diyala university.

Questions	No.	Erosion%
Hypersensitivity of teeth	262	65.1%
Energy drinks consumption	167	40%
Eat fresh fruit regularly	382	95%
Consumption of natural fruit juice	313	74.4%
Consumption of artificial fruit juice	307	75.4%
Eat spicy foods	291	74%
Eat Pickles frequently	225	56.8%
Eat Ketchup frequently	129	30.9%
Vomit (At least once a week)	75	15.1%
Brush your teeth after vomiting	241	57.1%
Ice coffee consumption	174	60.3%
Frequent coffee consumption	151	35.7%
Soft drink consumption	340	84.1%
Beverage consumed with straw	277	69.9%
Keep/rinse sweet carbonated drinks in mouth	184	46.3%
Brush your teeth after consumption of	126	28.7%

soft drink		
Frequent milk consumption	237	61.1%
Yogurt consumption	278	70.6%
Vitamin C supplement consumption	149	35.7%
Chew chewing gum	329	80.3%
Drink water before going to sleep	324	84%
Drink soft drink before sleeping	176	41.3%
Used whitening toothpaste	178	46%
Self-assessed gastric reflux	122	29.7%
Sour taste in your mouth	144	33.9%
Heartburn (Acid indigestion)	192	46.8%
Medical diseases	93	22.1%
Use Fluoride rinse or gel	63	17.1%

Note: * significant difference at ($p \leq 0.05$).
**Highly significant difference at ($p \leq 0.01$).

4. Discussion

There were 404 young adult male and female college undergraduate students in the study sample. Young college students are essential to the spread of preventative knowledge and health promotion among families and their community (7). Therefore, general health and dental health are interconnected and are critical to each other (8). There is much more to oral health than just having beautiful, white teeth. It affects each person's well-being and quality of life and is crucial to overall health (9). Oral health is closely linked to overall health and quality of life, as well as social connections and oral functions (10). It was discovered that dental erosion was greater in undergraduate students in previous studies (11,12) Conversely, the percentage was lower than the value found by other studies, 28%, 38.9%, and 26% (13–17). Variations in sample size, differences in the indices used to measure tooth erosion and the tooth surfaces examined caused variation in prevalence of tooth erosion with the above studies. Moreover, socioeconomic, cultural, regional and lifestyle variables may have an impact on the results of the prevalence data (18). In addition, variations in individual oral hygiene practices and the fluoride concentration of drinking water or dental fluoridation likely have a significant impact (19).

Furthermore, prior research has demonstrated that the BEWE index has good accuracy (6). Direct oral examination, dental photos, traditional dental models or digital dental models can all be used to assess the BEWE index. The BEWE index demonstrated sufficient intra- and inter-examiner repeatability in our study utilizing the direct oral examination(20). According to the result of current study females were higher percentage of dental erosion 56.9% than males 43.1% in score 0 of Basic Erosive Wear Examination index (BEWE), also females were higher percentage of dental erosion in score 1, score 2 and score 3. The difference between males and females in tooth erosion may be connected to variations in dietary choices and lifestyle/behavioral patterns. Score 1 and score 2 involved only the enamel, confirming findings in (15,21–25), also were observed in some studies (11,26,27). According to score 3, there was a low incidence of dentin lesions, which is consistent with earlier research (23,28). According to the report, there was no pulp involvement (25).

Lesion depth depend in many factors as prolong still of carbonated beverages in the oral cavity has been demonstrated to cause a PH decline (29,30). The degree to which dental erosion affects the surface of the mouth is also influenced by the amount of acidic beverages that are ingested(31), the effect becomes much more pronounced when temperature of acid becomes higher as a result of temperature of oral cavity, the frequency and timing of food intake was the frequent consumption of acidic fruits and the timing of fruit intake is also crucial(32).

In the result of present study in age 18 years the percent of erosion was higher in score 1 of BEWE index 7.8% and absent in score 3, while in age 19 years score 3 was highest 18.2% than other. In age 20 years and 21 years, higher percent in score 2 were 28.4% and 33.3% respectively. In age 22 years the percent of erosion was higher in score 1 42.7%. Hasselkvist *et al.*, (2016) discovered that the

development of erosive lesions was prevalent and correlated with lifestyle characteristics in Swedish teenagers between the ages of 17 and 18 (33). In Skalsky Jarkander et al. (2018) dental erosion was more common in 17-year-olds (34.3%). Teenagers aged 17 have a higher prevalence of severe erosive wear (grades 3) was 20.7%(2). Where the comparable percentage was 22.3% for those who were 18 and 19 years old. The variations in prevalence between these studies can be explain by different age ranges, study populations and/or grading schemes.

Erosion value of the stages was (19.5%, 39.3%, 26.4% and 14.8%) respectively, thus, result showed that second stage has higher value of dental erosion when compared with other stages. Thus, in first stage, the percent of erosion was higher in score 1 and lower percentage in score 3. In second stage, the percentage of erosion was higher in score 2. Score 3 was the higher in third and fourth stage. This different may be due to changes in lifestyle, dietary and personal hygiene habits of the student (34).

There was insignificant difference in answers of third question about eat fresh fruit. Fresh fruits are among the healthiest foods for teeth because of their nutritional value and positive effects on oral hygiene but excessive consumption of citrus fruits such as lemons, grapefruit and oranges (35), apples, bananas and grapes showed positive association with dental erosion (36). Previously Abdul Manaf *et al.*, (2012) concluded the presence of dental erosion was not related to amount of acidic fruits (37). Fruit consumption and tooth degradation are only associated when consumption is considerable. Therefore, eating citrus fruits more than twice a day (four to five times a day) has been linked to a significant risk of erosion.

Question two excessive energy drink use during physical activity combined with xerostomia from dehydration, which causes tooth erosive damage(38). The same results were found by Kumar *et al.* (12). About question four and five were insignificant difference in answers, frequent consumption of "unhealthy acidic beverages" soft drinks, for example, are thought to be more dangerous when it comes to the development of erosive wear since they are consumed more frequently and for longer periods of time than "healthy acidic beverages," like fruit juices (39).

Using a straw in question fourteen would decrease the amount of time that an acidic beverage is in contact with the hard teeth tissue; hence, acidic drinks will be less harmful (40). In question twenty three was agree with Binaljadm *et al.*, toothbrush and toothpaste abrasive properties will soften dental hard tissue and increase (40). Additionally, brushing your teeth before eating has been linked to an increased risk of erosion. Previous research has indicated that this association may be due to the dental biofilm's protective role, which decrease the mineralized tissues exposed to acidic environments by loss of ions (41–43).

5. Conclusion

The findings of this study showed a high prevalence of dental erosion in this group of students, especially among females, with the presence of many risk factors. Then young adults need to be aware about their dietary habits and oral hygiene, and also a proper dental health program needs to be applied.

Copyright:

References

[1]   Schlueter N, Amaechi BT, Bartlett D, Buzalaf MAR, Carvalho TS, Ganss C, et al. Terminology of Erosive Tooth Wear: Consensus Report of a Workshop Organized by the ORCA and the Cariology Research Group of the IADR. Caries Res. 2020;54(1):2–6.

[2]   Skalsky Jarkander M, Grindefjord M, Carlstedt K. Dental erosion, prevalence and risk factors among a group of adolescents in Stockholm County. Eur Arch Paediatr Dent. 2018 Feb;19(1):23–31.

[3]   Sezer B, Giritlioğlu B, Sıddıkoğlu D, Lussi A, Kargül B. Relationship between erosive tooth wear and possible etiological factors among dental students. Clin Oral Invest. 2022 May;26(5):4229–38.

[4]   Tulek A, Vieira AR, Weber ML, Bezamat M, Deeley K, Stenhagen KR, et al. Aquaporins' Influence on Different Dental Erosive Wear Phenotypes in Humans. Caries Res. 2020;54(2):165–75.

[5]   Campus G, Niu JY, Sezer B, Yu OY. Prevention and management of dental erosion and decay. BMC Oral Health. 2024 Apr 17;24(1):468, s12903-024-04257-y.

[6]   Bartlett D, Ganss C, Lussi A. Basic Erosive Wear Examination (BEWE): a new scoring system for scientific and clinical needs. Clin Oral Invest. 2008 Mar;12(S1):65–8.

[7]   Ahamed ST. Awareness of Oral Hygiene among Children in Chennai. Rese Jour of Pharm and Technol. 2016;9(8):1055.

[8]   Peres MA, Macpherson LMD, Weyant RJ, Daly B, Venturelli R, Mathur MR, et al. Oral diseases: a global public health challenge. The Lancet. 2019 Jul;394(10194):249–60.

[9]   Tadin A, Poljak Guberina R, Domazet J, Gavic L. Oral Hygiene Practices and Oral Health Knowledge among Students in Split, Croatia. Healthcare. 2022 Feb 21;10(2):406.

[10]   Vergnes JN, Mazevet M. Oral diseases: a global public health challenge. The Lancet. 2020 Jan;395(10219):186.

[11]   Vargas-Ferreira F, Praetzel JR, Ardenghi TM. Prevalence of tooth erosion and associated factors in 11–14–year-old Brazilian schoolchildren: Tooth erosion and risk factors. Journal of Public Health Dentistry. 2011 Jan;71(1):6–12.

[12]   Kumar S, Acharya S, Mishra P, Debnath N, Vasthare R. Prevalence and risk factors for dental erosion among 11- to 14-year-old school children in South India. J Oral Sci. 2013;55(4):329–36.

[13]   Chadwick BL, White DA, Morris AJ, Evans D, Pitts NB. Non-carious tooth conditions in children in the UK, 2003. Br Dent J. 2006 Apr;200(7):379–84.

[14]   Caglar GS, Kahyaoglu I, Pabuccu R, Demirtas S, Seker R. Anti-Mullerian hormone and insulin resistance in classic phenotype lean PCOS. Arch Gynecol Obstet. 2013 Oct;288(4):905–10.

[15]   Correr GM, Alonso RCB, Correa MA, Campos EA, Baratto-Filho F, Puppin-Rontani RM. Influence of diet and salivary characteristics on the prevalence of dental erosion among 12-year-old schoolchildren. J Dent Child (Chic). 2009;76(3):181–7.

[16]   Rasmia H, Ali F, Herwis K, Mohamed F, Musrati A. Prevalence of Dental Erosion in a Group of Schoolchildren from Benghazi, Libya. Int J Oral Craniofac Sci. 2016 Aug 24;2(2):052–6.

[17]   Universidad Privada Norbert Wiener. Lima, Peru, Tuya M, Cespedes J, Universidad Privada Norbert Wiener. Lima, Perú., Anampa M, Universidad Nacional Jorge Basadre Grohmann, Tacna, Perú., et al. Dental erosion and oral health-related quality of life in children aged 3 to 5 years living in Lima. Peru. J Oral Res. 2022 Jun 30;11(3):1–7.

[18]   Wang P, Lin HC, Chen JH, Liang HY. The prevalence of dental erosion and associated risk factors in 12-13-year-old school children in Southern China. BMC Public Health. 2010 Dec;10(1):478.

[19]   Dental Erosion and Its Relation to Potential Influencing Factors among 12-year-old Hungarian Schoolchildren. Oral Health and Preventive Dentistry. 2022 Mar 14;20(1):95–102.

[20]   Shotadze M, Gumbaridze L, Cui Y, Baramidze L, Kiladze N, Sturua L, et al. Attitudes and behaviors related to reducing secondhand smoke exposure among medical university students in the country of Georgia. Georgian Medical News. 2024;350(5):68–72.

[21]   Mahmood E, Sarhat E, Tawfeq M, Wadee S. Histological and biochemical study of the effect of fexofenadine on salivary gland in rats. Georgian Medical News. 2024;347(2):38–40.

[22]   Mulic A, Tveit AB, Songe D, Sivertsen H, Skaare AB. Dental erosive wear and salivary flow rate in physically active young adults. BMC Oral Health. 2012 Dec;12(1):8.

[23]   Huew R, Waterhouse PJ, Moynihan PJ, Kometa S, Maguire A. Dental erosion and its association with diet in Libyan schoolchildren. Eur Arch Paediatr Dent. 2011 Oct;12(5):234–40.

[24]   Arnadottir IB, Holbrook WP, Eggertsson H, Gudmundsdottir H, Jonsson SH, Gudlaugsson JO, et al. Prevalence of dental erosion in children: a national survey. Comm Dent Oral Epid. 2010 Dec;38(6):521–6.

[25]   Mangueira DF, Sampaio FC, Oliveira AF. Association Between Socioeconomic Factors and Dental Erosion in Brazilian Schoolchildren. J Public Health Dent. 2009 Sep;69(4):254–9.

[26]   Auad SM, Waterhouse PJ, Nunn JH, Steen N, Moynihan PJ. Dental erosion amongst 13- and 14–year-old Brazilian schoolchildren. International Dental Journal. 2007 Jun;57(3):161–7.

[27]   Auad SM, Waterhouse PJ, Nunn JH, Moynihan PJ. Dental caries and its association with sociodemographics, erosion, and diet in schoolchildren from southeast Brazil. Pediatr Dent. 2009;31(3):229–35.

[28]   Dugmore CR, Rock WP. A multifactorial analysis of factors associated with dental erosion. Br Dent J. 2004 Mar;196(5):283–6.

[29]   Alnori M. KJ. Smoking Modulated Salivary Alpha Amylase Synchronized by Daily Beverages. J Nat Sc Biol Med. 15(2):277–81.

[30]   Hafidah F, Apriningsih, Simanjorang C, Hanifah L. Determinants of Electronic Smoking Behavior among Adolescents in Indonesia (Analysis of Global Youth Tobacco Survey 2019). Public Health of Indonesia. 2024 Jun 25;10(2):133–42.

[31]   Keerthana T, Ramesh S. Knowledge, attitude and practice survey on awareness of the association between diet and dental erosion. IJDOS. 2021 Feb 22;8(2):1683–90.

[32]   32.   Eisenburger M, Addy M. Influence of liquid temperature and flow rate on enamel erosion and surface softening. J of Oral Rehabilitation. 2003 Nov;30(11):1076–80.

[33]   33.   Hasselkvist A, Johansson A, Johansson AK. A 4-year prospective longitudinal study of progression of dental erosion associated to lifestyle in 13–14–year-old Swedish adolescents. Journal of Dentistry. 2016 Apr; 47:55–62.

[34]   Strużycka I, Rusyan E, Bogusławska-Kapała A. Prevalence of dental erosion in young adults aged 18 years in Poland. Przegl Epidemiol. 2014;68(4):689–93.

[35]   Chan AS, Tran TTK, Hsu YH, Liu SYS, Kroon J. A systematic review of dietary acids and habits on dental erosion in adolescents. Int J Paed Dentistry. 2020 Nov;30(6):713–33.

[36]   Ruiz DC, Marqués Martínez L, García Miralles E. Dental Erosion and Diet in Young Children and Adolescents: A Systematic Review. Applied Sciences. 2023 Mar 9;13(6):3519.

[37]   Manaf ZA, Lee MT, Ali NHM, Samynathan S, Jie YP, Ismail NH, et al. Relationship between food habits and tooth erosion occurrence in Malaysian University students. Malays J Med Sci. 2012 Apr;19(2):56–66.

[38]   Jalaawi W, Selmi J, Bouguezzi A, Farhan H. Prevalence of Xerostomia and Associated Risks Factors Among Medically Compromised Persons. J Nat Sc Biol Med. 15(2):15–27.

[39]   Sharma S, Tiwari MS, Mishra A, Sharma D. Consumption behavior and awareness of medical students about dental erosion and its association with consumption of carbonated/acidic beverages. Asian J Pharm Clin Res. 2022 Oct 7;56–9.

[40]   Binaljadm TM, Aljuaid AO, Rummani GM, Almaghrabi HA, Halabi SA, Deeban YAM, et al. Assessment knowledge of dental erosion, signs and symptoms, and causes among adult in Saudi Arabia: A cross-sectional survey. Saudi Journal of Oral Sciences. 2023 Sep;10(3):157–63.

[41]   Honório HM, Rios D, Santos CF, Magalhães AC, Buzalaf MAR, Machado MAAM. Effects of Erosive, Cariogenic or Combined Erosive/Cariogenic Challenges on Human Enamel. Caries Res. 2008;42(6):454–9.

[42]   AlShehab A, AlHazoom A, Alowa M, AlAli H, Abdulmohsen A, Farooq I. Effect of bristle stiffness of manual toothbrushes on normal and demineralized human enamel—An in vitro profilometric study. Int J Dental Hygiene [Internet]. 2018 May [cited 2024 Sep 21];16(2). Available from: https://onlinelibrary.wiley.com/doi/10.1111/idh.12332

[43]   Avila V, Betlrán EO, Cortés A, Usuga-Vacca M, Castellanos Parras JE, Diaz-Baez D, et al. Prevalence of erosive tooth wear and associated risk factors in Colombian adolescents. Braz oral res. 2024;38:e050.