

Knowledge, Attitude and Practices of Dental Erosion related to Acidic Dietary Intake among Medical Undergraduates

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ABSTRACT

Aim: To assess knowledge, attitude and practice of dental erosion related to dietary acidic intake among medical undergraduates.

Methods: It was a cross sectional study conducted at Bahria University Medical and Dental College, Karachi from March-2019 to November 2019. The validated questionnaire was used to assess the study objectives. There were five sections in the study tool including demographic data, knowledge, self-reported signs and symptoms, attitude and practices of acidic dietary intake. The data was entered on SPSS version 23.0 for analysis. P-value <0.05 was considered as statistically significant.

Results: From total of 500 subjects; 498 questionnaires were completed in all aspects; hence the response rate was 99.6%. Respondents comprised of both males and females having age range from 17 to 25 years with a mean age of 20.82±SD 1.76. Majority of participants (74.4%) had high level of knowledge regarding dental erosion. Statistically significant association was found (p-value=0.02) when compared to level of knowledge with attitude. While assessing the association between practice and self-reported sign/symptoms; significant association was found in regards to frequency and timing of acidic dietary intake at a p-value of 0.000.

Conclusion: Majority of participants had high level of knowledge regarding erosion as related to acidic dietary intake and was positively reflected in their attitude. Overall, natural fruit juices were the highest consumed drinks followed by carbonated drinks.

Keywords: Dental erosion, Dietary behavior, Medical Undergraduates, Carbonated drinks, Dietary habits.

INTRODUCTION

Dental erosion is multi factorial in nature ranging from systemic endogenous causes to exogenous culprits, usually involving dietary elements^{1,2}. Carbonated and acidic fruit drinks are a recognized factor in dental erosion². Erosive traits of any food or beverage are a measure of its capacity to demineralize tooth substance. Erosion related tooth wear of enamel takes place if the pH falls below 5.5^{1,4}. However, time, duration and frequency of consuming beverages are factors which lead to the establishment of an erosive lesion³. Carbonated drinks consumption has increased dramatically in the last few decades and is significantly associated with particular tooth wear. Among young adolescents and children; the most probable etiology of tooth wear is consumption of carbonated drinks⁵. A study conducted in Poland in 2017, highlighted acidic diet as one of the significant factors causing erosion⁶. It is evident from various studies; that soft drinks have also been specifically linked to erosion^{2,7-9}.

Dental erosion is increasingly seen in adolescents and young adults in many countries. Various studies have validated this fact^{6,7,10}. A recent study conducted in 2017 in North Eastern Brazilian city encompassed subjects from 12 – 30 years; and reported 28.7% of the females having erosion which were predominantly found in 15 to 19 years of age group¹⁰. A similar cross sectional study conducted in Poland revealed positive signs of erosion in 42.3% of young adults⁶. In a Swedish population of 20 years old, 75% had erosion with soft drinks and extensive erosion in 18% of the sample⁷. Hence; globally the incidence of erosive tooth wear is increasing in younger age groups.

There are various studies conducted in Pakistan regarding the association of specifically carbonated drinks and dental erosion among school children; as well as other risk factors has also been evaluated among general population but not the acidic dietary intake as a whole^{3,11,12}.

Therefore; the primary aim of the study was to assess the knowledge, attitude and practice of dental erosion in relation to

dietary acidic intake with emphasis on acidic beverages as a whole among medical undergraduates. The secondary objective was to find an association of knowledge with preferred choices of acidic dietary intake (attitude); and self-reported sign and symptoms of dental erosion with practice of dietary habits.

METHODS

In this cross-sectional study, the target population comprised of medical undergraduates of all years of study in age range of 17 to 25 years. Dental students and students of medicine who didn't give consent were excluded from the study. The calculated sample size was 384 by using 50% anticipated frequency on a standard sample size formula. By considering 20% wastage and bring more significant results; the sample size was augmented as 500. Each year of medical study comprise of 150 students out of which 100 students were invited to participate through probability sampling technique (randomization). To achieve this, computer generated numbers were used. Verbal consent was obtained from each participant after briefing them about the rationale of the study. In addition, the participants were assured of confidentiality and anonymity of the data. In case the selected student didn't consent, the next number in the list was chosen. Questionnaire biases were controlled through randomization, augmenting the sample size, proper briefing and ambient environment of lecture halls.

A validated close ended questionnaire was used to assess the study objectives.¹ There were five sections in study tool; first section focused on demographic data while second section outlined the nine questions regarding the level of knowledge. The responses of this section was recorded on five points Likert scale from strongly agree to strongly disagree as 1 to 5. The cumulative score was 45. Levels of knowledge were categorized into poor, intermediate and good/ high levels by employing a pre-used scheme¹³ (Table 1). The third section assessed the self-reported signs and symptoms of dental erosion. There were five options given for self-reported symptoms such as teeth turning yellow, teeth having smoother and shiner surface, teeth having thinner edge and feeling of sour/painful when having hot/cold drinks or sour/sweet food. Subjects having one to all symptoms were

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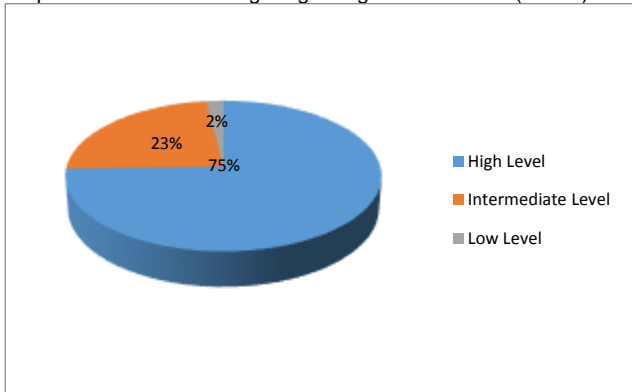
computed as yes and none was considered as symptomless. The fourth section focused on the attitude towards consuming acidic beverages such as the recommendations of dietary acidic intake for prolong consumption and the preferred choices in regard to natural fruit juices, carbonated drinks, energy drinks and lemon tea. The last section dealt with practices of consuming beverages exploring time of ingestion, frequency, duration of consumption and time of brushing as related to acidic dietary intake.

The data was entered on SPSS version 23.0 for statistical analysis. Descriptive analysis was tabulated as frequencies, mean and standard deviation. The Chi- square test or Fischer exact test was used to spot any statistical association regarding knowledge of dental erosion with attitude; and practices of acidic dietary intake with self-reported signs and symptoms. P-value <0.05 was considered as statistically significant.

RESULTS

From the total 500 subjects; 498 questionnaires were completed in all aspects; hence the response rate was 99.6%. The mean age of respondents was 20.82±SD 1.76 comprised of both males and females having age range from 17 to 25 years (Table 2). Total 371(74.4%) participants had high level of knowledge regarding dental erosion (Graph 1).

Graph 1: Level of knowledge regarding dental erosion (n=498)



Nine questions were asked to assess the levels of knowledge of dental erosion; Total 297(59.5%) participants strongly agreed with that prolonged consumption of carbonated drinks for a long time is bad for health (Question 1); followed by 174(34.9%) of participants agreed that prolonged consumption of acidic fruit based drink / lemon tea can cause erosion of teeth (Question 2). Nearly equal numbers of participants that were 168(33.7%) agreed and 174(34.9%) responded neutrally to question 4 regarding the erosive effects of prolonged consumption of acidic fruit based drink / lemon tea (Table-3).

The feedback of attitude section of the questionnaire revealed that greater number that was 446(89.6%) of participants refused to recommend carbonated beverages to others. A total of 177(35.5%) candidates preferred natural fruit juices solely as their choice of drink followed by 129(25.9%) that chose natural fruit juices with energy or Lemon tea (Table 4). Nearly half of the participants that are 45.1% (225) had started taking carbonated beverages at the age of 5-10 years. Significant association was found between preferred choices of acid intake and levels of knowledge, with a statistically significant P value of 0.02 (Table-4).

Regarding practices, four categories were made including natural fruit juices, carbonated with natural fruit juices, carbonated with energy drinks and combination of sugary and non-sugary

carbonated drinks. The most recurring response was occasional consumption for all categories mentioned (Table 5). The reported time of ingestion for natural fruit juices by 111(30.5%) participants was with meals whereas carbonated drinks was taken occasionally by 246(49.3%) subjects-Table 5. Majority of the participants; 24(48.1%) did not brush their teeth after taking any beverage. Regarding the duration of per beverage consumption, total 316(63.3%) took around or greater than 15 minutes to finish up a single feed /drink.

While assessing the association between practice and self-reported sign and symptoms; there was significant association found between frequency of dietary intake of natural fruit juices & self-reported symptoms at p-value of 0.000 (Table 5). There was significant association found between the time of consuming beverages with self-reported symptoms at p-value <0.05 for all intake categories except for sugary carbonated and non-sugary carbonated drinks (Table-5). A p-value of 0.06 was found when associated with duration of ingestion which is close to statistical significance. However, it was clearly not found to be associated with timing of brushing after intake with and 0.22 respectively.

The most frequent reported sign and symptom was feeling sour or painful teeth upon consumption of any sharp tasted foodstuff and hot/cold beverages with a frequency of 152(30.5%)-graph-2.

Table-1: Categorization of levels of knowledge regarding dental erosion.

Applied Formula ¹	Status regarding Dental Erosion	
Total knowledge level =	Poor level of knowledge	71-100%.
Total patient's knowledge score/	Intermediate level of knowledge	51-70%
Total maximum knowledge score x 100%	Good/ High level of knowledge	0-50%

Table 2: Demographics

Mean Age	20.82
SD	1.76
Age Range(year)	17-25
Gender	
Male (%)	72
Female (%)	28
Total	498

Graph 2: Self reported signs and symptoms

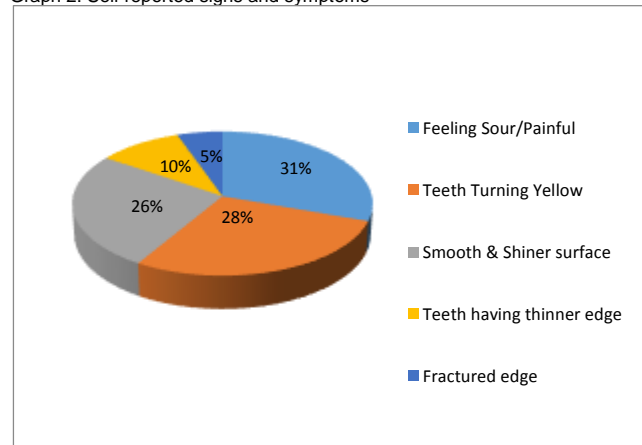


Table-3: Knowledge of Dental Erosion in relation to Dietary Acidic Intake (n=498)

Qs	Dental erosion Knowledge parameters	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
		N (%)	N (%)	N (%)	N (%)	N (%)
1	Prolong consumption of carbonated drinks for a long time is bad for health.	297(59.5)	177(35.7)	10(2)	6(1)	9(1.8)
2	Carbonated drinks have harmful effects on teeth.	249(50.1)	208(41.7)	30(6)	4(0.8)	7(1.4)
3	Prolong consumption of carbonated drinks leads to erosion of teeth.	204(41)	210(42.1)	64(12.8)	11(2.2)	9(1.8)
4	Prolong consumption of acidic fruit based drink / lemon tea can cause erosion of teeth.	76(15.3)	174(34.9)	168(33.7)	70(14)	10(2)
5	Acidic foodstuffs like vinegar/ yogurt/ pickles can cause erosion of teeth.	63(12.6)	145(29.1)	183(36.7)	88(17.6)	19(3.8)
6	Acid erosion can cause teeth to turn yellow	84(16.8)	207(41.5)	138(27.7)	56(11.2)	13(2.6)
7	Acid erosion can cause teeth to have smoother and shinier surface	42(8.4)	84(16.8)	142(28.5)	169(33.9)	61(12.2)
8	Acid erosion can cause teeth to have a thinner edge	93(18.6)	247(49.5)	115(23)	31(6.2)	12(2.4)
9	Acid erosion can cause teeth feeling sour or painful when having hot or cold beverages and sour or sweet foodstuffs	122(24.5)	272(54.5)	89(17.8)	7(1.4)	8(1.6)

Table-4: Association of Level of Knowledge of Dental Erosion and Preferred Choices of acidic dietary intake (Attitude)

Preferred choices of acidic dietary intake	Levels of Knowledge				P-Value
	Good 371(74.4%)	Intermediate 117 (23.4%)	Low 10 (2%)	Total N=498 (%)	
Natural Fruit Juices	140(37.7)	32(27.3)	5(0.5)	177(35.5)	0.02
Carbonated drinks	35(9.4)	10(8.5)	3(0.3)	48(9.6)	
Energy drinks	3(0.8)	2(1.7)	0(0)	5(1.0)	
Lemon Tea	7(1.9)	1(0.8)	0(0)	8(1.6)	
Natural Fruit Juices & Carbonated drinks	64(17.2)	16(13.6)	1(0.1)	81(16.2)	
Natural Fruit Juices & Carbonated drinks with energy drinks & Lemon Tea	31(8.3)	18(15.3)	2(0.2)	50(10.2)	
Natural Fruit Juices with energy drinks & Lemon Tea	91(24.4)	38(32.4)	0(0)	129(25.9)	

Table-5: Association of Self-reported Symptoms and Practices (n=498)

Frequency of Dietary Acidic Intake		Self-reported Symptoms		n	P-Value*
Dietary habits		Yes	No		
Natural Fruit Juices	Occasionally	202	86	288	0.004
	300ml/1 can/day	116	70	186	
	>900ml/>3 cans/day	8	4	24	
Carbonated drinks + Natural fruit juices	Occasionally	254	107	361	0.000
	300ml/1 can/day	72	52	124	
	>900ml/>3 cans/day	12	1	13	
Carbonated drinks + Energy Drinks	Occasionally	272	140	412	0.000
	300ml/1 can/day	50	19	69	
	>900ml/>3 cans/day	16	1	17	
Sugary carbonated + Non Sugary carbonated	Occasionally	266	132	398	0.002
	300ml/1 can/day	59	24	83	
	>900ml/>3 cans/day	13	4	17	
Time of Dietary Acidic Intake					
Natural Fruit Juices	Before breakfast	79	62	141	0.000*
	At night before going to bed	36	11	47	
	With meals	111	41	152	
	Occasionally	103	43	146	
	Before breakfast, at night, before going to bed & meals	8	4	12	
Carbonated drinks + Natural fruit juices	Before breakfast	83	44	127	0.007
	At night before going to bed	15	5	20	
	With meals	101	37	138	
	Occasionally	131	72	203	
	Before breakfast, at night, before going to bed & meals	7	3	10	
Carbonated drinks + Energy Drinks	Before breakfast	42	15	57	0.008
	At night before going to bed	8	8	16	
	With meals	32	13	45	
	Occasionally	256	124	380	
	Before breakfast, at night, before going to bed & meals	0	0	0	
Sugary carbonated + Non Sugary carbonated	Before breakfast	19	5	24	0.301
	At night before going to bed	27	15	42	
	With meals	123	55	178	
	Occasionally	165	81	246	
	Before breakfast, at night, before going to bed & meals	4	4	8	

*Chi square is significant at ≤ 0.05

DISCUSSION

Specifically erosive tooth wear has been scarcely researched especially in light of comprehensive acidic dietary intake in context to Pakistan. Therefore, the designed questionnaire of this study studied not only carbonated drinks but also other forms of acidic diet. Self-reported signs and symptoms were also explored related to dietary practices. Pakistani data mostly revolves around tooth wear in general with its relation to possible risk factors^{3,11-14}. Fewer studies reported erosion in particular and showed high intake of carbonated drinks with signs of erosion in primary as well as

permanent teeth^{15,16}. Another study by Zaidi et al¹⁷ related fizzy drinks with intense tooth hypersensitivity which may be a precursor to erosive tooth wear.

Our study have reported good knowledge with majority 372(74.5 %) of participants. This is in contrast to many other similar studies^{18,19}. A study of Turkey deduced low level of knowledge in non-dental students (47%) as compared to dental students (87%) which increased with level of academic year²⁰. Another study reported that only 39% of the university students had an inclination regarding the ill effects of carbonated drinks in contrast to our study which showed more than 50% strongly

agreeing to its ill effects¹⁹. Whereas, a Brazilian study conducted in a Dental school, showed approximately 79% students and dental faculty having heard about dental erosion and 89% preferred cutting down on carbonated drinks to prevent it²⁰. The difference in target population cannot be disregarded though. In our study, health sciences students were targeted. The influence of their mingling with the dental students which reside in the same campus and access to dental outpatient department cannot be underestimated. The awareness regarding healthy eating in this metropolitan city of Pakistan may have led to these results.

On further consideration of questions regarding the ill effects of acidic beverages like natural fruits juices or lemon tea, it is pertinent to mention that only 34% people had knowledge regarding its association with erosion. This relates to their attitude as majority of participants preferred natural fruit juices alone or with lemon tea over carbonated drinks. This was validated by statistical significant p-value= 0.02; when comparing knowledge with its preference.

Furthermore, these findings were reflected in their behavior as consumption of practices showed majority students consumed 300ml/day of natural fruit juices as compared to only 83 who had carbonated drinks alone. A similar study conducted at Princess Nourah University, Saudia Arabia revealed that one third of the students didn't take carbonated drinks at all with majority consuming citrus or fruits juices at least once a day²¹. The reason may be the increased level of awareness regarding the nutritional value of natural fruits juices in the recent years. Carbonated drinks due to its high sugar content has also been related to obesity rendering more healthy natural drinks to be preferred over it. A current systematic analysis of sugary beverages revealed that after the change of millennium there is a sharp decline in its consumption especially in adolescents²². An American study also cited that majority of the college students (61%) limited the consumption of sugar sweetened beverages to help maintain a healthy weight²³.

Our study also showed 30.5% of students feeling sensitivity followed closely by teeth turning yellow or smoother which is clinically significant. This was validated by a positive statistically significant association between self-reported signs/symptoms and consumption. Hence, it may be linked to the acidic content in both natural fruit juices and carbonated beverages which were the two most consumed drinks. Fruit flavorings in drinks also lead to increase in erosive potential of the beverages comparable to carbonated drinks⁴. This result is similar to many other studies^{5,6,10,24,25}. Since, dentine hypersensitivity has been found to be highly related with erosion, so this symptom may be likely assumed as a precursor to erosion. Yet it cannot be confirmed without clinical examination¹⁸.

Regarding the timing of acidic diet ingestion, our study reported most recurring response of random intake for carbonated drinks in contrast to natural fruits juices at mealtimes. However, timing of carbonated drinks was not found to be statistically associated with self-reported signs and symptoms. O Toole in a separate study specifically explored the timing of dietary acid intake with erosive tooth wear and reported significant odds ratio when consumed between meals²⁶. It has also been suggested that the buffering effect of meals high in calcium or phosphate may limit the effects of the acidic beverages⁴. However, clarity was not found regarding its timing after consumption of acidic drinks or their replacement to acidic diet.

Further exploration of their practices revealed that majority (63.3%) took around 15 minutes or more to finish the beverage. Studies have shown that duration of low pH in the oral cavity is positively related to erosion and symptom of sensitivity²⁷. O Toole et al observed that participants who took more than 10 minutes had 2.9 times more risk of having erosion⁴. This is attributed to its greater triturable acidity which is approximately 3.5 times greater than cola drinks. Moreover, long sipping leads to sustained drop in pH though it was not explored in this study. Similarly, around half of the participants did not brush their teeth after consuming the

acidic drink which may have decreased the frequency of sensitivity in the sample. However, the role of brushing immediately after consumption is not clear with studies showing mixed results²⁷. So, it can be safely said that the acidic potential of natural fruits juices is under estimated by our students with greater number of participants just being neutral to its association to erosion in contrast to carbonated drinks. The predisposition towards having a healthy lifestyle may be an influencing factor in the attitude of our students.

Since the study was single center so was only confined to a limited sample size and the results cannot be summed up for the entire population. It is pertinent to mention here that our students are admitted from all over Pakistan with great diversity among ethnicities. It was cross sectional study giving information only at the time of data collection. A better study design with greater representation of the population can be adopted for further researches. Therefore, interpretation of these results warrants cautious approach.

CONCLUSION

Within the limitations of our study, it can be concluded that majority had high level of knowledge regarding erosion and ill effects of carbonated drinks though with more respondents being neutral to relation of erosion to natural fruit juices. This was positively reflected in their attitude as well. Overall, natural fruit juices were the highest consumed drinks followed by carbonated drinks.

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Conflicts of Interest: None to declare

Ethical Approval Statement: It was a cross sectional study conducted at Bahria University Medical and Dental College from September 2019 to February 2020. It was conducted abiding by the principles of Declaration of Helsinki. The study was executed after obtaining ERC approval from the institutes' Ethical review committee numbered ERC 41/2019. Administrative permission was taken verbally.

Author Contribution: **SK** conceptualized, Designed and Drafted the article. **AB** provided Literature search, Data Collection and Drafting. **FI** critically revise the manuscript. **AM** Design and collect the data. **KFMB** interpretate the data and done the final approval of manuscript. **MFF** encode and analyze the data. **SAAZ** provided logistic & statistical support with little help in initial and final drafting. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript. Acknowledgement to WBK for providing his guidance.

REFERENCES

1. Chu CH, Pang KKL, Lo ECM. Dietary behavior and knowledge of dental erosion among Chinese adults. *BMC Oral Health* 2010; 10:13-19. <https://bmcoralhealth.biomedcentral.com/articles/10.1186/1472-6831-10-13>
2. Johansson AK, Omar R, Carlsson GE, Johansson A. Dental erosion and its growing importance in clinical practice: from past to present. *Int J Dent*. 2012;2012: 632907. doi:10.1155/2012/632907. <https://pubmed.ncbi.nlm.nih.gov/22505907/>
3. Ali KF, Memon MA. Anterior versus posterior tooth Wear and associated risk factors among patients attending Oral medicine OPD of Karachi. *J Pak Dent Assoc*. 2017 Oct;26(4):164. <http://www.jpda.com.pk/anterior-verses-posterior-tooth-wear-and-associated-risk-factors-among-patients-attending-oral-medicine-opd-of-karachi/>
4. O'Toole S, Mullan F. The role of the diet in tooth wear. *Br Dent J*. 2018 Mar 9;224(5):379-383. doi: 10.1038/sj.bdj.2018.127. <https://pubmed.ncbi.nlm.nih.gov/29471309/>
5. Hesselkvist A, Johansson A, Johansson AK. Association between soft drink consumption, oral health and some lifestyle factors in Swedish adolescents. 2014;1039-1046. <https://pubmed.ncbi.nlm.nih.gov/25183250/>

6. Struzeyka I, Lussi A, Kapala AB, Rusyan E. Prevalence of erosive lesions with respect to risk factors in a young adult population in Poland – a cross sectional study. *Clin Oral Invest* 2017;21:2197-2203. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5559558/>
7. Isaksson H, Birkhed D, Wendt LK, Alm A, Nilsson M, Koch G. Prevalence of dental erosion and association with lifestyle factors in Swedish 20 year olds. *Acta Odontol Scand*. 2014 Aug;72(6):448-57. <https://pubmed.ncbi.nlm.nih.gov/24286494/>
8. Manaf ZA, Lee MT, Ali NHM, Samynathan S, Jie YP, Ismail NH et al. Relationship between food habits and erosion occurrence in Malaysian university students. *Malays J Med Sci* 2012;19(2):56-66. <https://pubmed.ncbi.nlm.nih.gov/22973138/>
9. Richards D. Impact of diet on tooth erosion. *Evidence based Dentistry* 2016;17:40. <https://pubmed.ncbi.nlm.nih.gov/27339233/>
10. Luciano LCO, Ferreira MC, Paschoal MA. Prevalence and factors associated with dental erosion in individuals aged 12-30 years in a northeastern Brazilian city. *Clin Cosmet Investig Dent*. 2017 Oct 16;9:85-91. doi: 10.2147/CCIDE.S144150. <https://pubmed.ncbi.nlm.nih.gov/29081672/>
11. Shahbaz U, Quadir F, Hosein T. Determination of prevalence of dental erosion in 12-14 years school children and its relationship with dietary habits. *J Coll Physicians Surg Pakistan*. 2016 Jul 1;26:553-6. <https://pubmed.ncbi.nlm.nih.gov/27504542/>
12. Ali R, Khan FR. Evaluation of Occlusal Incisal Tooth Wear and Its Influential Factors among Subjects Visiting a University Hospital in Pakistan. *J Pak Dent Assoc* 2017; 26(1): 15-21 <http://www.jpda.com.pk/evaluation-of-occlusal-incisal-tooth-wear-and-its-influential-factors-among-subjects-visiting-a-university-hospital-in-pakistan/>
13. Toufique H, Nisar N, Saadat S. Tooth wear and its related factors Findings from a hospital based study. *Pak Oral Dent J* 2017;37(3):459-64. <https://www.podj.com.pk/index.php/podj/article/view/61/53>
14. QA Zafar, B Qureshi, S Sattar, H Khalid. Frequency of possible factors associated with non-carious cervical lesions in permanent teeth. *Pak Oral Dent J* 2020;40(2):88-99. <https://www.podj.com.pk/index.php/podj/article/view/548/343>
15. Najmi N, Nadeem M, Ayub T, Maqsood T. Prevalence of dental erosion in Pakistani children: A cross-sectional study. *J Muhammad Med Coll*, 2017; 8(2):49-53. <http://jmmc.mmc.edu.pk/index.php/JMMC/article/view/32/27>
16. Salman Ashraf Khan, Naima Khalid, Sanna Maqsood, Amina Tariq, Muhammad Hassan. Association of carbonated drinks intake with dental erosion among dental students: a comparison between day scholars and hostel residents. *Int J Contemp Med Res* 2020;7(4):D1-D4. DOI: 10.21276/ijcmr.2020.7.4.8
17. Zaidi A., Karim A. A., Mohiuddin S., Khan A., Syed A., Jehangir M., & Afzal I. Dental sensitivity associated with consumption of fizzy drinks: a cross sectional study *The Pakistan Journal of Medicine and Dentistry* 2019;7(4):p5. <http://ojs.zu.edu.pk/ojs/index.php/pjmd/article/view/155/77>
18. Al-Ashtal, A., Johansson, A., Omar, R. et al. Awareness and knowledge of dental erosion among Yemeni dental professionals and students. *BMC Oral Health* 2015;15:119. doi.org/10.1186/s12903-015-0103-x
19. <https://bmcoralhealth.biomedcentral.com/articles/10.1186/s12903-015-0103-x>
20. Ozsin Ozler, C., Inan-Eroglu, E., Uzamis Tekcicek, M. and Buyuktuncer, Z. The link between nutrition and dental erosion: what do students know?, *Nutrition & Food Science* 2019;50(4):665-678.
21. Hermont, Ana Paula & Oliveira, Patricia & Auad, Sheyla. Tooth Erosion Awareness in a Brazilian Dental School. *J Dent Educ* 2011;75:1620-6. <https://pubmed.ncbi.nlm.nih.gov/22184602/>
22. Al-Madi, E. , AlJamie, M. , Al-Dukhail, S. , Mohammed, Z. and Abubakr, N. Dietary Habits and Oral Hygiene Practice amongst Dental Students at the College of Dentistry, Princess Nourah University. *Open Journal of Stomatology* 2016;6:28-35. doi: 10.4236/ojst.2016.61004. <https://www.scirp.org/journal/paperinformation.aspx?paperid=62951>
23. Della Corte K, Fife J, Gardner A, et al. World trends in sugar-sweetened beverage and dietary sugar intakes in children and adolescents: a systematic review. *Nutrition Reviews*. 2020 Sep. DOI: 10.1093/nutrit/nuaa070. <https://pubmed.ncbi.nlm.nih.gov/32984896/>
24. Murad, Maram, Added Sugar Consumption Among College Students. *Theses & Dissertations*. 2017:6.
25. Hamasha AA, Zawaideh FI, Al-Hadithy RT. Risk indicators associated with dental erosion among Jordanian school children aged 12-14 years of age. *Int J Paediatr Dent*. 2014 Jan;24(1):56-68. doi: 10.1111/ipd.12026.
26. Kitasako V, Sasaki Y, Takagaki T, Sadr A, Tagami J. Multifactorial logistic regression analysis of factors associated with the incidence of erosive tooth wear among adults at different ages in Tokyo. *Lin Oral Invest* 2017;21:2637-2644. <https://pubmed.ncbi.nlm.nih.gov/28176000/>
27. Toole S, Bernabe E, Moazzez R, Bartlett D. Timing of dietary acid intake and erosive tooth wear: A case control study. *J Dent* 2017;56:99-104. <https://pubmed.ncbi.nlm.nih.gov/27856311/>
- Feroz S, Moeen F. Protective Effect of Chicken Egg Shell Powder Solution (CESP) on Artificially Induced Dental Erosion: An in Vitro Atomic Force Microscope Study. *Int. J Dent. Sci Med. Research* 2017; 5(3):49-55. <http://pubs.sciepub.com/ijdsr/5/3/2/index.html>