

ORIGINAL ARTICLE

Dental Problems Present among Healthcare Professionals in Pakistan due to the Consumption of Carbonated DrinksAsma Shakoor^{1*}, Javeriya Shahid¹, Mohsina Jalal¹, ZARBAKHT NISAR², Muhammad Usama³**ABSTRACT**

Objective: To comprehend the association between frequencies of consumption of carbonated drinks and oral complications as well as to recognize the practices of healthcare workers regarding intake of carbonated drinks.

Study Design: A descriptive cross-sectional study.

Place and Duration of Study: The study was conducted at Department of Community and Preventive Dentistry, CMH-Lahore Medical College and Institute of Dentistry Lahore, Pakistan from October 2021 to May 2022.

Methods: The study was conducted on recognized MBBS, BDS, and Allied Health Science healthcare professionals from urban and rural areas of Pakistan. A pre-tested questionnaire was filled out by 1930 healthcare workers from government and private setups. Frequency and cross-tabulation analysis was done to obtain chi-squared results and *P* values.

Results: Almost 90.6% of respondents were consumers and 9.3% weren't or had stopped consumption. From the daily consumers 85% had cavities, 84% had sensitivity. 97% of them had discoloration and 87% had erosion. It was found that increased frequency of consumption caused more of the above-mentioned dental effects and the *P*-value was found to be significant.

Conclusion: This study suggests that increased frequency of consumption can cause cavities, sensitivity, discoloration, and erosion of teeth. There is a need to create awareness among the general public by healthcare givers, about the injurious effects of carbonated drinks.

Keywords: Carbonated Beverages, Caries, Consumption, Discoloration, Erosion, Frequency, Sensitivity.

How to cite this: Shakoor A, Shahid J, Jalal M, Nisar Z, Usama M. Dental Problems Present Among Healthcare Professionals of Pakistan Due to Consumption of Carbonated Drinks. *Life and Science*. 2024; 5(3): 369-376. doi: <http://doi.org/10.37185/LnS.1.1.420>

This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International license. (<https://creativecommons.org/licenses/by-nc/4.0/>). Non-commercial uses of the work are permitted, provided the original work is properly cited.

Introduction

Several studies have emphasized the interconnection between the consumption of sugar-laden beverages and health problems.^{1,2} However,

obesity and systemic ailments remained in the limelight and meager importance has been given to oral health conditions. In spite of the fact that carbonated drinks are recognized miscreants behind dental caries and erosion-two prevalent oral conditions, due to the substantial amount of acid and sugar present in them.^{3,4} Additionally, their intake can promote teeth sensitivity, staining, periodontal problems, and eventual loss of dentition.^{5,6}

Progressive lifestyle changes have boomed the demand for carbonated drinks, this has raised immense concern, considering the cariogenic and eroding ability of these drinkables.^{7,8} Erosion results in constant and permanent denudation of enamel and dentin.⁹ This happens at a critical pH value of 5.5 for enamel and 6.8 for dentin.^{10,11} Carbonated drinks have an innate erosive potential due to a pH value of

¹Department of Community & Preventive Dentistry
CMH Lahore Medical College & Institute of Dentistry
Lahore, Pakistan

²Department of Community Medicine
Allama Iqbal Medical College Lahore, Pakistan

³Department of Community & Preventive Dentistry
Islam Medical and Dental College Sialkot, Pakistan

Correspondence:

Dr. Asma Shakoor

Associate Professor, Community & Preventive Dentistry
CMH Lahore Medical College & Institute of Dentistry
Lahore, Pakistan

E-mail: asmashakoor@hotmail.com

Received: Sep 07, 2023; Revised: Feb 11, 2024

Accepted: Mar 09, 2024

2.5 and the presence of carbonic acid, phosphoric acid, and other acids.⁸ Uncontrolled enamel erosion leads to teeth hypersensitivity and toothache.¹² Another prevalent drawback of carbonated drinks is dental erosion which occurs due to a dual effect of a substantial amount of a particular bacteria and the presence of fermentable form of carbohydrates that remain in oral cavity for an ample time period.^{13,14} Other effects include increased chances of periodontal diseases due to chronic inflammatory process, grinding of teeth and jaw clenching, and eventual tooth loss.¹⁵

In 2018, Giacaman et al. assessed the effect of carbonated beverages on the production of *Streptococcus mutans* within biofilms.¹⁶ An appreciable bacterial production was discovered. Additionally, the authors found out increased cariogenic potential of sugary soft drinks when compared with sugar-free soft drinks. In another study conducted in India highlighted the erosive nature of carbonated drinks as medical students who were frequently consuming these beverages had eroding teeth.⁶ A Nigerian study gauged tooth hypersensitivity among undergraduate healthcare workers due to consumption of carbonated beverages.¹⁷ It deduced that 77.0% of students were consumers of 1-2 bottles of carbonated beverages daily, the majority had sensitive teeth.

A survey was conducted among adolescent students related to their consumption of carbonated beverages. The authors were astounded to realize that the majority of students were aware of the ill effects of these injurious drinkables, still their consumption was still increasing relentlessly. Locally, a cross-sectional study that was employed among nursing students in Karachi also reached to a comparable conclusion.¹⁸ 84% of participants were consumers of carbonated drinks and 85% were aware of their damaging effects on health.¹⁹

The objective of this study is to primarily highlight the various dental issues associated with the consumption of carbonated beverages. Secondly, to assess the presence of dental problems among healthcare workers due to their habits of consuming carbonated drinks. The rationale of this study is to educate healthcare professionals all over Pakistan, about the damages of carbonated beverages on oral

health, as they can play a pivotal role in generating awareness among the local population. The present paper will be beneficial for society as it will inspire healthcare providers, who are exemplars and mentors for their relatives, acquaintances, and society; to discontinue the harmful habit of consuming carbonated drinkables.

Methods

The descriptive cross-sectionals study was carried out on healthcare workers of Pakistan, from both rural and urban areas between October 2021 and May 2022. The study was conducted after an ethical letter was received from the Ethical Review Board, of CMH Lahore Medical College and Institute of Dentistry. (Reference No.4412/ERC/CMH/LMC). The target population of this study is MBBS, BDS, and Allied Health Sciences healthcare workers; the data was gathered from biochemists, radiologists, nutritionists, psychologists, homeopathic doctors, physiotherapists, and speech therapists. Both the rural and urban population of healthcare professionals from all over Pakistan were included. Nurses, technicians, medical and dental assistants, and other helping staff were excluded. Non-carbonated drinkables, vinegar and lemon abuse, alcohol, and acidic medicines as well as healthcare workers with a history of any acid-producing conditions (gastroesophageal diseases; vomiting, bulimia, and anorexia) were also excluded. The sample size was kept at 2000, as calculated by the WHO formula with 95% confidence and a 5% margin of error. 1930 respondents were included as around 35 of respondents gave unsatisfactory data and approximately the same amount of healthcare givers refused to be a part of this study.

Data Collection

The major chunk of respondents was approached in person, by a team of moderators and was asked to fill out the questionnaire. A written informed consent was taken by the participants of this study before asking them to fill the response forms. The purpose, consent form, and content of the Questionnaire were clarified to them before gathering their responses. The questionnaire used was in English Language and the details of participants were kept anonymous. A few of them were approached by sending an internet link to the investigators' contact

list via emails, WhatsApp, Facebook, LinkedIn, and other social media channels, and encouraging them to pass the link to their contacts, the non-probability convenience sampling approach was employed to recruit the participants.

A pre-existing questionnaire was used in this study which had already been used in other studies.^{18,20} Using Survey Monkey (SurveyMonkey®), the questionnaires were developed for online administration. A pilot study was conducted on 30 healthcare professionals to increase the reliability of this questionnaire according to our study. The Cronbach's alpha value was calculated as 0.865. The questionnaire was split into three sections. In the first section, socio-demographic data was gathered from the respondents, i.e. their age, gender, employment city, sector, and division of their medical field was recorded. The second section analyzed the practice of consumption of carbonated drinkables by the healthcare givers i.e. the preferred time of drinking, frequency and quantity of consumption, and the time period since consumption began were noted. The final section included questions regarding the changes that healthcare professionals have noticed in their oral

cavities due to the consumption of carbonated drinks e.g. cavities, erosion, sensitivity, and staining.

Data analysis

Data analysis was done on a sample size of 1930 using SPSS-23 (statistical package for social sciences, IBM, USA). The questionnaire responses were compiled using descriptive statistics, and the results were displayed as frequencies and percentages. Frequency analysis and cross-tabulation was done. A chi-square test was carried out to determine the association between the consumption of carbonated drinks and their ill effects on the oral cavity. All statistical analyses used a 5% level of significance, with a P-value of ≤ 0.05 being considered significant.

Results

The sample consisted of almost equal number of male and female respondents (43.2% & 56.8%). Most of the respondents were young (57.3%) and very few respondents (12.6%) were aged 50 years and above. Almost half of the respondents (55.7%) were MBBS and 34.0% were BDS. Majority of the respondents belonged to government hospitals and colleges and only 36.3% were from private setups. (Table-1).

It was seen that almost 72% of the respondents

Table-1: Demographic and Background characteristics of participants

Variable	Frequency n (%)
Gender	
Male	834 (43.2)
Female	1096 (56.8)
Age	
20_29	1105 (57.3)
30_39	392 (20.3)
40_49	190 (9.8)
50_59	131 (6.8)
60 & above	112 (5.8)
Healthcare Profession	
MBBS	1074 (55.7)
BDS	657 (34.0)
Allied Health Sciences	199 (10.3)
Employment Sector	
Private setup/colleges	701 (36.3)
Government hospital/colleges	1229 (63.7)

belonged to urban areas and just 28% of the respondents were from rural areas. Majority of the respondents in the rural areas belonged to MBBS field but the respondents from urban areas were

mainly from Allied Health Sciences and Dentistry. In rural areas, fewer respondents belonged to the field of Allied Health Sciences. (Figure.1).

The majority of respondents had carbonated drinks

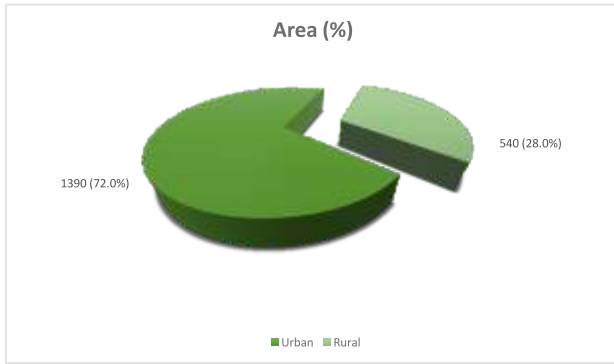


Fig.1: Description of Healthcare professional's area (n=1930)

once or twice a week (23.7%) or once or twice a month (22.9%), and some (13.4%) had carbonated drinks once or twice a day. 9.3% of healthcare workers were either not consumers of these beverages or had given up their consumption. (Figure. 2).

Consumers who didn't consume carbonated drinks did not report any tooth cavities and the majority of them also stated that they did not even experience any tooth sensitivity. Respondents who consumed carbonated drinks once or twice a day also reported a high rate of tooth cavity and sensitivity. Those who

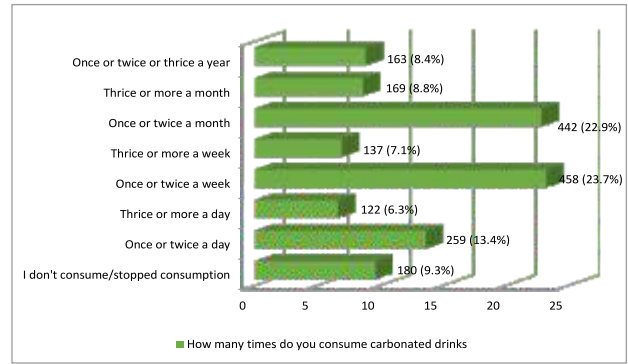


Fig.2: The percentage of consumption of carbonated drinks by healthcare professionals

consumed carbonated drinks once or twice or thrice a year reported very less tooth cavity and sensitivity. Thus, it can be depicted that a positive relationship is present between the consumption of carbonated drinks and tooth cavities. Moreover, carbonated drink consumption and tooth sensitivity are also positively related. The highly significant p-values for cavity and sensitivity along with their high chi-square values also depict that a strong relationship exists between these variables and consumption of carbonated drinks. (Table-2).

Tooth discoloration and erosion were hardly

Table-2: Relationship between frequency of consumption of carbonated drinks and tooth cavity and sensitivity (n=1930)

Frequency (n) of consumption of carbonated drinks	Tooth Cavity				Tooth Sensitivity			
	Yes	No	Maybe	Total	Yes	No	Maybe	Total
I don't consume	1	179	0	180	1	170	9	180
Once or twice a day	220	25	14	259	217	29	13	259
Thrice or more a day	118	4	0	122	111	9	2	122
Once or twice a week	239	172	47	458	274	134	50	458
Thrice or more a week	90	38	9	137	91	28	18	137
Once or twice a month	147	223	72	442	174	181	87	442
Thrice or more a month	47	90	32	169	69	60	40	169
Once or twice or thrice a year	11	133	19	163	19	119	25	163
Total (n)	873	864	193	1930	956	730	244	1930

	Chi-square value	P-value
Consumption and Tooth Cavity	714.197	0.01
Consumption and Tooth Sensitivity	640.631	0.01

reported among non-users of carbonated drinks. The majority of the respondents consumed carbonated

drinks once or twice a week and they reported high levels of tooth discoloration and erosion. Those who

Table-3: Relationship between frequency of consumption of carbonated drinks and tooth discoloration and erosion. (n=1930)

Frequency (n)of consumption of carbonated drinks	Tooth discoloration				Tooth erosion			
	Yes	No	Maybe	Total	Yes	No	Maybe	Total
I don't consume	1	175	4	180	2	178	0	180
Once or twice a day	251	1	7	259	231	21	7	259
Thrice or more a day	120	2	0	122	115	5	2	122
Once or twice a week	298	89	71	458	147	258	53	458
Thrice or more a week	94	14	29	137	82	33	22	137
Once or twice a month	181	163	98	442	58	353	31	442
Thrice or more a month	46	56	67	169	16	138	15	169
Once or twice or thrice a year	5	103	55	163	6	153	4	163
Total (n)	996	603	331	1930	657	1139	134	1930
	Chi-square value				P-value			
Consumption and Tooth Discoloration	995.054				0.01			
Consumption and Tooth Erosion	971.516				0.01			

consumed carbonated drinks once or twice or thrice a year experienced much less discoloration and erosion. So, there is a positive relation between consumption of carbonated drinks and discoloration. Moreover, there is a positive relation between tooth erosion and consumption of carbonated drinks. The highly significant p-values for discoloration and erosion along with their high chi-square values also depict that a strong relationship exists between these variables and consumption of carbonated drinks. (Table. 3).

Discussion

The noxious carbonated beverages, although prevalent in our society, but are culprits behind abundant health maladies.^{7,1,2} This study examined the various dental problems that results from the consumption of carbonated drinks and assessed the presence of dental effects among healthcare professionals of Pakistan due to their practices of consuming carbonated drinks. The present study findings noted that a remarkable percentage of healthcare professionals in Pakistan are consumers of carbonated drinks, although they are consuming in a modest amount. It also demonstrated that more oral issues were noted in healthcare workers who consumed these drinks more frequently and vice versa.

This study targeted healthcare professionals from

the fields of BDS, MBBS, and Allied health science. 63.7% of respondents were from government setups and the rest from private setups, as shown in Table-1. 72% of respondents are from urban areas and 28% from rural areas. (Figure.1) The present study depicts that 22.9% of the healthcare workers of Pakistan consume carbonated beverages once or twice a month, and 23.7% consume them once or twice a week. (Figure.2) The proportion of healthcare workers who consume these beverages once or twice daily is 13.4%, as opposed to the Tamil Nadu study in India which depicts that 68.32% of students were daily consumers of soft drinks.⁶ One of the study in Nigeria¹⁷ concluded that 26.9% of undergraduate students consumed carbonated drinks once a week, 16.3% consumed it once a day and 42.4% consumed them two to four times a week. The present paper deduced that 9.3% of healthcare workers were either not consumers of these drinks or had given up their consumption; in contrast with the Oderinu et al.¹⁷ work in which only about 1.0% of students were not consumers. Both of these mentioned studies were carried out on a small sample size and were directed only to medical and dental students.^{6,17} The present paper has a large sample size and targets a wider category of the healthcare field. The results signify that although majority of healthcare professionals were

consumers, their frequency of consumption was low. The present paper proves an association between the frequency of consumption of carbonated drinks and the ill effects on the oral cavity, such as caries, staining, periodontal issues, sensitivity, and tooth loss.^{5,6} The problems like cavities and erosion on tooth surfaces occur due to the significant amount of sugar and acidic content of these drinks.^{3,4} The present study is establishing a direct association between carious activity and sensitivity, since majority of the participants who noticed carious lesions in their oral cavities, also had complaint of sensitivity. Those respondents who weren't regular consumers or who didn't consume carbonated drinks at all, barely had any issue of caries or sensitivity. Observations in Table-2 further strengthens the above statement, that is, from the healthcare workers who consumed these harmful beverages once or twice daily, 85% had caries and 84% had sensitivity. 458 of the total respondents consumed once or twice a week, out of which 52% reported cavities and 60% reported sensitivity. Only 0.5% of the non-consumer participants reported caries and sensitivity.

Another study noticed the amount of sucrose present in Cola drinks to be 10.8g /100mL and in Fanta to be 12.1g/100mL.¹⁶ The authors further established that these carbonated drinks produced carious lesions by proliferating biofilms and led to the demineralization of dentin and enamel.¹⁶ This demineralization process can cause of loss of ions from the hydroxyapatite crystals of hard tissues which can increase the risk of sensitivity.²¹ A Saudi study also found out the presence of sucrose and other forms of sugars in soft drinks to be around 11.28 ± 0.23 to 16.46 ± 3.52 g/dl.⁵ The study established a link between the elevated levels of sugars present in soft drinks and the high prevalence of caries among Saudi children.⁵ In both of the above-mentioned studies, the correlation between the frequency of consumption of carbonated drinks and the presence of caries has not been established. This study sheds light on the proposition that increasing the frequency of carbonated beverages can increase the prevalence of caries. A study in Nigeria, however, worked on the link between the frequency of consumption of carbonated drinks and the presence

of sensitivity.¹⁷ It found out that 36.5% of respondents who drank twice or more a day had sensitivity in their teeth; as opposed to the results of our study in which 84% of those respondents who consumed once or twice a day had sensitivity, and 90% of participants who consumed thrice or more daily had sensitivity (Table-2).

The present study shows, 97% of those who consumed once or twice daily had discoloration and 89% had erosion. Similarly, 65% of the healthcare workers who consumed once or twice weekly reported discoloration, and 32% reported erosion (Table-3). Some of the healthcare professionals consumed these beverages once or twice or thrice yearly, 3% had discoloration and 4% had erosion (Table-3). Gupta et al. discovered that 39% of the students had eroded teeth. They found out the frequency of consumption of soft drinks among students, but they didn't establish the link between the frequency of intake and the presence of erosion.¹⁸ Amazingly, this research noticed that majority of healthcare professionals who had noticed cavities or erosion in their oral cavities had also ticked the option of teeth discoloration (Table-2 and 3). Based on the findings of the present study, it was concluded that 90.6% of healthcare workers in Pakistan are consumers of carbonated beverages, although majority of them consume in medium amounts, that is, once or twice monthly or weekly (Figure.2). It can also infer that there is a strong connection between carbonated drinks and oral health problems, but still there are certain limitations to our knowledge.

The findings of this study managed to establish some very significant points that can guide healthcare professionals to motivate the general public to abstain from the consumption of carbonated beverages and to limit themselves as well. The BDS doctors are more aware of the damages of these drinkables on dentition as compared to MBBS and Allied Health Science workers; the purpose of this study was to increase awareness among doctors of other fields as well. This study had targeted four of the oral problems, unlike previous studies which have highlighted either one or two issues. The conclusion of the present study sheds light on the fact that all these oral issues might be

interconnected. Thus, healthcare workers should highly consider spreading awareness among society about the ingredients present in these beverages that can assault the oral cavities, to become exemplars for laymen.

This study didn't collect data regarding sugar-free drinkables and how they can prove to be a less damaging alternative to sugary drinks. Moreover, this study lacks in providing evidence on how the style and timing of consumption can contribute to the erosive and cariogenic activity of these drinks. This study did collect data from both rural and urban healthcare workers, but it did not dig deeper into the other factors that can influence the frequency of consumption: such as the availability of carbonated drinks, the difference in background and thinking of rural and urban healthcare workers, and the effect of government and private working ambience. Additionally, it was observed that the majority of regular consumers of carbonated drinks had ticked all four discussed oral issues, but little work was done in our paper to establish their strong interconnection.

Conclusion

In Pakistan, the practice of healthcare workers regarding carbonated drinks is significant as only a small percentage of healthcare workers are not consumers or have ended this adverse habit. Although the intake was not very high but in moderate frequency. Furthermore, our study discovered a significant link between the frequency of consumption of carbonated beverages and caries, erosion, sensitivity, and discoloration. Thus, healthcare professionals need to refrain from consuming these beverages and should develop new strategies for creating awareness among general public about their injurious health hazards.

Acknowledgment: None

Conflict of Interest: The authors declare no conflict of interest

Grant Support and Financial Disclosure: None

REFERENCES

1. Park H, Yu S. Policy review: Implication of tax on sugar-sweetened beverages for reducing obesity and improving heart health. 2019; 8: 92-5. doi: 10.1016/j.hlpt.2018.12.002
2. Tahmassebi JF, BaniHani A. Impact of soft drinks to health and economy: a critical review. *European Archives of Paediatric Dentistry*. 2020; 21: 109-117. doi: 10.1007/s40368-019-00458-0
3. Moynihan PJ, Kelly SAM. Effect on Caries of Restricting Sugars Intake. *Journal of Dental Research*. 2013; 93: 8-18. doi: 10.1177/0022034513508954
4. Ofori H. Heavy Metal Analysis of Fruit Juice and Soft Drinks Bought from Retail Market in Accra, Ghana. *Journal of Scientific Research and Reports*. 2013; 2: 423-8. doi: 10.9734/JSRR/2013/3377
5. Idris A, Vani N, Almutari D, Jafar M, Boreak N. Analysis of sugars and pH in commercially available soft drinks in Saudi Arabia with a brief review on their dental implications. *Journal of International Society of Preventive and Community Dentistry*. 2016; 6: S192-6. doi: 10.4103/2231-0762.197190
6. Sivarajan M, Anjali AK, Ezhilarasan D. Awareness among students on ill effects of carbonated drinks on enamel. *Bioinformation*. 2020; 16: 1037-44. doi: 10.6026/973206300161037
7. Inchingolo AD, Ferrara I, Viapiano F, Netti A, Campanelli M, Buongiorno S, et al. Rapid Maxillary Expansion on the Adolescent Patient: Systematic Review and Case Report. *Children*. 2022;9: 1046. doi: 10.3390/children9071046
8. Shroff P, Gondivkar SM, Kumbhare SP, Sarode S, Gadbail AR, Patil S. Analyses of the Erosive Potential of Various Soft Drinks and Packaged Fruit Juices on Teeth. *The Journal of Contemporary Dental Practice*. 2018; 19: 1546-51. doi: 10.5005/jp-journals-10024-2463
9. Ramya G, Muralidharan NP. Estimation of demineralisation activity of soft drinks on extracted teeth—in vitro study. *Bioscience Biotechnology Research Communications*. 2020; 13: 468-71. doi: 10.21786/bbrc/13.7/78
10. Inchingolo AD, Gargiulo CI, Malcangi G, Ciocia AM, Patano A, Azzollini D, et al. Diagnosis of SARS-CoV-2 during the pandemic by multiplex RT-rPCR hCoV test: future perspectives. *Pathogens*. 2022; 11: 1378. doi: 10.3390/pathogens11111378
11. Morgado M, Ascenso C, Carmo J, Mendes JJ, Manso AC. pH analysis of still and carbonated bottled water: Potential influence on dental erosion. *Clinical and Experimental Dental Research*. 2022; 8: 552-60. doi: 10.1002/cre2.535
12. Alcântara PM, Barroso NFF, Botelho AM, Douglas-de-

- Oliveira DW, Gonçalves PF, Flecha OD. Associated factors to cervical dentin hypersensitivity in adults: a transversal study. *BMC Oral Health*. 2018; 18: 155. doi: 10.1186/s12903-018-0616-1
13. Kumar S, Acharya S, Singh S, Gupta A, Debnath N, Vasthare R. Dental caries experience in high risk soft drinks factory workers of South India: A comparative study. *Indian Journal of Dental Research*. 2014; 25: 174-7. doi: 10.4103/0970-9290.135913
 14. Burt BA. Relative Consumption of Sucrose and Other Sugars: Has it Been a Factor in Reduced Caries Experience? *Caries Research*. 1993; 27: 56-63. doi: 10.1159/000261604
 15. Song IS, Han K, Ko Y, Park YG, Ryu JJ, Park JB. Associations between the consumption of carbonated beverages and periodontal disease. *Medicine*. 2016; 95: e4253. doi: 10.1097/MD.0000000000004253
 16. Giacaman RA, Pailahual V, Díaz-Garrido N. Cariogenicity induced by commercial carbonated beverages in an experimental biofilm-caries model. *European Journal of Dentistry*. 2018; 12: 27-35. doi: 10.4103/ejd.ejd_188_17
 17. Oderinu OH, Savage KO, Uti OG, Adegbulugbe IC. Prevalence of self-reported hypersensitive teeth among a group of Nigerian undergraduate students. *The Nigerian Postgraduate Medical Journal*. 2011; 18: 205-9.
 18. Gupta R, Solanki A, Sharma S, Gumber P, Sharma A, Upadhyay R. A knowledge, attitude and practices of soft drinks among adolescent students and their dental health: A Questionnaire study. *International Journal of Dental Health Concerns*. 2015; 1: 1-5. doi: 10.15713/ins.ijdhc.3
 19. Ali J, Hameed F, Khan K, Rani S. The Knowledge, Attitude, and Practices of Soft Drinks and its association with gender among Nursing Students, Karachi, Pakistan: Knowledge, Attitude, and Practices of Soft Drinks. *Pakistan Journal of Health Sciences*. 2023; 4: 103-7. doi: 10.54393/pjhs.v4i02.577
 20. Alghadeer SZ. Awareness of Female Medical Students in King Faisal University about Hazards of Carbonated Soft Drink. *International Journal of Scientific Research*. 2019; 8: 10-12. DOI:10.36106/ijsr/3525402
 21. Abou Neel E, Aljabo A, Strange A, Ibrahim S, Coathup M, Young A, et al. Demineralization–remineralization dynamics in teeth and bone. *International Journal of Nanomedicine*. 2016; 11: 4743-63. doi: 10.2147/IJN.S107624

Authors Contribution

AS: Idea conception, study designing, data collection, data analysis, results and interpretation, manuscript writing and proofreading

JS: Idea conception, data collection, manuscript writing and proofreading

MI: Idea conception, study designing, data collection

ZN: Data collection, Data analysis, results and interpretation

MU: Data collection, manuscript writing and proofreading

.....