

Awareness among students on ill effects of carbonated drinks on enamel

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Abstract:

It is of interest to document data on the AWARENESS AMONG STUDENTS (18 to 25 years) ON ILL EFFECTS OF CARBONATED DRINK ON ENAMEL using an online survey questionnaire. Data shows that about 67.2% students consume carbonated drinks every day and only 41.8% of the students experienced ill effects. Moreover, 44.8% of students did not experience any discomfort after consumption of soft drinks. The prevalence of tooth erosion in students who consume soft drinks every day is high and the frequency of consumption of potentially erosive soft drinks with low pH values was the only possible risk factor for dental erosion. Most of the students did prefer fruit juices to carbonated drinks due to the constant exposure for a balanced health.

Keywords: Attitude; oral health; enamel damage; tooth erosion; questionnaire; students.

Background:

This study mainly focuses on the ill effects of prolonged consumption of soft drinks on the enamel in the oral cavity. Now a days, mostly consumption of carbonated drinks are much favored by the younger generation. No sector is left affected by its influence. People are consuming soft drinks almost every day without knowing the ill effects and the harm of soft drinks on their dental and general health [1]. Causative factors for tooth erosion are divided into extrinsic and intrinsic categories. Intrinsic erosion occurs from involuntary gastrointestinal disturbances such as gastro esophageal reflux disease (GERD) and from voluntary regurgitation of gastric acids exhibited by anorexic and or bulimic individuals. Extrinsic tooth erosion can be caused due to environmental factors, medicaments, lifestyle, and diet. A recent study in the USA indicates a definitive relationship between cumulative caries and frequency of mealtime and between meals with carbonated beverages intake [2]. Wear of enamel and dentin can occur through attrition, abrasion, and erosion. The theoretical process of abfraction may be a fourth predisposing factor. Enamel and Dentin appear particularly susceptible to erosion, and this chemical wear process may act in synergy with physical wear processes, particularly abrasion. The importance of erosion of teeth has been recognized for many decades with intrinsic and extrinsic acids as etiological agents. Recently, much attention has been directed towards soft drinks and researchers have demonstrated terrible effects on enamel and dentin. Immature enamel is porous and more easily dissolved by acids until the final intraoral maturation of the surface enamel has occurred [3]. Normally as immature enamel is bathed by salivary ions, it becomes progressively harder, less penetrable and fairly Resistant to acid

attack. Erosion occurs due to dissolution of enamel, and it falls below the pH of 5.5. Dental erosion can be induced as a result of many acidic drinks such as fruit juices, carbonated drinks etc. Several studies have examined a possible association between dental erosion and the consumption of soft drinks, i.e., carbonated cola beverages and citrus-based fruit drinks. There has also been increased interest in the dental effects of soft drink beverages due to the escalating consumption by children and adolescents over the last decade. Many studies have cleared the relation between acidic drink intake and erosion. Sports drink consumption has also dramatically increased with over \$1.5 billion in sales a year. Results from various studies show that on evaluating these beverages, they have shown that the destructive effect they have on enamel is even greater than cola-based carbonated beverages. The students who drink more carbonated drinks from a can have more chances of dental erosion. Coombes JS [5] concluded that in the patients with erosion, oral pH became fewer due to prolonged drinking of soft drinks and that plays a great impact on erosion. The largest increase in soft drink consumption has occurred among children and adolescents. The aim and the objective of this research is to evaluate knowledge, attitude and practices of soft drink consumption and their dental health between age group 18 - 25 years students. The amount and frequency were used as factors influencing the changes on dental health. The questionnaire is framed under the criteria with knowledge, causes, complications, diagnosis, management methods [17]. Therefore, it is of interest to document data on the awareness among students (18 to 25 years) on ill effects of carbonated drinks on enamel using an online survey questionnaire.

Table 1: The various drinks and it's composition consumed by students in a daily basis is listed below:

Group	Beverage	Composition	pH
1	Coca-cola	carbonated water, high fructose corn syrup, caramel colour, phosphoric acid, caffeine.	2.49
2	Diet coke	carbonated water, aspartame, caramel colour, phosphoric acid, potassium benzoate, natural flavours, citric acid caffeine	3.12
3	Gatorade	water, sucrose syrup, glucose-fructose syrup, citric acid, natural lime flavours, salt, sodium citrate, monopotassium phosphate, Ester gum, yellow dye	3.12
4	Red bull	water, sucrose, glucose, taurine, citric acid, caffeine, inositol, glucuronolactone, vitamin B12, artificial flavours, sodium citrate, pyridoxine HCL, artificial flavours and colours	3.41
5	Normal drinking water	water, minerals	7.11

Material and methods:

A cross-sectional study was carried out among students of various colleges, Tamil Nadu, India. The target population of this study was 200 students with no gastric disorders. In this study, a questionnaire was prepared which consisted of 20 questions

relating to knowledge, practice and altitude of soft drink consumption among students. The questionnaire consisted of both close-ended and open-ended questions. The questionnaire was also checked for validity. The results were collected and then analyzed through SPSS software. Descriptive statistical analysis was carried

out and chi square test was used and p value was calculated. The aim and the motive for this study were explained to all students before starting the study.

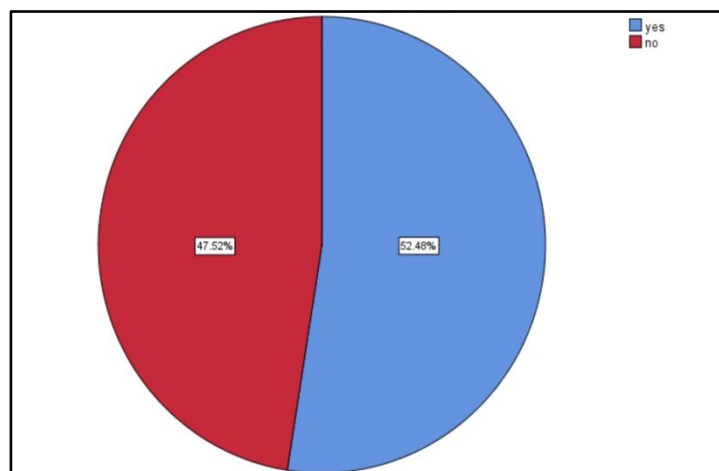


Figure 1: Pie chart showing the percentage distribution of students who prefer soft drinks between male and female students. Among the total participants, 47.52% were students who liked to drink soft drinks (red) and 52.48% were students who did not like to drink soft drinks on a regular basis (blue). Mostly people did not like to drink soft drinks on a regular basis but due to the expense of fruit juices everyday, students had to drink soft drinks everyday

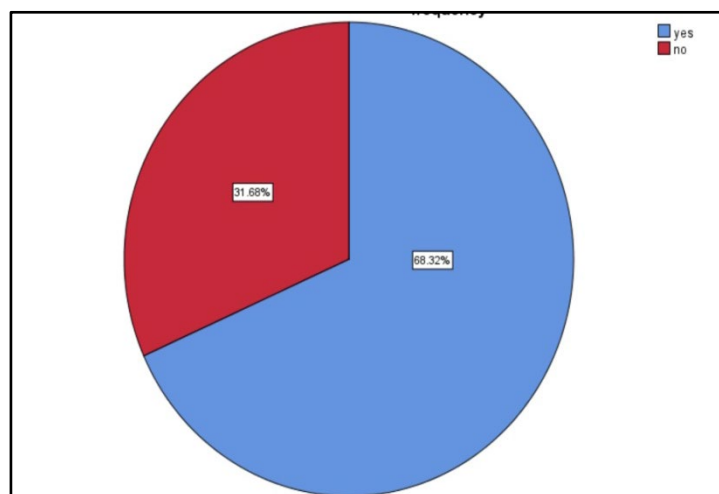


Figure 2: Pie chart showing the percentage distribution of students

who consume soft drinks on a regular basis. Among the total participants, 68.32% of the participants drink soft drinks on a regular basis (blue) and 31.68% did not drink soft drink on a regular basis (red), even though their consumption was more than normal. A majority of students drink carbonated drinks on a regular basis.

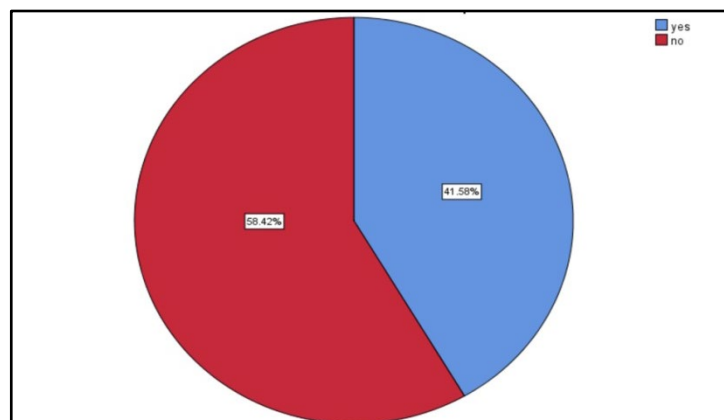


Figure 3: Pie chart showing the percentage distribution of students whose soft drink consumption has decreased or increased. When the students were asked if the consumption of carbonated drinks have increased or decreased recently, 41.58% students have responded that their intake has increased (blue) and 58.2% students responded that their intake has decreased (red). Students who have decreased their intake of soft drinks have also added that this was a recent move because students are becoming more aware of the general and oral health and are also aware of the increased sugar and acidic intake.

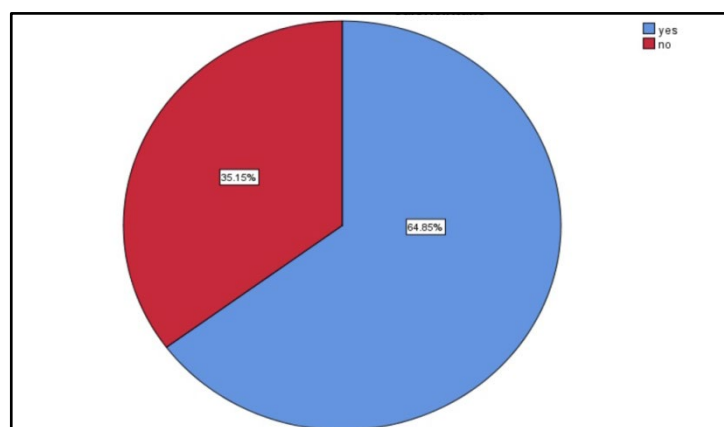


Figure 4: Pie chart showing the percentage distribution of students if they are aware of the calorie intake of the soft drink consumption. 64.85% of the students are aware of the calorie intake (blue) and 35.15% students are not aware of the calorie intake (red). They are mostly students who consume soft drinks on a regular basis.

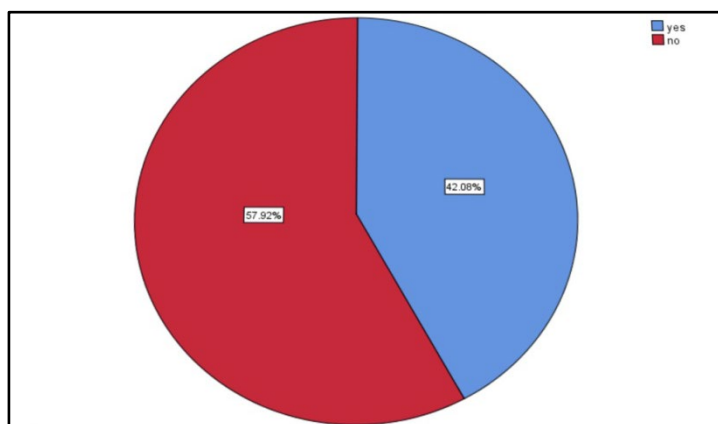


Figure 5: Pie chart indicating the percentage distribution of students if they have experienced any ill effects in their body after soft drink consumption. 57.92% students responded that they have not experienced any ill effects (red) and 42.08% have experienced ill effects after consumption (blue). The students who did experience these ill effects also added that they experienced cavities and irritation in the mouth.

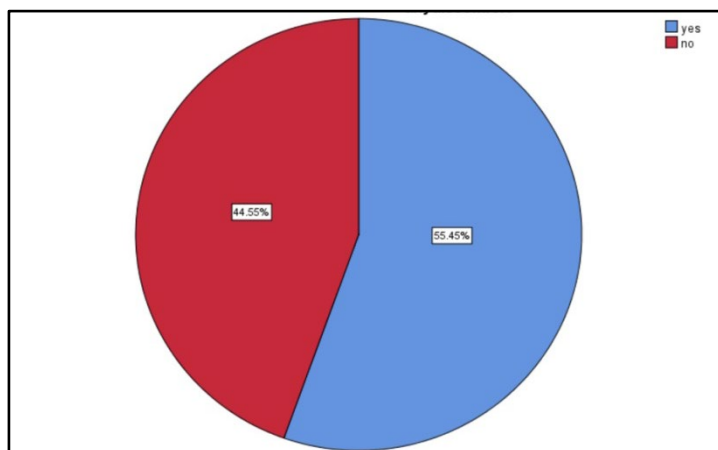


Figure 6: Pie chart indicating the percentage distribution of students if they have experienced any discomfort in their oral cavity after soft drink consumption. 55.45% students responded

that they have experienced discomfort (blue) and 44.55% have not experienced discomfort in their mouth after consumption (red). Sensitivity was prominent in their cases.

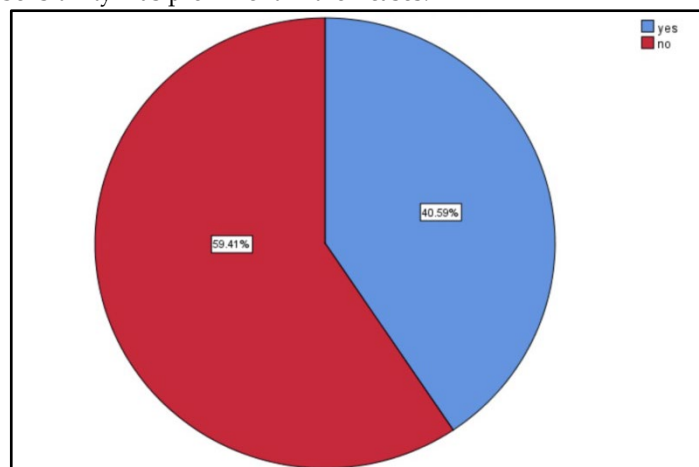


Figure 7: Pie chart indicating the percentage distribution of students if they are aware that enamel erosion is the first step to dental caries. 59.41% students responded that they are not aware (red) and 40.59% of the students are not aware that enamel erosion is the first step to dental caries (blue). Even though few students did know that consumption of soft drinks on a regular basis can cause enamel erosion.

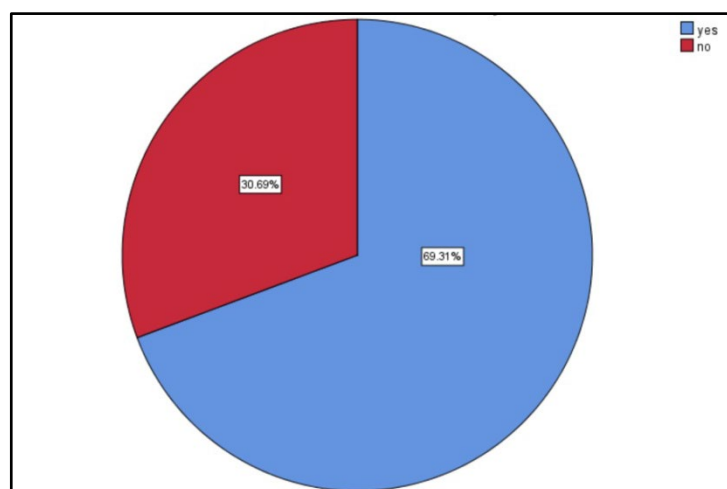


Figure 8: Pie chart indicating the percentage distribution of students if they have experienced any sensitivity in their oral cavity after soft drink consumption. 69.31% students responded that they

have experienced sensitivity (blue) and 30.69% have not experienced sensitivity after consumption (red). Majority of the students have experienced teeth sensitivity on regular consumption of soft drinks.

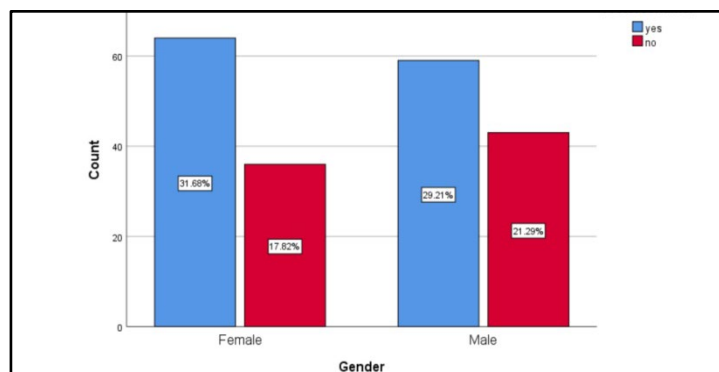


Figure 9: Bar graph depicting the association between gender and awareness of restoration of enamel, where red denotes that students are aware that enamel cannot be restored and red denotes that students are not aware that enamel cannot be restored. The X-axis represents the gender and the Y-axis represents the students' knowledge about enamel restoration. Chi square test shows $p=0.370$, so ($p>0.05$ indicates statistically not significant). So there is no significant difference between gender and students with awareness of restoration of enamel showing males are more aware than females.

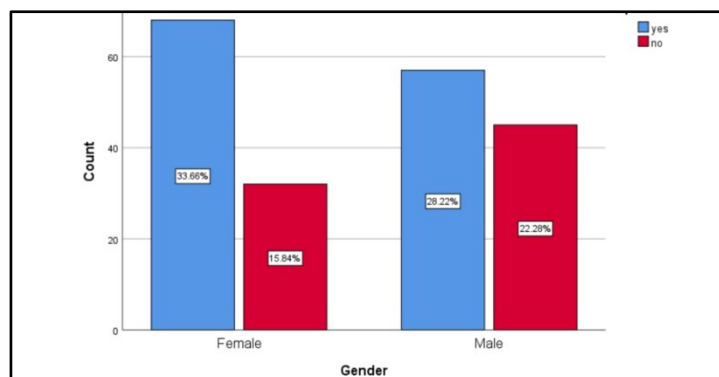


Figure 10: Bar graph depicting the association between gender and awareness of repair of enamel, where blue denotes that students are aware that enamel can only be repaired and not restored and red denotes that students are not aware that enamel cannot be repaired. The X-axis represents the gender and the Y-axis represents the

students' knowledge about the repair of enamel. Chi square test shows $p = 0.076$, so ($p>0.05$ indicates statistically not significant). So there is no significant difference between gender and students with awareness of the repair of enamel, showing females are more aware than males.

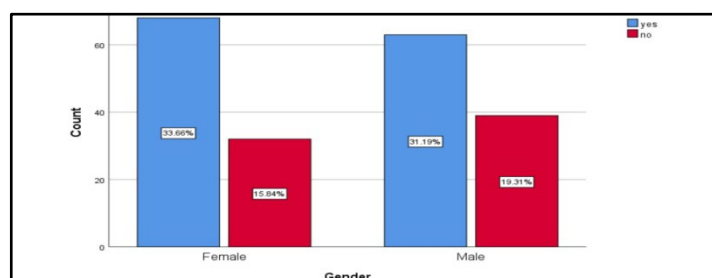


Figure 11: Bar graph depicting the association between gender and awareness of erosive potential of sugar free drinks, where blue denotes the students who are aware of the erosive potential of sugar free drinks and red denotes the students who are not aware of the erosive potential of sugar free drinks. The X-axis represents the gender and the Y-axis represents the students' knowledge about the erosive potential of sugar free drinks. Chi square test shows $p=0.076$, so ($p>0.05$ indicates statistically not significant). So there is no significant difference between gender and students with awareness of erosive potential of sugar free drinks, showing females are more aware than males.

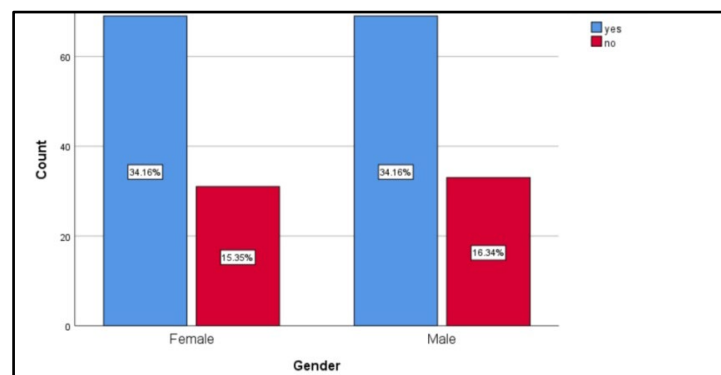


Figure 12: Bar graph depicting the association between gender and decrease in consumption of soft drinks in the future, where blue denotes the students who will stop consumption of soft drinks and will consume it very rarely as they are now aware of the impact of soft drinks on enamel and red denotes the students who will not stop consumption of soft drinks and will continue to consume them

regularly. The X-axis represents the gender and the Y-axis represents the students who will stop the consumption of soft drinks after attending this survey. Chi square test shows $p=0.836$, so ($p>0.05$ indicates statistically not significant). So there is no significant difference between gender and decrease in consumption of soft drinks in the future.

Results and Discussion:

By this study, we came to know that approximately 67.2% students drank 1 bottle / day mostly. And a lot of students have also decreased their intake of soft drinks (i.e.) 58.2% of students. Around 64.9% of the students are aware of the Calorie intake. And 41.8% of the students have experienced ill effects after consumption of carbonated drinks. Around 55.2% of the students have experienced a change in the oral cavity after soft drink consumption and 40.3% of students felt discomfort after consumption. 69.3%. Of the students are aware of the impact of soft drinks on oral hygiene. 60.9% of the students know that it can lead to bacterial infection thus causing dental caries. 61.9% of the students know that enamel erosion is the first step to caries and 64.9% of the students know that enamel erosion can cause extreme sensitivity to teeth. 59.7% of the students do not know that the enamel can be restored. And 51.8% of the students also know the means to repair damaged or eroded enamel. 50.9% of the students know that the sugar free drinks have the same erosive potential as regular soft drinks though 71.1% are aware of sugar free soft drinks. Even Though, a lot of students prefer fruit juices to carbonated drinks, the availability, the hygiene, the cost of a drink, all these factors play a major role for any consumption of a drink among students. An ideal environment for development of dental caries is by interaction between highly acidic pH of soda and sugar. But as there is no sugar in sugar free soda, it cannot produce acid from this beverage alone, but when consumed with high sugar beverages, it can cause erosion [5]. All beverages cause a fall in salivary pH but to differing degrees. The erosive effect of a soft drink depends not only on its intrinsic value but also on its buffering effect [6]. Erosion can be caused by soft drinks which are carbonated, have a low pH, with sugar and a variety of other additives [7]. Soft drinks intake at meal times is less harmful than those consumed alone and continuous sipping is more harmful to teeth than taking a drink at once [8]. Some soft drinks, especially cola beverages have properties retained on the tooth surface, which is very hard to remove by Saliva and hence increase the carcinogenicity [9]. The acidity of drinks is considered as the main reason in the development of dental erosion [10] this total acid level rather than the pH, is believed to be a vital factor in dental erosion due to its hydrogen

ion availability for interaction with enamel [11]. The effect of proteins in the saliva that bind to the enamel surface has been investigated with respect to reduction of erosion effects [12]. Dental erosion is the loss of dental hard tissue, associated with extrinsic and or intrinsic acid that is not produced by bacteria. Though, the chemical process of dental erosion is similar to that of carries [13]. Soft drinks, including carbonated beverages, fruit juices are almost exclusively acidic in nature in order to maintain a feeling of fresh and fizzy mouth and also to prevent the rapid growth of bacteria. Reduce the frequency of intake of carbonated drinks and starchy foods; frequency and duration of direct contact between teeth and acids are important factors for the development of erosive lesions. Rinsing with water drinking too much milk or even using remineralizing toothpaste immediately following the drinking of acidic beverages will accelerate the clearance of acids and help the oral pH to return to normal. Acidic medications like vitamin C should not be chewed. They must be swallowed. Taking Mineral supplements also help [14]. Most soft drinks contain phosphoric and citric acids, but other acids like tartaric, malic acids may also be present. The presence of these poly basic acids in beverages is important because of their ability to Chelate Calcium even at higher pH [15]. The prevalence of dental erosion in this study was high and the frequency of consumption of potentially invasive soft drinks with low pH values was the only plausible risk factor identified for development of dental erosion [16]. Previously our team had conducted numerous studies [17,18, 19 ,20 ,21 ,22, 23,24 ,25 ,26,27] and lab studies [28, 29, 30] and in vitro studies [31 ,32] over the past 5 years. The idea for this survey stemmed from the current interest in community.

Conclusion:

The prevalence of tooth erosion in students who consume soft drinks every day is high and the frequency of consumption of potentially erosive soft drinks with low pH values was the only possible risk factor for dental erosion. Data shows that about 67.2% students consume carbonated drinks every day and only 41.8% of the students experienced ill effects. Moreover, 44.8% of students did not experience any discomfort after consumption of soft drinks. Most of the students did prefer fruit juices to carbonated drinks due to the constant exposure for a balanced health.

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Conflict of interest:

Authors have no conflicts of interest to declare.

References:

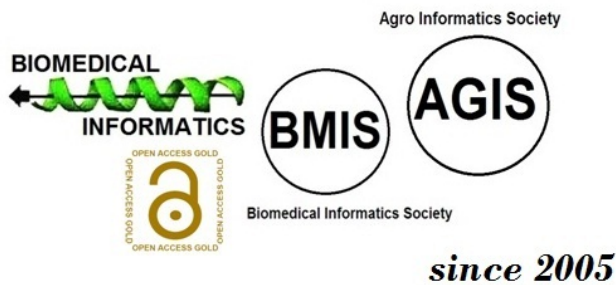
- [1] Gambon DL *et al. Open Dent J* 2010 **4**:198.
- [2] Tahmassebi JF *et al. J Dent* 2006 **34**:2. [PMID: 16157439]
- [3] Hooper S *et al. J Dent* 2004 **32**:541. [PMID: 15304299]
- [4] Coombes JS. *Am J Dent* 2005 **18**:101. [PMID: 15973827]
- [5] Denehy J J *Sch Nurs* 2003 **19**:63. [PMID: 12653616]
- [6] Sanchez GA and Fernandez de Preliasco MV. *Int J Paediatr Dent* 2003 **13**:251. [PMID: 12834385]
- [7] Moazzez R *et al. J Dent* 2000 **28**:395. [PMID: 10856803]
- [8] Johansson AK *et al. Acta Odontol Scand* 1996 **54**:369. [PMID: 8997436]
- [9] Larsen MJ and Nyvad B *Caries Res* 1999 **33**:81. [PMID: 9831784]
- [10] Shenkin JD *et al. Gen Dent* 2003 **51**:30. [PMID: 15061331]
- [11] Dale K *Heavy mountain dew consumption leads to challenging restorative case. Dent Town* 2002 **3**:52.
- [12] Ireland AJ *et al. Caries Res* 1995 **29**:470. [PMID: 8556751]
- [13] Zero DT *Eur J Oral Sci* 1996 **104**:162. [PMID: 8804884]
- [14] Beyer M *et al. Dent Mater* 2010 **26**:831. [PMID: 20569976]
- [15] Ten YF *et al. J Dent* 2008 **37**:167.
- [16] Jensdottir T *et al. Clin Oral Investig* 2004 **8**:91. [PMID: 14745590]

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