

ORIGINAL ARTICLE

An Assessment of Association between Carbonated Drink Consumption and Dental Caries Prevalence: A Cross-Sectional Study

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ABSTRACT

Objective: To assess the association between dental caries experience and carbonated drinks consumption in a population of adolescents (12-19 years) from Islamabad and Rawalpindi, Pakistan.

Study Design: Cross-sectional study.

Place and Duration of Study: This study was conducted in the department of Community Medicine at Islamic International Dental Hospital (IIDH) Islamabad from April 2014 to August 2014.

Materials and Methods: A sample of 50 participants was selected through convenience sampling. Only those participants were included who belonged to the selected age group of 12-19 years. The sample was examined by dental students at IIDH and a validated, dietary questionnaire was completed through face-to-face interview with each participant. Caries severity was measured via the DMFT (no. of Decayed, Missing and Filled Teeth) Index.

Results: Results were analyzed for the sample under study through SPSS Version 17. The mean DMFT for males (38%) was 1.31 ± 1.60 and for females (62%) was 1.77 ± 1.76 . Caries prevalence in relation to carbonated drink consumption was found to be 62% with more than 7% of the participants having a DMFT score of 4 and above. A decrease in DMFT score was observed with the increase in frequency of tooth brushing. On comparison of mean DMFT scores with frequency of carbonated drink consumption, no distinctive pattern could be seen.

Conclusion: Conclusive results establishing a strong association between carbonated drinks and dental caries could not be derived. Further research work is required for more valid results. While consuming carbonated drinks, safety guidelines for drinking should be followed.

Key words: Dental Caries, Beverages, Diet Drinks, Caries Prevalence.

Introduction

Dental caries may be defined as “a bacterial disease of the hard tissues of the teeth characterized by demineralization of the inorganic and destruction of the organic substance of tooth”.¹ It is the most prevalent oral disease worldwide.² It is a multi-factorial disease caused by the interaction of three principal factors; a susceptible host tissue, cariogenic micro flora and diet.^{3,4} Diet especially refined sugars, is an important etiological factor of dental caries. Both the frequency and the total amount of refined sugars consumed play a significant part in the etiology of caries. “The evidence establishing sugars as an etiological factor in dental caries is overwhelming”.⁵ Sugars are mostly contained in manufactured food and beverages and form an essential component of human diet.⁶ Most carbonated beverages contain up to 10 tea-spoons of sugar per 12 oz. as opposed to 1-2 tea-spoons in

fruit juices.^{4,7} Despite the differences in carbohydrate content, both seem to have similar cariogenic potential.⁸ In addition to the high amounts of sugar, carbonated beverages also contain phosphoric, citric and carbonic acids which show a deleterious effect on enamel.^{9,10} Caffeine, which makes up a considerable portion of carbonated beverages, is a mildly stimulant drug and it may contribute to the tendency for frequent consumption of such beverages. All the fore-mentioned factors are responsible towards the rapid initiation and progression of caries.¹¹ Diet drinks which use artificial sweeteners instead of refined sugars have been popularly used so as to reduce the caloric content. Although, diet drinks are considered less cariogenic than regular beverages, their greater erosive ability and the use of artificial sweeteners do not make them a healthier alternative.¹² The Aim of this Cross-sectional study was to assess the association between prevalence of dental caries and carbonated drink consumption in a population of 12 to 19 years old children from Islamabad and Rawalpindi.

Materials and Methods

A questionnaire-based cross-sectional study was conducted at the Islamic International Dental Hospital, Islamabad during the month of June. The

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study comprised a questionnaire survey followed by a visual oral examination. The participants comprised a convenience sample of 12-19 years old adolescents, who were visiting the hospital at any time during 16th to 20th June, 2014. The participants were mostly from Islamabad and Rawalpindi. A sample of 50 adolescents was selected conveniently. Verbal consent was obtained from each participant and his/her guardian beforehand. A questionnaire was completed through a face-to-face interview with each participant which helped in achieving a 100% response rate. The Questionnaire consisted of three sections. Section A dealt with the oral hygiene habits and the beverage consumption habits of participants. In Question 1, the frequency of intake of different beverages was recorded by using a scale of 5 values; Never, Rarely, Once a week, 1 glass daily and 2 or more glasses daily. In the next set of questions, the participants were asked about (Q2) their preferred time of drink consumption (at mealtimes or between meals); (Q3) their preference of either regular or diet drinks and (Q4) the use of straw. Questions 5-7 assessed their oral hygiene knowledge. Section B dealt with the socio-demographic details and section C recorded the DMFT score of each participant. After the interview, each participant was orally examined by a 2nd year BDS student. The examination took place under a tube-light with the participant seated in a normal chair. No mouth mirror or CPI (Community Periodontal Index) probe was used to assist in the diagnosis of caries. Only a tongue depressor was utilized by the examiner. The severity of caries was assessed via the DMFT index. A tooth was considered decayed (D) if a carious lesion was visibly appreciated; missing (M) if extracted due to caries and filled (F) if a restoration was seen. A restored tooth with recurrent decay was also counted as (D).¹³ Statistical Package for Social Sciences (SPSS) Version 17.0 was used to enter, organize and analyze the data. The effect of different variables; frequency and time of consumption of drinks, demographic factors and oral hygiene habits on the DMFT scores of participants was analyzed by deriving frequencies, means and standard deviations.

Results

Results were obtained for the sample of 50 participants by analyzing the data from their

completed questionnaires and dental examinations. The sample included 19 males (38%) and 31 females (62%). Out of the total number of participants, 15 (30%) were from the age group of 12-14 years, 14 (28%) from the 15-17 years group and 21 (42%) from the 18-19 years age group. Table I displays the number and percentages of participants in relation to beverage consumption and socio-demographic details. In terms of daily consumption, milk and juices were the most popular drinks (n=35, 70%), while carbonated drinks were consumed by only 17 (34%) participants on a daily basis. In the younger age group of 12-14 years, 93% (n=14) preferred carbonated beverages whereas, coffee and juices were the main preferences of the other two groups (15-17 years, 18-19 years) being consumed by 100% (n=14) and 95% (n=20) of the participants respectively.

Table I: Frequency Distribution of Different Drinks as per Consumption and Demographics

	n	Basic Types of Beverages				
		Carbonated Drinks n (%)	Juices n (%)	Milk n (%)	Coffee n (%)	Tee n (%)
<i>Frequency of Consumption</i>						
Never		5 (10)	3 (6)	0 (0)	16 (32)	12 (24)
Rarely		7 (14)	10 (20)	8 (16)	24 (48)	12 (24)
Once a week		21 (42)	10 (20)	7 (14)	9 (18)	6 (12)
1 glass daily		12 (24)	23 (46)	31 (62)	1 (2)	7 (14)
2 or more glasses daily		5 (10)	4 (8)	4 (8)	0 (0)	7 (14)
<i>Age Groups:</i>						
12-14 yrs.	15	14 (93)	14 (93)	13 (87)	13 (87)	12 (80)
15-17 yrs.	14	13 (93)	13 (93)	13 (93)	14 (100)	9 (64)
18-19 yrs.	21	18 (86)	20 (95)	16 (76)	19 (90)	17 (81)
<i>Gender:</i>						
Male	19	17 (89)	18 (95)	15 (79)	18 (95)	14 (74)
Females	31	28 (90)	29 (94)	27 (87)	28 (90)	24 (77)

Table II illustrates the prevalence and severity of dental caries in relation to different types of beverages consumed. Among the participants who consumed juices, 68% (n=32) had caries in contrast to the 62% (28) for carbonated drinks. Caries severity for carbonated drinks was highest with almost 7% (n=3) participants having recorded DMFT of more than 4. Table III shows the effect of different variables on DMFT score including time of consumption of carbonated drinks, use of straw, drink type, oral hygiene habits and demographic details. Around 56% (n=28) of participants reported consuming carbonated drinks at mealtimes. However, their

Table II: Caries Experience with reference to Beverages Consumption (n = Total number of consumers of a particular drink)

	Types of Beverages				
	Carbonated Drinks n (%)	Juices n (%)	Milk n (%)	Coffee n (%)	Tee n (%)
<i>Caries Prevalence</i>					
with Caries	28 (62)	32 (68)	32 (64)	20 (59)	25 (66)
without Caries	17 (38)	15 (32)	18 (36)	14 (41)	13 (34)
<i>Caries Severity:</i>					
DMFT ≤ 4	42 (93)	44 (94)	47 (94)	33 (97)	36 (95)
DMFT > 4	3 (7)	3 (6)	3 (6)	1 (3)	2 (5)

DMFT score was unexpectedly higher than those who consumed their carbonated drinks between meals (36%, n=18).

Diet drinks were preferred by only 4% (n=2) of the participants and their caries experience was low as compared to those who consumed regular drinks (94%, n=47). According to the findings, 30% (n=15) of participants used a straw during consumption and had a much lower DMFT score of 1.07 (± 1.22) in contrast to the 1.76 (± 1.82) score for those that didn't use straw (n=34, 68%).

Table III: Effect of carbonated drink related variables and demographicson mean DMFT

Variables	Number (%)	Mean DMFT \pm Std. Deviation
<i>Time of consumption</i>		
At meal times	28(56%)	1.71 \pm 1.86
Between meals	18(36%)	1.05 \pm 1.16
Both	3(6%)	3.00 \pm 2.00
<i>Type of Drink</i>		
Diet	2(4%)	0.50 \pm 0.71
Regular	47(94%)	1.59 \pm 1.70
<i>Use of Straw</i>		
Yes	15(30%)	1.07 \pm 1.22
No	34(68%)	1.76 \pm 1.82
<i>Frequency of tooth brushing</i>		
Once a day	22(44%)	1.86 \pm 1.75
Twice a day	25(50%)	1.44 \pm 1.73
Thrice a day	2(4%)	0.50 \pm 0.71
I don't brush daily	1(2%)	2.00 \pm 0.00

Frequency of brushing showed a significant effect on the DMFT score by decreasing it with each increase in frequency. In terms of gender, mean DMFT score of females was higher (1.77 \pm 1.76) than that of males (1.31 \pm 1.60). Among the three age-groups, the 15-17 year age group showed a slightly higher caries experience than other two groups. Mean DMFT of the sample was 1.60 \pm 1.702. Out of the total DMFT score of 80, 'Decayed' component had the highest frequency percentage (n=60, 75%), followed by

'Filled' (n=17, 21%) and 'Missing' (n=3, 4%) components, respectively. Participants who "Never" consumed carbonated drinks had a mean DMFT score of 2. Whereas, participants who consumed carbonated drinks "rarely", "once a week" or "one glass daily" had mean DMFT of 1, 1.52 and 1.92 respectively. "1.60" was the recorded mean DMFT of those who consumed two or more glasses of carbonated drinks daily.

Discussion

A strong association between carbonated beverages and dental caries has been indicated by many previous studies^{11,14-16} while a few indicate a much weaker association.^{17,18} We assessed this hypothesis by conducting a cross-sectional study in a sample of 50 participants from Islamabad and Rawalpindi. The results from our study found no association between carbonated drink consumption and dental caries. Those participants who had 'Never' consumed carbonated drinks showed the highest mean DMFT. Caries prevalence and caries severity in relation to carbonated drink consumption was high and similar to that for juices, indicating similar cariogenicity.^{8,19} Mean DMFT of those who consumed carbonated drinks 'at mealtimes' was surprisingly greater than for those who consumed 'between meals'; a direct contrast with a previous study from Slater P. et al.²⁰ Results from the current study showed that the mean DMFT decreased with the use of a straw during consumption. This is in accordance with a study by Tahmassebi et al. which proved that if juices were consumed through a straw, there was a less pronounced pH drop in plaque.²¹ Since carbonated beverages and juices possess similar cariogenic potential, the same situation might be true for carbonated beverages. Oral hygiene (frequency of tooth-brushing) had a strong effect on dental caries experience. DMFT was highest for those who did not brush daily and lowest for those who brushed thrice a day. This pattern is in congruity with the fact that despite the intake of sugary drinks, oral health is an important factor in the etiology of dental caries esp. with the advent of fluoridated toothpastes.²² Mean DMFT of females was found to be higher than that of males. This may be due to the uneven distribution of males (38%) and females (62%) in our study sample or it may also indicate that dental caries is statistically dependent on gender to some extent, as proven by

earlier studies.³ Relation of social status with beverage consumption patterns, oral hygiene, DMFT

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