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The Effect of Consumption of Carbonated Beverages on the Oral Health of Children: A Study in Real Life Situation

Efeito do Consumo de Refrigerantes na Saúde Bucal de Crianças: Estudo em uma Situação Real

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RESUMO

Objetivo: Avaliar a saúde bucal de crianças que consomem refrigerantes e também conhecer as razões para o consumo excessivo dessas bebidas.

Método: Um estudo de natureza transversal CAP (conhecimento, atitude e prática) com uma amostra de 200 crianças na faixa etária de 12-13 anos de idade foi realizado em Maharishi Markandeshwar International School, Mullana, Ambala, na Índia. Um questionário foi elaborado e distribuído para verificar as razões para o alto consumo de refrigerantes e os seus efeitos sobre a saúde bucal. Os dados coletados foram analisados estatisticamente.

Resultados: Em média, as crianças na faixa etária de 12-13 anos consumiam entre 7 e 8 refrigerantes (latas - 250ml) por semana, ou seja, de 1500mL a 2000mL. Verificou-se que a gravidade da cárie dentária foi elevada quando os resultados foram comparados a crianças que não consumiram bebidas carbonatadas na mesma escola. Os resultados também confirmam que as crianças não estão conscientes dos efeitos nocivos dos refrigerantes sobre a saúde bucal.

Conclusão: As crianças que consomem refrigerantes regularmente são mais propensas a cárie dentária.

ABSTRACT

Objective: To assess the oral health of children consuming carbonated beverages and also to ascertain the reasons for excess consumption of these beverages.

Methods: A cross-sectional KAP (knowledge, attitude and practice) survey of 200 children in the age group of 12 - 13 years was carried out in Maharishi Markandeshwar International School, Mullana, Ambala, India. A questionnaire was designed and distributed to ascertain the reasons for high consumption of carbonated beverages and its effects if any on oral health. The data collected was analysed statistically.

Results: The results of the study revealed that on an average, children in the age group of 12-13 years consumed 7-8 drinks (cans - 250ml) per week, i.e. 1500 - 2000 ml consumption. The severity of tooth decay was seen to be high, when the results were compared to those children who did not consume carbonated drinks in the same school. The findings also confirm that children are not aware of the detrimental effects of carbonated beverages on oral health.

Conclusion: The children who consume carbonated drinks regularly are more prone to tooth decay.

DESCRITORES

Refrigerantes; Saúde bucal; Dieta cariogênica; Cárie dentária.

KEYWORDS

Soft drinks; Oral health; Diet, cariogenic; Dental caries.

INTRODUCTION

Carbonated beverages are advertised through media. Sometimes, the advertising is so aggressive that the companies utilize the charisma of sports and film personalities to lure the teenage population. This advertising leaves a lasting impression on the minds of young generation and affect their health.

A study revealed that the children prefer cola to milk and fruit juice. The excess consumption of these carbonated beverages is playing havoc in teenage population as it contains no essential nutrients and harm their general and oral health.

Carbonated beverages contain high amounts of sugar, calories and caffeine, and provide no valuable nutrition. A carbonated/cola beverage is a mixture of Phosphoric acid, sugar, caffeine, colouring and flavouring agents. The active ingredient in these beverages is phosphoric acid, with an acidic pH generally less than three, which is same as acetic acid. However, it doesn't taste like acid as manufacturers add large quantities of sugar. High amount of phosphoric acid is added to keep the water sterile as no bacteria can live in such acidic conditions.

The solution of Phosphoric acid in cola drinks is strong enough to cause human teeth to become soft within 2 days. In the literature reports are also published that these beverages have the capacity to dissolve nail and limestone. The very substantial amount of caffeine in cola drinks without doubt has a direct bearing on the prevalence of gastric ulcers.

This raises the question of survival of symbiotic bacteria in human intestine. The intake of at least 1.5 L/wk of soft drinks containing phosphoric acid is a risk factor for the development of hypocalcemia.

MATERIAL AND METHODS

A KAP (Knowledge, attitude and practice) study was carried out in Maharishi Markandeshwar International school to reveal the carbonated beverage consumption and to know the relationship if any exists between cola consumption and dental caries in rural areas. Number of studies have been carried out in metropolitan cities in developed countries¹⁻³ as well as developing countries like India to know the relation of cola consumption and its effect on oral health, but no study has been done in rural area in India. The International school in Mullana, is situated in semi-rural area and was selected as children represented cross-strata of the society.

The recording procedure was standardized by sessions of calibration between the examiners. Uniform

interpretation, understanding and application between the examiner and the supervisor of the codes and criteria for various conditions to be observed were ensured.

Inter-examiner variability was ruled out by carrying out a reproducibility test. The chief examiner performed all examinations and recordings of the sample. Intra examiner reliability of the recorded data was assessed by re-examining a few children.

The selected school children were given a questionnaire and help was extended to fill the same. Questions were grouped according to socio-demographic factors, food-habits, consumption of cola beverages and oral-hygiene. After collecting the answer sheets, a detailed oral-examination was carried out the next day.

The clinical examination of the children was carried out in their respective school, with the children seated on an ordinary chair with adequate daylight, supplemented with a torch if required to facilitate the examination.

The dental caries was assessed as per the WHO criteria and data recorded on a WHO oral health assessment form⁴. The examination was carried out in the morning session as error generally occurs if it is done in the evening session due to less sunlight. Not more than 30 children were examined and questioned each day.

To overcome inter-examiner variability. Next day randomly 10 children were re-examined and result was found to be the same as previous day. Oral examination was carried out according to the WHO criteria⁴. Dental caries was recorded tooth by tooth, according to decayed, filled teeth and surfaces (DMFT and DMFS)⁴. The criteria and coding used for the diagnosis was as follows:

0. Sound crown: A crown is recorded as sound if it shows no evidence of treated or untreated dental caries. The stages of caries that precede cavitations, as well as other conditions similar to the early stages of caries, are excluded because they cannot be reliably diagnosed. Thus, a crown with the following defects, in the absence of other positive criteria, should be coded as sound:

- White or chalky spots.
- Discoloured or rough spots those are not soft to touch with a metal probe.
- Stained pits or fissures in the enamel that do not have visual signs of undermined enamel or softening of the floor or walls detectable with a probe.
- Dark shiny, hard, pitted areas of enamel in tooth showing signs of moderate to severe fluorosis.
- Lesions that, on the basis of their distribution or history, or visual tactile examination, appear to be due to abrasion.

1. Decayed Crown: Caries is recorded as present when a lesion in pit or fissure, or on a smooth tooth surface, has an unmistakable cavity, undermined enamel, or

a detectably softened floor or wall. A tooth with a temporary filling, or one which is sealed [code 6] but also decayed, should also be included in this category. In cases where the crown has been destroyed by caries and only the root is left, the caries is judged to have originated on the crown and therefore scored as crown caries only. Where any doubt exists, caries should not be recorded as present.

2. Filled crown, with decay: A crown is considered filled, with decay, when it has one or more permanent restoration and one or more areas that are decayed. No distinction is made between primary and secondary caries [i.e. the same code applies whether or not the carious lesions are in physical association with the restoration(s)].

3. Filled Crown, with no decay: A crown is considered filled, without decay, when one or more permanent restorations are present and there is no caries anywhere on the crown. A tooth that has been crowned because of previous decay is recorded in this category [A tooth that has been crowned for reason other than caries e.g. a bridge abutment is coded 7].

4. Missing tooth, as a result of caries: This code is used for permanent teeth that have been extracted because of caries and is recorded under coronal status.

Note: In some age groups, it may be difficult to distinguish between unerupted teeth (code 8) and missing teeth (codes 4 or 5). Basic knowledge of tooth eruption patterns, the appearance of the alveolar ridge in the area of the tooth space in question, and the caries status of other teeth of the mouth may provide helpful clues in making a differential diagnosis between unerupted and extracted teeth. Code 4 should not be used for teeth judged to be missing for any reason other than caries.

5. Permanent tooth missing, for any other reason: This code is used for permanent teeth judged to be absent congenitally, or extracted for orthodontic reasons or because of periodontal disease, trauma, etc.

6. Fissure sealant: This code is used for teeth in which a fissure sealant has been placed on the occlusal surface; or for teeth in which the occlusal fissure has been enlarged with a rounded or "flame-shaped" bur, and a composite material placed. If a tooth with a sealant has decay, it should be coded as 1.

7. Bridge abutment, special crown or veneer: This code is used under coronal status to indicate that a tooth forms part of a fixed bridge, i.e. is a bridge abutment. This code can also be used for crowns placed for reasons other than caries and for veneers or laminates covering the labial surfaces of a tooth on which there is no evidence of caries or a restoration.

Note: Missing teeth replaced by bridge pontics are

coded 4 or 5 under coronal status.

Implant: This code is used under root status to indicate that an implant has been placed as an abutment.

8. Unerupted crown: This classification is restricted to permanent teeth and used only for a tooth space with an unerupted permanent tooth but without a primary tooth. Teeth scored as unerupted are excluded from all calculation concerning dental caries. This category does include congenitally missing teeth, or teeth lost as a result of trauma, etc.

T. Trauma (fracture): A crown is scored as fractured when some of its surface is missing as a result of trauma and there is no evidence of caries.

9. Not recorded: This code is used in any erupted permanent tooth that cannot be examined for any reason (e.g. because of orthodontic bands, severe hypoplasia, etc.).

The presence of dental plaque was evaluated by Quigley and Hein index⁵ modified⁶. Findings of bleeding were recorded separately for each of the index teeth (DD 16, 11, 26, 36, 31 and 46). Gingival health status was assessed, data collected and analysed by Chi-square test and statistical analysis was performed by using SPSS software.

RESULTS

Questionnaire filled by 200 children revealed interesting findings. It was noticed that, 40 boys and 56 girls exhibited tooth decay (Table 1).

The soft drinks were grouped in two groups i.e. group A and group B. Group A included all cola beverages whereas group B included all other carbonated beverages (Table 2). Cola was consumed by 57 children regularly. Of these 30 exhibited dental decay. Other beverages were consumed by 113 children of these, 59 exhibited tooth decay. However, there were seven children who did not consume beverages but had dental decay.

Oral health status of children was also assessed according to the number of cans consumed per day (Table 3). 43.70 % children consuming 1-10 cans (1 can = 250 ml), per week, 68.42% consuming 11- 20 cans per week and 84.62% who consumed more than 20 cans per week exhibited dental caries (Table 4).

Gingival index was compared with the frequency of consumption of carbonated beverages and no significant difference seen. The mean gingival index was 2.65 with SD of 0.75 (Figure 3).

DMFT on comparison with the frequency of consumption of carbonated drinks showed a significant difference. With increase in carbonated beverages consumption, DMFT increased. A maximum score of

DMFT (7) with standard deviation 1.97 was noted in the group consuming more than 20 cans per week (Figure 4).

DMFS when compared with the frequency of consumption of carbonated drinks showed a significant

difference. With increase in frequency of consumption, DMFS increased. The maximum observed in children consuming more than 20 cans (1 can=250 ml.) per week, and maximum DMFS noted was 8 with SD of 1.73 (Figure 5).

Table 1. Description of the sample and their caries status.

Total no. of children	No. of children with dental caries	%age of children with dental caries	Boys		Girls	
			No.	%age with dental caries	No.	%age with dental caries
200	96	48%	93	43.01%	107	52.34%

Table 2. Distribution of the sample according to the brand of carbonated beverages consumed, and caries status.

Total no. of children	Carbonated brand	No.	%age	Caries	%age
200	A (Cola beverages)	57	28.50%	30	52.63%
	B (other carbonated beverages)	113	56.50%	59	52.21%
	None	30	15.00%	7	23.33%
Total		200	100%	96	48%

Table 3. Distribution of the sample according to the brand of carbonated beverages consumed, and caries status.

Frequency (no. of cans consumed per week)	No.	%age	Caries	%age	Plaque index		Gingival index		DMFT		DMFS	
					Mean	SD	Mean	SD	Mean	SD	Mean	SD
Nil	30/200	15%	7	23.33%	2.18	0.57	2.57	0.61	0.87	1.13	1.14	0.73
1-10 (250 ml)	119/200	59%	52	43.70%	2.34	1.14	2.64	0.69	2.67	1.21	3.55	1.17
11-20 (250 ml)	38/200	19%	26	68.425	2.43	1.02	2.72	0.84	4.78	1.74	5.67	1.61
>20 (250 ml)	13/200	6.50%	11	84.62%	2.52	0.87	2.79	0.89	6.45	1.97	8.34	1.73
Total	200/200	100%	96	48%								

Table 4. Dental Caries in relation to food habits.

Food Habits	No. of Children	No. of Children Affected with dental caries	%age
Fast foods	155	84	54.19
Fruits	34	11	32.35
Non-veg	8	2	25.00
Chocolates	24	16	66.67

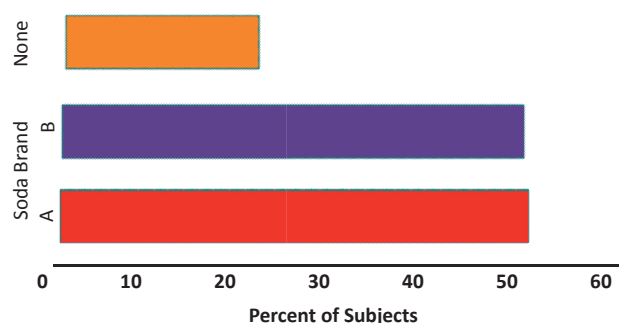


Figure 1. Number of children exhibiting caries, consuming different brands of carbonated beverages.

Questions regarding the hazardous and beneficial

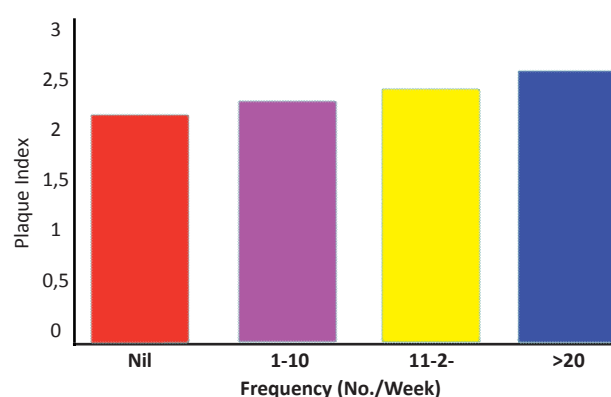


Figure 2. Plaque index in relation to consumption of number of cans per week.

effects of carbonated beverages, showed that only 42% children knew about the hazardous effects. Surprisingly, the other 58% thought of carbonated as a beneficial drink which helped in digestion, when consumed with meals.

Questions regarding the reasons for preference of specific carbonated beverage brands revealed that 80% children preferred brands endorsed by their favourite filmstars, and only few preferred the taste.

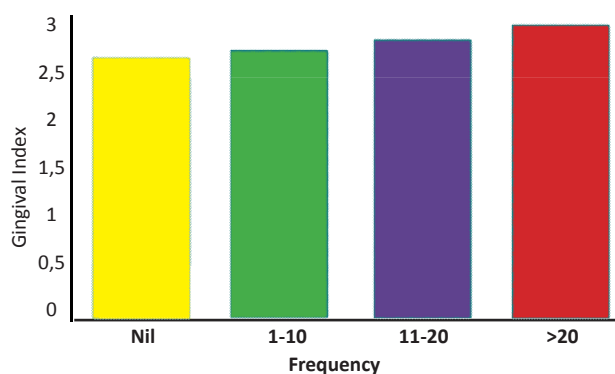


Figure 3. Gingival index in relation to consumption of number of cans of carbonated beverages consumed per week.

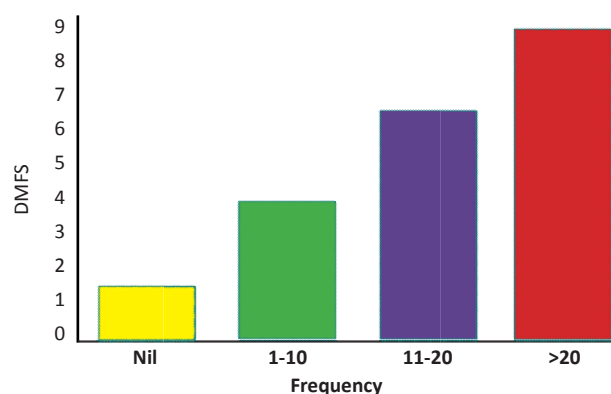


Figure 5. DMFS in relation to consumption of number of cans of carbonated beverages consumed per week.

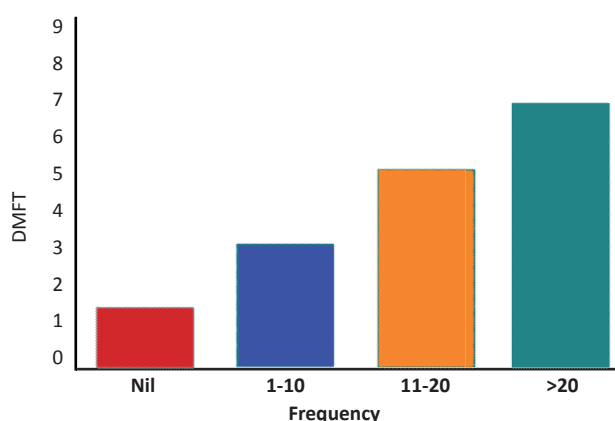


Figure 4. DMFT in relation to consumption of number of cans of carbonated beverages consumed per week.

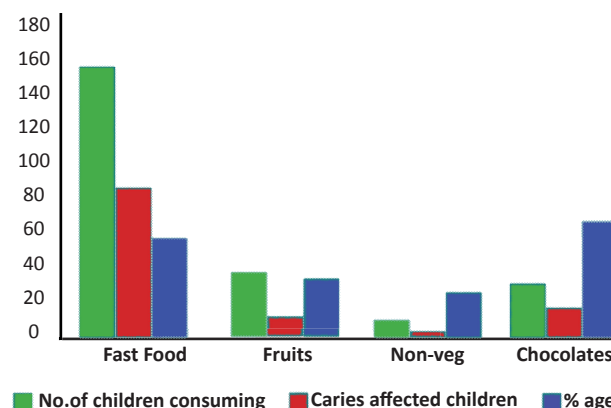


Figure 6. Number of children affected with dental caries with different food habits.

DISCUSSION

The aim and objective of present study was to evaluate the oral health in children who regularly consumed cola beverages. The DMFT/DMFS plaque index, and gingival index was assessed and further correlated as per the consumption of carbonated beverages.

The results revealed that 52.63% children from group A and 52.21% from group B had tooth decay. It was also noted that 43.70% children who exhibited caries consumed 1-10 cans (1 can =250ml) per week.

This is in accordance with a previous study which stated that an increase in consumption of soft drinks led to a decrease in dairy consumption among children and children and increased the risk for dental caries and a host of systemic complications¹.

There was no significant difference observed in plaque index and gingival index in relation to frequency of consumption of carbonated beverages. Though studies have been conducted to investigate the effect of different types of drinks on plaque pH, during normal and drug induced low salivary secretion rates. Three drinks tested were 1) Coca-Cola regular 2) Coca-Cola light 3) fresh orange juice. It was concluded that a low salivary secretion rate may accentuate the fall in dental plaque

after gentle mouth – rinsing with soft drinks⁷.

Another study assessed the effects of different methods of drinking a carbonated beverage on the pH of dental plaque, proved that use of a straw as compared to direct consumption of beverage from the bottle could limit harmful effects on dentition⁸.

An in vivo assessment of dental plaque pH variation with regular and diet soft drinks proved that regular coke poses a greater acid challenge potential on enamel than diet coke⁹.

A maximum DMFT score of 7 was noted in children consuming more than 20 cans (1 can =250 ml) per week. Increase in DMFS was found to be directly proportional to the frequency of consumption of carbonated beverages. A study carried out to evaluate the association of demographic and beverage consumption with dental caries suggest that carbonated soft drinks are not associated with poor dental health², whereas another study reported a significant positive association between the frequencies of at and in-between meal consumption of soft drinks and high DMFT scores³.

Also, authors suggest that high consumption of carbonated soft drinks by young children is a risk indicator for dental caries in the primary dentition and should be discouraged¹⁰.

A comparison between soft drinks, 100 percent fruit juice and milk representing the sugared beverages consumed by the cohort was performed. A cluster analysis of the relative proportion of each drink at baseline and follow-up revealed four consumption patterns. Using zero-inflated negative binomial models, the authors found that children who changed from being low consumers of soft drinks at baseline to high consumers after two years had a 1.75 times higher mean number of new decayed, missing and filled tooth surfaces compared with low consumers of soft drinks at both time points¹¹.

A study revealed that the prevalence of soft drink consumption among youth in age group of 6 to 17 years increased 48%, from a prevalence of 37% in 1977/1978 to 56% in 1994/1998. Mean intake of soft drinks more than doubled, from 5 fl oz to 12 fl oz per day. Although the home environment remained the largest source of children's soft drink access, an increasing share was obtained from restaurants and fast-food establishments (+53%), vending machines (+48%), and other sources (+37%)¹².

It has been proved that regular caffeine ingestion may lead to its increased/habitual usage. This combination of consumption of highly sweetened soft drinks and habitual usage of caffeine may significantly increase a susceptible adolescent's potential for developing dental caries. Cases are presented demonstrating the early initiation and rapid progression of dental caries in three children. A common factor is the ingestion of high amounts of caffeinated-carbonated soft drinks¹³.

Many authors suggest that contemporary changes in beverage patterns, particularly the increase in carbonated pop consumption, have the potential to increase dental caries rates in children. Consumption of regular carbonated pop, regular powdered beverages, and, to a lesser extent, 100% juice was associated with increased caries risk¹⁴.

In the present study a small minority (42%) of children knew about the hazardous effects of carbonated beverages. Hence, it is the responsibility of the dental surgeons to make younger generation aware of the ill effects of these drinks and motivate them to maintain their oral-health.

CONCLUSION

Children being unaware of all these detrimental effects of carbonated beverages, on their oral health consume these drinks, being lured by the advertisements of their favourite bollywood stars who endorse the brands. These carbonated beverages have detrimental effect on the tooth surfaces and contribute towards the increased number of decayed teeth in the younger

generation. These children need to be made aware of the harmful effects of carbonated beverages, and be guided towards a healthy diet, for their oral health and general well being.

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