



This is an open access article distributed in accordance with the Creative Commons Attribution (CC BY 4.0) license: <https://creativecommons.org/licenses/by/4.0/> which permits any use, Share — copy and redistribute the material in any medium or format, Adapt — remix, transform, and build upon the material for any purpose, as long as the authors and the original source are properly cited. © The Author(s) 2021

Dental caries in relation to sugar consumption among children - a study from Southern Punjab, Pakistan

Rabia Zafar^{1*}, Amna Urooj², Sehrish Masood³

ABSTRACT

Background and Objective: Dental caries is one of the most prevalent diseases among children around the world. It has a complex aetiology and different factors like sugar intake, brushing habits, body mass index, and socio-economic status may play a significant role. Apart from dental pain, caries affects children's over all body functions, body growth, and pose a financial burden on families. The objective of the study was to determine the association between sugar intake and dental decay among local paediatric population.

Methods: This cross-sectional study was conducted at the Ibn-e-Sina Hospital Multan, Pakistan from July, 2019 to December, 2019. Data were collected on a specifically designed questionnaire. A total of 540 participants of age range between 5 and 12 years were selected for this study after taking consent from their parents. The data were analysed using statistical tests of significance.

Results: Female children were predominantly affected as compared to males (56.7% vs. 43.3%). Caries was seen more frequently in children brushing teeth once than those doing it twice ($p = 0.01$). Children taking cariogenic food between meals and 2 hours before sleep showed a significant association with caries development ($p = 0.02$; $p = 0.01$). Primary teeth were affected more (74.18%) than the secondary teeth (11.92%).

Conclusion: Irregular brushing habits and frequency and timing of cariogenic food intake are the leading causes of caries in children from local population.

Keywords: Dental caries, Caries, Sugar intake, Children.

Received: 13 January 2021

Revised date: 20 May 2021

Accepted: 06 June 2021

Correspondence to: Rabia Zafar

*Assistant Professor, Department of Paediatric Dentistry, Multan Medical and Dental College, Multan, Pakistan.

Email: rabiazafar2009dent@gmail.com

Full list of author information is available at the end of the article.

Introduction

Dental caries is one of the most prevalent chronic childhood diseases worldwide [1]. High intake of dietary sugars can lead to many non-communicable diseases such as obesity, diabetes and also cause an important dental condition known as caries. Dental caries is multifactorial complex process which effects the health and wellbeing of the individuals. Health problems related to caries include pain, tooth loss, and economic burden. Consumption of sugar causes demineralization of teeth with a rise in the pH of mouth. Remineralisation of teeth is a natural process and both demineralization and remineralisation lead to caries development. There are multiple risk factors for causing caries. Some of these factors are plaque producing bacteria, tooth susceptibility, eating habits, hygienic measures of oral cavity, fluoride supplementation, and flow of saliva [3,4].

Increased consumption of refined food has led to increased risk of dental caries. Factors related to the consumption of sugar that may affect the caries development include amount and type of sugar, frequency of sugar intake and dental hygiene. World Health organization has recommended the reduced consumption of sugar to lower the risk of dental caries [4]. Apart from sugar intake, brushing habits also influence the dental health. Children having the habit of brushing twice a day are less prone to develop caries [3]. The incidence of caries is low in developed countries when compared to developing countries. Fifty one percent children from pre-school population complaint of dental caries thus indicating the unmet health care need [5]. High prevalence of caries in Pakistan necessitates the implementation of oral health policies and programs to enhance the quality of life in children [6].

This study was carried out to determine the association of sugar consumption and caries among the children presenting at dental outdoor department of a private hospital in Southern Punjab, Pakistan.

Methods

This cross-sectional study was conducted in the dental outdoor department of Ibn-e-Sina Hospital, Multan, Pakistan from July, 2019 to December, 2019 after taking approval from Ethical Review Committee vide Letter No, C-7-120. A total of 540 children, aged from 5 to 12 years and presenting with caries were selected for this study. Informed written consent was taken from their parents. Children with chronic disorders such as juvenile diabetes or other metabolic/congenital disorders were excluded. Data consisting of age, gender, brushing frequency, type of sugar, frequency of sugary meals, and Decayed/Missing/Filled Teeth (DMFT) index was obtained through a specifically designed and validated questionnaire. Clinically, children were examined by a trained dentist.

Statistical analysis

Statistical analysis was done by using Statistical Package for the Social Sciences version 20. Quantitative variables like DMFT score, number of sweets intake and brushing were measured as mean \pm SD. Qualitative variables like gender, caries, and types of the sweets were determined by using frequencies and percentages. Chi-square test was applied and p -value >0.05 was considered to be significant.

Results

The study population comprised 540 children between 5 and 12 years of age. There were 56.7% female and 43.3% male children with a male to female ratio of 1:1.3.

On surveying, it was revealed that different types of sweets including candies, cold drinks, ice cream etc were taken by children (Figure 1).

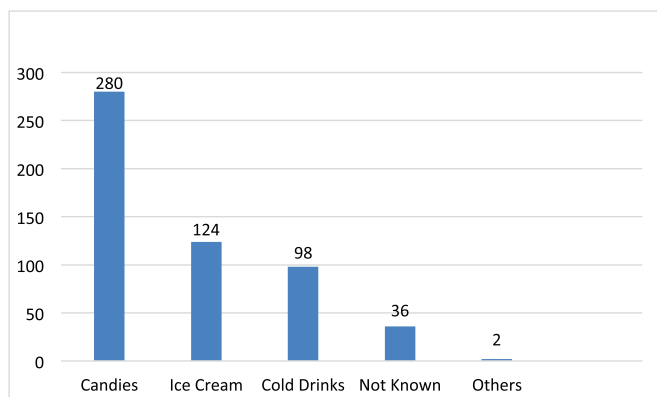


Figure 1. Distribution of sweets intake among 540 children.

When brushing habits were probed, it was found out that 420 (77.7%) and 120 (22.2%) children brushed their teeth once and twice a day, respectively. A significant association was found between brushing habits and caries ($p = 0.01$). Regarding frequency of sweet intake, 53% children were taking sweets >4 times per day, but it was not significantly related with the development of caries (Table 1). However, cariogenic food intake between meals and 2 hours before sleep showed a significant association with the caries development (Table 1).

Among all study participants, caries was seen more frequently in the primary teeth (74.18%) than in the secondary teeth (11.92%) with a DMFT score for primary teeth being 0 in 140 (25.29%) children and greater than 10 in 21 (3.88%) children (Table 2).

A total of 481 (89.07%) children presented with no caries in secondary teeth (Table 3).

Discussion

Geographic variation in the prevalence of dental caries can be observed across the world. Many factors like ethnicity, food habits, cultural habits, sedentary lifestyle, and environmental factors are responsible for this variation. The prevalence of caries is very high in developing countries like Pakistan. The prevalence of dental caries was found to be 60%-80% among the school children from 8 to 12 years of age [3].

Another study showed high frequency of caries (49.7%) among the children of public and private schools in Hyderabad Sindh, Pakistan. Different studies report the consensus that increase in sugar intake and irregular brushing habits may result in a higher risk of development of caries [3-6]. In the current study, an increased frequency of caries was seen in primary teeth while comparing to the secondary teeth. Similar studies conducted in India by Viswanath et al. [4] and Wilson et al. [7] showed high caries prevalence in primary teeth as 74.7% and 34.47% while comparing to 15.3% and 21.79% in secondary dentitions, respectively. Primary teeth are prone to caries thereby they are affected more [4]. Therefore, it is important to utilize available measures such as fissure sealant and fluoride therapy to prevent caries, especially in primary teeth in children [8]. Brushing habits has a significant effect on the development of caries. The present study showed a significant association between frequency of teeth brushing and risk of caries. Skafida et al. [9] and Sahito et al. [3] reported a significantly lower risk of caries development ($p = 0.001$) in children who brushed their teeth twice. These studies also found an increased dental decay caused by the consumption of sugar rich food [3,9]. Therefore, diet improvement by reducing the added sugars and sugar-sweetened beverages may lower the disease burden associated with the paediatric tooth decay [10]. As

Table 1. Distribution of cariogenic food intake among children.

Frequency and timing of cariogenic food intake	Responses from participants	Frequency and percentage	p-value*
Daily cariogenic food intake	>4/day	288 (53.33%)	0.4
	<4/day	252 (46.66%)	
Cariogenic food intake with meal	Yes	50 (9.25%)	0.3
	No	490 (90.75%)	
Cariogenic food between meals	Yes	190 (35.19%)	0.02
	No	350 (64.81%)	
Cariogenic food 2 hours before bed time	Yes	300 (55.55%)	0.01
	No	240 (44.45%)	

*Chi-square test. Significant associations are given in bold.

Table 2. DMFT score distribution in primary teeth in different age groups.

DMFT score	Age in years			Total (%)
	6-7 years	8-9 years	10-11 years	
Nil	20 (10.1%)	30 (20%)	90 (46.8%)	140 (25.9%)
1-2	75 (37.8%)	70 (46.67%)	70 (36.4%)	215 (39.8%)
3-5	60 (30.3%)	30 (20%)	30 (15.6%)	120 (22.2%)
6-10	23 (11.6%)	19 (12.6%)	2 (1.04%)	44 (8.14%)
>10	20 (10.1%)	1 (0.67%)	0 (0%)	21 (3.8%)
Total	198	150	192	540

Table 3. DMFT score distribution in secondary teeth in different age groups.

DMFT	Age in years			Total
	6-7 years	8-9 years	10-11 years	
Nil	190 (95.9%)	131 (87.3%)	160 (83.3%)	481 (89%)
1-2	8 (4%)	18 (12%)	27 (14%)	53 (9.81%)
3-5	0 (0%)	1 (0.67%)	5 (2.6%)	6 (1.1%)
>5	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	198	150	192	540

observed in the present study, the timings of cariogenic food intake significantly affect the development of caries. Similar findings were also reported in other studies [4,7,11].

Studies have shown that high sugar consumption patterns like more than once daily, are significant risk factors for dental caries [7,11]. The present study did not find any significant relationship between these. This may be due to recall bias or non-random sampling and single institution-based study. Candies were most frequently (51.85%) used by the children which is in consensus with the literature that shows refined foods such as chocolates, toffees, beverages, cakes, and candies increase the risk of caries among children [11,12]. Different studies conducted in Saudi Arabia and Indonesia revealed a significant association of caries with brushing frequency, and cariogenic food intake between meals [13,14]. Younger children are at a higher risk of experiencing caries

of primary teeth, whereas permanent teeth are commonly involved in older and female children [15]. Therefore, preventive, therapeutic, and informative programs must be established and implemented for controlling dental caries at individual, family, and school levels.

In Pakistan, caries prevalence is increasing due to irregular teeth brushing habits and an ease of availability of processed food, especially at schools. This study calls for urgent measures to raise the awareness among people regarding timely screening, early management, and avoidance of risk factors with resultant reduced prevalence of loss of teeth in children because of caries.

Conclusion

Caries is more prevalent among female children affecting the primary teeth more than the secondary teeth. Also, irregular

brushing habits and cariogenic food intake increases the risk of caries development.

Limitations of the study

As it is a single centre study, hence results cannot be generalized. Patients presenting to the private hospital may not be the true representative of the general population of Southern Punjab. Hence, larger scale studies in public sector hospitals may be carried out to precisely determine the actual burden of this disease in our general population.

Acknowledgment

The authors would like to acknowledge all my colleagues and staff of Ibn-e-Sina Hospital, Multan, Pakistan for their support and cooperation during the study.

Conflict of interest

None to declare.

Grant support & financial disclosure

None to disclose.

Ethical approval

The protocol of this research was approved by the Ethical Committee of Ibn-e-Sina Hospital, Multan, Pakistan (Letter No. C-7-120/19). Parents of all participants signed the written informed consent form.

Author contributions

RZ: Conception and design of study, acquisition and analysis of data, drafting the manuscript.

AU: Acquisition and analysis of data, critical analysis with intellectual output.

SM: Acquisition and analysis of data, drafting the manuscript, statistical analysis.

ALL AUTHORS: Approval of the final version of the manuscript to be published.

Author details

Rabia Zafar¹, Amna Urooj², Sehrish Masood³

1. Assistant Professor, Department of Paediatric Dentistry, Multan Medical and Dental College, Multan, Pakistan.

2. Postgraduate trainee, Department of Operative Dentistry, Nishtar Institute of Dentistry, Multan, Pakistan.

3. Dental Surgeon, Multan, Pakistan.

References

1. Kassebaum NJ, Bernabé E, Dahiya M, Bhandari B, Murray C, Marcenes W. Global burden of untreated caries: a systematic review and meta regression. *J Dent Res*. 2015;94(5):650–8. <https://doi.org/10.1177/0022034515573272>
2. Peres MA, Sheiham A, Liu P, Demarco FF, Silva AE, Assunção MC et al. Sugar consumption and changes in dental caries from childhood to adolescence. *J Dent Res*. 2016;95(4):388–94. <https://doi.org/10.1177/0022034515625907>
3. Sahito N, Sahito MA, Fazlani KA. Prevalence of dental caries among school children in Hyderabad Pakistan. *Int J Appl Sci Res*. 2015;2(1):34–8
4. Viswanath D, Sabu N. Prevalence of dental caries, the effect of sugar intake and tooth brushing practices in children aged 5-11 years in Bangalore North. *SRM J Res Dent Sci*. 2014;5(3):155–9. <https://doi.org/10.4103/0976-433X.138721>
5. Dawani N, Nisar N, Khan N, Syed S, Tanweer N. Prevalence and factors related to dental caries among pre-school children of Saddar town, Karachi, Pakistan: a cross-sectional study. *BMC Oral Health*. 2012;12(1):1–9. <https://doi.org/10.1186/1472-6831-12-59>
6. Ahmed W, Manzoor F, Khayyam U. Dental caries status among public and private school children in Hyderabad district-Sindh. *Pak Oral Dent J*. 2017;37(2): 309–12.
7. Wilson B, Mallikarjuna SB, Narsimha VV, Muddaiah S, Suresh LR, Mallikarjuna SB. Dental caries and co-relation with sugar intake in 12-year-old school children Coorg, India. *J Public Health*. 2018;2(2):1–6.
8. Wagner Y, Heinrich-Weltzien R. Caries prevalence and risk assessment in Thuringian infants, Germany. *Oral Health Prev Dent*. 2017;15(5):489–94. <https://doi.org/10.3290/j.ohpd.a38735>
9. Skafida V, Chambers S. Positive association between sugar consumption and dental decay prevalence independent of oral hygiene in pre-school children: a longitudinal prospective study. *J Public Health*. 2018;40(3):275–83. <https://doi.org/10.1093/pubmed/idx184>
10. Chi DL, Hopkins S, O'Brien D, Mancl L, Orr E, Lenaker D. Association between added sugar intake and dental caries in Yup'ik children using a novel hair biomarker. *BMC Oral Health*. 2015;15(1):121–9. <https://doi.org/10.1186/s12903-015-0101-z>
11. Taqi M, Razak IA, Ab-Murat N. Sugar consumption and caries occurrence among Pakistani school children. *J Pak Med Assoc*. 2018;68(10):1483–7.
12. Nithya K, Peedikayil FC, Chandru TP, Kottayi S, Ismail S, Aparna TP. Caries prevalence and associated risk factors in school children at Kannur in Kerala, India: a cross-sectional study. *J Indian Assoc Public Health Dent*. 2021;19(1):32–6. https://doi.org/10.4103/jiaphd.jiaphd_137_20
13. Alhabdan YA, Albeshr AG, Yenugadhathi N, Jradi H. Prevalence of dental caries and associated factors among primary school children: a population-based cross-sectional study in Riyadh, Saudi Arabia. *Environ Health Prev Med*. 2018;23(1):1–4. <https://doi.org/10.1186/s12199-018-0750-z>
14. Bramantoro T, Setijanto RD, Palupi R, Aghazy AZ, Irmalia WR. Dental caries and associated factors among primary school children in metropolitan city with the largest javanese race population: a cross sectional study. *Contemp Clin Dent*. 2019;10(2):274–83. https://doi.org/10.4103/ccd.ccd_517_18
15. Youssefi MA, Afroughi S. Prevalence and associated factors of dental caries in primary school children: an Iranian setting. *Int J Dent*. 2020;2020(1):1–7. <https://doi.org/10.1155/2020/8731486>