Original Article

Dental Caries and Body Mass Index: A Cross-Sectional Study among Urban Schoolchildren of age between 7 and 15 Years in Chennai, India

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Abstract

Objectives: The objective of the study was to determine the association between dental caries and commonly proposed risk factors such as age, gender, body mass index (BMI), sugar intake, junk food consumption, and intermittent snacking habit among school-going children of upper socioeconomic status in Chennai city. **Materials and Methods:** The present cross-sectional study was carried out among 610 children of age between 7 and 15 years studying in a private school. A preformed content-validated pro forma was used to collect the data regarding demographic details (age, gender, height, and weight), dietary pattern (sugar consumption in the past 24 h assessed through sweet score, snacking in between meals, and junk food consumption in the past 24 h), and dental chart (for the presence of decay, missing, filled, trauma, and other findings). Weight and height of the children were recorded, and BMI was calculated using the formula weight (kg)/height (m^2). **Results:** On the whole, except for age and gender, none of the factors assessed including BMI, junk food intake, and snack intake were found to be associated with dental caries. **Conclusion:** With the changing dietary patterns and demography, the dynamic nature of dental caries is better assessed if approached in terms of common risk factors.

Keywords: Body mass index, Chennai city, children, dental caries, school

Introduction

Voluminous literature exist establishing diet as an important risk factor in determining dental caries.[1] With the changes in the economic front and dietary habits of Indians, the prevalence of dental caries also shows a clear variation between the rural and urban societies.[2] Children from the upper socioeconomic class are generally believed to be less prone to dental caries due to the higher literacy rates seen among the parents and better access to oral health-care facilities.[2,3] This diet has also been an important contributory factor for childhood obesity.[4] Obesity by itself is an independent risk for many noncommunicable diseases. With the changing ways of lifestyle, the prevalence of overweight among Indian children is estimated to be about 19.3%, with a proposed trend of 0.6%–11.3% in Chennai.[5] An increase in the intake of free sugars through beverages and other high-calorie foods among children has led to poor diet quality and in turn higher risk of childhood obesity. The positive association between free dietary sugars and the occurrence of dental caries has also been widely established.[6] Despite the improvements in the prevention and treatment of dental diseases in the past decades, caries prevalence among 12-year-old school-going children in India is still between 60% and 90, causing pain, anxiety, and functional limitation (including poor school attendance and performance in children).[7,8] However, this high prevalence is seen only in selected group of individuals. Children from the urban society receiving pocket money from parents are reported to have frequent snacking habit and unhealthy dietary habits which influence both their oral and overall health. However, the effect of this on their body mass index (BMI) was found to be more predominant than the presence of oral diseases.[9] With these inconclusive reports connecting dental caries, BMI,

Access this article online

Quick Response Code:

Website: www.ijcommdent.com

DOI: 10.4103/ijcd.ijcd_4_19

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How to cite this article: Anusha R, Krishnan L, Diwakar MP. Dental caries and body mass index: A cross-sectional study among urban schoolchildren of age between 7 and 15 years in Chennai, India. Int J Community Dent 2019;7:7-10.

Received: 19-06-19; **Accepted:** 10-10-19; **Web Published:** 06-01-20.

and the current influence of urbanization, this study was designed to determine the association between dental caries and commonly proposed risk factors, such as age, gender, BMI, sugar intake, junk food consumption, and intermittent snacking habit among school-going children of upper socioeconomic status in Chennai city.

Materials and Methods

The present cross-sectional study was carried out among 610 children of age between 7 and 15 years studying in a private school in Chennai city, India. The study was approved by the Institutional Review Board of Ragas Dental College and Hospital, Chennai. A written approval from the principal of the concerned school was obtained, and the children were priorly informed about the study.

Children who gave consent and were cooperative for the clinical examination were only included. Children who suffered from systemic illness, those who were under any medication, or those who presented with any acute illness on the day of the examination were excluded. The sample size was calculated using caries prevalence as 70% (78% prevalence has been reported in a study done by Elangovan A *et al*. in 2012), alpha error = 0.5, and power as 95% due to previously reported positive association of higher prevalence of decay among overweight and obese children. The estimated sample size was 575. However, since there were more number of students present on the day of examination, a total of 610 children were examined. Two calibrated dentists with an inter-rater agreement of 87.8% examined twenty students each day over a period of 3 months from January to March 2018.

A preformed content-validated pro forma was used to collect the data regarding demographic details (age, gender, height, and weight), dietary pattern (sugar consumption in the past 24 h assessed through sweet score, snacking in between meals, and junk food consumption in the past 24 h), and dental chart (for the presence of decay, missing, filled, trauma, and other findings). Weight and height of the children were recorded by a calibrated weighing machine corrected to zero error and with least measurement of 0.1 kg; height was measured using self-retracting tape with least measurement of 0.1 cm.

BMI was calculated using the formula weight (kg)/height (m^2), i.e., weight in kilograms divided by height in meter square. The value obtained was plotted for age-specific percentile curves on centers for disease control growth charts. Based on these percentile curves, the children were grouped into the following categories:

- Underweight: "BMI-for-age" <5th percentile
- Normal weight: "BMI-for-age" ≥5th percentile and <85th percentile
- Risk of overweight: "BMI-for-age" ≥85th percentile and <95th percentile
- Overweight: "BMI-for-age" >95th percentile.

Dental examination was conducted inside the school premises by Type III examination. All the participants were examined in the supine position under adequate daylight. Sterilized instruments including mouth mirror no. 5 and no. 23 Shepard's explorer were used for examination. Dental caries were recorded using decayed, missing, and filled teeth (DMFT) index (Klein HT, Palmer CE, and Knutson JW, 1938). Age was categorized into seven groups (≤9 years, 9–10 years, 10–11 years, 11–12 years, 12–13 years, 13–14 years, and 14–15 years coded from 1 to 7, respectively), gender (male and female coded as 1 and 2, respectively), sweet score (low, moderate, and high risks as 1, 2, and 3, respectively), junk and snack intakes were dichotomized as yes/no, and dental caries was further categorized as present or absent based on DMFT score.

The data were entered in Microsoft Excel Sheet 2007, and analysis was done using the SPSS version 20 (SPSS Inc., IBM SPSS Statistics for Windows, Armonk, NY: IBM Corp., USA) software. The Chi-square test was done to determine the association between dental caries and the assessed factors, and Spearman's ranked correlation was done to determine the degree of association. $P = 0.05$ was considered as statistically significant.

Results

Of the 610 samples, 318 (52.1%) were boys and 292 (47.9%) were girls. A total of 141 (23.15%) children belonged to the underweight BMI-for-age category, 307 (50.3%) children belonged to normal BMI-for-age category, 154 (25.2%) children belonged to the overweight category, and 8 (1.3%) children belonged to obese category. The mean DMFT score was the highest among 15-year-old children (2.52 ± 2.36) and the lowest among 9-year-old children (1.46 ± 1.20). Gender was the only variable found to be significantly associated with dental caries although it showed a weak positive correlation. Table 1 gives the frequency distribution of the various factors and their association with dental caries.

Discussion

The study of dental caries and its associated factors remains a daunting task to the health-care professional due to its multifactorial nature. The only significant relationship in our present study was the increasing prevalence of dental caries with an age- and gender-wise difference in caries occurrence. These are similar to the existing literature as reported by Veerasamy *et al*. in 2016 in which the authors concluded female gender being more vulnerable to be affected by dental caries.[2]

Due to recent increase in the global prevalence of childhood obesity, a plausible biological gradient between obesity and dental caries was proposed in the literature using diet as a common risk factor.[10] Although numerous studies have been reported in this regard, a systematic review by Kantovitz *et al*. reported an inconclusive relationship between childhood obesity and dental caries.[11]

Table 1: Distribution of the variables assessed in the study

Factors	Distribution, *n* (%)	Chi-square significance	Spearman's correlation (*r*)
Age (years)			
≤9	26 (4.3)	0.173	0.095*
9-10	60 (9.8)		
10-11	88 (14.4)		
11-12	104 (17.0)		
12-13	98 (16.1)		
13-14	115 (18.9)		
14-15	119 (19.5)		
Gender			
Male	318 (52.1)	0.007*	0.111*
Female	292 (47.9)		
BMI			
Underweight	141 (23.1)	0.510	−0.038
Normal	307 (50.3)		
Risk of overweight	154 (25.2)		
Overweight	8 (1.3)		
Sweet score			
Low risk	67 (11.0)	0.765	0.007
Moderate risk	323 (53.0)		
High risk	220 (36.1)		
Junk intake			
Yes	237 (38.9)	0.549	−0.029
No	373 (61.1)		
Snack intake			
Yes	417 (68.4)	0.210	−0.052
No	193 (31.6)		

*Represents significance at the level of $P<0.05$. BMI: Body mass index

Obesity has increased markedly with this nutritional evolution in most Asian countries. A similar nutritional transition is underway in India as well. The prevalence of obesity among children in the present study was higher than that reported by Mohan *et al*.,[12] in Ludhiana, but lower than that reported by Sharma and Hegde in Mangalore.[13] This finding may be due to differences in sampling techniques or in lifestyle and cultural practices between different regions of India. Little or no association was found between BMI and caries scores in some previous reports.[13,14] On the contrary, elevated BMI was found to be associated with increased dental caries in other studies.[15,16] Our present study also showed results similar to the former.

Dental caries being a chronic multifactorial disease whose risk factors include sugars, oral bacteria, saliva, tooth enamel, food substrate, and host susceptibility.[17,18] A possible relationship between obesity and dental decay was attributed to the frequent snacking on food high in fat or sugar among children.[19] Previous studies of caries-related factors showed that caries-associated dietary habits during infancy are maintained throughout early childhood.[20] Consequently, it was assumed that early established behavior with a high-sucrose intake appears to persist during childhood and adolescence. Hence, the hypothesized association in our present study between dietary sugar intake, frequent snacking between meals, and intake of junk food in the past 24 h did not show any significance, thus indicating the need for exploration of factors relating to oral hygiene behavior and a detailed assessment of life course factors which could have contributed to caries development. The correlation of BMI, junk food intake, and snacking habit could be due to the changing pattern of food habits among children who are frequently exposed to foods rich in fats and oils.

This being a cross-sectional pilot study lacks external validity due to its own limitations. The overall assessment of dietary habits was done only through a self-reported, 24-h diet recall which could not directly influence the overall caries experience of the individuals. There is also a possibility of under/over-reporting, as the study population was only children of age 7–15 years. Furthermore, the study population belonged to a higher socioeconomic class having better access to periodic oral health-care facilities which could have influenced the overall results.

Dental caries and its associated factors are complex inter-related issues, and our analysis was primarily limited to dietary and demographic characteristics. Further, follow-up studies are recommended to evaluate the triangular relationship between consumption of sweets, caries, and obesity.

Conclusion

Being a multifactorial disease, dental caries occurrence has been attributed to a wide variety of risk factors. Although factors such as sugar intake, snacking habit, and BMI were assessed in our present study only, gender of the children emerged to be significantly associated. Further, longitudinal studies are needed to explore the triangular association of obesity, dental caries, and sweet consumption in line with a common risk factor approach to prevent dental caries.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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