

Dental Caries and Co-Relation with Sugar Intake in 12-Year-Old School Children Coorg, India

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Abstract

Aims and Objectives: To assess the caries prevalence and its association with cariogenic dietary habits in 12-year-old school children, rural, India. Coorg

Materials and Method: The 12 years old data was collected from BEO (Board of Educational office, Coorg), according to their data the total population of 12 years old from the region were 8930. Twelve schools were selected from the four zones of Virajpet using stratified random sampling method. The consent was obtained from BEO, School authorities and parents after obtaining the ethical clearance from the Institutional Review Board. The 647 twelve-year-old children studying in the 12 schools were examined for caries experience using WHO (World Health Organisation) criteria under broad day light by four trained and calibrated examiners.

A 24-hour recall diet history questionnaire was designed to assess the consumption of sugar containing foods in a day. The children who participated in the survey were invited to complete a structured questionnaire that consisted of open ended questions relating to frequency and time of day the sugary foods. The questions were structured both in local language and English. The data obtained was subjected to statistical evaluation.

Results: The prevalence of caries experience in the primary dentition was 34.47% and in permanent dentition 21.79%. There was no association observed between the DMFT experience and the gender (p-value 0.797).

The low degree of co-relation ($r=0.0384$) observed between the number of sugar exposure and the DMFT experience and was found to be not significant (P value 0.392). Children who had sugar at least three times a day had higher DMFT scores than those did not and was found to be significant. (0.4 ± 0.9 vs. 0.2 ± 0.6 ; $p=0.004$).

Conclusion: In conclusion the role of sugar intake as a factor affecting caries experience has varied over time and the data from this study suggests the lower prevalence of caries and its association with sugar consumption in Coorg population. Still diet counselling on balanced diet with permitted sugar intake with recommendation of good brushing practices would be of most important factor in overall health care of the child and caries experience.

Keywords: Dental caries, Diet, Sugar consumption, 12-year, School children

Introduction

Dental caries is a diet dependent bacterial disease. The sucrose (sugar) is regarded critical in the dietary component as the etiological factor of dental caries [1,2]. Sucrose consumed at high frequency supports S-mutans (*Streptococcus mutans*) and is caries supportive dietary substance. The absolute amount and nature of the sugar consumed is important, as the frequency and pattern of diet is a powerful determinant of the individual's caries activity [3].

Eating patterns and food choices among children are important factors to know its effect on dental caries because each time sugar comes in contact with plaque microflora and the s-mutans in the oral environment, the substrate (sugar) is metabolized to acids resulting in drop in pH and demineralization of tooth surface & cavitation [4]. Lately, there has been a move towards expanding taste horizons as a result of the overall lifestyle changes. India's economic reforms in the 1990s allowed the country to participate in the global economy, paving the way for making the domestic market more consumers driven and resulting in changing life style. The caries risk and caries experience are the other additional problems associated with lifestyle changes.

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Several prevalent studies have been conducted and reported on different occasions on the dental caries and the treatment needs in developing countries such as India. In India, children comprise 40% of a rapidly growing population. The prevalence of dental caries varies from 33.7%-90% in children population and is increasing at an alarming rate [5]. The evidence of sugar being an etiological factor in dental caries is overwhelming and the absolute relation between food sucrose content and caries has not been specifically addressed in epidemiological studies of caries [6,7].

Coorg is a hill station located at an altitude of 900 meters in the Western Ghats of South-East region of India, with a unique climate and topography. Situated in the rural part of India, with the most of its economy based on agriculture, plantation and forestry, the land and its people—Kodavas cuisine relies greatly on fruits, stems of plants, mushrooms and ferns and in non vegetarian pork is practically staple. The food is cooked with the use of a wide variety of spices. Honey and jaggery are also extensively used. The present study was initiated as there was no evidence of caries prevalence and its association with the sugar intake in the 12 year old school children in Coorg.

Thus, we aimed to determine the caries prevalence and its association with sugar consumption habits in 12-year-old school children, in Coorg, India.

Methodology

Study subjects

Data pertaining to the total number of 12-year-olds school going children residing in the region was collected from the Board of Education Office (BEO) of the three taluks of Coorg, namely Madikeri, Virajpet and Somwarpet. Cluster sampling was done by including children from one school, which was randomly selected (by chit), from each of the four zonal clusters (North, South, East, West) in the three taluks, respectively. Thus, 12-year-old children from a total of 12 schools (four from each taluk) were surveyed.

Ethical clearance to conduct the study was obtained from the institutional review board and official permissions were obtained from the three BEO offices. Consent was also obtained from the head of each institution in the selected schools. Additionally, informed consent from parents of the participating students were obtained before commencement of the survey.

Inclusion criteria

1. Children in the age group of 12 years irrespective of sex, race or socioeconomic status.
2. Children who were cooperative.

Exclusion criteria

1. Children with any communicable or systemic diseases.
2. Children wearing braces for fixed orthodontic treatment.

Procedure for recording dental caries

A clinical oral examination was carried out to assess dental caries experience. On the stipulated days, all children aged 12 years who were present on the day of the survey were invited to participate.

The procedure was explained to the class teacher and students of each class separately and the children were examined

under natural day light and seated beside a window. Hard tissue examination was done using the WHO (World Health Organization) oral health assessment form (2013) [8]. The teeth were examined for caries using mouth mirror and CPITN (Community Periodontal Index for Treatment Needs) probe. Clinically detectable caries was recorded using visual and tactile method and caries recorded according to diagnostic criteria recommended by the WHO for oral health surveys (2013). The status of both primary and permanent teeth was recorded.

The examination was carried out from one tooth to adjacent tooth. A tooth was considered present, if any part of it is visible in the oral cavity. If permanent and primary tooth occupy the same tooth space, the status of the permanent tooth was recorded. Four examiners were trained to conduct the intraoral examinations and calibrated to minimize interobserver bias (Kappa statistics for interobserver agreement revealed substantial agreement).

At the examination site, the examiner called out the scores for each tooth and the recorder orally repeated the scores for the examiner to hear and correct, if necessary, and entered in the appropriate place in the proforma. Neither radiographic examination nor drying of teeth was carried out.

For recording dentition status, alphabets were used for primary teeth and numbers were used for permanent teeth. Both primary and permanent teeth status were recorded in mixed dentition individuals. Codes for the dentition status of primary and permanent teeth are given in table below, as prompted by WHO [8] (Figures 1 and 2).

Procedure for recording the diet questionnaire

A 24-hour recall diet history questionnaire was designed to assess the consumption of sugar containing foods in a day. Apart from recording name, class, school and date, the proforma contained six questions with some of the most common sources of sugar in children's diet. Weekends and holidays were excluded to avoid possible bias. The children who participated in the survey were invited to complete a structured questionnaire that consisted of open ended questions relating to frequency and time of day the sugary foods (Figures 3 and 4). The questions were structured both in local language and English. Each child was asked to fill the questionnaire either by putting a tick mark on the enlisted sugar containing foods or by writing the specific food they had in the space given in the questionnaire.

Data Analysis

The data collected through the WHO oral health assessment form and the one-day diet assessment chart were tabulated and subjected to statistical analyses using SPSS software programme, version 16.0. ANOVA test was used to find significant differences between different groups. To compare between the means, t-test was used. Pearson's correlation coefficient was used to determine linear relationship. The level of significance was set at 5%.

Results

The total numbers of children examined in the age group of 12 years in this population were 647 with the distribution of 319 girls and 328 boys (Table 1).

The prevalence of caries experience in the primary dentition was 34.47% and in permanent dentition 21.79% (Table 2).

TYPE OF SUGAR EXPOSURE	DMFT							Total
	0	1	2	3	4	5	6	
Type I: No sugar exposure	31	1	1	0	0	0	0	33
Type II: Sugar exposure at meals time	11	0	1	0	0	0	0	12
Type III: Sugar exposure between meals	86	17	7	1	1	0	0	112
Type IV: Sugar exposure both at meals and between meals	129	38	25	5	1	1	1	200
No data of sugar exposure	104	26	10	6	0	1	0	147
Total	361	82	44	12	2	2	1	504

The Chi-square value obtained is 19.023 with 24 df and the p-value is 0.751

Table 6: The association between DMFT and type of sugar exposure

Name: _____ Age: _____ Sex: _____
 School name: _____ Date: _____

- What did you have in the morning, before and for breakfast?
 - Milk with added sugar/Jam/Honey/jaggery/honey/any other?
 - Quantity?
- What did you have before lunch?
 - Biscuits / cakes / Chocolates / any other
 - Quantity?
- What did you have for lunch?
 - If any sweets, what sweet and quantity?
- What did you have in the evening?
 - Biscuits / Cakes / Chocolate / any other
 - Quantity?
- What did you have for dinner?
 - If any sweets, what sweet and quantity.
- What did you have at bed time?
 - Milk with added sugar / Juices containing sugar / any other
 - Quantity?

Figure 3: Diet assessment Questionnaire.

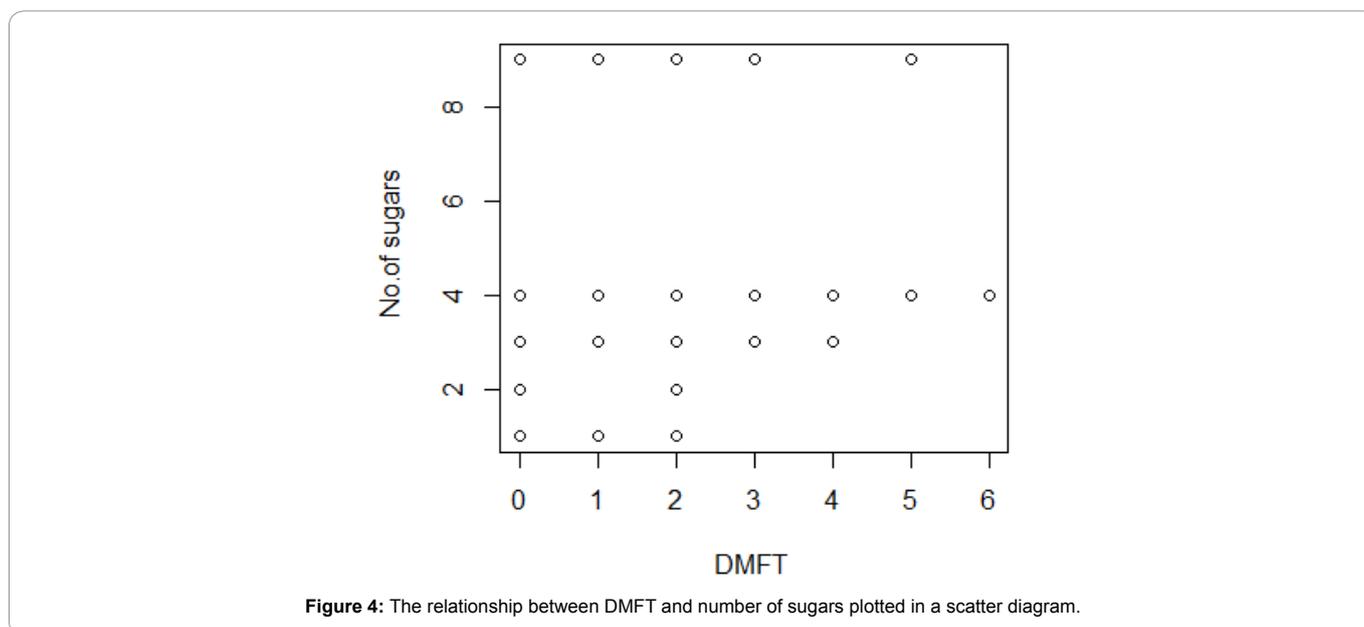


Figure 4: The relationship between DMFT and number of sugars plotted in a scatter diagram.

has been relatively very few data reported in literature concerning the prevalence of dental caries among Coorg children, particularly in 12 years old group and the prevalence of caries experience in the primary dentition was 34.47% and in permanent dentition 21.79%. Whereas the caries experience was lower in permanent dentition (0.21) than in primary dentition (2.20) reported from South India (Kerala, Tamilnadu and Mangalore) [11,18,19].

The mean deft in 12-year-old children obtained was 0.70, which is less than the studies in India [12,18,19]. The mean DMFT observed for the age was 0.35 shows a similar value to that reported in rural Thiruvananthapuram [20]. Bradley Christian and Wendell Evans [1] in their study conducted in 2007 reported in rural Belur [12], Varkala [19] and Chandigarh [14]; the DMFT values are 2.88, 2.06 and 3.33 respectively. In Belgium [21] children among 12 years, the DMFT score reported (0.92) and in Trinidad and Tobago [22] (0.61). In south India [18] reported a mean DMFT of 1.29 whereas in rural north India [23] it was 0.69.

Children and adults are most likely of all age groups to have diets high in added sugars [24]. Sugar consumption has been suggested to contribute to high energy intakes and is also associated with low diet quality and dental caries. It is estimated that 40% of children have tooth decay by the time they turn 6 years old [25].

Diet in general and sugar intake varies from individual to individual and is based on the socio-cultural and geographical location of the individual. Different methods like diet diary, interview method, weighing method, questionnaire method can be used to assess the sugar intake of an individual, but there is no consensus on the most valid method of measuring dietary intake. Comparing in between studies, using these different methods can thus lead to varying results [26]. Hence, to assess the consumption of sugar containing food a 24 hour recall diet history questionnaire was used. A 24-hour recall is an interviewer administered dietary assessment tool designed to gather information about food and beverage intakes and meals patterns [27]. Hammond J, Nelson M, Chinn S, Rona RJ reported that recalls were better for children below the age of 12 years [28]. Open-ended prodding questions are asked to facilitate recall of foods and beverages consumed. Similarly, in our study the questionnaire consists of open ended questions relating to frequency and time of day the sugary foods were consumed. The quantity and frequency of meals and snacks influences patients' exposure to fermentable carbohydrates and subsequently caries risk. Key areas to include in a dietary assessment of caries risk are the number of dietary exposures (Meals and Snacks) and the number of sugary food intake [27].

Thus, this data was analysed and grouped into four sugar types namely, type I – children with no sugar exposure, type II – sugar exposure at meal time, type III – sugar exposure between the meals and type IV – sugar exposure both at meals and between meals.

A small percentage of the variance in caries increase was explained by dietary components since the introduction and use of fluoridated toothpaste. The relation between sugars and dental caries is difficult to quantify because of inherent limitations.

The concerns of dietary components in caries experience are: 1) Variability in patterns of sugars consumption affects the

duration of exposure of the teeth to sugars, 2) dietary recalls or food diaries only provide an approximation of actual sugars consumption and food consumption patterns, 3) patterns of sugars consumption are reported on an annual basis but caries formation can take several years, and 4) caries prevalence is influenced by several factors that are difficult to control for, including the dietary mineral content (fluoride, calcium, and phosphorus), health care, oral hygiene habits, and education level. Sugar consumption and caries experience has shown an increase of 0.05–0.13 new caries surfaces per year in children aged 11–15 y for each 20-g (5-tsp) increase in daily sugar intake. These findings suggest that frequent consumption of sweets still an important determinant for caries [29].

At the 2001 National Institutes of Health Consensus Development Conference on diet and caries reported a strong diet-caries relation. Although there are reports indicating a decline in caries risk in relation to sugar intake, it is attributed to the relative decrease to fluoride use. Sugar consumption is likely to be a more powerful indicator for risk of caries in persons who don't have regular exposure to fluoride or non-fluoride remineralizing agents.

A joint report by Food and Agriculture Organization of the United Nations and the WHO (2003) concluded that there is a clear association between quantity and frequency of sugary foods and dental caries [30]. Sugars enter the diet in two forms: natural sugars, those found naturally in foods and added sugars, those that are added to foods during processing to alter the flavour, taste or texture of the food. The National Academy of Sciences (NAS) suggests limiting added sugar intake to 25% or less of total energy intake, which is based on the evidence that added sugar consumption exceeding 25% of total calories, may lead to dental caries. The WHO also recommends limiting added sugar intake to less than 10% of total energy [25].

Conclusion

1. The prevalence of caries experience in the primary dentition and in permanent dentition in Coorg population was less compared to other parts of South India
2. The low degree of number of sugar exposure per day and caries experience was observed.
3. Children who had sugar at least three times a day were observed to have higher caries experience
4. The type of sugar exposure and caries experience was found to have no association

In conclusion the role of sugar intake as a factor affecting caries experience has varied over time and the data from this study suggests the lower prevalence of caries and its association with sugar consumption in Coorg population.

Still diet counselling on balanced diet with permitted sugar intake with recommendation of good brushing practices would be of most important factor in overall health care of the child and caries experience.

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