

## Research Article

# Dietary Pattern, Tooth Brushing Habits and Caries Experience of School Children in Panchkula District, India

Manav Lakhanpal\*, Amandeep Chopra, NC Rao, Nidhi Gupta, and Shelja Vashisth

Department of Public Health Dentistry, Swami Devi Dyal Hospital & Dental College, India

## Corresponding author

Manav Lakhanpal, Department of Public Health Dentistry, Swami Devi Dyal Hospital & Dental College, Golpura, Barwala, District. Panchkula, Haryana, India, Email: manavlakhanpal@yahoo.com

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## Keywords

- NMES food and drinks
- Diet
- Dental caries
- Tooth brushing

## Abstract

**Aims and objective:** The aim of this study was to investigate the relationship between the original dietary pattern, tooth brushing habit and oral health of the school children of India in 2013.

**Material and methods:** This study was conducted in different Government and Non Government School's of Panchkula, Haryana, India in 2013. The original sample consisted of 296 children between 10-15 years age groups. A Performa was prepared to collect the data about the oral health status of the subjects and NMES food consumption by the subjects. The samples were examined using a plane mouth mirror and CPI probe where necessary according to WHO caries diagnostic criteria (World Health Organization, 1993). To record the caries experience decayed, missing, filled (DMF) caries index was used. ANOVA, Chi square and Multiple Regression Analysis were done by using SPSS software.

**Results:** A significant relationship was found between caries and NMES food or drinks, bed time NMES consumption frequency. It shows that caries experience tend to increase with consumption of NMES food and drinks. Significantly less caries was associated with the reported moderate consumption of dairy products by the children but this association as only for frequency less than 2 times daily. Multiple Regression Analysis revealed that the best predictors for DMFT scores were dairy products consumption frequency, which provided a variance of 24.8% in DMFT.

**Conclusion:** The reported consumption of NMES food; drinks and lack of regular tooth brushing were found to be the factors most strongly linked to caries.

## INTRODUCTION

Dental caries has been called as scourge of modern civilization and is without doubt, one of mankind's most prevalent chronic diseases. Dental caries is most commonly seen oral disease showing striking geographic variation, socio economic patterns and severity of distribution all over the world [1,2].

There is abundant evidence that dietary patterns in children have an influence on caries experience [3] while much of this evidence is from cross sections studies, it is recognized that caries takes time to develop and caries status of an individual may reflect the dietary pattern at an earlier age. The lack of a substantial body of published studies relating early dietary pattern with the subsequent development of caries reflects the difficulty in conducting such longitudinal studies.

Utilizing data collected by numerous investigators, Circa 1959, Buttner [4] determined the relation between sugar intake and caries for 11 -12 year old children. He concluded that there was a positive relation between these two varieties. In the current literature sugar consumption has been implicated as one of major contributors to dental caries [5].

Consumption of sugar containing foods is believed to be on the increase in developing countries particularly among urban residents from higher socio-economic background [6]. It has been suggested that variation in dietary and oral hygiene habits might account for the social and regional distribution of caries experience in Ghanaian school children [6].

During these two decades largely as a result of WHO activities in oral epidemiology [7], comparable data on the prevalence of

caries for ages 6 and 12 has been acquired. These recent data have been used to re-examine and reassess the association of sugar and dental caries.

Following the introduction of fluoride tooth paste it has been recognized that daily brushing with fluoride tooth paste is an effective means for personal caries prevention [8]. The widespread use of topical fluoride agent, both professionally and self applied in the form of tooth paste and rinses, together with ingested fluoride from the water supply and supplements now make it more difficult to determine which is the more important means of caries prevention, dietary control or brushing with fluoride toothpaste.

Between 1996 and 1998, an interventional study, the Apples project, was conducted in ten Leeds; West Yorkshire primary school aimed at documenting the dietary and physical recreation pattern of 7-11 year old children, followed by dietary advice using nationally agreed guidelines [9].

The existence of detailed dietary information on this cohort of primary school children provided the opportunity to follow the original subject and to study the relationship between diet and the development of dental disease.

Epidemiological and experimental investigations have demonstrated certain foods and consumption patterns, mainly the frequent consumption of sugar, to be essential factors in the etiology of caries.

In the classic experimental Vipeholm study [10] it was clearly demonstrated that the consumption of sugar can increase caries activity and that the caries risk is greatest if the sugar is consumed between meals in a form which can adhere to the teeth.

In a recently published paper by SREEBNY [11] it was also shown that in countries with a high availability of sugar there is also a high caries rate.

GARN et al [12] analyzed data from the Ten State Nutrition Survey of the United States and showed that children with a high consumption of sugar had DMFT- values about twice as high as those with a low consumption of sugar. If between, meal-eating-alone has been taken into consideration, closer relationship have been shown between dental caries and the consumption of sweets, confectionary etc. [13- 15].

Sugar consumption frequency and caries prevalence have been shown to vary with socioeconomic factors. In a study by Samuelson et al. [16] a negative relationship between parent's socioeconomic level and the children's caries experience was found. This has later been confirmed in several other Sweden studies [17-19].

Non Milk Extrinsic Sugar (NMES) is not a part of the cellular structure of foods - includes sugar added to foods as well as sugar in fruit juices and other drinks. This type of sugar can cause tooth decay The sugar naturally found in milk is not counted as NMES as it is not harmful to teeth. Non-milk extrinsic sugars are considered more cariogenic than intrinsic and milk sugars, however, the relationships among sugar types and dental caries have not been thoroughly investigated. We hypothesized that children with dental caries have higher intakes of extrinsic

sugars, particularly from beverages, than do children without dental caries.

The aim of this study was to investigate the relationship between the original dietary pattern, tooth brushing habit and oral health of the school children of Panchkula district, India in 2013.

## MATERIAL AND METHODS

This study was conducted in different Government and Non Government School's of Panchkula in Haryana, India. The schools were selected to provide a range of socio-economic status and data was collected on school children in four schools of Panchkula, Haryana, India in 2013. The original sample consisted of 296 children between 10-15 years age groups. 53 children were excluded from our study those who were absent on the day of examination and those who did not cooperate us for oral examination.

The 24 hour dietary recall protocol developed for the original project was adapted for use in our study. This was based on a checklist in which all possible foods for each of meals eaten during the day were listed with an option to record consumed food not on the list. The questionnaire was refined so that only coded information was obtained.

A Performa was prepared to collect the data about the oral health status of the subjects and NMES food consumption by the subjects. The Performa consisted of question about the daily NMES food and drink consumption. In addition, subject were asked to record their tooth brushing frequency, mode of cleaning the tooth, material for cleaning of teeth and daily dairy products consumption frequency. It was decided not to attempt to addition a replicate sample for a reproducibility analysis. Data was collected prior to dental examination basis.

The samples were examined using a plane mouth mirror and CPI probe where necessary according to WHO caries diagnostic criteria (World Health Organization, 1993). Instruments were sterilized; Examinations were performed using Type III examination procedure. To record the caries experience decayed, missing, filled (DMF) caries index was used. Both DMFT and DMFS were recorded. Before starting the study inter examiner variability was tested by using kappa statistics which was 94.3%

Ethical Clearance was obtained from the ethical committee of Swami Devi Dyal Hospital and Dental College.

DMFT at increasing level of food and drink consumption were analyzed using the ANOVA and percent DMFT > 0 was analyzed for same breakdown using the linear Chi Square analysis. Step wise Multiple Linear Regression analysis was also done to find out the effect of various independent variables on DMFT.

ANOVA, Chi square & Multiple Regression Analysis was done by using SPSS software (version 11.0)

## RESULTS

Table 1 shows the sample distribution according to age and sex. Percentage of subjects between ages 10-11 years is 37.5% out of which 19.3% are male and 18.2% are female. Percentage of subjects between ages 12-13 years is 31.4% of total population in which 22% are male and 9.5% are female.

Table 2 shows that caries experience tend to increase with consumption of NMES foods. Subjects in those consumption frequency is less than 2 times daily mean DMFT is 2.99 and in those consumption frequency is 2-3 times and more than 4 times, mean DMFT is 3.47 and 4.30 respectively. There was statistically significant relation between caries and frequency of NMES food consumption. (P=0.008)

Table 3 shows relation between caries and bed time consumption frequency. When consumption frequency is less than one, mean DMFT is 3.15 and when it is more than one, mean DMFT is 3.68. It shows that caries prevalence is increasing with increased NMES bed time consumption frequency.

Table 4 shows that NMES drink are predictive of the presence of caries. In those children whose NMES drink consumption frequency was less than twice daily, mean DMFT were 3.09 and those who were taking NMES drink 2-3 times and more than 4 times daily mean DMFT value was 3.47 and 4.30 respectively. It shows increased caries experience with increased consumption frequency of NMES drink. (P=0.002).

Table 5 shows that high consumption of dairy products at all age the groups was associated with more caries prevalence. Mean DMFT value increases from 2.82 to 3.57. When daily dairy product consumption frequency increase from less than 2 times to 2-3 times. Moderate consumption of dairy products at all age group was associated with less caries but this association as only for frequency less than 2 times daily.

Table 6 shows that children who clean their teeth less than

**Table1:** Sample Distribution according to age and sex.

Age	Male	Female	Total
10-11Year	(57) (19.3%)	(54) (18.2%)	(111) (37.5%)
12-13 Year	(65) (22.0%)	(28) (9.5%)	(93) (31.4%)
14-15 Year	(81) (27.4%)	(11) (3.7%)	(92) (31.1%)
Total	(203) (68.6%)	(93) (31.4%)	(296) (100.0%)

$\chi^2=31.59, P=0.000$

**Table 2:** Caries and reported daily NMES food consumption frequency.

	NMES food consumption frequency			
	1) <2	2) (2-3)	3) + 4	All
Number	178	88	30	296
DMFT*(mean)	2.99	3.47	4.30	3.27
% DMFT>0	88.8%	90.9%	86.7%	89.25
Decayed**(mean)	2.94	3.38	3.90	2.78

ANOVA, F- 4.946, P=0.008, F\*-3.073, P=0.048  $\chi^2= 0.501, P= 0.778$

**Table 3:** Caries and Reported daily bedtime NMES consumption frequency.

	Daily bedtime NMES consumption frequency		
	1) < 1	2) + 1	4) Total
Number	242	54	296
DMFT*(mean)	3.15	3.68	2.25
% DMFT>0	88.8%	90.6%	89.2%
Decayed** (mean)	3.09	3.43	3.17

**Table 4:** Caries and reported daily NMES Drink consumption frequency.

	NMES drink consumption frequency			
	1) <2	2) (2-3)	3) + 4	4) All
Number	147	106	43	296
DMFT* (mean)	3.09	3.47	4.30	3.27
% DMFT>0	86.4%	90.6%	95.3%	89.2%
Decayed** (mean)	2.97	3.05	4.14	3.17

ANOVA, F\*- 6.482. P=0.002 F\*\*- 5.166, P=0.006  $\chi^2= 3.091, P= 0.213$

**Table 5:** Caries and reported daily dairy products consumption frequency.

	Dairy product consumption frequency			
	1) <2	2) (2-3)	3) + 4	4) All
Number	165	88	43	296
DMFT* (mean)	2.82	3.57	2.30	4.27
% DMFT>0	86.7%	92.0%	92.7%	89.2%
Decayed** (mean)	2.78	3.41	4.15	3.17

ANOVA, F\*- 6.363, P=0.000, F\*\*- 5.616, P=0.001  $\chi^2= 2.595, P=0.458$

once daily, mean DMFT value is higher (3.89) and mean value of decayed teeth was also higher when compared to the subjects who brush their teeth at least once daily.

Table 7 shows that prevalence of caries also depends on the mode of cleaning their teeth. Subjects who clean their teeth with finger mean DMFT value is 3.89. In subjects who clean their teeth by neem stick mean DMFT value is 3.63 and with tooth brush are 3.23. This shows that children who use tooth brush for cleaning had less caries prevalence.

Table 8 shows multiple regression analysis in which depending variable is DMFT and all such as NMES food and drink consumption frequency, NMES bed time consumption frequency, brushing technique, brushing frequency, Dairy products consumption are independent variable. Multiple Regression Analysis revealed that the best predictors for DMFT scores were dairy products consumption frequency, which provided a variance of 24.8% in DMFT.

## DISCUSSION

An Important coordination in the interpretation of these data is that the dietary pattern of young children changes rapidly. The findings generally support exerting evidence on the relationship between the consumption of NMES food by the children and caries.

The consumption of dairy products is recognized as protective dietary factor [20] and the finding of reduction in DMFT with moderate consumption is significant and it is consistent with previous studies.

In assessing the result from the tooth brushing data we have assumed that the vast majoring of the children would be using a fluoride containing toothpaste. The finding of a significant difference in caries prevalence between those children who did not brush regularly and those who brushed at last once a day is strong support for the effectiveness of the regular use of fluoride toothpaste for caries prevention. Indeed, the finding that children

**Table 6:** DMFT and reported tooth brushing frequency.

	Reported tooth brushing frequency			
	1) Once daily	2) twice	3) Less than once daily	4) All
Number	170	118	8	296
DMFT* (mean)	3.39	3.05	3.88	3.27
% DMFT	88.2%	89.8%	100%	89.2%
Decayed** (mean)	3.32	3.05	4.14	3.17

ANOVA, F\*- 1.085, P- 0.339, F\*\*- 1.571, P-0.210 X<sup>2</sup>=1.180, P=0.554

**Table 7:** DMFT and Mode of cleaning the teeth.

	Mode of cleaning the teeth			
	1) Finger	2) Neem Stick	3) Tooth Brush	4) All
Number	12	8	296	296
DMFT* (mean)	3.89	3.63	3.23	
% DMFT	100.0%	100.0%	88.5%	89.2%
Decayed** (mean)	3.67	3.13	3.15	3.17

ANOVA, F\*- 0.514, P-0.599 F\*\*- 0.325, P-0.723 X<sup>2</sup>=2.60 P= 0.273

**Table 8:** Step Wise Multiple Regression Analysis.

Model	R	R <sup>2</sup>	Standard Error	F	P
DMFT					
1	0.248(a)	0.061	2.18	19.217	0.000

<sup>a</sup>Predictors: (Constant), Dairy

who did not brush regularly had almost 50% more caries than regular brushers is higher than the benefits suggested from most fluoride tooth paste trials comparing fluoride tooth paste with placebo tooth paste [21]. This finding is consistent with the view expressed by some authorities, of an additional benefit from the mechanical removal plaque beyond that attributable to the fluoride content of the paste.

The finding from this study support previous research on the relationship between caries, diet and tooth brushing from the UK National Diet and Nutrition Survey [22] The results suggest that the consumption of sugar sweetened drinks is possibly a more important determinant for caries than the consumption of sugar sweetened foods and would support the advice that water should be the main fluid intake for children [23].

The finding of a significant relationship between the consumption of sugar sweetened drink at bedtime and caries further support previous research and it is consistent with the advice that, the hour before bed should be a "sugar free zone". Despite the low overall caries prevalence in this study, the finding that the lack of regular tooth brushing was associated with a 50% increase in caries is consistent with the established advice to brush twice daily with fluoride tooth paste [24].

Overall in this study the children had a higher mean caries prevalence (DMFT-3.27) than that found in the most recent survey of Leeds 12 years olds (DMFT-1.39) [24].

The findings of a significant relationship between caries and initial bedtime consumption of NMES drinks is consistent with previous studies [25] however this relation was not seen when

compared to a study conducted by R.S.Levine [26] which showed that current bed time consumption at 11 to 15 years providing support for the concept that the dietary environment into which teeth eruption takes place is an important factor is determining caries experiences.

In our study the relationship between caries and daily reported NMES food show a significant relationship. Caries prevalence is increasing with increased consumption frequency. Subjects in those consumption frequency is less than 2 times daily mean DMFT is 2.99 and in those consumption frequency is 2-3 times and more than 4 times, mean DMFT is 3.47 and 4.30 respectively. These finding are also consistent with a previous study conducted by Levine RS [26].

Several studies have been correlated to determine the relationship of the frequency of sugar consumption to caries. In some of them, there has been no co-relation at all [27-29]. While other have shown clear relationship [15,30,31]. It is also consistent with our study which also shows a strong relationship between frequency of sugar consumption and caries.

In our study a positive significant relationship was found between the consumption of either food or drinks containing non-milk extrinsic sugar (NMES) in the hour before bed and DMFT in the sample as a whole. This result is consistent with a study conducted by Levine RS [25] which shows that subjects consuming NMES food had a mean DMFT of 1.18 compared to 0.42 for subjects who did not. The corresponding mean scores for NMES drinks were 0.94 compared to 0.46. Gender, ethnicity and social-economic status were not significantly related to caries experience. The strongest relationship found was between caries experience and the consumption of both NMES food and drinks before bed, those children having four times the mean DMFT score (1.24) of those who consumed neither (0.31). while in our study, Subjects in those consumption frequency is less than 2 times daily mean DMFT is less (2.99) and in those consumption frequency is 2-3 times and more than 4 times, mean DMFT is higher(3.47 and 4.30) respectively.

Our study shows that caries prevalence also depends upon mode of cleaning of teeth. Subjects cleaning their teeth with finger mean DMFT value is 3.89. In children who clean their teeth by Neem Stick mean DMFT value is 3.63 and with tooth brush is 3.23. This shows that children those use tooth brush for cleaning had less caries prevalence.

Quite a few cross sectional epidemiologic studies of children have related caries prevalence to the consumption of sugar or confectionary as revealed by dietary interviews or questionnaire methods. When the correlation between total amount of sugar consumed and caries prevalence has been studied the results have been conflicting. A significant but not very strong co-relation was found in some studies [12,32] but not in other [27,33] while in our study we found strong co-relation between caries and consumption of NMES food and NMES drinks.

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