

# Oral health of 12-year-old Bangladeshi children

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Previous dental caries studies in Bangladesh have been performed on non-randomized samples, using various clinical criteria. Estimates of dental caries prevalence in 12-year-olds are therefore uncertain. In the present study a clustered, stratified random sampling procedure was used. Dental caries was scored as DMFT in accordance with the WHO recommendations and related to oral hygiene and various behavioral and social variables. The caries experience was found to be low, with a mean DMFT score of 0.97. Poor oral hygiene and bleeding gingiva were frequently detected. Dental caries experience was associated with sex, oral hygiene (girls), and use of dental services (more caries among frequent users than non-users). A correlation matrix analyzing the most influential independent variables indicated that sex and oral hygiene seemed to have an independent effect, whereas a web of social factors interfered with the 'use of dental services' variable. □ *Bangladesh; children; dental caries; oral health; oral hygiene*

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The oral health condition among Bangladeshi children is characterized by a low prevalence of dental caries, poor oral hygiene, and a high prevalence of gingivitis with bleeding papillae, typical of many developing countries (1). Previous dental caries data available from studies on Bangladeshi 12-year-olds are presented in Table 1 and indicate that the estimates vary between DMFT scores of 0.6 and 3.0 (2–7), with the oldest study (6, reporting from a study performed in 1978) showing the highest value. Furthermore, studies indicate that 81%–95% of 12-year-old children have calculus and bleeding gums (8, 9). A closer look at the existing oral health data from Bangladesh shows, however, that most of the studies available seem to be based on non-randomized convenience samples, mainly from urban areas. In addition, various clinical criteria seem to be applied. The external validity and estimation of time trends based on results from the different studies may therefore be insufficient.

Taking into account the uncertainties linked to the previous oral health studies in Bangladesh, a national survey of 12-year-olds was considered appropriate. Furthermore, the existing scientific documentation of factors associated with dental caries and periodontal conditions was found to be insufficient. Data on oral health-related habits such as sweet consumption, tooth-brushing habits, and use of fluoride-containing toothpaste have not been systematically recorded in Bangladesh, and caries prevalence has not been associated with fluoride exposure, socioeconomic conditions, or urbanization, which might be of importance in understanding caries distribution and prevalence. The specific objectives of the present study were therefore as follows: i) to describe the experience of dental caries among 12-year-olds in Bangladesh, ii) to assess their oral hygiene and periodontal conditions, iii) to collect representative data on oral health

habits, and iv) to relate dental caries data, oral hygiene, and periodontal conditions to sex, residence (urban, semi-urban, and rural), tooth-cleaning habits, and social factors.

## Materials and methods

The present study was designed as a cross-sectional epidemiological survey of 12-year-old Bangladeshi school-children. A stratified random sampling procedure was performed on the basis of urban, semi-urban, and rural residence in accordance with WHO recommendations (10). A total of 14 schools—4 urban, 2 semi-urban, and 8 rural—representative of their respective regions (11), were selected to obtain a representative national sample constituting a total of 631 individuals. The subjects attending school on the day of examination were invited to participate after explaining the purpose of the study. The number of absentees was not recorded. Data collection included a clinical examination and a structured self-reported questionnaire completed in the classrooms assisted by the teachers before the clinical examination. The clinical examination was performed during school time on a flat table in an ergonomic lying-down position,

Table 1. Caries data from previous oral health studies in Bangladesh

Reference	Location	DMFT (mean)
Nayeem & Ahmed, 1981 (2)	National	1.5
Leous et al., 1982 (3)	Rural	0.6
Tchernykh, 1985 (4)	National	1.4
Begum & Moral, 1991 (5)	Semi-urban	1.7
Kalam et al., 1992 (6)	Not indicated	3.0
Jaman et al., 1992 (7)	Not indicated	1.8

Table 2. Dental caries prevalence related bivariately to various independent variables (analysis of variance)

Variables	No.	DT, mean $\pm$ s	DMFT, mean $\pm$ s
OHI-S score		NS	NS
Low (OHI-S <1)	45	0.78 (1.08)	0.89 (1.25)
Moderate (OHI-S 1–1.5)	477	0.86 (1.38)	0.93 (1.42)
High (OHI-S >1.5)	109	1.10 (1.39)	1.17 (1.43)
Sex		*	*
Boys	337	0.75 (1.35)	0.83 (1.42)
Girls	294	1.06 (1.36)	1.12 (1.40)
Residence		NS	NS
Urban	187	1.00 (1.38)	1.14 (1.48)
Semi-urban	83	0.63 (1.16)	0.73 (1.22)
Rural	361	0.90 (1.40)	0.93 (1.42)
Social class (father's profession) (13)		NS	NS
High	229	0.93 (1.23)	1.01 (1.28)
Medium	142	0.71 (1.20)	0.80 (1.31)
Low	260	0.96 (1.55)	1.02 (1.58)
Social class (father's education)		NS	NS
High (>12 years)	95	1.01 (1.34)	1.17 (1.42)
Medium (6–12 years)	233	0.87 (1.26)	0.80 (1.33)
Low (<6 years)	301	0.88 (1.45)	0.93 (1.48)
Sweets consumption (biscuits, cakes, candy)		NS	NS
High (>once a day)	144	1.01 (1.39)	1.14 (1.50)
Medium (once a day)	180	0.93 (1.27)	1.04 (1.36)
Low (<once a day)	185	0.84 (1.56)	0.85 (1.56)
Seldom/never	122	0.79 (1.12)	0.83 (1.11)
Soft drinks (frequency)		NS	NS
High (>once a day)	90	0.77 (1.25)	0.91 (1.34)
Moderate (once a day)	119	0.86 (1.18)	1.01 (1.31)
Low (<once a day)	122	0.87 (1.27)	0.94 (1.38)
Seldom/never	300	0.96 (1.50)	0.98 (1.49)
Chewing gum (sugar) (frequency)		*	*
High (>once a day)	141	1.09 (1.45)	1.16 (1.46)
Moderate (once a day)	247	0.91 (1.48)	0.98 (1.54)
Low (<once a day)	143	0.87 (1.27)	0.69 (1.03)
Seldom/never	100	0.95 (1.37)	1.06 (1.47)
Jam, jelly, honey consumption (frequency)		NS	NS
High (>once a day)	96	1.02 (1.51)	1.18 (1.67)
Moderate (once a day)	46	1.04 (1.25)	1.11 (1.25)
Low (<once a day)	184	0.85 (1.16)	0.93 (1.19)
Seldom/never	305	0.86 (1.45)	0.90 (1.47)
Tooth-cleaning device		NS	NS
Toothbrush	321	0.90 (1.28)	1.01 (1.36)
Chewing stick	40	0.65 (1.14)	0.72 (1.18)
Finger	253	0.95 (1.51)	0.98 (1.52)
Brushing frequency		NS	NS
High ( $\geq$ once a day)	321	0.90 (1.28)	1.01 (1.36)
Moderate (2–6 t/week)	3	2.00 (1.00)	2.33 (1.53)
Seldom or never	307	0.87 (1.45)	1.17 (1.43)
Toothpaste		NS	NS
Yes	304	0.92 (1.30)	1.02 (1.38)
Fluoride	139	1.00 (1.32)	1.17 (1.45)
Non-fluoride	176	0.84 (1.25)	0.91 (1.29)
No	327	0.87 (1.43)	0.90 (1.29)
Dental visit pattern		*	**
Regular (>once a year)	51	1.08 (1.51)	1.20 (1.52)
Irregular (<once a year)	83	1.08 (1.18)	1.27 (1.27)
Do not remember	50	1.28 (1.44)	1.50 (1.57)
Never	447	0.79 (1.36)	0.83 (1.39)
Reasons for dental visit		**	***
Emergency	166	1.19 (1.40)	1.34 (1.45)
Check-up	14	0.71 (0.91)	1.21 (1.48)
No visit	451	0.79 (1.35)	0.82 (1.38)

\* 0.01 &lt; P &lt; 0.05, \*\* 0.001 &lt; P &lt; 0.01, \*\*\* P &lt; 0.001, NS = not significant, s = standard deviation.

Table 3. DMFT scores divided into separate components

Variables	Mean DMFT scores $\pm$ <i>s</i>
DT	0.89 (1.37)
MT	0.01 (0.14)
FT	0.04 (0.30)
DMFT	0.97 (1.41)

*s* = standard deviation.

using headlamp illumination. The teeth were examined by the visual tactile method, using plane mouth mirrors and regular dental probes for dental caries registration using the WHO criteria (10). Caries experience is presented as the number of decayed, missing, and filled permanent teeth (DMFT). Oral hygiene was recorded by examining dental plaque in accordance with the debris part of the simplified oral hygiene index (OHI-S, scale 0–3) (12). Periodontal conditions were registered by the prevalence of sextants with inter-dental bleeding papillae after probing with wooden toothpicks in accordance with Caton & Polson (13). These three estimates were used both as dependent and independent variables in the present analyses.

The clinical data were collected by one examiner (M.S. Ullah) during the summer of 2000, with assistants helping to record the observations. Before data collection the examiner was calibrated at the Faculty of Dentistry, University of Oslo, with an experienced epidemiologist, reaching a kappa value of 0.96. During the calibration sessions a re-examination of 20 patients was arranged, and the intra-examiner consistency was found to be 95% for DMFT and 90% for oral plaque scores. Bleeding points were not re-examined.

The following factors were used as independent variables (Table 2): sex (male, female), residence (urban, semi-urban, rural), socioeconomic conditions on the basis of the father's profession (14) and years of education, sugar consumption habits, tooth-cleaning habits (frequency and type), tooth-cleaning agents (toothpaste, tooth powder, and

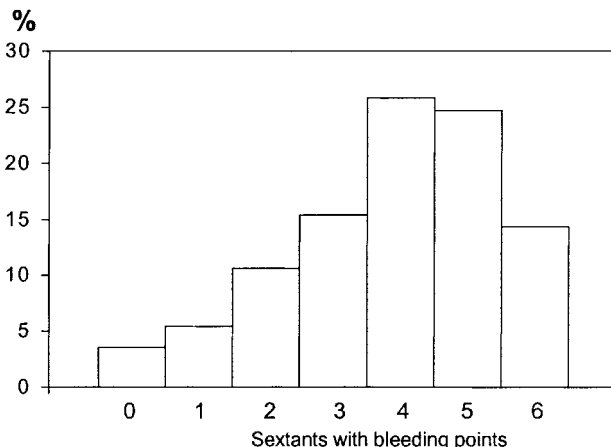


Fig. 2. Individual distribution of sextants with bleeding papillae. Half the sample had three to four sextants showing bleeding on probing.

other agents like charcoal and salt), toothpaste (fluoride and non-fluoride), and dental visiting habits (frequency and main reason).

The data were computerized and analyzed by applying the Statistical Package for the Social Sciences (SPSS) program. Descriptive statistics are presented by using mean and standard distribution. To relate caries prevalence to oral hygiene, periodontal conditions, and selected independent variables, bivariate analyses were performed by means of correlation tests, chi-square tests, and one-way ANOVA analyses. A multivariate regression analysis was used to detect the relative importance of the various variables, and a correlation matrix was created to study interactions between the most important independent variables.

## Results

### Dental caries and treatment experience

The experience of dental caries was found to be low, with a mean DMFT score 0.97 (Table 3) and very low levels of missing (mean, 0.01) and filled teeth (mean, 0.04). As shown in Fig. 1, more than half of the individuals investigated had a DMFT score of 0, and very few showed scores greater than 4. The highest caries occurrence was found in the lower first molars (24%), and almost all lesions detected were in occlusal fissures.

Girls presented with higher caries experience than boys. The mean DMFT was 1.12 for girls and 0.83 for boys, and the mean DT was 1.06 for girls and 0.75 for boys. These differences were statistically significant (Table 2). There was a tendency to more caries among urban residents than among semi-urban and rural. Except for filled teeth, the differences were not statistically significant. The same pattern was detected for caries experience related to social class (Table 2).

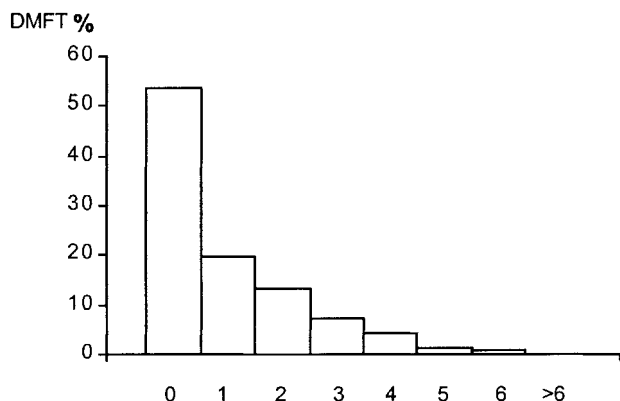


Fig. 1. Individual distribution of dental caries experience in the sample. The majority (54%) is caries-free.

Table 4. Oral hygiene scores related bivariately to various independent variables

Variables	No.	OHI-S scores, mean $\pm$ s
Sex		NS
Boys	337	1.35 (0.30)
Girls	294	1.30 (0.30)
Residence		NS
Urban	187	1.31 (0.29)
Semi-urban	83	1.31 (0.28)
Rural	361	1.34 (0.31)
Social class (father's education)		**
High (>12 years)	95	1.23 (0.29)
Medium (6–12 years)	233	1.32 (0.30)
Low (<6 years)	301	1.36 (0.29)
Tooth-cleaning device		**
Toothbrush	321	1.29 (0.31)
Chewing stick	40	1.43 (0.31)
Finger	253	1.36 (0.29)
Brushing frequency		**
High ( $\geq$ once a day)	321	1.29 (0.31)
Moderate (2–6 t/week)	3	1.56 (0.26)
Seldom or never	307	1.36 (0.28)
Toothpaste		*
Yes	304	1.30 (0.31)
No	327	1.36 (0.29)
Dental visit pattern		NS
Regular (>once a year)	51	1.37 (0.26)
Irregular (<once a year)	83	1.32 (0.33)
Do not remember	50	1.25 (0.30)
Never	447	1.33 (0.30)

\*  $0.01 < P < 0.05$ , \*\*  $0.001 < P < 0.01$ , NS = not significant, s = standard deviation.

Variation in sugar consumption showed only a minor impact on caries experience among the individuals investigated. With regard to tooth-cleaning devices and agents, the various methods used did not make any substantial difference in caries experience. Slightly higher caries treatment scores (FT) were associated with the use of fluoride-containing compared with non-fluoride-containing toothpaste or other alternative agents for dental cleaning. Those who attended a dentist, either regularly or irregularly, presented with more caries than those who did not see a dentist at all (Table 2).

#### Oral hygiene and periodontal conditions

The mean value of the OHI-S debris index (12) was 1.3. For most of the population (75%) OHI-S debris index values were within the range of 1–1.5, which means that on average more than one-third of the surfaces of their index teeth were covered with plaque (Table 4). Periodontal conditions were measured by means of the number of sextants with one or more bleeding papillae (13). The mean value of sextants with bleeding sites was 3.9 (Fig. 2). Twenty-three subjects (3.6%) had no bleeding sites, whereas 91 subjects (14.4%) had a maximum of 6 sextants with bleeding sites.

Although a few of the demographic and sweet consumption variables were statistically significantly asso-

ciated with variation in oral plaque scores, the differences were small. Regular cleaning with a toothbrush and the use of toothpaste were associated with cleaner teeth than the other tooth-cleaning habits and agents, but the difference was negligible. Dental visiting habits and dental health-related knowledge did not show any association with plaque levels.

Only dental visiting pattern (regular/irregular/never) and consumption of jam, jelly, and honey showed a statistically significant correlation with variation in sextants with bleeding sites, whereas brushing habits and agents did not show any impact on this factor.

An analysis testing possible correlation between prevalence of dental caries and oral hygiene showed no correlation for the total material. However, when the sample was divided on the basis of sex, there was a statistically significant correlation between caries and oral hygiene for girls ( $r = 0.14$ ,  $P = 0.02$ ) but not for boys.

To better understand the context determining variation in dental caries, a correlation matrix was created to study the pattern of covariance among the most important independent variables. The correlations found among the independent variables strongly support a sociocultural dimension explaining variation in caries experience (Table 5). Finally, a set of the most important independent variables was selected from the bivariate analyses. These variables were included in a multivariate stepwise regression analysis, using DMFT values as the dependent variable. Care was taken to avoid more than one variable measuring the same dimension. The multiple regression analysis showed 'reason for last dental visit', 'sex', and 'oral hygiene' as the three most important determinants for variation in caries prevalence. However, the  $R^2$  was only 0.04, indicating a low explained variance by the set of independent variables introduced.

#### Discussion

In the present study a stratified cluster sampling procedure was followed in accordance with the recommendations from the WHO (10) to obtain a representative sample of 12-year-olds in Bangladesh. The final sample constituted a slight overrepresentation from urban regions. This may result in a slight overestimation of the real caries prevalence in this cohort. On the other hand, more girls than boys are discontinuing their formal education before the age of 12 for cultural and economic reasons (15), resulting in a slight overrepresentation of boys in the total sample. This may have the opposite effect. The recorded caries prevalence level (54% caries-free and a mean DMFT score of 0.97) is therefore probably close to the real value for 12-year-olds in Bangladesh.

One well-calibrated examiner performed all the clinical registrations. Results from the intra- and inter-observer calibration tests before the study indicate a consistent and reliable level of registrations. The high kappa value (0.96) is in part due to low caries experience among the test

Table 5. Correlation matrix showing co-variation between a set of independent variables showing the highest degree of co-variance (Spearman correlation test)

	OHI-S scores	Sex	Residence	Social class (father's edu.)	Sweets consump.	Brushing frequency
Sex	$r = 0.08$ NS					
Residence	$r = 0.04$ NS	$r = 0.05$ NS				
Social class (father's edu.)	$r = 0.13^{**}$	$r = 0.00$ NS	$r = 0.39^{**}$			
Sweet consumption	$r = 0.07$ NS	$r = 0.03$ NS	$r = 0.23^{**}$	$r = 0.08^*$		
Brushing frequency	$r = 0.12^{**}$	$r = 0.09^*$	$r = 0.46^{**}$	$r = 0.31^{**}$	$r = 0.18^{**}$	
Reason for dental visit	$r = 0.06$ NS	$r = 0.02$ NS	$r = 0.37^{**}$	$r = 0.25^{**}$	$r = 0.12^{**}$	$r = 0.38^{**}$

\*  $0.01 < P < 0.05$ , \*\*  $0.001 < P < 0.01$ , NS = not significant.

subjects. However, this reflects the Bangladesh situation and is therefore valid for the sample investigated. During the field study repeated measurements were not performed for practical reasons.

The dental caries experience was found to be low and involved mainly the occlusal surfaces of the first molars. Compared with the results from previously performed surveys (Table 1), there is no indication of an increase in caries prevalence among Bangladeshi 12-year-olds. Considering the substantial variation reported in previous studies (Table 1), the results from the present representative national study indicate that care should be taken with regard to statements about an increased disease trend. However, due to globalization and possible economic growth resulting in altered food habits in Bangladesh, there is a potential danger of a future increase in dental caries (16). Insufficient knowledge about oral health care and lack of preventive measures, including proper use of fluorides and lack of manpower, will probably increase this risk (16), but so far the present results do not indicate such a trend.

In the present study it is important to consider findings in the context of the characteristics of the material analyzed. Given little variation in the outcome variables, one might expect relatively weak associations between dependent and their related independent variables (Table 2). There seems, however, to be a tendency to more caries in the urban than in the semi-urban and rural regions. This is supported by higher caries experience among the well-educated. The slightly higher caries experience among fluoride-containing toothpaste users compared with non-users also indicates a social gradient more than an unexpected response to fluoride as the most probable explanation. The higher prevalence among girls than boys may be due to the effect of earlier tooth eruption (17). In general, the overall low experience of dental caries with little variation in the sample investigated limits the possibilities of disclosing clear patterns with regard to association with independent variables.

The multiple regression analysis showed that the reason for the last visit to a dentist (usually emergency), sex, and oral hygiene were the three strongest variables explaining variation in dental caries. The correlation matrix showed a correlation pattern, particularly among social variables, residence (urban), reason for the last visit to a dentist, oral

hygiene habits (using a toothbrush), and education constituting a web of factors acting together. This pattern was not disclosed in the regression analysis because the variables with the single most influential impact were selected by the statistical procedure, thus masking the effect of other important factors.

The results of the present study indicate that the level of oral hygiene was poor and that gingivitis with bleeding gums seems to be endemic. According to the present results, slightly better oral hygiene was obtained by using a toothbrush and toothpaste than with traditional methods. However, since no difference in dental caries scores or bleeding sites was found to be related to oral hygiene, a disease-preventive level was obviously not reached. On the basis of the present results the potential benefit of the established traditional cleaning methods should not be ignored.

### Conclusions

The present investigation showed a low prevalence of dental caries, poor oral hygiene conditions, and gingivitis with bleeding papillae to be common among 12-year-old children from Bangladesh. There seems to be a social gradient linked to variation in caries experience, with more disease among urban, high social class children. However, as preventive activities are also more common in this group, no distinct pattern explaining variation in dental caries could be detected.

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