



Original Article

Prevalence of Dental Caries, Oral Hygiene Status, and Associated Risk Factors Among Schoolgoing Children of Rajshahi District in Bangladesh

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Abstract

Introduction: Dental caries is one of the most prevalent and chronic oral diseases, particularly in childhood, associated with multifactorial causation. **Objective:** The study aimed to determine the prevalence of dental caries, oral hygiene status, and associated risk factors among school-going children of Rajshahi District in Bangladesh.

Methods: This cross-sectional design type of descriptive study was carried out among primary school-going children of 5-13 years of age in the Rajshahi district. The sample size was 2000, and that was selected purposively. Data were collected through a partially structured questionnaire. Descriptive variables were explained with mean and standard deviation. The Chi-square test was applied to see the relationship with qualitative variables. Statistical significance was found by applying relevant statistical tests at an appropriate probability level ($p < 0.05$ or < 0.01). **Results:** A total of 2000 children between 5-13 years of age participated in this survey. The study findings showed a high prevalence of dental caries among 8-10-years old school children. Most (56.9%) of the respondents' fathers were workers, and most (86.3%) of the respondents' mothers were homemakers. It was found that 64.2% of the respondents' fathers and 74.05% of the respondents' mothers had below SSC level of education. About 60% of the respondents brushed their teeth twice a day, and a good number (81.0%) brushed their teeth before breakfast. The majority (68.80%) of the respondents had a family history of dental problems, and 45.6% had average oral hygiene. A large number (49.6%) of the respondents' favorite food was junk food. The relationship of age of the respondents with oral hygiene status was found to be statistically significant ($p < 0.001$) but not with sex, parents' education, and occupation ($p > 0.05$ each). The relationship of oral hygiene status of the respondents was found to be statistically significant with the frequency of tooth brushing ($p < 0.05$), time of tooth brushing ($p < 0.01$), family history of dental problems ($p < 0.05$), most favorite food ($p < 0.001$), dental plaque index ($p < 0.001$) and dental caries index ($p < 0.001$).

Conclusions: The prevalence of dental caries was higher among school-going children in the Rajshahi district of Bangladesh.

Keywords: Children, dental caries, oral hygiene, Bangladesh, prevalence,

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Introduction

Dental caries is the most prevalent and chronic oral disease, particularly in childhood age.^{1,2} It is a

progressive infectious process with a multifactorial etiology.^{3,4} Dietary habits, oral microorganisms that ferment sugars, and host

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susceptibility are co-existing factors for dental caries to initiate and develop.^{3,4,5} Dental caries have high morbidity potential. Thus, it has been the main focus of dental health professionals.⁶

Dental caries is caused by dental plaque deposits on the tooth surface.^{7,8} After intake of fermentable carbohydrates, *Streptococcus mutans* ferments it and produce a copious amount of acid, lowering the local pH to a level where the minerals of enamel and dentine dissolve.^{9,10,11} The frequent intake of sweets, dry mouth, and poor oral hygiene increases the chances of cavities.^{8,12} Dental caries causes tooth pain, discomfort, eating impairment, loss of the tooth, and delayed language development. Furthermore, dental caries affects children's concentration in school and imparts a financial burden on families.^{6,13} Risk factors such as sex, age, dietary habits, socioeconomic and oral hygiene status are associated with increased prevalence and incidence of dental caries in a population.¹⁴ Although the trend is not clear in developing countries, the burden of dental caries has been increasing among children due to the unlimited consumption of sugary substances, poor oral care practices, and inadequate health service utilization.¹⁵ Several researchers showed that dental caries affected 60–90% of school children in both developing and developed countries.^{16,17} Several studies showed that the prevalence of dental caries was up to 83.3% among Middle-Eastern school children.^{18,19,20} Furthermore, investigations revealed that most dental caries was higher among urban children.^{14,21} A study reported that the prevalence of dental caries was 36.5% among urban school-going children in Ethiopia.⁸

Moreover, studies have reported that children's age and sex and parents' education, occupation, and residential place impact their dental caries experiences.^{8,22,23}

Although dental caries is more prevalent in school children, there was no documented data on overall prevalence and associated factors in primary school children in Rajshahi district, Bangladesh. Therefore, the present study was carried out to investigate the prevalence of dental caries, oral hygiene status, and associated risk factors among

school-going children of the Rajshahi district in Bangladesh.

Materials and Methods

This was a cross-sectional descriptive study carried out among the primary school-going children aged 5–13 years in the Rajshahi district to assess the prevalence of dental caries, oral hygiene status, and associated risk factors. The sample size was 2000, which was selected following the purposive sampling technique. Data were collected through a partially structured questionnaire. Two schools from each Upazilla, namely, Bagha, Bagmara, Charghat, Durgapur, Godagari, Mohanpur, Paba, Puthia, and Tanore, and four schools from Rajshahi Metropolitan Thana, Boalia were selected. More or less 100 students from each school were included in the study. Prior to the commencement of the study, the research protocol was approved by the ethical committee of the Institute of Biological Sciences of the University of Rajshahi. In addition, the permission of the authority/Headmaster of different schools in the Rajshahi district was taken before starting the study.

The researcher collected data from the respondents by following standard clinical guidelines, and proper sterilization was maintained. All the recordings were carried out in the daylight, and the child was made to sit in an ordinary chair facing away from direct sunlight. The oral examination of the study subjects was conducted in respective schools using a plane mouth mirror under natural light and a community periodontal index (CPI) probe; as indicated by the WHO, CPI probes are used (standard tools). Baseline information on some selected socio-demographic characteristics and information regarding dental caries and oral hygiene practices of the respondents was collected.

The data were analyzed according to the objectives of the study by using window-based computer software devised with Statistical Packages for Social Sciences (SPSS-23). Exploratory data analysis was carried out to describe the study population where categorical variables were summarized using frequency tables

while continuous/descriptive variables were explained with/summarized as mean and standard deviation. The Chi-square test was performed to determine the associations with different variables.

Statistical significance was found by applying relevant statistical tests at an appropriate probability level ($p < 0.05$ or 0.01).

Results

It was found that out of 2000 respondents majority (55.4%) were in the age group of 8-10 years, 36.3 % were in the age group of 11-13 years, and only a very few (8.2%) were in the age group of 5-7 years (Table 1). It was found that 52.85% of the respondents were female, and 47.15% were male (Fig. 1). Furthermore, it was found that most (89.05%) of the respondents were Muslim, 7.90% were Hindu, 2.55% were Christian, and only 0.50% were from other religions (Fig. 2).

Regarding the occupation of the respondent's fathers, it was revealed that the majority (56.9%) were workers, 26.2% were business people, 9.6% were in Govt. service, and 7.1% were in private services (Table 2). Table no. 3 showed that most (86.3%) of the respondents' mothers were housewives, 8.6% were workers, 2.5% were in Govt. service, and 2.4% were in private services (Table 3). It was found that 64.2% of the respondents' fathers had below SSC level of education, 15.2% had HSC/SSC level of education, 14.7% were graduates, and 5.8% were illiterate (Table 4). Regarding the educational qualification of mothers, it was observed that most (74.05%) of the respondents' mothers had below SSC level of education, 13.1% had HSC/SSC level of education, 8.8% were graduates, and 4.05% were illiterate (Table 5). The above table showed that the majority (59.8%) of the respondents brushed their teeth twice a day, 38.4% brushed once, 1.8% brushed thrice daily, and 0.0% did not brush their teeth at all (Table 6). The above table showed that most (81.0%) of the respondents brushed their teeth before breakfast, 16.6% brushed after any meal, and 2.4% brushed after dinner (Table 7).

It was found that most (68.80%) of the respondents had a family history of dental problems, and 31.20% had no dental problems (Fig. 3). Furthermore, it was revealed that 45.6% of the respondents had average oral hygiene, 40.6% had good oral hygiene, 11.6% had poor oral hygiene, and 2.2% had very poor oral hygiene (Fig. 4). The above graph showed that most (49.6%) of the respondents' favorite food was junk food, 23.6% chose fruits, 15.4% chose vegetables, 7.7% chose carbohydrates, 3.4% liked protein, and 0.2% liked other food (Fig. 5).

Table no. 8 shows the relationship of oral hygiene status with age, sex, father's occupation, mother's occupation, father's education, and mother's education of the respondents. It was found that 37.57% of the respondents in the age group of 5-7 years had good oral hygiene status, 43.73% in the 8-10 years age group, and 36.64% in the 11 – 13 age group the respondents had good oral hygiene status. The association between age group and oral hygiene status was statistically significant ($p < 0.01$). Male respondents (39.24%) had good oral hygiene, 41.92% of the female respondents had good oral hygiene status, and the association was not found statistically significant ($p > 0.05$). It was found that 39.38% of the respondents who were in Govt. service had good oral hygiene status, 33.57% of respondents who were in private service had good oral hygiene, 39.24% of them who were businessmen had good oral hygiene, and 42.41% respondents who were workers had good oral hygiene. There was no significant relationship between the occupation of the fathers and oral hygiene status ($p > 0.05$). It was also found that 35.30% of the mothers who were in Govt. service had good oral hygiene status, 37.50% of them who were in private service had good oral hygiene, 39.72% who were housewives had good oral hygiene, and 42.41% who were workers had good oral hygiene. The association between these two variables was not significant ($P > 0.05$) [Table 8].

Table no. 8 also shows the relationships between the oral hygiene status of the respondents and with educational qualifications of fathers and mothers.

Table no. 9 shows the relationship of oral hygiene status of the respondents with the frequency of tooth brushing, time of tooth brushing, family history of dental problem, dental plaque, and dental caries index. It was found that 36.46% of the respondents who brushed their teeth once, 43.48% of them who brushed twice, and 33.33% of the respondents who brushed thrice daily had good oral hygiene status. The relationship between the frequency of tooth brushing and the oral hygiene status of the respondents was found significant ($p < 0.05$). It was also found that 38.44% of the respondents who brushed their teeth after any meal, 31.25% who brushed after dinner, and 41.38 respondents who brushed their teeth in the morning had good oral hygiene. The relationship between the time of tooth brushing and the oral hygiene status of the respondents was found significant ($p < 0.05$) [Table 9].

Only 36.19% of the respondents who had a family history of the dental problem had good oral hygiene, and 50.48% of respondents who did not have any family history of the dental problem had good oral hygiene, and the association was found statistically significant ($p < 0.01$). In addition, it was found that the association between the consumption of most favorite foods and the oral hygiene status of the respondents was substantial ($P < 0.01$) [Table 9].

It was found that 54.43% of the respondents who had mild dental plaque had good oral hygiene, 5.24% of respondents who had moderate dental plaque had good oral hygiene, and none of the respondents who had severe dental plaque had good oral hygiene. The difference was highly significant ($p < 0.001$). Similarly, it was also found that 57.68% of the respondents who had mild dental caries had good oral hygiene, 8.67% of respondents who had moderate dental caries had good oral hygiene, and no respondents who had severe dental caries had poor oral hygiene, and the difference was highly significant ($p < 0.001$) [Table 9].

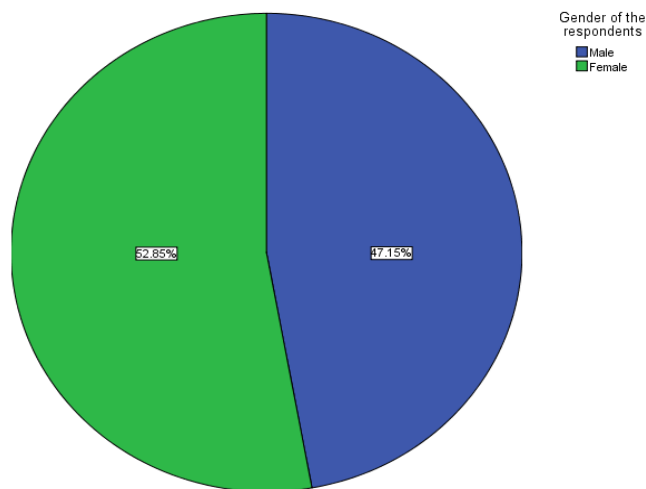


Figure 1: Distribution of respondents by gender

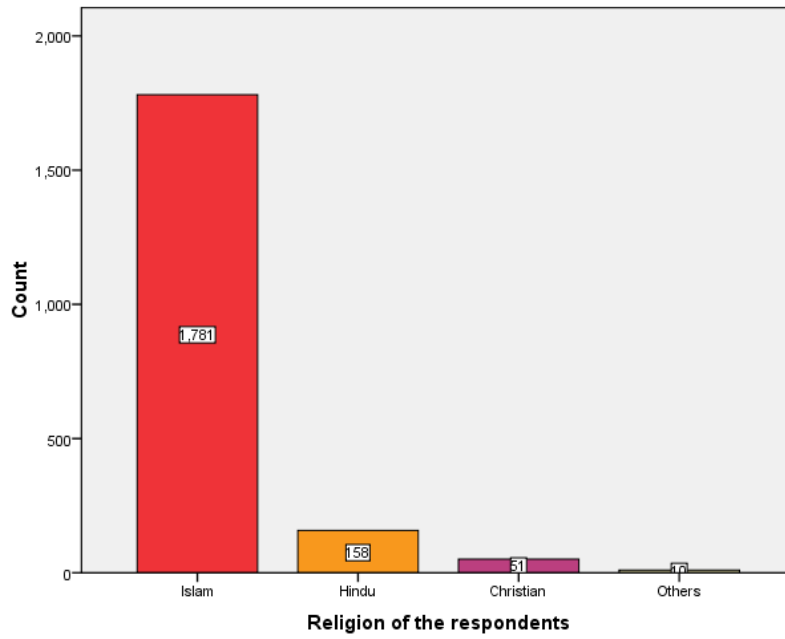


Figure 2: Distribution of respondents by religion

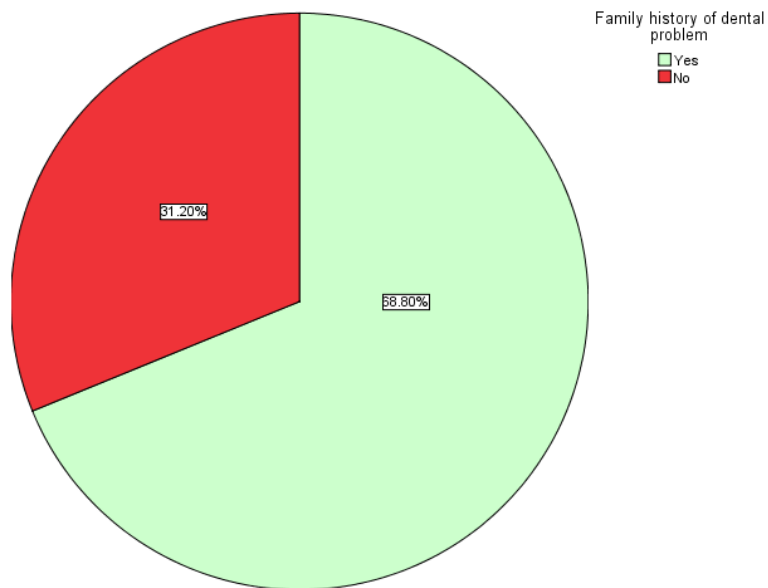


Figure 3: Distribution of respondents by family history of dental problem

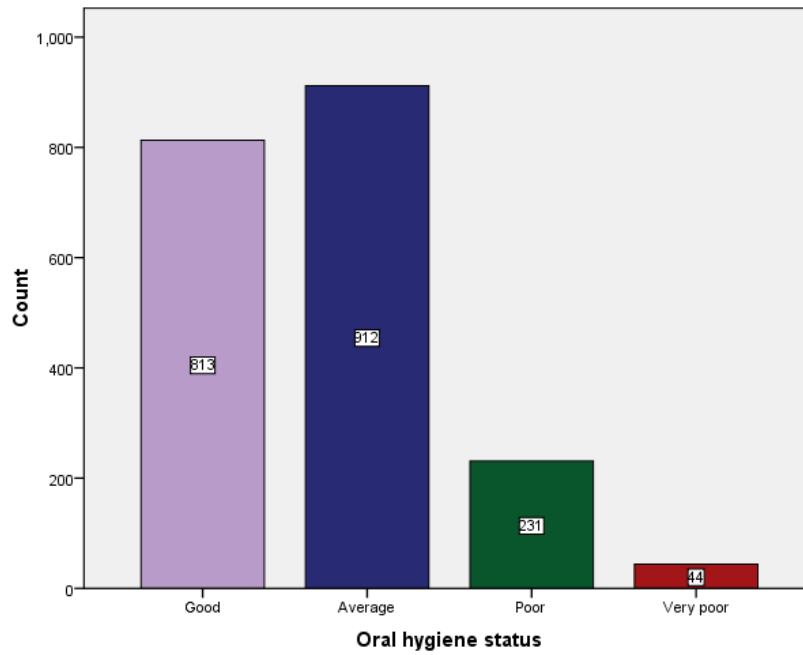


Figure 4: Distribution of respondents by oral hygiene status

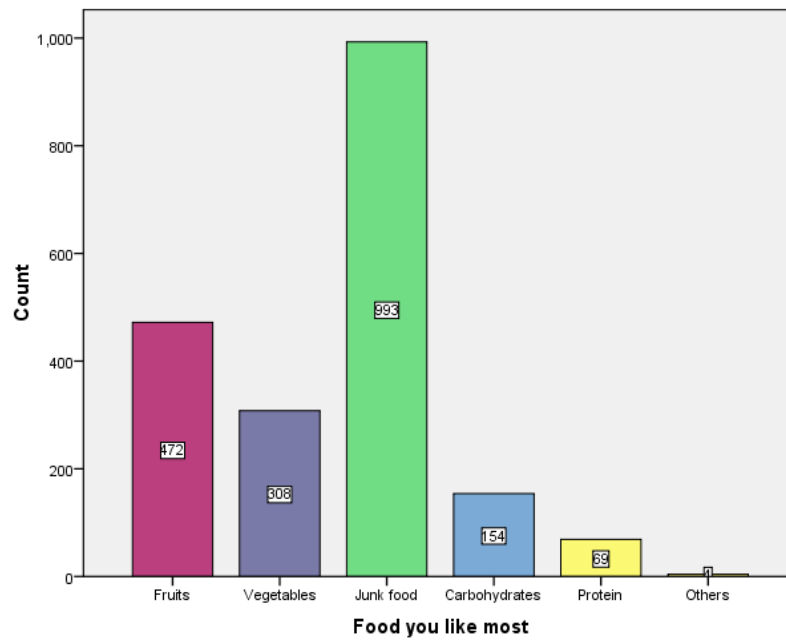


Figure 5: Distribution of respondents by most favorite food

TABLES**Table 1: Distribution of the respondents by age group**

Age in group	Respondents	
	No.	%
5-7 years	165	8.2%
8-10 years	1109	55.4%
11-13 years	726	36.3%
Total	2000	100.0

Table 2: Distribution of the respondents by the occupation of father

Occupation of respondent's father	Respondents	
	No.	%
Govt. service	193	9.6%
Private service	143	7.1%
Business	525	26.2%
Worker	1139	56.9%
Total	2000	100.0

Table 3: Distribution of the respondents by the occupation of mother

Occupation of mother	Respondents	
	No.	%
Govt. Service	51	2.5%
Private Service	48	2.4%
Housewife	1727	86.3%
Worker	173	8.6%
Total	2000	100.0

Table 4: Distribution of the respondents by fathers' educational qualification

Educational qualification of father	Respondents	
	No.	%
Graduate	295	14.7
HSC/SSC	304	15.2%
Below SSC	1284	64.2
Illiterate	117	5.8%
Total	2000	100.0

Table 5: Distribution of the respondents by educational qualification of mother

Educational qualification of mother	Respondents	
	No.	%
Graduate	176	8.8%
HSC/SSC	262	13.1%
Below SSC	1481	74.05%
Illiterate	81	4.05%
Total	2000	100.0

Table 6: Distribution of the respondents by frequency of tooth brushing

Frequency of tooth brushing	Respondents	
	No.	%
Once	767	38.4 %
Twice	1196	59.8 %
Thrice	36	1.8 %
Not at all	1	0.0 %
Total	2000	100.0

Table 7: Distribution of the respondents by the time of tooth brushing

Time of tooth brushing	Respondents	
	No.	%
After any meal	333	16.6 %
After dinner	48	2.4 %
Before breakfast	1619	81.0 %
Total	2000	100.0

Table 8: Distribution of the respondents by oral hygiene status with their socio-demographic characteristics (n = 2000).

Variable	Group	Oral hygiene status				Test statistic	p-value
		Good N (%)	Average N (%)	Poor N (%)	Very poor N (%)		
Age	5-7 years	62(37.57)	77(46.67)	20(12.12)	6(3.63)	24.729	0.000
	8-10 years	485(43.73)	456(41.12)	141(12.71)	27(2.44)		
	11-13 years	266(36.64)	379(52.20)	70(9.64)	11(1.52)		

Gender	Male	370(39.24)	453(48.07)	98(10.39)	22(2.33)	5.417	0.144
	Female	443(41.92)	459(43.42)	133(12.58)	22(2.08)		
Occupation of father	Govt. Service	76(39.38)	80(41.45)	30(15.54)	7(3.63)	13.435	0.144
	Private Service	48(33.57)	78(54.55)	14(9.79)	3(2.09)		
	Business	206(39.24)	254(48.38)	55(10.48)	10(1.90)		
	Worker	483(42.41)	500(43.90)	132(11.59)	24(2.10)		
Occupation of mother	Govt. Service	18(35.30)	27(52.94)	5(9.80)	1(1.96)	13.946	0.124
	Private Service	18(37.50)	21(43.75)	7(14.58)	2(4.17)		
	Housewife	686(39.72)	798(46.21)	205(11.87)	38(2.20)		
	Worker	91(52.60)	66(38.15)	13(7.52)	3(1.73)		
Educational qualification of father	Graduate	117(39.67)	144(48.82)	29(9.83)	5(1.70)	4.962	0.838
	HSC/SSC	116(38.15)	146(48.03)	34(11.19)	8(2.63)		
	Below SSC	531(41.35)	569(44.31)	154(12.00)	30(2.34)		
	Illiterate	49(41.88)	53(45.30)	14(11.96)	1(0.86)		
Educational qualification of mother	Graduate	74(42.05)	88(50.00)	11(6.25)	3(1.70)	8.624	0.473
	HSC/SSC	100(38.17)	121(46.18)	35(13.36)	6(2.29)		
	Below SSC	609(41.12)	661(44.63)	177(11.95)	34(2.30)		
	Illiterate	30(37.03)	42(51.86)	8(9.88)	1(1.23)		

Table 9: Distribution of the respondents by oral hygiene status with oral hygiene practices (n = 2000).

Variable	Group	Oral hygiene status				Test statistic	p-value
		Good N (%)	Average N (%)	Poor N (%)	Very poor N (%)		
Frequency of tooth brushing	Once	280(36.46)	369(48.05)	97(12.63)	22(2.86)	18.891	0.026
	Twice	520(43.48)	529(44.23)	125(10.45)	22(1.84)		
	Thrice	12(33.33)	14(38.89)	9(25.00)	1(2.78)		
Time of tooth brushing	After any meal	128(38.44)	139(41.74)	56(16.82)	10(3.00)	17.662	0.007
	After	15(31.25)	22(45.83)	9(18.75)	2(4.17)		

	dinner						
	Before breakfast	670(41.38)	751(46.39)	166(10.25)	32(1.98)		
Family history of dental problems	Yes	498(36.19)	661(48.03)	184(13.37)	33(2.40)	40.776	0.00 0
	No	315(50.48)	251(40.22)	47(7.53)	11(1.76)		
Most favorite food	Fruits	162(34.32)	236(50.00)	68(14.41)	6 (1.27)	80.020	0.00 0
	Vegetable	145(47.08)	128(41.55)	31(10.06)	4(1.30)		
	Junk food	444(44.71)	415(41.79)	102(10.27)	32(3.22)		
	Carbohydrate	53(34.41)	75(48.70)	24(15.58)	2(1.30)		
	Protein	8(11.59)	57(82.61)	4(5.80)	0(0.0)		
	Others	1(25.00)	1(25.00)	2(50.00)	0(0.0)		
Dental Plaque Index	Mild	786(54.43)	593(41.06)	58(4.02)	7(0.48)	801.00 3	0.00 0
	Moderate	27(5.24)	313(60.77)	153(29.71)	22(4.27)		
	Severe	0(0.0)	6(14.63)	20(48.78)	15(36.58)		
Dental Caries Index (DMF Scoring)	Mild	762(57.68)	545(41.26)	14(1.06)	0(0.0)	1468. 381	0.00 0
	Moderate	51(8.67)	366(62.24)	165(28.06)	6(1.02)		
	Severe	0(0.0)	1(1.10)	52(57.14)	38(41.76)		

Discussion

Dental caries is a neglected public health issue in Bangladesh. Regarding the age distribution of the respondents, it was found that out of 2000 respondents majority (55.4%) were in the age group of 8-10 years, and only a very few, 8.2% were in the age group of 5-7 years. In a study by Haque et al.²⁴ in Bangladesh, approximately 34.0 % of participants were 10–12 years old. In another study, the majority of children (69.6%) were from 11 to 15 years of age.²⁵

Most (52.85%) of the respondents were female in our study, In a study by Haque et al.²⁴ in Bangladesh, more than three-fifths of the participants were female (63.2 %), and the remaining 36.8 % were male. In another study,²⁵ a total of 147 children participated in the study. Of these, 82 (55.4%) were girls, dissimilar to our findings. A good number (59.8%) of the

respondents brushed their teeth twice daily, 38.4% brushed once, and 1.8% brushed thrice daily (Table No. 6). Around 83% of the students brushed once daily, and only 17% brushed twice a day found in another study²⁶ in Bangladesh. The poor habit of tooth cleaning was significantly associated with dental caries. Children who had cleaned their teeth revealed a lower prevalence of dental caries. It is generally true that cleaning teeth will remove away the food debris from the oral. Therefore, *Streptococcus mutans* cannot get enough nutrients and time for growth and no acid production, which causes dental caries development.^{27,28} Most (81.0%) of the respondents brushed their teeth before breakfast, 16.6% brushed after any meal, and 2.4% brushed after dinner (Table No. 7). In another study,²⁶ most children brushed in the morning, before or after their first meal, while only 8% brushed at night as well before bedtime. One hundred five (71.4%) of the

children were used to clean their teeth. Of whom, 16 (15.2%) cleaned their teeth before and after a meal. However, nearly half of the children cleaned their teeth only after meal intake.²⁵

It was revealed that most (45.6%) of the respondents had average oral hygiene, 40.6% had good oral hygiene, 11.6% had poor oral hygiene, and 2.2% had very poor oral hygiene (Fig. no. 04). A similar finding was reported in Tanzania (Masumo *et al.*, 2012), stating that poor oral hygiene practice was the associated factor of dental caries. Moreover, other studies established such associations.²⁹ Most (49.6%) of the respondents' favorite food was junk food; 23.6% chose fruits, 15.4% chose vegetables, 7.7% chose carbohydrates, 3.4% liked protein, and 0.2% liked other food. On bivariate analysis, the habit of consumption of sweet foods has been significantly associated with dental caries. This finding was in agreement with a study done in Saudi Arabia.⁵ This might be associated with copious acid production by cariogenic bacteria like *Streptococcus mutans* that are adherent to teeth as a result of fermentation of sweet foods. Later the enamel of the tooth went into tooth decay.^{5,28}

The relationships of oral hygiene status with the age group of the respondents, frequency of tooth brushing, timing of tooth brushing, family history of dental problems, most favorite food, dental plaque index, and dental caries index were found statistically significant. In another study,²⁶ results show that 81% of the children interviewed used a toothbrush and toothpaste to clean their teeth. The other 15% used their finger or neem stick (aka meshwork) and an abrasive such as toothpaste, charcoal, ash, and salt. In contrast, other studies showed that toothbrushes and toothpaste were the most common means of maintaining oral hygiene.^{8,17}

Conclusion

Oral health is a core component of general health and well-being. A healthy mouth enables an individual to speak, eat, and socialize without experiencing active disease, discomfort, or embarrassment. A few aspects of health care

include access to personal control and oral hygiene, which simple behavioral changes can improve. The study reveals that the students have limited awareness about oral health and poor knowledge of oral hygiene habits. Oral health awareness and hygiene practices amongst the school-going children were found to be very poor and created a much-needed niche for implementing school-based oral health awareness and education projects/programs.

Conflict of interest: None declared

References

- Okoye LO, Ekwueme OC. Prevalence of Dental Caries in a Nigerian Rural Community: A Preliminary Local Survey. *Ann Med Health Sci Res* 2011; 1:187–196.
- Dawkins E, Michimi A, Ellis-Griffith G, Peterson T, Carter D, English G. Dental caries among children visiting a mobile dental clinic in south central Kentucky: a pooled cross-sectional study. *BMC Oral Health* 2013; 13:19.
- Franco FE, Amoroso P, Marin JM, Ávila FA. Detection of *Streptococcus mutans* and *Streptococcus sobrinus* in dental plaque samples from Brazilian preschool children by Polymerase Chain Reaction. *Braz Dent J* 2007; 18: 329–333.
- Garcla-Closa R, Garcla-Closas M, Serra-Majem L. A cross-sectional study of dental caries, intake of confectionery and foods rich in starch and sugars, and salivary counts of *Streptococcus mutans* in children in Spain. *Am J Clin Nutr* 1997; 66:1257–1263.
- Colak H, Corul T, Dulgergi CT, Dalli M, Hamidi MM. Early childhood caries updates A review of causes, diagnosis, and treatments. *J Nat Sci Biol Med* 2013; 4:29–38.
- Moses J, Rangeeth BN, Gurunathan D. Prevalence of dental caries, old socioeconomic school going children of Chid Tambaram status and treatment needs among 5 to 15-year-old school going children Of Chidambaram. *J Clin Diagn Res* 2011; 5:146–151.
- Maher R, Rahimtoola S, Khan A, Bratthall D. Prevalence of mutans streptococci and dental caries in Pakistani children. *J Pak Med Assoc* 1992; 42:213–215.
- Ayele FA, Taye BW, Ayele TA, Gelaye KA. Predictors of dental caries among children 7–14 years old in Northwest Ethiopia: a community-based cross-sectional study. *BMC Oral Health* 2013; 13(1): 7.
- Tinanoff N, Michael MS, Kanellis MJ, Vargas CM. Current understanding of the epidemiology, mechanisms, and prevention of dental caries in preschool children. *Pediatr Dent* 2002; 24:543–551.
- Amoroso P, Ávila FA, Gagliardi CM. Prevalence of different *Streptococci* species in the oral cavity of children and adolescents. *Braz J Oral Sci* 2003; 2:164–168.
- Okada M, Soda Y, Hayashi F. Longitudinal study of dental caries incidence associated with *Streptococcus*

- mutans* and *Streptococcus sobrinus* in preschool children. J Med Microbiol 2005; 54:661–665.
12. Ritter AV. Dental caries talking with Patients. J Esthet Restor Dent 2004; 16:76.
 13. Zhang S, Liu J, Lo EC, Chu C. Dental caries status of Bulang preschool children in Southwest China. BMC Oral Health 2014; 14:2–7.
 14. Okoye LO. Caries experience among school children in South-Eastern Nigeria. Caries Res 2010; 44:171.
 15. World Health Organization. Prevention Methods and Program for Oral Diseases WHO Technical Report Series 713. Geneva: WHO. 1984.
 16. Petersen PE, Bourgeois D, Ogawa H, Estupinan-Day S, Ndiaye C. The global burden of oral diseases and risks to oral health. Bull World Health Organ 2005; 83 (9): 661–9.
 17. Dixit LP, Shakya A, Shrestha M, Shrestha A. Dental caries prevalence, oral health knowledge and practice among indigenous Chepang school children of Nepal. BMC Oral Health 2013; 13(1): 20.
 18. Jessri M, Jessri M, Rashidkhani B, Kimiagar SM. Oral health behaviors in relation to caries and gingivitis in primary-school children in Tehran. Eastern Mediterranean Health Journal 2008; 19(6):527–534.
 19. Ahmed NA, Åstrøm AN, Skaug N, Petersen PE. Dental caries prevalence and risk factors among 12-year old schoolchildren from Baghdad, Iraq: a post-war survey. International Dental Journal 2007; 57(1):36–44.
 20. Al-Akwa AA, Al-Maweri SA. Prevalence of dental caries among Yemeni schoolchildren: a large school-based survey. Global Journal of Health Science 2017; 9(5):1–9.
 21. Udoye CI, Aguwa E, Chukezie R, Ezeokenwa M, Jerry-Oji O, Okpaji, C. Prevalence and distribution of caries in the 12–15-year urban school children in Enugu, Nigeria. J Dent Sci 2012; 7(2):12-19.
 22. Veiga N, Pereira C, Amaral O. Prevalence and determinants of dental caries in Portuguese children. Procedia-Social and Behavioral Sciences 2015; 171: 995–1002.
 23. Shanthi M, Reddy BV, Venkataramana V, Gowrisankar S, Reddy BT, Chennupati S. Relationship between drinking water fluoride levels, dental fluorosis, dental caries and associated risk factors in 9–12 years old, school children of Nelakondapally Mandal of Khammam district, Andhra Pradesh, India: a cross-sectional survey. Journal of International Oral Health 2014; 6(3):106–110.
 24. Haque S E, Rahman M, Itsuko K, Mutahara M, Kayako S, Tsutsumi A, Islam M J and Mostofa MG. Effect of school-based oral health education in preventing untreated dental caries and increasing knowledge, attitude, and practices among adolescents in Bangladesh. BMC oral health 2013; 16: 44.
 25. Mulu W, Demi lie T, Yimer M, Meshesha K, and Abera B. Dental caries and associated factors among primary school children in Bahir Dar city: a cross-sectional study. BMC research notes 2014; 7: 949.
 26. Bhuiyan MA, Anwar HB, Anwar RB, Ali MN, and Agrawal P. Oral Hygiene Awareness and Practices among a Sample of Primary School Children in Rural Bangladesh. Dentistry journal 2020; 8(2): 36.
 27. Roberson TM, Heymann HO, Swift EJ. Sturdevants the art and science of operative dentistry. 2000: 66–132.
 28. Dawani N, Nisar N, Khan N, Syed S, Tanweer N. Prevalence and factors related to dental caries among preschool children of sadder town, Karachi, Pakistan: a cross-sectional study. BMC Oral Health 2012; 12:59.
 29. Declerck D, Roos Leroy R, Martens L et al. Factors associated with prevalence and severity of caries experience in preschool children. Community Dent Oral Epidemiol 2008; 36: 168–178.

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