National oral health survey in 6- and 12-year-old Bhutanese school children

Sonam Ngedup[1], Dorji Phurpa[2]

[1,2]Dental Department, Jigme Dorji Wangchuck National Referral Hospital, Thimphu, Bhutan

ABSTRACT

Introduction: Dental caries is a highly prevalent and a significant public health problem affecting 70% to 95% of children, including adults in member states of the South East Asia region. Epidemiological data on the prevalence of dental caries amongst Bhutanese children at the national level is non-existent. The objective of this study was to determine the prevalence of dental caries, periodontal status, traumatic dental injuries and fluorosis in 6-and 12-year-old school children. **Methods:** A descriptive cross-sectional survey in two age groups of school children in Bhutan was conducted in 2014. A total of 2904 students participated in the survey. A multistage cluster random sampling method was adopted that included samples from both urban and rural schools. The assessments for dental caries and periodontal conditions were done as per modified WHO methodology and criteria. Dental trauma and fluorosis were identified as present or absent irrespective of severity levels. **Results:** Dental caries prevalence was 41.90% and 83.80% with mean DMFT/ dmft 0.80 and 5.54 for 12-and 6-year-olds respectively. Urban students had more caries than their rural counterparts. Overall, 13.00% of 12-year-olds had healthy gingiva but more calculus was detected in rural children. Dental trauma and fluorosis were very low (0.01% to 5.00%) in both the age groups. **Conclusions:** Caries prevalence was very high in 6-year-olds while periodontal status in 12-year-olds was poor. Rural school children had lower caries levels compared to their urban counterparts. Imparting oral health awareness among parents can lower caries severity in younger children.

Keywords: Dental caries; Dental trauma; Fluorosis; Periodontal status.

INTRODUCTION

The oral health program and clinic based curative dental services of Bhutan have developed over the last several decades. In 1972, a small dental unit with limited resources was started alongside the main hospital in the capital city Thimphu[1]. Over four decades,the unit has become a well-established department of dentistry at the Jigme Dorji Wangchuck National Referral Hospital (JDWNRH). Great improvements have been achieved, although shortages persist[2].

Dental caries is a highly prevalent and a significant public health problem, affecting more than 60-90% school children in the world[3]. In member states of the World Health Organization (WHO) South East Asia Region, up to 70-95% children including adults have tooth decay[4]. However, the oral health status of the Bhutanese population in general and children in particular is presently unknown, thus hampering proper oral health planning, program implementation and their evaluation. Records maintained by the ministry of health and hospitals also indicate the seriousness of dental caries as a public health problem whereby curative services have taken precedence over preventive programs in the dental public health care system[5-6]. Sporadic dental health surveys with smaller samples were conducted in a few places starting in 1985, with results showing low index of mean decayed, missing and filled permanent teeth (DMFT)[7-9]. No surveys were done on children with primary teeth nor that attempted to gauge incidence of traumatic teeth or dental fluorosis. Given the long period of time and limited scope of previous studies, the present survey was conducted to find out the prevalence of dental caries, periodontal status, trauma and fluorosis in 6-and 12-year-old children at the national level.

Corresponding author:
SonamNgedup
gortshom@gmail.com

METHODS

This descriptive cross-sectional survey was conducted in 40 schools covering all 20 districts in Bhutan. Clinical examination was done from May till October, 2014. The research protocol and informed consent were approved by the Research Ethics Board of Health and the National Statistics Bureau (NSB), Bhutan.

Inclusion and exclusion criteria

The study included Bhutanese school children having reached either age 6 or 12 years who were under the care of biological parents or legal guardians.

Children with the presence of 20 erupted primary teeth in 6 year olds and 28 permanent teeth in 12-year-olds were included. In either age group, children with disabilities, non-Bhutanese, those who did not provide parental consents or who were absent on oral examinations days were excluded from the study. A letter explaining the purpose of the survey was sent through children to parents/guardians who signed and returned it as proxy for positive consent.

Sampling

A multistage cluster sampling method was adopted. Clustering was based on four regions, districts and finally urban and rural locations. The western, central, southern and eastern regions havesix, three, five and six districts respectively. In all regions,

each district was represented by one urban and one rural school which were selected randomly based on the alphabetical order of school names with maximum number of sample age children within each geographic stratum. A school was considered urban if it was located within the municipal boundary of the main district town. Those schools away from the district capital and which had village settlements in the vicinity were considered rural location. The sample size calculation was based on achieving high precision resulting in 406 for both age groups for each region. Thus, 3,136 students formed the final sample size, comprised of 1,550 and 1,586 6-and 12-year-olds respectively[10].

Materials

Pre-sterilized dental explorers and graded periodontal probes, in conjunction with mouth mirrors were used to examine caries and periodontal conditions (gum condition) as per WHO criteria for oral health surveys[11].Two calibrated clinicians examined all dental and gingival conditions with children seated in ordinary chair under natural light.

Caries and periodontal scoring

Dental caries status was recorded on a modified oral examination form as per the WHO criteria for oral health surveys in 6-and 12-year-olds. The extent of dental decay was measured using the dmft/DMFT (primary dentition/permanent dentition) indices. This is a count of the number of teeth in a person's mouth that are decayed, missing (extracted) or filled. Teeth that were sound, decayed without filling, filled but have decays and those missing due to caries were coded as 0,1,2,3 and 4 respectively.

Periodontal condition was assessed in 12-year-olds only. The *Ramfjord* teeth numbers 16, 11, 26, 36, 41 and 46 were assessed for periodontal conditions using Community Periodontal Index (CPI) scoring probe. Healthy gingiva was scored CPI=0, bleeding gums CPI=1 and presence of calculus as CPI=212.

Dental trauma and fluorosis

Dental trauma involving eitherenamel, dentine or pulp was coded as T=1, withT=0 for sound tooth. A similar coding system was followed to indicate presence (F=1) or absence (F=0) of dental fluorosis. In both cases, severity levels were not measured.

Data analysis

The data were first coded and then entered into an excel spread sheet before transferring to the Statistical Package for Social Sciences (SPSS version IBM 20). The descriptive statistics for mean, standard deviation (SD), percentages, frequency and range described the caries, periodontal (gum) status, tooth injury and fluorosis as appropriate.

RESULTS

A total of 3,136 students including 1,550 6-year-olds and 1,586 12-year-olds from public schools were approached and 1,393 and 1,511 participated. The final response rates were 89.87% for 6-year-olds and 95.27% for 12-year-olds.

Caries

Comparative caries prevalence in the two age groups nationally and by regions is shown in Table 1 and 2. The overall national prevalence of caries was 83.80% among 6-year-olds (Table 1) and 41.20% among 12-year-olds (Table 2). The mean dmft/DMFT was 5.54 for 6-year-olds and 0.80 for 12-year-olds. In both age groups, urban children had more caries than their rural counterparts (88.40% vs. 78.60%) and (44.10% vs. 39.70%) among the 6- and 12-year-old age groups respectively.

Periodontal condition

The periodontal status in 12-year-olds at the national level and by urban-rural locations is shown in Figure

Table 1. Dental status in 6-year-old children by region and school location, 2014(*n*=1393)

Area	Sample (*n*)	caries affected teeth *n*(%)	caries free teeth *n*(%)	decayed (Mean±SD)	missing (Mean±SD)	filled (Mean±SD)	dmft (Mean±SD)
National	1393	1168(83.80)	225(16.20)	5.31± 4.07	0.15±0.54	0.08±0.40	5.54 ± 5.00
Urban	683	604(88.40)	79(11.60)	6.07 ± 4.09	0.17 ± 0.54	0.11 ± 0.48	6.25 ± 5.10
Rural	710	558(78.60)	152(21.40)	4.57 ± 3.92	0.13 ± 0.54	0.05± 0.31	4.75 ± 4.80
Western	401	345(86.00)	56(14.00)	5.40 ± 4.02	0.16 ± 0.59	0.07 ± 0.33	5.63 ± 4.91
Urban	198	198(91.90)	16(8.10)	6.23 ± 4.03	0.20 ± 0.56	0.12 ± 0.44	6.55 ± 5.00
Rural	203	163(80.30)	40(19.70)	4.59 ± 3.84	0.12 ± 0.61	0.02± 0.14	4.73 ± 4.58
Eastern	328	275(83.80)	53(16.20)	5.62 ± 4.13	0.13 ± 0.51	0.08 ± 0.38	5.83 ± 5.01
Urban	160	137(85.60)	23(14.40)	6.30 ± 4.28	0.14 ± 0.48	0.08 ± 0.40	6.51 ± 5.15
Rural	168	138(82.10)	30(17.90)	4.98 ± 3.88	0.11 ± 0.53	0.08 ± 0.37	5.17 ± 4.78
Central	281	244(86.80)	37(13.20)	5.60 ± 3.95	0.21 ± 0.61	0.10 ± 0.45	5.91 ± 4.08
Urban	138	126(91.30)	12(8.70)	6.43 ± 4.01	0.19 ± 0.59	0.11 ± 0.41	6.73 ± 4.99
Rural	143	118(82.50)	25(17.50)	4.81 ± 3.75	0.22 ± 0.63	0.10 ± 0.48	5.13 ± 4.84
Southern	383	304(79.40)	79(20.60)	4.72 ± 4.12	0.11 ± 0.45	0.08 ± 0.46	4.91 ± 5.00
Urban	187	165(88.20)	22(11.80)	5.44 ± 4.02	0.15 ± 0.52	0.14 ± 0.62	5.73 ± 5.14
Rural	196	139(70.90)	57(29.10)	4.02 ± 4.10	0.08 ± 0.37	0.02 ± 0.20	4.12 ± 4.66

Table 2. Dental status in 12-year-old children by region and school location, 2014 (*n*=1511)

Area	Sample	Caries affected teeth *n*(%)	Caries free teeth *n*(%)	Decayed (Mean ± SD)	Missing (Mean ± SD)	Filled (Mean ± SD)	dmft (Mean±SD)
National	1511	633(41.90)	878(58.10)	0.75±1.14	0.03±0.18	0.06±0.30	0.8±1.52
Urban	743	328(44.10)	415(55.90)	0.77±1.10	0.03±0.20	0.07± 0.34	0.87±1.64
Rural	768	305(39.70)	463(60.30)	0.73±1.18	0.02±0.15	0.05± 0.25	0.80±1.58
Western	405	162(40.00)	243(60.00)	0.68±1.02	0.02±0.14	0.05±0.30	0.75±1.46
Urban	202	85(42.10)	117(57.90)	0.71±1.05	0.02±0.17	0.09± 0.38	0.82± 1.60
Rural	203	77(37.90)	126(62.10)	0.65± 0.99	0.01± 0.12	0.02± 0.17	0.68± 1.28
Eastern	375	171(45.60)	204(54.40)	0.89 ± 1.28	0.02 ± 0.16	0.05 ± 0.29	0.96 ± 1.72
Urban	182	84(46.20)	98(53.80)	0.84 ± 1.14	0.03 ± 0.18	0.09 ± 0.38	0.96 ± 1.68
Rural	193	87(45.10)	106(54.90)	0.93 ± 1.41	0.01 ± 0.14	0.02 ± 0.14	0.96 ± 1.68
Central	321	146(45.50)	175(54.50)	0.75 ± 1.12	0.03 ± 0.21	0.11 ± 0.44	0.89 ± 1.77
Urban	154	73(47.40)	81(52.60)	0.74 ± 0.99	0.05 ± 0.26	0.08 ± 0.43	0.87 ± 1.66
Rural	167	73(43.70)	94(56.30)	0.75 ± 1.24	0.02 ± 0.15	0.14 ± 0.45	0.91 ± 1.83
Southern	410	154(37.60)	256(62.40)	0.70 ± 1.11	0.03 ± 0.19	0.01 ± 0.12	0.74 ± 1.42
Urban	205	86(42.00)	119(58.00)	0.80 ± 1.19	0.03 ± 0.21	0.01 ± 0.10	0.84 ± 1.47
Rural	205	68(33.20)	137(66.80)	0.60 ± 1.04	0.02 ± 0.18	0.02 ± 0.14	0.64 ± 1.34

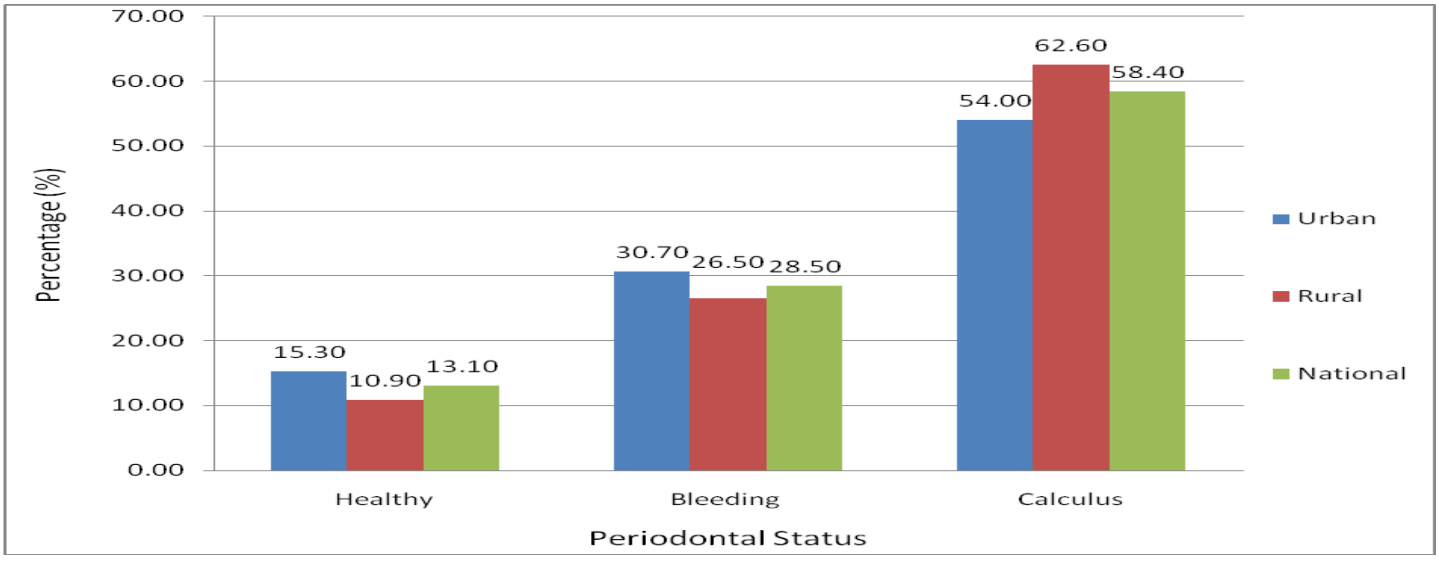

Figure 1. Periodontal status in 12-year-old students, 2014 (*n*=1511)

1. Urban students had healthy score for 15.30% with similar higher bleeding score at 30.70%. The presence of calculus among urban students was lowest compared to that of overall and rural (54.00% vs. 58.40% vs. 62.60%).

Traumatic dental injuries and fluorosis

Dental trauma was evident in 0.10% of 6-year- olds and 3.00% of 12 year old. Dental fluorosis was present in 2.00% of 6-year-olds and 5.00% of 12-year-children.

DISCUSSION

This is the first time a study achieved a national survey of oral health among 6 and 12 years old school children in Bhutan, finding a high level of caries, with lower levels among older children compared to younger and among urban compared to rural children. The caries and periodontal scores among southern school children were better than from other regions irrespective of the school locations. The prevalence of caries (41.93%) in 12 year old school children in our study was lower than in the 2008 study by Ngedup S et al[8]. This decline in caries by more than 15% may be attributed to improved literacy, income and dental manpower with attendant positive oral behavior, knowledge and attitudes. It may also be due to a difference in the sample, whereby our current study is more nationally representative.

While the proportion with caries was high, our findings indicate that the caries severity in 12 years old is low with the mean DMFT 0.82. According to FDI/WHO criteria, this level already achieves the goals of the international dental bodies[13,14].

The study in three eastern Indian states of Sikkim,

Orissa and West Bengal assessed the caries situation in urban versus rural areas among three age brackets and found that caries were very high (48.30% to 61.80%) among 5-6 year groups, with urban children having more caries than rural counterpart which is consistent with this finding[15]. In contrast, Gorbatova et al. found more caries in 6 year old north Russian rural children[16]. In an Indian study, Das UM et al. found caries in 6 year olds to be 57.21% in Bangalore city which is much lower than those in our study[17].

The result from our study also suggests that there is higher caries prevalence in urban children than their rural counterparts in both age groups. This contrast could possibly be due to dietary factors which we didn't look at for association.

Regarding periodontal condition, with only 13.10% being healthy, this aspect of oral hygiene of children in the survey could be stated as poor and in need of concerted professional care. Of note, a 58.00% of calculus similar to our study was detected in12-year-olds in Bulang, China[18]. Regarding urban-rural periodontal status, more urban children had healthier gingiva with less calculus than rural school children. Although no research had been done in the country that looked into factors, it could be due to more brushing frequency and better access to dental services in urban settings.

The national Department of Dentistry presently performs tooth cleaning mainly on adult patients, which suggests that children are neglected; this could have detrimental effects on the morbidity and mortality of teeth as children grow into adulthood[6,19]. As pointed out previously, these findings on periodontal conditions indicate not only the importance of oral health education in schools but also a need forresearch on barriers to dental service utilization.

Both dental injury and fluorosis were found to be low in both 6 and 12 years old in Bhutan. This stands in contrast with other locations; for example, data shows trauma at 8.00-32.00% among children 7-14 year olds in the Middle East and at 15-36.80% in Latin American, mostly in Brazilian children[20,21]. In Spain, Valencia school children have nearly the same dental injury percentages (6.00%) thus confirming findings in our study[22]. Although the number, type and severity of dental injuries per patient differ according to the patient age and causes of injury, trauma was not truly graded in our study. The most common cause of tooth injury could be uncomplicated enamel fracture as found by Elisa B. Bastone et al[23].

Dental fluorosis was found to be very low in both age groups. This is consistent with the low levels of fluoride in drinking waters in Bhutan[24,25]. A study in 12-year-olds in the central Indian state of Andra Pradesh further corroborates the link between optimal fluoride, fluorosis and caries[26-28].

This survey findings were representative from schools samples only where physically challenged children with separate schools and those out of schools were not included which may have altered the results. Dental trauma was also low, not permitting examination of associated risk factors or by sub-groups. The recently introduced International Caries Detection and Assessment System (ICDAS), which measures initial enamel changes in the process of caries progression was not employed nor was the dental x-ray used in this survey. Thus, caries prevalence could be under reported in both the age groups.

CONCLUSIONS

In the study groups, caries-free children represented 16.20% and 58.10% for 6-and 12 years old children respectively. The majority of caries indices in both age groups was the dt/DT component and was disturbingly untreated. This situation needs to be tackled with an oral health education and awareness campaign, especially for parents of younger children.

Most children had poor periodontal health as 28.00% bleeding and 58.40% calculus was observed. The present brushing sessions that have been implemented in some schoolsettings, if made universal across all schools, could prevent and reduce periodontal diseases in children.

Although traumatic dental injury and fluorosis prevalence were very low, prevention of these conditions may need to be instituted in order to create awareness.

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AUTHORS CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

SN: Concept, design, literature search, data collection and analysis, manuscript writing and review.

DP: Concept, design, data analysis, manuscript writing and review.

Author agree to be accountable for all respects of the work in ensuring that questions related to the accuracy and integrity of any part of the work are appropriately investigated and resolved.

CONFLICT OF INTEREST

None

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