



Oral health status of 3 to 5-year-old children attending Early Childhood Care and Development Centers in Bhutan

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ABSTRACT

Introduction: Early Childhood Caries (ECC) is a common childhood dental disease worldwide. To date, dental disease prevalence in children in Bhutan is unknown. **Objectives:** This study was conducted to estimate the prevalence of early childhood caries and its modifiable risk factors. **Methods:** We conducted a cross-sectional survey in 3-5-years old children attending Early Childhood Care and Development Centers in Bhutan. Mouth examination recorded teeth with decay (d), missing due to decay (m) and filled (f), to calculate caries experience (mean dmft and standard deviation=SD). Parents and caregivers were interviewed about their children's oral health status, oral hygiene practices and diets among others. The prevalence of modifiable risk factors for disease was described based on parental responses. The association between decay and selected sociodemographic characteristics and oral health variables were investigated with bivariate analyses (X²). **Results:** Overall, 80.5% children had caries experience with mean dmft + or - SD (4.9 + 4.2). In fact, 79.9% had untreated decay. Only few had fillings as an evidence for availing dental care with mean filled 0.2 (SD=0.7). The percentage of decay increased significantly as maternal education increased and with low socioeconomic status ($p=0.02$). **Conclusions:** Early Childhood Caries are highly prevalent in Bhutan. Very few young children sought dental care. We recommend engaging relevant stakeholders in efforts to promote dental care and educate parents to use fluoridated toothpastes.

Key words: Early childhood caries; Oral health; Fluoride; Prevention.

INTRODUCTION

Oral health is an essential component of overall health that contributes to normal growth and development in children. Dental caries including Early Childhood Caries (ECC) is the most common chronic disease in children¹. The ECC is a serious, rapidly progressive infection of the teeth in children up to 71 months of age. ECC exerts both immediate and life-long consequences for overall health and quality of life². It is caused by cariogenic bacteria transmitted to children from mothers or caregivers with poor oral health. The final sequelae are destruction of teeth and increases risk for caries in permanent teeth and malocclusion. Dental caries initiation and progression trajectory in general is uncertain. However, tooth decays both in

primary and permanent dentitions increases with advancing age, not brushing teeth using fluoridated toothpaste for at least twice a day and exposure of teeth to more frequent sugary snacks among other factors³⁻⁷.

The Annual Health Bulletin, 2016, recorded 1048 dental caries incidences among 1 to 4-year-old children which demonstrated that milk teeth decay begins before eruption of permanent teeth⁸⁻⁹. Ngedup S et al. reported nearly 84% caries in 6-year-old children with mean dmft=5.54, exceeding the World Health Organization's goal for caries-free children (>50% of children age 6)¹⁰⁻¹². Bhutan presently depends entirely on fluoridated toothpaste and oral hygiene practices to protect children's teeth from decay¹³⁻¹⁴.

The purpose of this study was to estimate the prevalence of Early Childhood Caries (ECC) and modifiable risk factors in 3 to 5-year-old children. This study is the first of its kind in the country and is built on previous findings of tooth decay in children and mothers^{11,15}.

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METHODS

Study Design

We conducted a cross-sectional study of oral health and modifiable risk factors for dental decay in children attending Early Childhood Care and Development Centers (ECCD) in Bhutan, using methods consistent with WHO recommendations¹⁶. The research protocol and informed consent were approved by the Research Ethics Board of Health (REBH) vide approval No. REBH/Approval/2018/076, dated 17th April, 2019. Yale University also approved the study concomitantly. Administrative approvals were granted by the Ministries of Health and Education¹⁷.

Inclusion and Exclusion Criteria

Children ages 3 to 5 in sample ECCD centers were included in the study if they were present on the day of the survey and accompanied by a parent who consented to participate in the survey. Non-Bhutanese children were excluded from the survey.

Sampling

We conducted oral health survey, with sampling designed to capture data from regions, districts and urban-rural locations for specific age groups by adopting non-probable stratified cluster sampling method based on 2017 ECCD enrollment¹⁸. Within each of three regions of the country (Western, Central, Eastern), we selected one district each from northern, central and southern respectively. Among the selected districts, one urban and two

rural ECCD centers with the greatest number of children enrolled were included in the sampling process. Thus, the survey was conducted at 27 sites (Table 1). Assuming 20% attrition, at 95% confidence level and 5% margin of error, we estimated sample size of 700 children based on 884 children enrolled in 27 selected sites for the 2017 academic year.

Data Collection

The oral examinations and questionnaire surveys were conducted over a day at each of 27 ECCD centers from May to June 2019. The research team explained the study objectives and obtained written consent from parents before oral examinations of the children and parental interviews. The data collection procedures were standardized for validity, reliability and reproducibility through classroom lectures and field calibrations prior to the survey. Mouth examination and interview data were recorded on modified WHO forms¹⁶.

The mouth examination was done in a spacious room having sufficient natural light with children lying down on a flat table. Parents were invited to sit near the children to allay fears of mouth examination. The mouth examination recorded teeth with decay, filled and teeth missing due to decayed and presence of pulp involvement, ulceration, fistula or abscess (pufa) on the mucosa adjacent to the affected teeth.

The questionnaire for this study was modified from WHO data collection instruments. The parents were interviewed and collected sociodemographic information about the child and

Table 1. Early Childhood Care and Development Centers: Selected Study Sites

REGION	DISTRICT	SITES	
		URBAN ECCD	RURAL ECCD
West	Thimphu	Pelkyi Losel	Kasadrachu Kuzuchen
	Punakha	Kunga, Kuruthang	Lekhar Tana
	Chhuka	Chhukha HPP (Dzong site)	Pachu RamiteyTensung
Central	Bumthang	Tamshing	Lodhen, Ura Gyatsa
	Trongsa	Sherabling	Dangdung Yudurungcholing
	Sarpang	Pelrithang	Umling Chuzagang
East	Lhuentse	Tangmachu	Gortshom Minjey
	Trashigang	Trashigang Thromde	Moshi Bartsham
	Samdrup Jongkhar	Thrimsung	Jompa Samdrupcholing Tensung

Source: Annual Education Bulletin, Ministry of Education, June 2017

family and important aspects of oral health knowledge, attitude and practices¹⁹⁻²⁰.

Data analysis

The data were entered into Excel spreadsheet and transferred into OpenEpi® for analysis. The percentage, mean dmft and standard deviations were considered according to the WHO caries severity levels for children age 5-6²¹. Results were considered statistically significant if the *p*-value <0.05.

RESULTS

Description of the Study Sample

Table 2 shows the Sociodemographic characteristics of children and their parents/caregivers. A total of 713 child-parent pairs participated with 80.6% response rate; the mean age of children were 4.3 years old.

Table 2. Sociodemographic characteristics of study sample, 2019

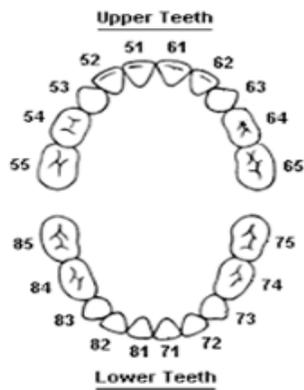
		Number	Percent
Total		713	100.0%
Child	Age		
	3 years	117	16.4%
	4 years	273	38.3%
	5 years	323	45.3%
	Gender		
	Male	369	51.8%
	Female	344	48.2%
Mother	Age	31.5 years average (range: 19-50)	
	Highest level of education completed		
	No education at all	142	19.9%
	Non-formal education	128	18.0%
	Primary education	63	8.8%
	Lower secondary education	61	8.6%
	Middle secondary education	159	22.3%
	Higher secondary education	108	15.1%
	University or college	51	7.2%
	Monastic education	1	0.1%
	Don't know	0	0%
	Ethnicity		
	Sharchop	406	56.9%
	Ngalop	112	15.7%
	Bumthap & Khengpa	140	19.6%
	Lhotsampa	53	7.4%
	Other ethnic group	2	0.3%
Income	No income at all	23	3.2%
	Nu 1 to 4,500	47	6.6%
	Nu 4,501 to 10,000	133	18.7%
	Nu 10,001 to 15,000	209	29.3%
	Nu 15,001 to 20,000	101	14.2%
	More than Nu 20,000	200	28.1%
Household	Number of children under 18	2.3 average (range: 1-8)	
Region	Western	210	29.5%
	Central	275	38.6%
	Eastern	228	32.0%
Residence	Urban	311	43.6%
	Towns around district capital	6	0.8%
	Rural	396	55.5%
Survey respondent for child	Mother	536	75.2%
	Father	78	10.9%
	Other caregiver	99	13.9%

Prevalence of Dental Caries and Disease Severity

Overall, 80.5% of children had caries experience (mean dmft=4.9 + or - 4.2). 79.9% had untreated decay with mean index 4.7 + or - 4.1 (Table 3). Among those with decayed teeth, nearly one in six also had gum lesions (pufa). Very few children had filled teeth or teeth missing due to caries. Teeth most affected by dental caries in upper and lower jaws is as shown below (Figure 1). The prevalence of dental caries and indices by region is shown in Table 4.

The rural children had higher caries prevalence but less pufa. Rural areas had more untreated decays including the caries severity (Table 5).

More than 80% of children were affected by dental decay. The prevalence increased with age of the children. Children of



Upper anterior incisors:

51	52.2%
61	51.8%
52	32.8%
62	33.2%

Lower molars:

84	35.3%
75	42.4%
85	46.9%
74	43.4%

Figure 1. Primary teeth affected by dental caries

Table 3. Prevalence of dental caries and disease severity, 2019

	Number	Percent
Total	713	100.0%
Caries prevalence	574	80.5%
Caries index for primary teeth	Mean dmft (SD)	Range
Decayed (active or filled with active decay) (d)	4.7 (4.1)	0-19
Missing due to caries (m)	0.0 (0.2)	0-4
Filled (f)	0.2 (0.7)	0-6
Mean dmft (SD)	4.9 (4.2)	0-20
Children with any untreated decay	570	79.9%
Children with decayed teeth who have pulpal involvement (p), ulceration (u), fistula (f) and/or abscess (a)	89	15.6%

Table 4. Prevalence of dental caries and disease severity by region

	REGION			
	Total	Western	Central	Eastern
TOTAL	713 (100.0%)	210 (29.5%)	275 (38.6%)	228 (32.0%)
Caries index for primary teeth	Mean dmft (SD)			
Decayed (d)	4.7 (4.1)	4.5 (4.0)	5.0 (3.9)	4.6 (4.3)
Missing due to caries (m)	0.0 (0.2)	0.0 (0.3)	0.0 (0.2)	0.0 (0.1)
Filled (f)	0.2 (0.7)	0.2 (0.8)	0.2 (0.7)	0.0 (0.4)
Mean dmft (SD)	4.9 (4.2)	4.7 (4.2)	5.2 (4.0)	4.6 (4.4)
Children with any untreated decay	570 (79.9%)	165 (78.6%)	229 (83.3%)	176 (77.2%)
Children with decayed teeth who also have pulpal involvement (p), ulceration (u), fistula (f) and/or abscess (a)	89 (15.6%)	24 (14.5%)	42 (18.3%)	20 (11.4%)

Table 5. Prevalence of dental caries and disease severity for urban and rural areas, 2019

	TOTAL	URBAN	RURAL
TOTAL	713 (100.0%)	317 (44.5%)	396 (55.5%)
Caries index for primary teeth	Mean (SD)		
Decayed (d)	4.7 (4.1)	4.4 (4.0)	4.9 (4.1)
Missing due to caries (m)	0.0 (0.2)	0.0 (0.2)	0.0 (0.3)
Filled (f)	0.2 (0.7)	0.2 (0.8)	0.1 (0.5)
Mean dmft (SD)	4.9 (4.2)	4.6 (4.1)	5.1 (4.2)
Children with any untreated decay	570 (79.9%)	246 (77.6%)	324 (81.8%)
Children with decayed teeth who also have pulpal involvement (p), ulceration (u), fistula (f) and/or abscess (a)	89 (15.6%)	40 (16.3%)	49 (15.1%)

mothers with higher education and lower incomes showed caries prevalence of 87.4% and 87.1% respectively ($p=0.02$) (Table 6).

Prevalence of Modifiable Risk Factors for Oral Disease

Risk factors for ECC in children are shown in Table 7. Nearly 50% of parents rated their children’s mouth as good. More than

25% of children who attended dental clinics were due to pain and 65.5% were introduced to brushing after 2 years of age. While almost 100% used toothbrush to clean the teeth, about 64% didn’t know the benefits of fluoridated toothpastes.

Table 6. Prevalence of dental caries by child and family characteristics

	Mean dmft (SD)	Untreated decay
TOTAL	4.9 (4.2)	79.9%
Child’s age:		
3 years	3.5 (3.6)	76.9%
4 years	4.7 (4.2)	78.4%
5 years	5.5 (4.3)	83.6%
Mother’s educational attainment*:		
No education or non-formal education	4.5 (4.0)	76.3%
Primary or lower-middle secondary education	5.1 (4.2)	80.6%
Higher secondary education/university or college	5.5 (4.3)	87.4%
Monthly household income:		
Lower (none to Nu 4,500)	6.0 (4.4)	87.1%
Middle (Nu 4,501-Nu 20,000)	4.6 (4.1)	78.1%
Higher (more than Nu 20,000)	5.0 (4.1)	83.5%

*Prevalence of caries increased significantly with maternal education

Table 7. Modifiable risk factors for ECC

	Number	Percent
TOTAL	713	100.0%
ORAL HEALTH STATUS		
How would you describe the health of child’s teeth and gums?		
Good	342	48.0%
Poor	325	45.6%
Don’t know	46	6.5%
Did your child have a toothache in past 12 months?		
Yes	205	28.8%
No	508	71.2%
DENTAL CARE		
Did your child go to the dental clinic in past 12 months?		
Yes	190	26.6%
No	523	73.4%
What was the reason for visit to dental clinic?		
Dental check-up	1	0.1%
Toothache	182	25.5%
Concern about child’s teeth	5	0.7%
Injury to teeth or mouth	3	0.4%
No dental visit	522	73.2%
CARE OF CHILD’S TEETH		
How old was your child when you started cleaning the teeth?		
Less than one year of age	23	3.2%
One to two years of age	204	28.6%
After two years of age	467	65.5%
Never cleaned my child’s teeth	9	1.3%
Don’t know	10	1.4%
How often do you clean your child’s teeth?		
Never clean my child’s teeth	12	1.7%
Once a day	466	65.4%
At least twice a day	235	33.0%
Who told you how to care for your child’s teeth?		
Dental care provider	177	24.8%
Nurse or midwife or doctor	98	13.7%
Teacher	96	13.5%

Cont..

	Family member	271	38.0%
	Friend	22	3.1%
	Others	49	6.9%
Do you use any of the following to clean your child's teeth?			
	Toothbrush	710	99.6%
	Toothpicks	1	0.1%
	Floss (thread)	0	0.0%
	Cloth	0	0.0%
	Any combination of the above	2	0.3%
Do you use fluoridated toothpaste to clean you child's teeth?			
	Yes	257	36.0%
	No	39	5.5%
	Don't know	417	58.5%
CARE OF CHILD'S TEETH			
After your child was born, was your child ever breastfed?			
	Yes	681	95.5%
	No	32	4.5%
How long was your child breastfed?			
	Less than 6 months	19	2.7%
	6 months to 1 year	58	8.1%
	13 months to 18 months	104	14.6%
	More than 18 months	502	70.4%
	Not breastfed	30	4.2%
Has your child ever used a bottle to fall asleep at night?			
	Yes	90	12.6%
	No	623	87.4%
CHILD'S DIET			
Child eats [high sugar food or drink] at least once or two or more times a day.			
	Fresh fruit?	280	39.2%
	Sugar-sweetened foods?	211	29.6%
	Sugar-sweetened fizzy drinks?	336	47.1%
	Packaged snack foods?	272	38.1%
	Candy or ice cream?	69	9.7%
	Milk with sugar?	69	9.7%
	Tea with sugar?	423	59.3%
Because of your child's teeth, does your child have difficulty biting or chewing?			
	Yes	144	20.2%
	No	569	79.8%
Has your child ever eaten food that was pre-chewed by a parent or caregiver?			
	Yes	121	17.0%
	No	592	83.0%
KNOWLEDGE AND ATTITUDES ABOUT ORAL HEALTH			
What causes tooth decay?			
	Bacteria or germs	556	78.0%
	Demons	11	1.5%
	Eating fruit	8	1.1%
	Don't know	138	19.4%
If I have poor oral health, it affects my child's oral health.			
	Agree	465	65.2%
	Disagree	123	17.3%
	Don't know	125	17.5%
Healthy teeth and gums are important for overall health.			
	Agree	615	86.3%
	Disagree	30	4.2%
	Don't know	68	9.5%

Note: Counts and percents are based on parent responses

DISCUSSION

The results of this study showed that ECC is rampant among 3-5-year-old children in Bhutan. Overall, 80.5% children had decay with mean dmft+ or - SD (4.9 + or - 4.2). This finding is consistent with findings of 2014 study of school children with 83 % caries prevalence in 6 years old and mean dmft + or - SD (5.54 + or - 5.00)¹¹. As per the WHO caries severity classification, this level of disease is high (dmft 4.5-6.5) and far from its goal

that at least 50 percent of six-year old children be caries-free. In fact, we found 79.9% had untreated decay and low evidence of availing dental care with mean filled 0.2 (SD=0.7)²². Another recent survey in pregnant women showed more than 60% caries prevalence, a risk factor for transmission of cariogenic bacteria to their children. The present study finding of 17% children fed with prechewed food corroborated the risky practice for caries¹⁶. We found slightly higher caries in children living in rural areas compared to those from urban locations, consistent with findings

from past nationwide survey of school children¹¹. The prevalence of decay increased with age among children in this age group.

The disease was also higher among children with higher levels of maternal education, suggesting easy access to cariogenic snacks through pocket money affordability and neglected the importance of oral health. Dental caries prevalence was 87.1% among families with low income which could be due to poor access to dental hygiene tools beyond episodic care for treatment of pain²³. The majority of respondents knew that dental decay is caused by germs and the positive link between general health and oral health. Dental professionals contend that the earlier the brushing is introduced for children, greater the caries protection. However, we found that most parents delayed brushing the child's teeth until the age of 2 years^{24,25}.

Research literature from other developing and developed countries is useful for putting the disease prevalence in context. A systematic review of reports from 88 countries showed ECC prevalence at over 57%, in children aged 36-72 months²⁶. Another systematic review in South East Asia between 2006 and 2015 showed that the prevalence of ECC among 5- to 6-year-old children varied considerably across countries from 25-95%²⁷. In India, ECC prevalence ranged from 42 - 63% in 54 studies carried out in schools and hospitals in 2016²⁸. Our findings of 80.5% caries prevalence is higher than those reports which in comparison are alarming and need concerted efforts to bring down the prevalence of dental decays²⁹.

LIMITATIONS

The findings of this cross-sectional survey are unlikely to be representative oral health among children who are out of ECCD programs. The study also didn't look at other oral diseases.

CONCLUSIONS

The prevalence of ECC in Bhutan was found to be very high which is a public health concern. Although, respondents had acceptable levels of oral health knowledge and attitudes, we recommend relevant stakeholders to educate mothers or caregivers to start brushing children teeth as soon as tooth erupts in mouth and use fluoridated toothpaste to prevent and fight tooth decay. The parents need to be educated to lower consumption of sweetened foods while increasing frequency of dental checkup.

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AUTHORS CONTRIBUTION

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

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

SN: Design, data collection and analysis, manuscript writing and review

DP: Design, data collection and analysis, manuscript writing and review

MAL: Design, data collection and 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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