Knowledge, Attitude, and Practice of Bhutanese Oral Health Practitioners Regarding Fluoride Toothpaste for Prevention of Early Childhood Caries

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Abstract

Tooth decay in early childhood has deleterious impacts on children's health and well-being. It is preventable with the key strategy of toothbrushing twice daily with fluoride toothpaste. The prevalence of tooth decay in Bhutanese children is alarmingly high even with fluoride toothpaste being widely available. Oral health practitioners play a key role in oral health advocacy and promotion. The study aimed to assess the knowledge, attitude, and practice of Bhutanese oral health practitioners regarding fluoride toothpaste recommendations for children aged six and under. A cross-sectional study was conducted with self-administered online questionnaires sent to all active registered oral health practitioners in Bhutan. The respondents included 73 dentists and 61 dental hygienists achieving a response rate of 88.2%. They had 8.4± 7.1 mean years of experience and rarely saw child patients. Significant knowledge gaps were identified, with 46.3% lacking awareness of the effective fluoride concentration and 66.4% not knowing its indication for children under three years old. While practitioners exhibited a positive attitude towards fluoride toothpaste, practices concerning its recommendation and hands-on brushing training for the children's caregivers fell short, especially for younger children. The study underscores the importance of addressing knowledge-attitude-practice gaps by integrating early prevention modules into dental hygienist curricula, developing a national guideline for fluoride toothpaste use, and conducting mandatory continuing dental education. This study serves as a foundation for future research, policy initiatives, and proactive strategies to improve tooth decay prevention efforts in early childhood, thus contributing to better health outcomes in Bhutan.

Keywords**:** *Early Childhood Caries (ECC), Fluoride Toothpaste, Oral Health Practitioners, Bhutan, KAP, Preventive Dentistry*

1. Introduction

Tooth decay, or dental caries, remains one of the most prevalent childhood diseases globally despite being preventable. Its prevalence is disproportionally higher in low-income and middle-income countries (Peres et al., 2019). The presence of one or more tooth decay lesions, either an initial stage or cavitated stage, or tooth removal due to caries, or dental filling in a child under the age of six years is termed "early childhood caries" (ECC) (Tinanoff, & O'Sullivan, 1997). The prevalence of ECC worldwide has been reported at 48% (Uribe, Innes, & Maldupa, 2021). ECC not only impacts growth, development, nutrition, and oral health-related quality of life but also poses economic burdens on the healthcare systems of nations (Peres et al., 2019; Tinanoff et al., 2019).

In Bhutan, ECC prevalence is particularly alarming, reaching 80.5% (dmft of 4.9) among three to five-year-olds in 2019, with a significant percentage of untreated caries (Phurpa, Ngedup, Pem, & Lee, 2020). Bhutan, a small landlocked nation in southern Asia between China and India, has a population of 0.77 million. The modern healthcare system was initiated in the early 1960s, including dental services in the 1970s (Tobgay, Dorji, Pelzom, & Gibbons, 2011). Notably, private healthcare services are absent, and the government is mandated to provide free healthcare services per the country's constitution. Oral health practitioners in Bhutan include dental hygienists trained domestically and dentists trained across various

Asian nations due to the absence of dental schools in the country. Currently, oral health practitioners are not stationed in primary health care centers, where only urgent pain relief treatment is available (World Health Organization, 2021). Oral health services are provided only in district and referral hospitals.

Primary preventive strategies for ECC include avoiding sugar intake for children under age two, limiting sugar intake for older children; and brushing teeth twice daily with at least 1000 ppm fluoride toothpaste, adjusting the amount based on age (Tinanoff et al., 2019). Topical fluoride is widely accepted for preventing tooth decay by strengthening the enamel, making it more acid resistant (Medjedovic, Medjedovic, Deljo, & Sukalo, 2015). Fluoride toothpaste is recognized as the most widely used fluoride method for maintaining a constant low level of fluoride in the oral environment, contributing to the decline in dental caries in developed countries in recent decades (O'Mullane et al., 2016). Fluoride toothpaste is manufactured with varying amounts of fluoride concentration. However, evidence from a systematic review by Walsh et al. (2019) emerged that a fluoride concentration of less than 1000 ppm does not have a significant effect on decreasing caries prevalence. And dos Santos, Nadanovsky, & de Oliveira (2013) reported that the prevented fraction in primary teeth when toothbrushing with at least 1000ppm fluoride toothpaste is estimated at 31%. The guidelines from the International Association of Pediatric Dentistry (IAPD, 2020), the European Academy of Pediatric Dentistry [EAPD] (Toumba et al., 2019), and the American Academy of Pediatric Dentistry (AAPD, 2023) recommend the use of 1000 ppm fluoride concentration with a smear or rice grain size amount for children below three years and pea-sized for three to six-year-olds. In Bhutan, even though fluoride toothpaste is the only source of fluoride widely accessible in all regions, according to the study by Phurpa et al. (2020), only 36% of the parents reported using fluoride toothpaste for their three-to-five-year-old children, with merely 24.8% receiving oral health information from oral care providers.

Oral health practitioners are key influencers in shaping oral health outcomes by advocating and providing evidence-based preventive care. There is an emphasis on direct oral health promotion and caries prevention for children younger than six years (Uribe et al., 2021). The study hypothesis was that evaluating the existing status of caries preventive practices, specifically focusing on fluoride toothpaste, among Bhutanese oral health practitioners, can reveal areas for improvement and offer insights that can inform targeted interventions and educational initiatives, ultimately fostering better oral health outcomes among Bhutanese children. This pioneering study aims to assess the knowledge, attitude, and practice of Bhutanese oral health practitioners regarding fluoride toothpaste recommendation in children aged six years and under.

2. Objectives

The objectives of the study are:

1) To evaluate Bhutanese oral health practitioners' knowledge of fluoride toothpaste recommendations for ECC prevention based on current international guidelines.

2) To assess the attitude of Bhutanese oral health practitioners towards fluoride toothpaste use in children aged six years and under.

3) To assess the frequency with which Bhutanese oral health practitioners recommend fluoride toothpaste use and hands-on brushing training for children aged six years and under.

3. Materials and Methods

This cross-sectional descriptive study employed a self-administered online questionnaire and was approved by the Research Ethics Board of Health (REBH), Bhutan (REBH/Approval/2022/007).

3.1 Participants

This study involved purposive sampling of the entire population of oral health practitioners, all 163 registered oral health practitioners working in Bhutan, excluding two pediatric dentists to prevent bias as their training

focuses on ECC prevention. Contact was established via phone by a non-health personnel research assistant. Of the contacted individuals, two dentists and nine dental hygienists could not be reached.

3.2 Data collection

An invitation letter and an online consent form, along with the questionnaire, were emailed. Non-respondents received email reminders after one week, followed by a phone call reminder after two weeks. An additional phone call was made four weeks later for the remaining non-respondents.

3.3. Questionnaire

The questionnaire was developed based on fluoride toothpaste recommendations from reputable organizations such as the IAPD (2020), the EAPD (Toumba et al., 2019), and the AAPD (2023). Two experts in pediatric dentistry assisted in formulating a structured and close-ended questionnaire in English. The Item Objective Congruence (IOC) index was used to screen item quality by three preventive dentistry experts, resulting in the modification and deletion of certain items. The questionnaire was pre-tested by two Bhutanese dentists and two dental hygienists who were currently not practicing. The questionnaire comprised five sections: 1) demographic background and professional characteristics, 2) knowledge of fluoride toothpaste, 3) statement to assess attitude toward fluoride toothpaste, and 4) practice of fluoride toothpaste recommendation and teaching hands-on brushing technique for specific age groups.

3.4. Data analysis

Data verification, coding, and analysis were performed using IBM SPSS Statistics Version 26. Descriptive statistics were utilized. Pearson's chi-square test of association and Fisher's exact test were employed to assess the association between the type of profession (dentist and dental hygienist) and also between different age groups. The Mann-Whitney U test compared the average years of practice between dentists and dental hygienists. A *p*-value of less than .05 indicated statistical significance.

4. Results and Discussion

4.1 Results

Questionnaires were sent to 78 dentists, and 74 dental hygienists. A total of 134 oral health practitioners, 73 dentists and 61 dental hygienists, responded anonymously, resulting in an overall response rate of 88.2%.

4.1.1 Sociodemographic characteristics

Oral health practitioners reported an average of 8.4 ± 7.1 years of practice, with dental hygienists having significantly more years of experience, as shown in Table 1. There was an equal gender distribution among the participants. They seldom encounter young patients, with only 2.2% of the practitioners often practicing on younger than three years and 13.4% often practicing on three- to six-year-olds. Notably, around one-third of practitioners, predominantly dentists, had not participated in any continuing dental education (CDE) on caries prevention in children in the past 5 years.

Table 1 Demographic information and professional characteristics of oral health practitioners

Characteristics		Total 134(100)	Dentist 73(100)	Dental hygienist 61(100)	p-value
Gender	Male	67 (50)	33 (45.2)	34 (55.7)	.23
	Female	67 (50)	40 (54.8)	27 (44.3)	
Years of practice	Mean±SD years (min-max)	8.4±7.1 (1-38)	6.1±5.2 (1-38)	11.1±8.1 (1-31)	<.01†

Characteristics		Total 134(100)	Dentist 73(100)	Dental hygienist 61(100)	p-value
Workplace	Referral hospital	53 (39.6)	27 (37)	26 (42.6)	.51
	District hospital	81 (60.4)	46 (63)	35 (57.4)	
Practice often in children	< 3 years old	3 (2.2)	1 (1.4)	2 (3.3)	
	3-6 years old	18 (13.4)	8 (10.9)	10 (16.4)	.18[a]
Practice busyness	Overburdened	78(58.2)	43(58.9)	35(57.4)	.86
	Not overburdened	56 (41.8)	30 (41.1)	26 (42.6)	
Last CDE attendance on caries prevention	Less than 2 years	48 (35.8)	15 (20.5)	33 (54.1)	.032
	2 to 5 years	39 (29.1)	26 (35.6)	13 (21.3)	
	More than 5 years/never attended	47 (35.1)	32 (43.8)	15 (24.6)	

Abbreviations: SD, standard deviation; CDE: continuing dental education
Pearson's Chi-square test between dentists and dental hygienists
[a] Fisher's exact test between dentists and dental hygienists
† Mann-Whitney U test between dentists and dental hygienists

4.1.2 Knowledge of fluoride toothpaste recommendation

Table 2 illustrates the oral health practitioners' knowledge regarding the effective concentration of fluoride for caries prevention in children aged six and below. While approximately half of them (53.7%) correctly identified 1000 ppm fluoride as the lowest fluoride concentration for caries prevention, a substantial percentage (29%) responded to suboptimal concentration and 10% reported not knowing.

Table 2 Oral health practitioner's knowledge of fluoride concentration in toothpaste for six-year-olds and younger

	Total 134(100)	Dentist 73(100)	Dental hygienist 61(100)	p-value
Don't know	14(10.4)	8(11)	6(9.8)	
250 ppm	13(9.7)	6(8.2)	7(11.5)	.972
500 ppm	26(19.4)	15(20.5)	11(18)	
1000ppm	72(53.7)	39(53.4)	33(54.1)	
1400 ppm	9(6.7)	5(6.8)	4(6.6)	

Pearson's Chi-square test between dentists and dental hygienists

Table 3 further delineates oral health practitioners' knowledge of fluoride toothpaste concerning two age groups of young children. Significantly more practitioners correctly responded to questions about fluoride toothpaste for children aged three to six years compared to those younger than three years old. Over 80% of respondents were aware of the appropriate amount of fluoride toothpaste for children. However, only one-third were knowledgeable about its indication for children younger than three years, which is significantly lower than that for three to -six-year-olds.

Table 3 Oral health practitioners with correct responses on fluoride toothpaste according to age of children

	First tooth eruption to 3 years old	3 to 6 years old	p-value
Indication for fluoride toothpaste			
Total 134(100)	45(33.6)	98(73.1)	
Dentist 73(100)	24(32.9)	60(82.2)	

Dental hygienist 61(100)	21(34.4)	38(62.3)	.003
Recommended amount of fluoride toothpaste			
Total 134(100)	108(80.6)	120(89.6)	
Dentists 73(100)	60(82.2)	69(94.5)	
Dental hygienist 61(100)	48(44.4)	51(83.6)	.47[a]

Pearson's Chi-square test between the two age groups

[a] Fisher's exact test between the two age groups

4.1.3 Attitude towards fluoride toothpaste use for caries prevention

Most oral health practitioners showed a positive attitude towards fluoride toothpaste as an ECC preventive modality for Bhutanese children regardless of the practitioner groups. While the majority agreed or strongly agreed on its appropriateness, a small fraction (6.7%) disagreed or strongly disagreed as displayed in Table 4.

Table 4 Oral health practitioners' attitude towards the use of fluoride toothpaste in children aged six years and younger.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	p-value
Total 134(100)	73(54.5)	46(34.2)	5(3.7)	1(0.7)	9(6.7)	
Dentist 73(100)	39(53.4)	26(35.6)	3(4.1)	0	5(6.8)	.954[a]
Dental Hygienist 61(100)	34(55.7)	20(32.8)	2(3.3)	1(1.6)	4(6.6)	

[a] Fisher's exact test between dentists and dental hygienists

4.1.4 Practice of fluoride toothpaste recommendation

Table 5 demonstrates the frequency of oral health practitioners' practice concerning advice on fluoride toothpaste and teaching hands-on brushing techniques to children and their parents or caregivers in the past year. Half of the practitioners reported advising on the use of fluoride toothpaste often for children younger than three years old. Three-fifths of the respondents reported the same in three to six-year-old children. Less than half (43.3%) often taught hands-on toothbrushing to children younger than 3 years old and more than half (53%) often taught it to three to six-year-old children.

Table 5 Oral health practitioners' practice frequency in the past year

	Never	Rarely	Occasionally	Often
For children younger than 3 years old				
Advice on the use of fluoride toothpaste				
Total 134(100)	15(11.2)	36(26.9)	17(12.7)	66(49.3)
Dentist 73(100)	13(17.8)	14(19.2)	10(13.7)	36(49.3)
Dental hygienist 61(100)	2(3.3)	22(36.1)	7(11.5)	30(49.2)
Teaching hands-on brushing technique				
Total 134(100)	8(6)	44(32.8)	24(17.9)	58(43.3)
Dentist 73(100)	7(9.6)	25(34.2)	11(15.1)	30(41.1)
Dental hygienist 61(100)	1(1.6)	19(31.1)	13(21.3)	28(45.9)
For 3 to 6 -year-old children				
Advice on the use of fluoride toothpaste				
Total 134(100)	7(5.2)	26(19.4)	21(15.7)	80(59.7)
Dentist 73(100)	7(9.6)	10(13.7)	11(15.1)	45(61.6)
Dental hygienist 61(100)	0	16(26.2)	10(16.4)	35(57.4)

Teaching hands-on brushing technique				
Total 134(100)	7(5.2)	35(26.1)	21(15.7)	71(53)
Dentist 73(100)	6(8.2)	17(23.3)	14(19.2)	36(49.3)
Dental hygienist 61(100)	1(1.6)	18(29.5)	7(11.5)	35(57.4)

4.2 Discussion

The findings from this cross-sectional study shed light on the current state of knowledge, attitude, and practice among Bhutanese oral health practitioners regarding the prevention of ECC, focusing on fluoride toothpaste usage. The notable strength lies in the high response rate of 88.2%. The study revealed significant knowledge gaps among practitioners, particularly concerning the effective fluoride concentration in toothpaste and its indication for children under three years old. Despite predominantly positive attitudes towards fluoride toothpaste use in children, their practice in terms of advising on fluoride toothpaste use and teaching hands-on toothbrushing techniques, fell short, especially for children under three years old.

Boustedt, Dahlgren, Twetman, & Roswall (2020) reported that the current best practice for reducing the risk of ECC is to advocate for twice-daily brushing with fluoride toothpaste for all children starting from when the first tooth erupts (around the age of six months), irrespective of whether they reside in optimally fluoridated or fluoride-deficient communities. However, it is concerning that nearly half of Bhutanese oral health practitioners were unaware of the effective fluoride concentration for caries control. Similar gaps in knowledge have been observed in studies conducted in other countries, such as the UK (Yusuf et al., 2015) and Bahrain (Alrowaili, 2021). This highlights a systemic issue in dental education, and addressing these knowledge gaps is crucial, as evidenced by the clear association between effectiveness on caries prevention and fluoride concentration in toothpaste (Walsh et al., 2019).

Only one-third of the practitioners recognized fluoride toothpaste as being indicated for children under three years old. A similar finding was reported in Bahrain where roughly half of the oral health practitioners believed brushing without toothpaste would prevent caries in toddlers (Alrowaili, 2021). Among the dental hygienists in the United States of America, 90% of them believed fluoride toothpaste to be effective for caries prevention in three to six-year-old children. Only 64% believed so for children younger than three years old (Clovis et al., 2012). However, it is important to emphasize that fluoride toothpaste has demonstrated efficacy in caries control among children under six years old. (Wright et al., 2014). Alm et al. (2011) This highlighted the significance of early dental caries occurrence in primary dentition as a predictor for future caries. Moreover, individuals who remained caries-free at 15 years old were more likely to have adopted regular brushing with fluoride toothpaste by three years old. Interestingly, while the data from this study indicated that 62% of the practitioners have occasionally or often advised parents or caregivers on fluoride toothpaste for children younger than three years, only 33% knew it was indicated for that age group. This discrepancy between knowledge and practice could be attributed to desirability bias, where the respondents may over-report desirable behaviors.

AAPD (2023) recommends parents or caregivers brush their infants' and toddlers' teeth, a practice that may continue to preschool age. A review by Aliakbari et al. (2021) suggests that one of the main barriers for parents to brushing their children's teeth is a lack of practical knowledge regarding how and when to brush, as well as the appropriate use of toothpaste. Our study revealed that roughly half of oral health practitioners did hands-on brushing training for parents or caregivers. This could be attributed to time constraints in the clinic, as more than half of the oral health practitioners reported feeling overburdened during their daily practice. Dental auxiliaries, health assistants, and nurses could be trained to provide hands-on toothbrushing in maternal and child health (MCH) clinics to ensure that effective toothbrushing is established at an early age. According to a prospective study by Boustedt et al. (2020), starting brushing at two years old

and following up until five years old would increase the risk of getting caries by 2.5 times if parents had difficulties with brushing technique while brushing their children's teeth. Therefore, oral health professionals should make an effort to provide brushing instruction. And that should include hands-on training for every parent.

The data from this study indicated that more oral health practitioners identified toothpaste with a fluoride concentration below 1000 ppm (29%) as effective for caries prevention compared to concentrations above 1000 ppm (6.7%). This might be attributed to the old concept of using lower fluoride concentration toothpaste for children. Additionally, the majority of participants were unaware that fluoride toothpaste is indicated for children under three years old, although they were knowledgeable about the appropriate amount of fluoride toothpaste to be used for children. These results may stem from concerns regarding fluorosis due to fluoride toothpaste ingestion. Indeed, children under four years old are considered at risk of dental fluorosis of permanent incisors, which causes the most esthetic concerns (Toumba et al., 2019). Oral health practitioners must understand that the risk of fluorosis is minimal with the use of 1000 ppm fluoride toothpaste, provided it is used in the appropriate amount for the child's age and under parental supervision (Wright et al., 2014; Walsh et al., 2019). Effective communication of this information to parents or caregivers is essential to ensure proper oral hygiene practices while mitigating concerns about potential fluorosis.

The findings suggest that oral health practitioners in Bhutan do not encounter children younger than six years old often in their practice. There is inadequate practice of fluoride toothpaste recommendation and teaching of hands-on brushing technique among Bhutanese oral health practitioners, unlike among the Libyan dentists, where more than 80% of the dentists gave oral hygiene instructions and recommended the use of fluoride toothpaste (Arheiam, & Bernabé, 2015). A study done by Phurpa et al. (2019) revealed that 96% of Bhutanese children aged three to five visiting dental clinics were due to "toothache". That indicated a predominant focus on curative rather than preventive measures among both parents and oral health practitioners. To enhance preventive care at the primary level, training community nurses and health assistants in primary healthcare centers on fluoride toothpaste and brushing techniques could be considered. Moreover, a proactive strategy is needed to target children whose parents have not sought dental services, aiming to reduce inequalities in access to dental care. Scotland's national oral health improvement program for children has implemented various universal and targeted strategies, with nursery-supervised brushing with fluoride toothpaste showing the greatest impact and cost-effectiveness, particularly in children with high caries risk (Kidd et al., 2020). Bhutan could adopt similar initiatives nationwide.

5. Conclusion

The study revealed a generally positive attitude towards fluoride toothpaste use in children among Bhutanese oral health practitioners. However, significant gaps were identified in their knowledge regarding the effective fluoride concentration in toothpaste, its indication for children under three years old, and corresponding practices, particularly for this younger age group. The study recommends providing evidence-based, up-to-date knowledge on fluoride toothpaste use in children to all oral health practitioners in Bhutan through well-planned mandatory CDE programs, the integration of ECC prevention modules into dental hygienist curricula, and the development of a national guideline for using fluoride toothpaste that will provide consistency in service. This study serves as a catalyst for future research on exploring other caries preventive measures and the feasibility of policy development initiatives to address the knowledge gap. Acknowledging potential desirability bias, this study marks a significant stride toward effective ECC prevention in Bhutanese children.

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