Original Article

TOOTHPASTE UTILIZATION PROFILES OF 6 TO 8-YEAR-OLD NIGERIAN CHILDREN

[1]Agboola S.O.; [1]Aliyu Z, [1,2]Ibiyemi O.
[1]Department of Preventive Dentistry, Faculty of Dentistry, University of Maiduguri, Nigeria;
[2]Department of Periodontology and Community Dentistry, Faculty of Dentistry, University of Ibadan, Nigeria

ABSTRACT

Background: In children, toothbrushing with fluoride toothpaste is the method of choice for preventing dental caries and it is influenced mainly by their mothers.

Objective: To provide descriptive information about toothpaste utilization profiles of 6 to 8-year-old Nigerian children.

Materials and methods: A cross-section of 130 mothers of 6-8 year-old Nigerians provided information on sociodemographic characteristics, knowledge of toothpaste use, tooth brushing habits and criteria for selecting toothpaste for their child. Their 6-8 year-old children who attended the Dental Centre of the University of Maiduguri Teaching Hospital North-Eastern Nigeria were examined for presence of dental caries and fluorosis. Data analysis included both descriptive and inferential statistics at $p<0.05$. 6-8-year-old school children who attended

Results: Forty-one (31.5%) mothers had good knowledge score of toothpaste use. Fifty-six (43.1%) and 23 (177.7%) of children had fluorosis and dental caries respectively. There was no statistical significant relationship between sociodemographic characteristics and occurrence of dental caries ($p>0.05$). Females (54.2%) and children of mothers who had no formal education (65.6%) had more fluorosis than their counterparts ($p<0.05$).

Conclusions: Many mothers had poor knowledge score of toothpaste use. Children who had fluorosis were more than those who had dental caries. Females and children of mothers who had no formal education had more dental fluorosis than their counterparts.

Keywords: Toothpaste, Utilization, Nigerian, Children, Dental caries, Dental fluorosis

Running title: Toothpaste utilization Nigerian children

NigerJmed 2019: 451-464

INTRODUCTION

Dental caries is a disease of hard tissues of the teeth caused by an imbalance in the process of de-and re-mineralization over time during the interactions between cariogenic bacteria in dental plaque and refined sugars.[1]Dental caries affects about 60% to 90% of school-aged children and the vast majority of adults.[2] In children, it causes pain which may result in their inability to eat and sleep thereby affecting their growth. Pain from dental caries could prevent a child from going to school and their parents or carers from going to work.

One of the priorities for oral health services is the prevention of dental caries in children which is considered more cost effective than its treatment.[3] Fluoride use in various regimens has been the centerpiece of caries-preventive methods since the introduction of water fluoridation programmes several years ago.[4] The use of topically applied fluoride regimens which are much more

Correspondence to: Olushola Ibiyemi
Department of Periodontology and Community Dentistry
Faculty of Dentistry
University of Ibadan, Nigeria
Email: shola_ibiyemi@yahoo.com
Phone+234-8037201253

concentrated than fluoride in drinking has increased over recent decades.[5] The most important anti-caries effect of fluoride is its topical action on the tooth/plaque interface through the promotion of remineralization of early carious lesions and by reducing tooth enamel solubility.[6]Currently, fluoride is used in various forms either alone or in combination as toothpastes, gels, varnishes and mouth rinses, each with its own recommended concentration, frequency of use and dosage schedule.[5]Toothpastes are the commonest form of fluoride use.[7] The decline in the prevalence of dental caries in children from different countries has been mainly attributed to the gradual increase in and regular home use of fluoride toothpastes[8,9]although the reason for the decline continues to be debated.[10]

During early years of life, tooth brushing habits are learnt and are deeply ingrained in the child's mind leading to adoption of good oral hygiene methods later in life.[11] Maternal attitudes are likely to modify oral health behaviours of children and thus play an important part in the uptake of favourable oral health practices. Young children's health behaviours and outcomes are influenced by their parent's knowledge and beliefs which affect oral hygiene and healthy eating habits.[12]The parents especially mothers are influential figures in determining children's behavior since they decide the kind tooth brush and the pattern of brushing their children adopt.[11]In addition, the type, frequency and quantity of toothpaste used by children are based purely on parental preferences.[13]It is important to assess the pattern of toothpaste use among children to obtain information that will influence policy and practice on appropriate use of toothpaste based on recommended guidelines and the design of effective interventions that will promote oral health of children. Therefore, this study aimed to provide descriptive information about toothpaste utilization profiles of 6-8 year old Nigerian children.

Materials and methods

Ethical approval to undertake a Community Dentistry Undergraduate Project among consecutive nursing mothers and their 6-8-year-old school children who attended the Dental Centre of the University of Maiduguri Teaching Hospital North-Eastern Nigeria was obtained from the Dean Faculty of Dentistry, University of Maiduguri Nigeria after the protocol for the study was read. Prior to data collection, the nursing mothers were informed about the details of the study after which those who were interested in taking part in the study provided written consent. The sample size for the study was determined as 130 based on a prevalence of 9% of non-toothpaste use among preschool children in Peril, Malaysia.[14]The inclusion criteria were mothers who were willing to participate in the study and whose children were between ages 6 and 8 years and had no obvious physical, mental and emotional disorders. One hundred and thirty mothers consented to participate and were interviewed using an interviewer-administered questionnaire which was pretested among 20 mothers who earlier attended the dental facility and were not part of the study participants. The questionnaire was used to collect information on sociodemographic characteristics, knowledge of toothpaste use, tooth brushing habits and criteria for selecting toothpaste for the child. The sociodemographic information included age, level of education, occupation and tribe of the nursing mothers; age and gender of their children while information about tooth brushing habits included toothpaste usage, frequency of tooth brushing, quantity of toothpaste used and whether child's tooth brushing was supervised. For the knowledge of toothpaste use score, a score of 1 was allotted to the right answer to

each variable and the total obtainable mark was 9 points with poor, fair and good knowledge scoring 0-3, 4-6 and 7-9 respectively. The content validity of the questionnaire was confirmed by an expert panel comprising of 2 specialists in dental public health and 2 pediatric dentists. Prior to questionnaire administration, the questionnaire was translated into Hausa, the major local language spoken by inhabitants of study location. After the questionnaire was filled, it was back translated into English Language. After interviewing the mothers, their 6-8 year-old children were clinically dentally examined for presence of dental caries and dental fluorosis using the dmft/DMFT and Dean's indices by 2 trained and calibrated examiners. The examination was undertaken using disposable wooden spatula and sterile mouth mirror. Data were entered into Statistical Package of Social Science (SPSS) version 22 (Chicago, IL, USA). Data analysis included both descriptive statistics (proportions, means, standard deviations) and inferential statistics (chi-square test for association between categorical variables) at $p<0.05$for level of statistical significance. Level of education was re-categorized into formal education (primary, secondary and tertiary education) and no formal education (never went to school and quranic education).

Results

The mean (SD) age of the mothers was 23.4 (4.6) years. Table 1 shows that 14 (10.8%) and 18 (13.8%) of the mothers never went to school and had Quranic education respectively. The majority 60 (46.2%) and 82 (63.1%) were full time house wives and of Kanuri tribe respectively. Males 71 (54.6%) and aged 6 years 50 (38.5%) constituted the majority of their children. Table 2 shows that 60 (46.2%) of mothers were unaware of fluoride toothpaste while 27 (20.8%) were unaware ofdental caries preventive effects of toothpaste. Ninety-nine (76.2%) of mothers are unaware that excessive consumption of fluoride can lead to dental fluorosis. The majority 105 (80.8%) of the mothers did not know that smear sized toothpaste should be used for children less than 2 years while 100 (76.9%) of the mothers did not know that pea sized toothpaste should be used for children between 2 and 6 years. The mean (SD) knowledge score of toothpaste use by the mothers was 4.0 (2.61) with 41 (31.6%) of them having good knowledge score (Fig 1).

Table 3 shows that 118 (90.8%) mothers reported that they commenced tooth brushing for their children after eruption of first primary tooth. Fourteen(10.8%) and 63 (48.5%) mothers reported that they did so immediately and more than 1 year after eruption of first primary tooth respectively. Ninety-two (70.8%) of the mothers did not consult a dentist before using fluoridated toothpaste for their children (Table 4).Table 4 also shows that 73 (61.9%) of the mothers reported that they used adult toothpaste to clean the teeth of their children. Fifty-seven (48.3%) of all mothers placed half-length toothpaste on their children's toothbrush bristles. Swallowing of toothpaste, twice daily toothbrushing and brushing unsupervised was reported by 25 (21.2%), 53 (44.9%) and 65 (55.1%) of mothers respectively. Thirty-eight (32.2%) of mothers stated that the main criteria for selection of toothpaste for child was the brand of the toothpaste.

Table 5 shows the relationship between socio-demographic characteristics and knowledge of toothpaste use and toothpaste behaviours. There was a statistically significant relationship between age and knowledge score of toothpaste use and supervised toothbrushing. Poor knowledge score of toothpaste use for children was observed among 45.9%, 46.0% and 51.2% of

mothers of 8, 6 and 7 yearolds respectively (p=0.004). Supervision of their children's toothbrushing was reported by 25.7%, 50.0% and 56.8% of mother of 8, 6 and 7 year olds respectively (p=0.02). Toothbrushing of children's teeth at least twice daily was reported by 43.9% of mothers whose children were females and 63.9% of mothers whose children were males (p=0.04). There was a statistical significant relationship between occupation of the mothers and knowledge score of toothpaste use, type of toothpaste used, supervised toothbrushing, tooth brushing frequency of the child and consulting dentist before child's toothbrushing. Good knowledge of toothpaste use for children was observed by 24.3% of mothers who were employed and 10.0% of mothers who were full house wives (p=0.01). Use of children toothpaste to brush the teeth of children was reported by 23.2% and 48.4% of employed and full house wives respectively (p=0.01). Supervision of their children's toothbrushing was reported by 30.4% of mothers who were full house wives and 58.1% of mothers who were employed (p=0.003). Toothbrushing of children's teeth at least twice daily was reported by 35.7% and 71.0% of mothers who were full house wives and employed respectively (p<0.0001).

Table 5 also shows that there was a statistically significant relationship between mother's educational status and knowledge score of toothpaste use, types of toothpaste used, supervised toothbrushing, frequency of child's toothbrushing and consult dentist before child's toothbrushing. Good knowledge of toothpaste use for children was observed among 9.4% of mothers who had no formal education and 20.4% who had formal education (p<0.0001). The use of children toothpaste to brush the teeth of children was not reported by any mother who had no formal education while it was reported by 43.9% of mothers who had formal education (p<0.0001). Toothbrushing of children's teeth at least twice daily was reported by 25.0% of mothers who had no formal education and 60.2% of mothers who had formal education (p=0.01). No mother who had no formal education reported that they consulted the dentist before their children started toothbrushing while 26.5% of mothers who had formal education reported that they did so (p=0.01).

Fifty-six (43.1) of the children had dental fluorosis while 23 (17.7%) had dental caries. The mean (SD) and median (minimum, maximum) number of teeth with dental caries and dental fluorosis were 0.34 (0.86) and 0 (0,5) respectively.

Table 6 shows that there was no statistical significant relationship between sociodemographic characteristics and occurrence of dental caries (p>0.05). Table 7 shows that female children (54.2%) and children of nursing mothers who had no formal education (65.6%) had more dental fluorosis than males and children of nursing mothers who had a formal education respectively (p<0.05).

Discussion

Parents are the best group of people that could motivate school children towards the use of toothpaste to maintain good oral health. Parents' knowledge, attitudes and practices towards use of toothpaste could play an important role in their children's tooth cleaning practices. Mothers were included in this study because in Nigeria, they are usually the caretakers of children. They are primary decision makers with regards to children's health related behaviours and health care. This assertion was confirmed by previous studies on toothbrushing habits among preschool children where tooth brushing habits were

mainly introduced by mothers.[11,15]

In this present study, many mothers were not aware of fluoride toothpaste and its dental caries preventive effects. These findings were at variance with previous studies where all the mothers were aware that toothpastes used to brush their children's teeth contained fluoride and that it would prevent dental caries.[13,16]Differences in the level of education and availability of oral health education might be the reason for the observed differences. In agreement with previous studies many (57.7%) mothers were not aware that excessive consumption of fluoride can lead to dental fluorosis.[13,16]The poor knowledge of some mothers about fluoride toothpaste and the effects of fluoride was further shown by poor knowledge score of the use of fluoride toothpaste by 68.5% of mothers. Therefore, the public, especially mothers, should be educated about use of fluoride containing toothpastes as well as caries preventive effects of fluoride. They should also be informed about the effects of excessive ingestion of fluoride.

The American Dental Association (ADA) Council on Scientific Affairs observed differing public messaging on the use of fluoride toothpaste for young children and agreed on a unified recommendation which will be less confusing to the public.[17] They advised caregivers to brush with water and to consult with a dentist or physician before using fluoride toothpaste for children younger than 2 years but if they intend to use toothpaste they should use a smear. They also recommended use of a pea-sized fluoride toothpaste for children from 2 to 6 years. In this present study, the majority did not know that smear sized toothpaste should be used for children less than 2 years and pea sized toothpaste should be used for children between 2 and 6 years. Using a smear of toothpaste (approximately 0.1 grams of toothpaste or 0.1 miligram of fluoride) for children younger than 2 years and a pea-sized amount (approximately 0.25 gram toothpaste or 0.25 mg fluoride) for children from 2 to 6 years of age is intended to maximize the caries preventive of fluoride while minimizing the risk of occurrence of dental fluorosis. In this present study, the majority of mothers did not know that parents should consult a dentist before using fluoridated toothpaste for their children. Therefore, it is not surprising that 92 (70.8%) of mothers did not. The low awareness and high number of mothers who did not consult a dentist before they used toothpaste for their children may be due to ignorance of who a dentist is and low utilization of oral health care facilities. It may also be due to their socio-economic status since many people in this study had no formal education and were full time house wives. To address the risks and benefits associated with fluoride toothpaste use in young children adequately, the dentist should aim in conversations with caregivers to assess a child's total fluoride exposure on the basis of all potential sources.[17]

In this present study, many mothers (38.1%) reported that they brushed the teeth of their children with children and herbal toothpastes. These types of toothpastes contain less than 1000 ppm fluoride which may not provide adequate caries preventive effect since a Cochrane review found limited evidence of any caries preventive effect following use of toothpaste with less than 1000 ppm fluoride.[1]Early use of fluoride toothpastes by young children may be an important risk factor for dental fluorosis especially in fluoridated communities,[18] therefore, children toothpaste which contain no more than 500 ppm fluoride could be adequate.
Regarding commencement of use of

toothpaste for their children immediately after eruption of first primary tooth, many (89.2%) mothers did not. This was consistent with findings in United Arab Emirates,[15] India[13] and Malaysia[16] where mothers reported that they did not commence tooth cleaning with fluoride toothpaste for their children immediately after eruption of first primary teeth. Non-commencement of use of toothpaste for young children immediately after emergence of tooth in the oral cavity might make these children's teeth to be prone to dental caries. Commencement of use of toothpaste at approximately 6 months old when the first teeth begin to erupt recognizes that teeth are at risk of dental caries from that time. It helps to prevent early childhood caries among high risk children. Chronic ingestion of fluoride toothpaste has been reported to cause dental fluorosis[19] however, in Nigeria, commencing use of toothpaste as soon as teeth begin to erupt is adequate because of limited evidence of moderate or severe dental fluorosis. The reason for non-commencement of use of toothpaste for their children immediately after eruption of first primary tooth might be due to non-tolerance of toothbrushes or toothpastes. However, for children who cannot tolerate toothbrushes or toothpastes, wet clean cloth or a soft small headed toothbrush with smear amount of toothpaste could be used to clean their teeth as they erupt.[20-22] This early childhood practice will provide a learning curve for a child to accustom to tooth brushing with toothpaste as child grows older.[16]

In agreement with findings from previous studies,[13,14] most mothers used adult toothpastes which contain between 1000ppm and 1500 ppm to brush their children's teeth. This might be due to ignorance as confirmed in this present study where the majority (80.8%) were not aware of toothpaste which are used by children. Contrary to the finding in this present study, some studies reported that most mothers used children's toothpaste.[18,23] The use of adult toothpaste by young children is at variance with the recommendations of European Academy of Paediatric Dentistry (EAPD)[20] and American Academy of Pediatric Dentistry (AAPD)[22] that children below 6 years of age should use children's toothpastes containing low fluoride concentrations (less than 500 ppm) because they are prone to swallowing toothpaste during toothbrushing due to poor swallowing reflex. The younger children are, the more likely they are to swallow larger amounts, which often represent a substantial part of the total daily fluoride intake which can be enough to cause dental fluorosis.[24] Use of adult toothpastes, though confer greater protection against dental caries could enhance the occurrence of dental fluorosis when chronically ingested. As in previous studies, the majority of mothers use toothpastes to brush their children's teeth twice daily.[16,23] Brushing twice daily confer greater caries reductions than brushing once daily or less.[25] In this present study, some children's teeth were brushed more than two times daily. Multiple tooth brushing episodes daily, can probably result in excess intake of fluoride especially by children[26] since children under the age of six years may ingest between 25% and 65% of toothpaste placed on toothbrush due to poor swallowing reflex.Chronic ingestion of fluoride from toothpaste in children is common,[27] therefore, it is important to educate mothers on toothpaste selection, total fluoride ingestion and its effects on children.

In this present study, about 48% of mothers reported that they place toothpaste on half-length of toothbrush bristle to brush the teeth of their children. This finding is contrary to the reports by other studies

where the majority of mothers used the entire length of toothpaste[13] or pea-sized length[14,16]on toothbrushes. A pea-sized length of toothpaste is recommended for preschoolers.[20,22,28]The result of this present study showed that many mothers had inadequate knowledge about quantity of toothpaste that should be used. Further studies are recommended to explore factors that influenced their decisions concerning quantity of toothpaste used. Use of toothpaste on the entire length of toothbrushes was also reported by many mothers which could enhance swallowing of toothpaste. Applying toothpaste on the entire length of toothbrushes could enhance swallowing and could be the reason why about 21% of mothers reported that their children swallowed toothpaste during toothbrushing. Another reason for toothpaste swallowing could be brushing unsupervised. The majority of mothers (55.1%) reported that their children brushed their teeth unsupervised. Similar finding was observed in some previous studies.[14,16]Mothers must ensure they supervise toothbrush sessions of their children to ensure that the teeth are properly cleaned and to prevent frequent ingestion of toothpaste which could cause some forms of dental fluorosis. The main criteria for selection of toothpaste used for children was the brand of the toothpaste. This finding is not in agreement with findings in a previous study where selection was based on suggestions from friends, family and advertisement and price of toothpaste.[13]

Many mothers who were employed had good knowledge of toothpaste use compared to full house wives. For example, many of them reported that they supervised their children during toothbrushing, their children brushed their teeth twice daily and used children toothpaste to do so than full house wives. This may be due to greater awareness of toothpaste use among these working mothers than full house wives. Similarly, many mothers who had formal education had good knowledge score of use of toothpaste than mothers who had no formal education. Mothers who had formal education reported that their children brushed their teeth more than once daily, used children's toothpaste during tooth brushing and commenced tooth brushing with fluoride toothpaste for their children after eruption of first primary tooth than mothers who had no formal education. In addition, their children swallowed toothpaste less than children of mothers who had no formal education. These findings highlight the importance of education in health promotion and justify the need for health education on adequate use of toothpaste among mothers who had no formal education.

In this present study, the prevalence of dental caries was 17.7%, which falls within 5.2% and 48% reported in Nigeria.[29]This prevalence among 6 to 8 year olds in Northern Nigeria is higher than 13.6% reported among 8-year-oldsin Southern Nigeria[30]and it confirms previous report[29]that the prevalence of dental caries is higher in the former than in the latter. The reason for the observed differences might be due to differences in tooth cleaning and dietary practices. The prevalence of dental fluorosis was 43.1%, it falls within 29.8% to 51% reported for 8 year-old[30] and 12 to 15 year-old[31]Nigerian children living in both fluoridated and non-fluoridated communities. Differences in fluoride exposure from various sources, the age group studied and investigative methods might be the reason for the observed differences in the prevalence of dental fluorosis. There was no relationship between socio-demographic characteristics and the occurrence of dental caries. On the contrary, a female preponderance of dental

fluorosis found in our study is similar to the findings in some studies[32,33] whereas some other authors have reported that males were more likely to have dental fluorosis in their study.[34] However, some other previous studies reported no gender differences.[35,36] Children of mothers who had no formal education had more dental fluorosis than children of mothers who had a formal education respectively.

In the present study, the probability of memory bias was reduced since all study participants were mothers who were currently nursing children. There might be certain amount of measurement error in handling self-care reported instead of observed behaviours but mothers were informed before start of study to provide truthful information and that information provided will not be used against them. Further research is recommended among nursing mothers from other communities in Nigeria to allow for generalization. In addition, to further strengthen the conclusion of findings from this study, additional analysis using multivariate approaches may be undertaken in the future, but the intent of this present study was to provide initial descriptive information.

Conclusions

Many mothers had poor knowledge score of use of toothpaste. Many mothers reported that their children did not brush their teeth twice daily, brushed unsupervised and swallowed toothpaste during toothbrushing. Many of them selected toothpaste based on its brand. Many mothers who had formal education had good knowledge score of use of toothpaste than mothers who had no formal education. Many mothers who were employed or who had formal education reported that their children brushed their teeth atleast twice daily and used children's toothpaste more than mothers who were full house wives. Children who had dental fluorosis were more than those who had dental caries. Female children and children of mothers who had no formal education had more dental fluorosis than males and children of mothers who had formal education respectively.

Table 1: Sociodemographic characteristics of study participants (n=130)

Socio-demographic characteristics	No.	%
Level of education of nursing mothers		
Never went to school	14	10.8
Quranic education	18	13.8
Primary education	8	6.2
Secondary education	40	30.8
Tertiary education	50	38.5
Occupation of nursing mothers		
Full time house wife	60	46.2
Trader	33	25.4
Civil servant	37	28.4

Tribe of nursing mothers		
Kanuri	82	63.1
Hausa	15	11.5
Marghi	12	9.2
Barbur	11	8.5
Fulani	10	7.7
Age of child (years)		
6	50	38.5
7	43	33.1
8	37	28.5
Gender of child		
Male	71	54.6
Female	59	45.4

Table 2: Knowledge of toothpaste use (n=130)

Knowledge of toothpaste use	**Yes**		**No**	
	No.	**%**	**No.**	**%**
Are you aware of fluoride toothpaste?	70	53.8	60	46.2
Are you aware that toothpaste can prevent dental caries?	103	79.2	27	20.8
Are you aware that excessive consumption of fluoride can lead to dental fluorosis?	31	23.8	99	76.2
Are you aware of fluoride toothpaste specific for children?	55	42.3	75	57.7
Do you know that smear sized toothpaste should be used for children less than 2 years?	25	19.2	105	80.8
Do you know that pea sized toothpaste should be used for children between 2 and 6 years?	30	23.1	100	76.9
Do you know that a child should brush twice daily?	98	75.4	32	24.6
Do you know that a child below 8 years should be supervised when brushing?	73	56.2	57	43.8
Do you know that parents should consult a dentist before using fluoridated toothpaste for the child?	36	27.7	94	72.3

Table 3: Commencement of tooth brushing after eruption of first primary tooth (n=130)

Commencement of tooth brushing	No.	%
Never	12	9.2
Immediately after eruption of first primary tooth	14	10.8
Few months to 1 year after eruption of first primary tooth	41	31.5
More than 1 year after eruption of first primary tooth	63	48.5

Table 4: Tooth brushing parameters when tooth brushing was commenced after eruption of first primary tooth (n=118)

Tooth brushing parameters	No.	%
Did you consult the dentist before using fluoridated toothpaste for child?		
No	92	78.0
Yes	26	22.0
Type of toothpaste used to brush the teeth of child		
Adult toothpaste	73	61.9
Children toothpaste	41	34.7
Herbal toothpaste	4	3.4
Quantity of toothpaste used by child		
Smear	11	9.3
Pea size	34	28.8
Half-length of tooth brush bristle	57	48.3
Entire length of tooth brush bristle	16	13.6
Does child swallowed toothpaste during tooth brushing?		
No	41	34.7
Yes	25	21.2
Am not sure	52	44.1
Number of times toothpaste and tooth brushing?		
Once daily	54	45.8
Twice daily	53	44.9
More than twice daily	11	9.3
Was child's tooth brushing supervised?		
No	65	55.1
Yes	53	44.9
Main criteria for selection of toothpaste for child		
Price	27	22.9
Brand	38	32.2
Dentist advice	33	28.0
Advertisement	11	9.3
Fluoride concentration	5	4.2
Family/friends	4	3.4

Table 5: Relationship between sociodemographic characteristics and knowledge of toothpaste use and toothpaste behaviour

Socio-demographic characteristics	Knowledge score of toothpaste use (n=130)			p	Types of toothpaste used (n=114)		p	Supervised toothbrushing (n=118)		p	Frequency		p	Consulting dentist before child's toothbrushing (n=118)		p
	Poor No.(%)	Fair No.(%)	Good No.(%)		Adult No(.%)	Children No.(%)		Yes No.(%)	No No.(%)		Once No.(%)	≥ twice No.(%)		Yes No.(%)	No No(.%)	
Age (years)																
6	23(46.0)	15(30.0)	12(24.0)	0.004*	30(68.2)	14(31.8)	0.75	23(50.0)	23(50.0)	0.02*	27(58.7)	19(41.3)	0.07	9(19.6)	37(80.4)	0.26
7	22(51.2)	10(23.3)	11(25.6)		21(60.0)	14(40.0)		21(56.8)	16(43.2)		13(35.1)	24(64.9)		6(16.2)	31(83.8)	
8	17(45.9)	20(54.1)	0(0.0)		22(62.9)	13(37.1)		9(25.7)	26(74.3)		14(40.0)	21(60.0)		11(31.4)	24(68.6)	
Gender																
Male	32(45.1)	26(36.6)	13(18.3)	0.80	37(62.7)	22(37.3)	0.85	31(50.8)	30(49.2)	0.20	22(36.1)	39(63.9)	0.04*	11(18.0)	50(82.0)	0.37
Female	30(50.8)	19(32.2)	10(16.9)		36(65.5)	19(34.5)		22(38.6)	35(61.4)		32(56.1)	25(43.9)		15(26.3)	42(73.7)	
Mothers occupation																
Employed	25(35.7)	28(40.0)	17(24.3)	0.01*	31(51.7)	29(48.3)	0.01*	36(58.1)	26(41.9)	0.003*	18(29.0)	44(71.0)	<0.001*	45(72.6)	17(27.4)	0.18
Full house wife	37(61.7)	17(28.3)	6(10.0)		42(77.8)	12(22.2)		17(30.4)	39(69.6)		36(64.3)	20(35.7)		47(83.9)	9(16.1)	
Mothers educational status																
No formal education	26(81.3)	3(9.4)	3(9.4)	<0.001*	19(100.0)	0(0.0)	<0.01*	6(30.0)	14(70.0)	0.14	15(75.0)	5(25.0)	0.01*	0(0.0)	20(100.0)	0.01*
Formal education	36(36.7)	42(42.9)	20(20.4)		54(56.8)	41(43.2)		47(48.0)	51(52.0)		39(39.8)	59(60.2)		26(26.5)	72(73.5)	

Note: * - Statistically significant

Table 6: Relationship between sociodemographic characteristics of study participants and occurrence of dental caries

Socio-demographic characteristics	Dental caries		p	R (95% CI)
	Yes	No		
	No. (%)	No.(%)		
Age of child (years)				
6	10 (20.0)	40 (80.0)	0.43	[a]
7	9 (20.9)	34 (79.1)		
8	4 (10.8)	33 (89.2)		
Gender of child				
Male	13 (18.3)	58 (81.7)	1.00	1.10 (0.44-2.72)
Female	10 (16.9)	49 (83.1)		
Mothers level of education				
No formal education	7 (21.9)	25 (78.1)	0.59	1.43 (0.53-3.88)
Formal education	16 (16.3)	82 (83.7)		
Mothers employment status				
Full house wife	10 (16.7)	50 (83.3)	0.82	0.88 (0.35-2.17)
Employed	13 (18.6)	57 (81.4)		
Tribe of mothers				
Kanuri	11 (16.4)	56 (83.6)	0.82	0.84 (0.34-2.06)
Other tribes	12 (19.0)	51 (81.0)		

[a]Risk estimate statistics cannot be computed since it is not a 2*2 table

Table 7: Relationship between sociodemographic characteristics of study participants and occurrence of dental fluorosis

Socio-demographic characteristics	Dental fluorosis		p	R (95% CI)
	Yes	No		
	No. (%)	No. (%)		
Age of child (years)				
6	25 (50.0)	25 (50.0)	0.38	[a]
7	18 (41.9)	25 (58.1)		
8	13 (35.1)	24 (64.9)		
Gender of child				
Male	24 (33.8)	58 (66.2)	0.02	0.43 (0.21-0.88)
Female	10 (54.2)	49 (45.8)		
Mothers level of education				
No formal education	21 (65.6)	11 (34.4)	0.004	3.44 (1.49-7.95)
Formal education	35 (35.7)	63 (64.3)		
Mothers employment status				
Full house wife	29 (48.3)	31 (51.7)	0.29	1.49 (0.74-3.00)
Employed	27 (38.6)	43 (61.4)		
Tribe of mothers				
Kanuri	30 (44.8)	37 (55.2)	0.73	1.15 (0.58-2.31)
Other tribes	26 (41.3)	37 (58.7)		

[a]Risk estimate statistics cannot be computed since it is not a 2*2 table

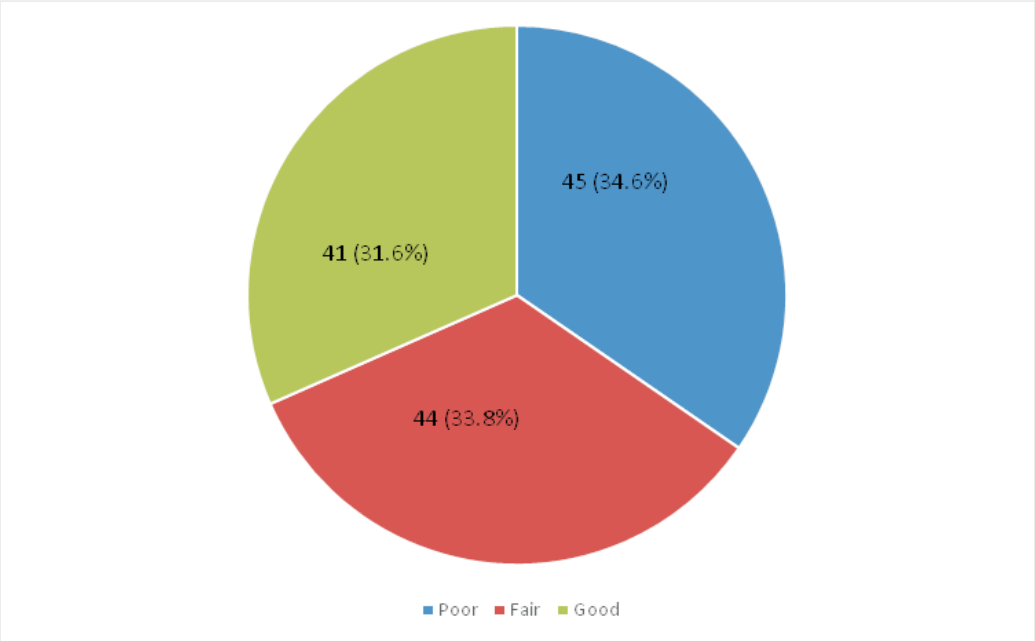

Figure 1: Knowledge score of toothpaste use (n=130)

References

1. Walsh T, Worthington HV, Glenny A, et al. Fluoride toothpastes of different concentrations for preventing dental caries in children and adolescents. Cochrane Database Syst Rev 2010;1: CD007868. Doi: 10.1002/14651858.CD007868.pub2
2. Petersen PE, Lennon MA. Effective use of fluorides for the prevention of dental caries in the 21st century: the WHO approach. 2004. Community Dent Oral Epidemiol.2004;32:319-321.
3. Burt BA. Prevention policies in the light of the changed distribution of dental caries. *Acta Odontologica Scandinavica*1998;**56**:179-186.
4. Murray JJ, Rugg-Gunn AJ, Jenkins GN, editors. A history of water fluoridation. *Fluorides in Caries Prevention*. Oxford: Wright, 1991:7-37.
5. Marinho VCC, Higgins J, Logan S, et al. Fluoride toothpastes for preventing dental caries in children and adolescents. Cochrane Database Syst Rev. 2003;1:CD002278
6. Featherstone JDB, Ten Cate JM. Physicochemical aspects of fluoride-enamel interactions. In: Ekstrand J, Fejerskov O, Silverstone LM editor(s). *Fluoride in Dentistry*. Copenhagen: Munksgaard, 1988:125-149.
7. Ripa LW. A critique of topical fluoride methods (dentifrices, mouthrinses, operator-, and self-applied gels) in an era of decreased caries and increased fluorosis prevalence. *J Public Health Dent* 1991;**51**:23-41.
8. Marthaler TM, Steiner M, Menghini G, et al. Caries prevalence in Switzerland. *Int Dent J.* 1994;**44**:393-340
9. Bratthall D, Hansel-Petersson G, Sundberg H. Reasons for the caries decline: what do the experts believe? *Eur J Oral Sci.* 1996;**104**:416-22.
10. Krasse B. The caries decline: is the effect of fluoride toothpaste overrated? *Eur J Oral Sci.* 1996;**104**:426-429.
11. Pullishery F, Panchmal GS, Shenoy R. Parental attitudes and tooth brushing habits in preschool children in Mangalore, Karnataka: A cross-sectional study. Int J Clin Pediatr Dent2013;6:156-160.
12. Huebner CE, Riedy CA. Behavioural determinants of brushing young children's teeth: implications for anticipatory guidance. Pediatr Dent2007;35:272-281
13. Bennadi D, Kshetrimayum N, Sibyi S, et al. Toothpaste utilization profiles among preschool children. J Clin Diagn Res.2014;8:212-215.
14. Tay HL, Zainudin IS, Jaafar N. Fluoride toothpaste utilization behaviour among preschool children in Perlis, Malaysia. Community Dent Health. 2009;26:211–215.
15. Khadri FA, Gopinath VK, Hector MP, et al. How preschool children learn to brush their teeth in Sharjah, United Arab Emirates. Int J Paediatr Dent. 2010;20:230-234.
16. Nagarajan S, Sockalingam MP, Jani Suhairah, et al. Pattern of Toothpaste Usage in Children Under Six Years Old. Malaysian Dent J. 2010;31:14–19.
17. American Dental Association Council on Scientific Affairs. Fluoride toothpaste use for young children. JADA. 2014;145:190-191.
18. Ellwood RP, O'Mullane DM. Dental enamel opacities in three groups with varying levels of fluoride in their drinking water. Caries Res.1995;29:137-142.
19. Kroon J. The relation between

toothpaste usage and fluorosis: a cause for concern? SADJ;56(1):20-27.
20. Oulis CJ, Raadal M, Martens L. Guidelines on the use of fluoride in children; a EAPD policy document. Eur J Paed Dent. 2000;1:7–12.
21. New Zealand Guidelines Group. Guidelines for the use of fluorides. Wellington: New Zealand Ministry of Health; 2009.
22. American Academy of Pediatric Dentistry. Policy on early childhood caries (ECC): Classifications, consequences, and preventive strategies. PeadiatrDent. 2008;30(suppl):40–42.
23. Tay HL, Jaafar N. Mothers' Knowledge of Fluoride Toothpaste Usage By Their Preschool – Children. Malaysian Dent J. 2008;29:140–145.
24. Lewis DW, Limeback H. Comparison of recoomended and actual mean intakes of fluoride by Canadians. J Can Dent Assoc. 1996;62:708-709, 712-715
25. Ashley PF, Attrill DC, Ellwood RP, et al. Toothbrushing habits and caries experience. Caries Res1999;33:401-402.
26. Levy SM. Review of fluoride intake from fluoride dentifrice. J Dent Child. 1993;61:115–124.
27. Rojas-Sanchez F, Kelly SA, Drake KM, et al. Fluoride intake from foods, beverages and dentifrice by young children in communities with negligibly and optimally fluoridated water: a pilot study. Community Dent Oral Epidemiol. 1999;27:288-297.
28. Levy SM, McGrady JA, Bhuridej P, et al. Factors affecting dentifrice use and ingestion among a sample of U.S. preschoolers. Pediatr Dent. 2000;22:389–394.
29. Folayan MO, Adeniyi AA, Chukwumah NM, et al. Programme guidelines for promoting good oral health for children in Nigeria: a position paper. BMC Oral Health 2014, 128
30. Ibiyemi O, Zohoori FV, Valentine RA, et al. (2018). Prevalence and extent of enamel defects in the permanent teeth of 8-year-old Nigerian Children Community Dent Oral Epidemiol.2018;46:54-62.
31. El-Nadeef MA, Honkala E. Fluorosis in relation to fluoride levels in water in central Nigeria. Community Dent Oral Epidemiol. 1998;26:26-30.
32. Wondwossen F, Astrom AN, Bjorvatn K, et al. Sociodemographic and behavioural correlates of severe dental fluorosis Int J Paed Dent. 2006;16:95-103
33. Zerihun L, Demisse B, Makonnen E, et al. The prospect of dental fluorosis prevention in Wonji Ethiopia. Ethiop Med J.2006;44:43-48.
34. Vargas-Ferreira F, Zeng J, Thomson WM, et al. Association between developmental defects of enamel and dental caries in school children. J Dent. 2014;42:540-546.
35. Ng'ang'a PM, Valderhaug J. Prevalence and severity of dental fluorosis in primary school in Nairobi, Kenya. Community Dent Oral Epidemiol. 1993;21(1):15-8
36. Sukhabogi JR, Parthasarathi P, Anjum S, Shekar B, Padma C, Rani AS. Dental fluorosis and dental caries prevalence among 12 and 15 year-old school children in Nalgonda district, Andhra Pradesh, India. Ann Med Health Sci Res. 2014; 4(Suppl 3):S245-252