The prevalence of early childhood caries and its associated risk factors among preschool children referred to a tertiary care institution

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Abstract

Objective: The aim was to determine the prevalence of early childhood caries (ECC) and its association with infant feeding and oral health-related behavior among preschool children aged 6–71 months in Lagos.

Materials and Methods: This was a descriptive cross-sectional study in which 302 children aged 6–71 months were selected from four pediatric outpatient clinics in Lagos, Nigeria. A structured questionnaire was used to obtain information regarding oral hygiene practices, dietary habits, breast and bottle feeding, birth weight of child and socioeconomic status of the family, from mothers of the children. The status of dental caries was recorded according to the World Health Organization criteria.

Results: The prevalence of ECC among 302 children aged 6–71 months was 21.2% while the mean deft was 0.735. Multivariate logistic regression analysis showed the correlation of ECC with the associated risk factors. ECC was significantly higher in children who were bottle-fed at night. Method of tooth cleaning other than using fluoridated toothpaste significantly increased the prevalence of ECC. Breastfeeding for duration of 3–6 months showed significantly lesser caries prevalence. Caries significantly increased with age.

Conclusion: Early childhood caries is a multifactorial disease in which prolonged duration of breastfeeding, nocturnal bottle feeding, and use of cleaning methods other than fluoridated toothpaste are risk factors for ECC. Oral health promotion programs should be targeted at mothers, pediatricians, nurses, caretakers at day care centers and primary care health workers.

Key words: Early childhood caries, Lagos, prevalence, risk factors

Introduction

Early childhood caries (ECC) is a widespread, socio-behavioral and dental condition seen among children throughout the world.[1] ECC is defined as the presence of one or more decayed (noncavitated or cavitated), missing (due to caries), or filled tooth surfaces in any primary tooth in a child up to 71 months of age or younger. Severe-ECC (S-ECC) is any sign of smooth surface caries seen in children younger than 3 years of age and from ages 3 to 5, 1 or more cavitated, missing (due to caries) or filled smooth surfaces in primary maxillary anterior teeth or decayed, missing, or filled score of ≥4 (age 3), or ≥5 (age 4), or ≥6 (age 5) surfaces constitutes S-ECC.[2]

Early childhood caries is a disease with multiple causative

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factors. It is a plaque-induced infectious disease caused by endogenous bacteria. Some of the well-documented factors implicated in the development of ECC include high level of cariogenic micro-organisms such as *mutans* streptococci, which is usually transmitted to the child's oral cavity by parents or caregivers, susceptible host and fermentable carbohydrate diet.[3]

Other risk factors that have been associated with ECC include oral hygiene practices, frequent between-meal snacks, parental attitudes, educational status of mother, socioeconomic status (SES), children with chronic illness or with special health care needs, breastfeeding and bottle feeding habits especially at night, and frequent use of sweetened medication.

Dental caries is the most common childhood disease, being at least 5 times more common than asthma, although it is not life-threatening, if left untreated can lead to significant acute and chronic conditions, bacteremia, early loss of tooth, malocclusion in the permanent dentition, high cost of treatment, low self-esteem and failure to thrive.[4,5]

Despite the decline in the prevalence of dental caries in the western countries, caries in preschool children remains a problem in both developed and developing countries.[3,6]

A comprehensive review including studies from Europe, Africa, the Middle East and North America revealed the prevalence of ECC in socially disadvantage group globally could be as high as 70% and found the highest caries prevalence in Africa and South-East Asia.[7] ECC has been considered at epidemic proportions in developing countries. ECC has remained relatively unexplored in many developing countries including sub-Saharan Africa.[8]

In Nigeria studies on the prevalence of ECC and risk factors are scanty. Most of the studies on caries in children available were carried out in children above the age of 6 years and are limited to specific towns and cities. A recent publication showed that there is a decrease in the prevalence of caries in the permanent dentition of primary school children in Nigeria, however there is an increase in prevalence and severity of caries in the primary dentition of primary school children.[9]

Despite the complications resulting from ECC, there is scarcity of studies on the prevalence of ECC and associated risk factors in Nigeria. Hence the knowledge on prevalence of ECC and associated factors will help to develop targeted interventions for prevention of ECC, proper planning for the utilization of scare resources available for oral health prevention program and the potential decrease in the number of children requiring emergency treatment.

The purpose of this study was therefore to determine the prevalence of ECC and its association with infant feeding and oral health-related behavior among children aged 6–71 months referred to pediatric outpatient clinics at the Lagos University Teaching Hospital (LUTH).

Materials and Methods

Sampling
The study was carried out among children aged 6–71 months selected from patients referred to four different paediatric outpatient clinics in LUTH. The Lagos University Teaching Hospital (LUTH) is one of the biggest federal government owned tertiary hospitals in Nigeria, patients with diverse ethnicities, languages, cultures and religion from Lagos, and its environs are usually referred.

Random sampling was used to select children from four pediatric outpatient clinics.

Data collection tools
A validated structured questionnaire was used and also a clinical examination was done to determine the presence of ECC. The questionnaire consisted of demographic information on the child, feeding practices, practices related to oral health, medical history and milestone. Questions on feeding practices included the type of infant feeding method, breastfeeding, bottle feeding, or both, on-demand feeding, between-meal snacks, pacifier use, and past medical history.

Questions on oral health related practices included; frequency of tooth brushing, type of dentifrice used, method of cleaning, initiation of cleaning. For the purpose of this study the SES was based on a composite of two indices: Mother's education and father's occupation. This allocated each child to a social class I to V, social class V being at the bottom of the table. The suitability and applicability of this social classification have been well tested and found to be reliable. Fathers' occupations were classified as described by a Nigerian study.[10] For the children with single parents, socioeconomic classifications were based on the occupation of either parent the child was staying with.

Clinical examination
The chief investigator and two other pediatric dentists were calibrated to carry out the clinical examination of the children according to the World Health Organization oral health survey methods. The examiners were calibrated before the survey. Kappa scores higher than 0.9 were attained for both inter and intra-examiner calibration exercises for identifying cavitated and noncavitated carious lesions indicating high reliability between investigators.

The children were examined by using disposable explorer, dental mouth mirrors and flashlights. During the

examination, the older children were seated on a chair, and infants were examined with the assistance of their mothers', by means of the "knee-to-knee" technique. Gauze pads were used to clean and dry teeth surfaces before examination.

Dental caries was assessed by means of visual/tactile examination without radiographs. Children having one or more decayed (noncavitated or cavitated), missing (due to caries), or filled tooth surfaces (dmfs) in any primary tooth up to 71 months of age or younger were considered to have ECC. Children from ages 3 through 5, with one or more cavitated, missing (due to caries) or filled smooth surfaces in primary maxillary anterior teeth or decayed, missing, or filled score of ≥4 (age 3), or ≥5 (age 4), or ≥6 (age 5) surfaces were considered to have S-ECC. Dental caries were recorded using decay, missing, filling/teeth (dmft) and surface (dmfs) index for each participating child. Children with untreated caries were referred to the department of child dental health LUTH.

Data analysis

The data were analyzed using SPSS (Statistical Package for Social Sciences) software, version 17 (SPSS Inc., Chicago, IL, USA) Data analysis included descriptive statistics, comparisons of means and test of association. Statistical analyses of association of ECC with various categorical variables were performed using Chi-square and Fisher's exact test. $P \le 0.05$ were considered as statistically significant.

Ethics

Approval for research was obtained from the Health Research and Ethics Committee of the Lagos University Teaching Hospital and informed consent were obtained from mothers before each child was enrolled.

Results

The overall ECC prevalence of 302 children whose ages ranged from 6 to 71 months was 21.2% with a mean deft of 0.735. One hundred and forty-four (47.7%) were males, and 158 (52.3%) were females.

The highest distribution of children was in the age group 6–16 months. The prevalence of ECC increased with age. Children aged 61–71 months had the highest (35.4%) prevalence of ECC. The association between dental caries and age was statistically significant ($P < 0.001$). Only one of the children in the 6–16 months age group had caries. A total of 222 decayed, extracted and filled teeth were found on examination mean deft 0.735 ± 2.07 [Table 1].

The SES was based on the combination of the mother's level of education and father's occupation. The children were divided into five groups based on this, with Groups I

and V being the highest and lowest SES respectively. There was a tendency toward high caries in children of higher and

Table 1: Prevalence of ECC in relation to age

Age group (months)	ECC (n (%))		Total	P
	Yes	No		
6-16	1 (1.6)	60 (98.4)	61	P<0.001*
17-27	8 (15.7)	43 (84.3)	51	
28-38	11 (27.5)	29 (72.5)	40	
39-49	13 (22.8)	44 (77.2)	57	
50-60	14 (31.1)	31 (68.9)	45	
61-71	17 (35.4)	31 (64.6)	48	
Total	64 (21.2)	238 (78.8)	302	

*Fisher's exact test is significant at level ≤0.05; **Chi-square is significant at level ≤0.05. ECC=Early childhood caries

Table 2: Association of ECC and SES

SES	ECC (n (%))		Total	P
	Yes	No		
I	22 (18.6)	96 (81.4)	118	0.731
II	14 (25.0)	42 (75.0)	56	
III	18 (22.5)	62 (77.5)	80	
IV	8 (25.0)	24 (75.0)	32	
V	2 (12.5)	14 (87.5)	16	
Total	64 (21.2)	238 (78.8)	302	

SES=Socioeconomic status; ECC=Early childhood caries

Table 3: Association between infant feeding practice variables and ECC

	ECC (n (%))		Total	P
	Yes	No		
Manner of feeding				
Breast	21 (15.7)	113 (84.3)	134	0.089
Bottle	2 (33.3)	4 (66.7)	6	
Mixed	41 (25.3)	121 (74.7)	162	
Duration of breastfeeding				
<3 months	3 (25.0)	9 (75.0)	12	<0.001*
3-6 months	8 (7.0)	102 (93.0)	110	
7-12 months	10 (10.0)	92 (90.0)	102	
>13 months	41 (57.0)	31 (43.0)	72	
On demand breast feeding				
Yes	54 (21.0)	203 (79.0)	257	0.943
No	8 (20.5)	31 (79.5)	39	
Breastfeeding at night				
Yes	61 (21.2)	227 (78.8)	288	0.400
No	1 (12.5)	7 (87.5)	8	
Duration of bottle feeding				
<12	28 (28.0)	72 (72.0)	100	0.668
13-18	12 (21.1)	45 (78.9)	57	
19-24	2 (22.2)	7 (77.8)	9	
>24	1 (50.0)	1 (50.0)	2	
Sleep with bottle				
Yes	28 (51.0)	27 (49.0)	55	<0.001**
No	15 (13.0)	98 (87.0)	113	

ECC=Early childhood caries; *=Fisher's exact test is significant at level ≤ 0.05, **=Chi-square is significant at level ≤ 0.05

Table 4: Association between intake/frequency of cariogenic snacks/drinks and ECC

	ECC (n (%))		Total	P
	Yes	No		
Snacks between meals				
Yes	58 (23.0)	194 (77.0)	252	0.082
No	6 (12.0)	44 (88.0)	50	
Total	64 (21.2)	238 (78.8)	302	
Sugarnated drinks				
Yes	59 (24.7)	180 (75.3)	239	0.004**
No	5 (7.9)	58 (92.1)	63	
Total	64 (21.2)	238 (78.8)	302	
How often				
Not everyday	23 (19.0)	100 (81.0)	123	<0.001*
1-2 times/day	29 (27.0)	80 (73.0)	109	
>2 times/day	1 (100)	0 (0.0)	1	
Rarely	6 (100)	0 (0.0)	6	
Total	59 (24.7)	180 (75.3)	239	
Sweet/sugar				
Yes	62 (23.5)	202 (76.5)	264	0.01*
No	2 (5.3)	36 (94.7)	38	
Total	64 (21.2)	238 (78.8)	302	
How often				
Not everyday	2 (3.8)	50 (96.2)	52	<0.001*
Once a day	41 (23.8)	130 (75.6)	171	
Twice a day	7 (28.0)	18 (72.0)	25	
>twice a day	12 (75.0)	4 (25.0)	16	
Total	202	62	264	

ECC=Early childhood caries; *=Fisher's exact test is significant at level ≤ 0.05, **=Chi-square is significant at level ≤ 0.05

Figure 1: Severe early child hood caries seen in a 5-year-old child

middle SES, with children in the low SES having low caries prevalence (12.5%), this association was not statistically significant (P = 0.731) [Table 2].

Table 3 shows the association between infant feeding practices and ECC. 144 (44.4%) children were exclusively breastfed, only 6 (1.99%) were exclusively bottle-fed and the rest 162 (53.6%) were both breast and bottle-fed. There was higher caries prevalence among children who were exclusively bottle-fed (33.3%). There was no statistically significant difference in the three methods of infant feeding with regards to the prevalence of ECC among the children (P = 0.089).

The prevalence of ECC increased significantly with long duration of breastfeeding. Among those that were breastfed for 12 months or less, a caries prevalence of 7–25% was recorded while those that were breastfed for >13 months had a prevalence of 57%. The longer the duration of breastfeeding, the higher the prevalence of ECC. There was a statistically significant association between the duration of breastfeeding and the prevalence of dental caries (P < 0.001).

Out of 257 (86.8%) children who were breastfed on-demand, 54 (21%) had ECC while 39 (13.2%) children who were not breastfed on-demand 8 (20.5%) had ECC. Although there was a marginal increase in the prevalence of ECC in those that were breastfed on-demand, this relationship was not statistically significant (P = 0.943). The prevalence of caries was higher (21.2%) in those children who were breastfed at night than those who were not (12.5%), but there was no statistically significant difference in the two groups (P = 0.4).

More than half 100 (59.5%) of the children were bottled-fed for <12 months. Children that were bottle-fed >2 years had a higher prevalence (50%) of ECC. There was no statistically significant association between the duration of the bottle feeding and the development of ECC P = 0.668. Out of the 55 children who were bottle-fed at night, a significantly higher percentage (51%) had ECC compared with those who were not bottle-fed at night (13%). There was a statistically significant association between children who were bottle-fed at night and those who were not and the occurrence of ECC (P < 0.001).

Table 4 shows the association of ECC with cariogenic snacks/drinks and frequency of intake. 252 children had snacks in-between their meals out of which 58 (23%) had ECC compared with 50 children who did not have snack in-between-meals, but 6 (12%) had ECC. There was a higher prevalence of ECC in those who snacked between-meals than those who did not but this relationship was not statistically significant (P = 0.082).

Children who had soft drinks and related drinks had a significantly higher (24.7%) prevalence of ECC than those who did not (7.9%) (P = 0.004).

There was a statistically significant association between the frequency of consumption of sugar drinks and occurrence of ECC (P < 0.001). 264 (87.4%) children

Table 5: Association between dental health variables and ECC

	ECC (*n* (%))		Total	*P*
	Yes	No		
Method of tooth cleaning				
Salt water/cloth	13 (22.8)	44 (77.2)	57	<0.001**
Glycerine	24 (58.5)	17 (41.5)	41	
Ground glass	5 (10.2)	44 (89.8)	49	
Toothpaste/brush	22 (14.2)	133 (85.8)	155	
Total	64 (21.2)	238 (78.8)	302	
Onset of tooth cleaning (months)				
0-6	13 (17.6)	61 (82.4)	74	0.508
7-12	47 (21.9)	168 (78.1)	215	
>12	4 (30.8)	9 (69.2)	13	
Total	64 (21.2)	238 (78.8)	302	
Frequency of tooth cleaning				
Once daily	57 (20.9)	216 (79.1)	273	0.721
Twice daily	7 (24.1)	22 (75.9)	29	
>twice daily	0 (0.0)	0 (0.0)	0	
Total	64 (21.20)	238 (78.8)	302	
Who cleans teeth				
Child alone	10 (41.7)	14 (58.3)	24	0.004**
Care giver alone	9 (36.0)	16 (64.0)	25	
Child supervised	45 (17.8)	208 (82.2)	253	
Total	64 (21.2)	238 (78.8)	302	

ECC=Early childhood caries; *=Fisher's exact test is significant at level ≤ 0.05; **=Chi-square is significant at level ≤ 0.05

Table 6: Association between neonatal and infancy variables and ECC

	ECC *n* (%)		Total	*P*
	Yes	No		
Birth weight				
1500-2500	15 (22.7)	51 (77.3)	66	0.712
2501-4000	38 (22.0)	135 (78.0)	173	
>4000	11 (17.5)	52 (82.5)	63	
Total	64 (21.2)	238 (78.8)	302	
Medical illness				
Yes	17 (23.6)	55 (76.4)	72	0.565
No	47 (20.4)	183 (79.6)	230	
Total	64 (21.2)	238 (78.8)	302	
Medication				
No	49 (21.1)	183 (78.9)	232	0.956
Yes	15 (21.4)	55 (78.6)	70	
Total	64 (21.2)	238 (78.8)	302	

ECC=Early childhood caries

had been given a form of sweet or sugar. A significantly higher proportion of children (23.5%) who were given sweet/sugar had ECC compared with those who were not (5.3%) (*P* = 0.01).

The association between dental health variables and ECC is shown in Table 5. The different methods of tooth cleaning were recorded among the children, they include; glycerin, ground glass, toothpaste/brush and salt water/cloth. The prevalence of ECC was lowest among the children who used ground glass (10.2%), followed by those who used toothpaste/brush (14.2%), those who used glycerin had the highest prevalence of ECC (58.5%) (*P* < 0.001).

Early childhood caries prevalence 13 (17.6%) was lowest in children whose parents started cleaning their teeth as early as from birth to 6 months of age and was highest 4 (30.8%) in children whose parents started brushing their teeth later than 12 months of age. There was no statistically significant association between the age tooth cleaning started and the prevalence of ECC (*P* = 0.508).

Most of the children 273 (90.4%) had their teeth brushed once a day and only 29 (9.6%) had their teeth brushed twice a day. There was no statistically significant association between those who brushed once daily and those who brushed twice and ECC (*P* = 0.721).

There was a decrease in the prevalence 45 (17.8%) of ECC among children whose tooth cleaning was assisted or supervised by their parents or caregivers while those children who cleaned their teeth by themselves had a higher prevalence of ECC 10 (41.7%). This relationship was statistically significant (*P* = 0.004).

As shown in Table 6, children with low birth weight had a slightly higher prevalence (22.7%) of ECC than those with normal (22%) and high (17.5%) birth weight. There was no statistically significant association between child's birth weight and ECC (*P* = 0.712). Seventeen (23.6%) of the children who had a history of previous medical illness had ECC compared with 47 (20.4%) without a history of previous childhood illness. This relationship was not statistically significant (*P* = 0.565). There was no statistically significant association between children who had taken prescribed medication and the prevalence of ECC (*P* = 0.956).

Multivariate logistic regression analysis showed the correlation of ECC with the associated risk factors. It was observed that ECC was more likely to occur in children who slept with bottles and those who had their mouths cleaned with glycerin. Children who slept with feeding bottles containing infant formulas were about 3.5 times likely to have ECC when compared with those who did not (odds ratio [OR] = 3.5; 95% confidence interval [CI] = 1.11–10.95). Children who had their teeth cleaned with glycerin were 17.7 times more likely to develop ECC when compared with those whose mouths were clean with fluoridated toothpaste (OR = 17.7; CI = 3.0–103.7). Children between 6 and 16 months of age where less likely to develop ECC when compare with those between 61 and 71 months of age. Children who where breastfed for a duration of 3 to 6 months is less likely to develop ECC

Table 7: Multivariable logistic regression model for ECC risk factors							
Variables	B	SE	Wald	P	OR	95% CI	
						Lower	Upper
Age in months							
6-16	−4.348	1.409	9.519	0.002*	0.013	0.001	0.205
17-27	−1.087	0.702	2.395	0.122	0.337	0.085	1.336
28-38	−0.172	0.635	0.073	0.787	0.842	0.243	2.925
39-49	−0.599	0.657	0.833	0.361	0.549	0.152	1.989
50-60	−0.627	0.667	0.884	0.347	0.534	0.144	1.975
61-71	Referent						
Duration of breastfeeding							
<3 months	−1.650	0.970	2.891	0.089	0.192	0.029	1.286
3-6 months	−2.275	0.537	17.969	0.000*	0.103	0.036	0.294
7-12 months	−1.409	0.539	6.826	0.009	0.244	0.085	0.703
>13 months	Referent						
Sleep with bottle (yes)	1.250	0.583	4.592	0.032*	3.490	1.113	10.949
Sleep with bottle (no)	Referent						
Sweet/sugar (yes)	−1.042	1.978	0.277	0.598	0.353	0.007	17.033
Sweet/sugar (no)	Referent						
Not everyday	−2.064	1.268	2.649	0.104	0.127	0.011	1.525
Once a day	−0.433	1.031	0.176	0.675	0.649	0.086	4.895
Twice a day	−0.599	1.197	0.251	0.617	0.549	0.053	5.737
>twice a day	Referent						
Salt water/cloth	1.302	0.765	2.895	0.089	3.677	0.820	16.483
Glycerine	2.876	0.901	10.191	0.001*	17.745	3.035	103.747
Toothpaste/brush	0.336	0.643	0.274	0.601	1.400	0.397	4.934
Ground glass	Referent						
Child cleaning	−1.119	0.890	1.582	0.208	0.327	0.057	1.868
Child supervised	−0.899	0.647	1.929	0.165	0.407	0.115	1.447
Care giver alone	Referent						

SE=Standard error; CI=Confidence interval; ECC=Early childhood caries; OR=Odds ratio; Adjusted OR>1; Positive association; Adjusted OR<; Negative association; *$P<0.05$ significant

when compared with those who where breastfed for longer than 12 months [Table 7].

Discussion

Prevalence and severity of early childhood caries
Dental caries among preschool children is still of concern in Nigeria. Reports from previous studies show that the prevalence of ECC varies from 1% in Australia to 70% in developing countries or deprived groups in developed countries.[6] The wide variation may be due to so many factors some of which are beliefs, cultural and ethnic differences in feeding practices.

The prevalence of ECC in children studied was found to be 21.2% with mean deft of 0.735. The 21.2% prevalence reported in this study is higher than that seen in some other similar Nigerian studies.[10-12] The trends from previous Nigerian studies show that there an increase in the prevalence of ECC from the year 2007 till date. In recent times, despite intervention, the prevalence of caries in the primary dentition increased from 17.9% to 20.4% over a 3 years period.[8,9] Although the severity of caries was low,

the number of untreated caries seen in the children in this study constituted 96% of the dmft score this is consistent with previous studies in Nigeria [Figure 1].[9,10,13] The high level of untreated caries could be ascribed to the low pediatric dentist/population ratio in Nigerian, attitude of parents toward the primary dentition and high cost of treatment.[14,15] During the present investigation parents and caregivers were referred to the pediatric dentistry unit, which was also within the same hospital, only a few parents showed up with their children and some never came back after the first visit, this may be due to the high cost of treatment. A current study revealed that there is a silent epidemic of caries in Nigerian children and they concluded that a national survey will be needed to generate the needed evidence for planning of community relevant responses to the national caries epidemic in children.[8]

Age and gender
Similar to the result of previous studies, this present study also showed that caries prevalence increased significantly with age. Children above the age of 61 months showed an overall higher caries prevalence than the younger age.[16,17] The finding that caries prevalence and the number of

confirmed cases of ECC increased with increasing age was as expected, because there is an increasing number of erupted primary teeth, which become exposed to the oral environment and cariogenic challenge. Also as children grow older there is a change in their dietary habit and oral hygiene practices. Although the prevalence of ECC was higher in females 60.9% as compared to males 39.1%, the difference was not statistically significant. Boys showed higher ECC severity index. This corroborates with previous studies.[1,10,18] Higher prevalence of ECC in females may be due to the fact that females have more teeth erupting earlier than males of the same age group. The females also tend to consume more refined carbohydrate than males.

Socioeconomic status

Early childhood caries is a social, political, behavioral, and medical problem that can be controlled only through understanding the dynamic changes that are taking place in the society, particularly as they pertain to environmental factors such as neighborhood, family structure, nurturing of children, and SES.[19]

In this study, the combined mothers' education and fathers' occupation were used to determine the SES of the children studied. There was a tendency toward higher caries levels in the children in the high and middle socioeconomic groups than in the lower socioeconomic group. The children in the lowest socioeconomic group, SES V had the lowest prevalence (12.5%) of ECC. The difference was not statistically significant. This is a rare finding as ECC has been associated with children from, low socioeconomic back ground, ethnic minority, and low income groups.[1] This may be as a result of the fact that those in the higher SES can afford and consume greater quantity of refined carbohydrate than those in the lower SES. Another reason for this may be because the evaluated sample was very homogeneous as to socioeconomic and cultural status. This finding is similar to Nigerian study where the authors also reported higher caries prevalence in the high SES group.[10] This finding is contrary to other findings where higher prevalence of ECC among children of low SES.[17,20] In Nigeria it is difficult to classify people according to their SES because of the peculiarities of our environment, logistics and multiple sources of income. Many SES variables have been used to determine the risk for factor ECC, some authors concluded that the combined impact of neighborhood deprivation and ethnicity seemed to be of such importance that it masks the effect of the other SES variables (income, highest educational level, and occupational level in the family.[21]

Feeding practices

In this study, 44.4% children were exclusively breastfed, 1.99% children were exclusively bottle-fed the remaining 53.6% had mixed feeding. The caries prevalence was highest in those who were exclusively bottle-fed. The pattern of infant feeding practice was not statistically significant in this study. A study in the United States has indicated that infant breastfeeding and its duration, whether exclusive feeding or not, is not associated with any increased risk for ECC.[22] A systematic review of the relationship between breastfeeding and ECC has thereby suggested that a definite conclusion cannot be drawn due to the inconsistent methodological approach in the research which makes it difficult to compare findings.[23] This shows that influence of infant feeding/standard error on ECC remains a complex and somewhat controversial issue. The American Association of Pediatricians recommends exclusive breastfeeding for 6 months with continuation of breastfeeding for 1-year or as long as mutually desired by mother and infant.[24] The American Academy of Pediatric Dentistry (AAPD) encourages breastfeeding of infants to ensure the best possible health and developmental and psychosocial outcomes, with care to wiping or brushing as the first primary tooth begins to erupt and other dietary carbohydrates are introduced.[25]

In this study although the prevalence of ECC was higher in children who were breastfed on-demand and at night, this relationship was not statistically significant. In a critical review of the literature to determine whether nocturnal and on-demand breastfeeding were associated with caries in infants and preschool children, the authors and others pointed to the lack of evidence that human milk is cariogenic and stated that other factors, such as oral hygiene, may be more influential in caries development than on-demand breastfeeding.[22,23,26] Thus, on the basis of the current scientific evidence, it appears that the relationship between unrestricted (*ad libitum*) breastfeeding and an increased risk of developing caries is equivocal. A critical review concluded that there was "no evidence" to prove human milk can be associated with the development of caries. It was concluded that there is no strong and consistent evidence between breastfeeding and caries.[23]

There was a statistically significantly higher caries prevalence in children who were breastfed longer than 12 months of age, this is similar to another current study.[27] White in her critical review of the literature on breastfeeding and the risk of ECC posed as a clinical scenario concluded that there was a lack of consistent evidence linking breastfeeding to the development of ECC.[23]

In the present study, there was a significantly higher prevalence of ECC in children who were bottle-fed at night (51%) than those who were not (13%). This conclusion agrees with other studies that examined bottle feeding in detail that duration of bottle feeding particularly at night is the most important determinant for ECC development rather than bottle feeding itself.[1,28]

The contents of bottles of children who were bottle-fed were also investigated in this study, children who had

formula milk, chocolate drinks and juice in their bottle showed a higher prevalence of ECC than those who had water and pap (local cereal) in their bottles. This association was statistically significant. The AAPD recommends that parents should avoid high frequency consumption of liquids and/or solid foods containing sugar in their children. In particular: Sugar-containing beverages (e.g. juices, soft drinks, sweetened tea, milk with sugar added) in a baby bottle or no-spill training cup should be avoided. Infants should not be put to sleep with a bottle filled with milk or liquids containing sugars. *Ad libitum* breastfeeding should be avoided after the first primary tooth begins to erupt and other dietary carbohydrates are introduced. Parents should be encouraged to have infants drink from a cup as they approach their first birthday. Infants should be weaned from the bottle between 12 and 18 months of age.

In the present study, there was a statistically significant association found between caries prevalence and consumption of cariogenic food in form of sweets and sugar, intake of soft drinks and related drinks and the frequency of consumption of soft drinks, this correlates with some other studies.

The eating habits of children have changed dramatically in the past years, consumption of soft drinks, juices, noncitric beverages and carbohydrate has increased.[12,29] From the present study most of children took at least one soft drink, juice or noncitric drink and biscuit to school every day, some children took soft drink along with their meals daily. The sugar intake in the early stages of life may accelerate the accumulation of *mutans* streptococci in the infant's mouth, which is a risk factor for caries. The *mutans* streptococci colonization is directly proportional with increased snacking habits leading to increase in ECC prevalence. The present study supports the earlier studies, which states that frequent consumption of cariogenic foods, snacks and drinks in-between-meals increases the risk for caries.[16,27]

Oral hygiene practices and early childhood caries
Preventive dental health behaviors, such as method of tooth brushing, early onset of tooth brushing, parental supervision of tooth brushing and daily use of fluoride dentifrices were shown to significantly reduce prevalence of ECC in this study population. Other cross-sectional studies have demonstrated that earlier tooth brushing has a strong counter effect on poor infant feeding practice.[5,11]

Parental assistance and guidance is essential to reduce the risk of developing ECC. Tooth brushing by parents or caregivers has the potential of removing dental plaque more effectively, optimally saturating the oral environment with fluoride, thereby decreasing the risk of caries among children.[22,26] In the present study, the prevalence of caries in those children who practiced tooth brushing by themselves was significantly higher than those children who brushed under parental supervision. The importance of prolonged participation of parents in tooth cleaning of these preschool children should be emphasized. Most children (90.4%) in this study brushed or cleaned their teeth once daily. It is surprising to find that those children who brushed their teeth twice daily had a slightly higher prevalence of ECC although this finding was not statistically significant. This may be due to the fact that most of the children brushed their teeth without supervision of their parents and the use of wrong brushing technique. Tooth brushing with a frequency of at least twice a day under parental guidance using fluoridated toothpaste has been shown to decrease the risk of caries among children. Various methods of tooth cleaning such as water and salt, ground glass, glycerin, cloth were used for the children in this study. Children who used toothbrush and fluoridated toothpaste had a significantly lower prevalence of caries when compared with the other methods. It is worthy to note that most of the parents in this study were not familiar with the difference in toothpaste content and many did not know the effect of fluoride content in the toothpaste on their children's teeth. In most cases the parents used the same toothpaste, which they were using for themselves for their children with perhaps lesser amount than theirs. The AAPD recommends that pea size amount of dentifrice be used in children.[2]

Medical status and early childhood caries
Neonatal and infancy risk factors such as birth prematurity (<36 weeks gestation, low birth weight (<2500 g) and history of previous childhood illness were not significantly associated with the ECC in this study. Although in a cross-sectional study to determine the social and behavioral determinants of ECC the authors concluded that a history of prescribed medicine (most commonly antibiotic therapy) was associated with a significantly less prevalence of ECC and they further explained that the protective effect may be as a result of frequent use of antibiotics to manage childhood illness, thereby reducing the level of active oral *mutans* streptococci infection and the predisposition for dental caries development.[1] However it has been reported that chronically ill children who take lots of sugar-containing medications have a risk of having caries.[3,7]

This survey has identified risk factors for the presence of ECC in preschool children in Lagos. Data from this study can serve as a baseline for planning effective caries prevention methods and oral health promotion programs. The burden of dental decay in this population reveals the need for effective preventive method. Screening for dental caries should start as soon as the first primary tooth erupts or not later than the 1-year of age. Oral health promotion programs should be established focusing on mothers, caregivers, community health workers, pediatricians, preschool teachers and children.[30]

The study had its limitations. Some of the limitations were deriving detailed and accurate information from parents regarding the feeding and oral hygiene practices, also being a hospital based study, there is need for a national survey on the prevalence of ECC to support oral health promotion program.

Conclusion

The study documents the prevalence and risk factors for the presence of ECC in preschool children in Lagos. The prevalence of ECC was 21.2% with the mean deft of 0.735. The level of untreated caries was high among the study population. After adjusting for possible cofounders, it can be concluded that

- ECC was significantly higher in children who were bottle-fed at night
- Method of tooth cleaning other than using fluoridated toothpaste significantly increased the prevalence of ECC
- Breastfeeding for a duration of 3 to 6 months showed significantly lesser caries prevalence
- Caries significantly increased with age.

The findings from this survey will form part of the baseline for oral health assessment for children below the age of 6 years in Nigeria.

Acknowledgment

We wish to thank the mothers and children who participated in the study.

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