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ABSTRACT

Background: Early childhood caries (ECC) is a growing oral health problem in the developing nations and has been associated with a number of socio-economic and behavioural factors.

Objective: To determine the effects of some socio-economic and behavioural factors related to ECC in 3-6-year-old children attending an out-patient paediatric dental clinic in Nairobi, Kenya.

Design: A descriptive cross-sectional study

Setting: The Lady Northey dental clinic during the period of October to November 2014.

Subjects: Two hundred and seventy two (272) children whose parents/guardians were initially interviewed to determine the socio-economic status of each of the children.

Results: The prevalence of dental caries among the children was 95.5%, most of whom had poor oral hygiene. The high decayed, missing and filled teeth (dmft) was associated with the low socio-economic status of the parents/guardians, poor oral hygiene, increased consumption of cariogenic sugars and low oral health seeking behaviour.

Conclusion: The high prevalence of ECC of 95.5% found among the children who participated in the study has a prominent association to their socio-economic and behavioural factors.

INTRODUCTION

Early Childhood Caries (ECC) has been defined as the presence of one or more decayed, missing (due to caries), or filled tooth surfaces (dmfts) in any primary tooth in a child aged 71 months or younger (1). It is prevalent in many communities in developing countries and in the underserved communities in the developed countries (2). The prevalence of ECC has ranged from 1-12% for the communities in the developed countries to as high as 70% for the communities in the developing countries (3). The predisposing factors for ECC have been associated with prolonged and night-time bottle feeding with milk, sweetened water or juice, "ad lib" breast feeding, prolonged use of a pacifier coated with sugar, sweetened foods and the presence of hypoplastic primary teeth in a child who is already predisposed to any of these factors. Furthermore, the parents' socioeconomic status also determines the capability of the child accessing their daily needs, including daily feeding and maintenance of oral health. Parents with inadequate availability of finance are unlikely

to provide adequate nutrition or the tools needed for maintenance of the good oral hygiene of their children. As a result, children from these families are likely to be predisposed to ECC.

Early adoption of good daily oral health habits, for example, daily brushing of teeth, controlled consumption of cariogenic foods and regular consultation with a dentist can help prevent the development of ECC (4). It has been suggested that habits acquired by children early in their lives continue to shape their attitudes and lifestyle choices they make as adults. Thus, good oral hygiene and dietary habits adopted at an early age by the children could ensure that the children maintain optimal oral health later in their lives (5). Additionally, the *sine qua non* is that children aged below 5 years spend more time with their parents. Parents who have previously acquired good oral health habits are more likely to impact positively to their children (5).

When ECC remains untreated, the long-term consequences are pain and premature loss of primary teeth. The early loss of teeth may predispose the child to malocclusion in the permanent dentition, increased

risk of developing caries in the same dentition and reduced oral health related quality of life (6). Past studies conducted among 3-5-year-old children in Nairobi, Kenya and its environs gave a prevalence rate of ECC ranging from 59.5 to 93.6%, with dmft ranging from 1.95 to 8.0 (7, 8). These prevalence levels are high when related to those obtained in Ghana where the prevalence of ECC was reportedly 47% (9). Probably there could be unique factors to the Kenyan communities predisposing the children to ECC. The objective of the present study was to correlate ECC in the 3-6-year-old children attending Lady Northey dental clinic with family-related socio-demographic factors and their oral health habits.

MATERIALS AND METHODS

Study Area: The study was conducted at Lady Northey dental clinic, in Nairobi City County which is divided into 17 parliamentary constituencies with several private and non-governmental health institutions. Out of these health institutions, only the Kenyatta National, University of Nairobi Dental and Gertrude's Children Hospitals have established units for specialized oral health care for children while Lady Northey Dental Clinic is the only other stand-alone public out-patient dental clinic that offers oral health care to children from the County and its environs. Lady Northey Dental clinic was established in 1978 and is located very close to the central business district (CBD) with easy access by road and walkways. The clinic offers free oral health services to children. Currently the staff at the facility consists of two general dental practitioners, two paediatric dentists (seconded from the Ministry of Health), two Community Oral Health Officers (COHOs) and five nurses.

Study Population: The present study population included 272 children aged 3-6 years in full primary dentition who were attended to at The Lady Northey dental clinic during the period of October to November 2014.

Study Design and Data Collection: This was a descriptive cross-sectional study with a minimal analytic component. A purposive sampling method was used to select the study population. Prior to the commencement of the study, approval was obtained from the Kenyatta National Hospital and the University of Nairobi Ethics and Research Committee (P356/06/2014).

The study was conducted in two parts. There was the initial face-face interview with the parents/guardians using a pre-tested questionnaire followed by a clinical oral examination of the child, for dental plaque and caries. The face-face interview was conducted by a trained and calibrated research assistant. Through this interview, the participating

children's background information on socio-demographic characteristics, oral hygiene, dietary practices, tooth-brushing and visits to a dentist were obtained.

The Principal Investigator (PI), who had previously been calibrated by an experienced paediatric dentist, examined the children for dental plaque and dental caries. The oral examination of the children was carried under natural lighting with the child seated on a bench or on the parent's lap. The Rodrigues (1990) simplified debri index was used to score for plaque (10), with four scores taken: no debri, soft debri not more than one third of the tooth surface, soft debri covering more than one third and soft debri covering more than two thirds of the tooth surface. In the case of detection of dental caries, sterile cotton gauze, a dental mirror and a blunt explorer were used. The teeth were cleaned and dried with gauze before being examined with the explorer for caries using the WHO 2013 criteria (11). Every tenth child was re-examined by the PI to establish the intra-examiner consistency. All the children who participated in the study together with their parents were further provided with oral health information on preventive measures and treatment options available with regard to the children's oral health status.

Statistical analysis: Data were entered into a computer and processed using the Statistical Package for Social Sciences version 20 computer programme (SPSS Inc, Chicago, IL, USA). Appropriate statistical tests were used and the results obtained presented using charts and tables to provide an overview of the findings of the study.

RESULTS

Dental caries: Two hundred and seventy two children aged 3 to 6 years and their parents/guardians participated in the study. The male to female ratio for the children was 1:1 with a mean age of 4.5 (SD = ±0.8) years. The overall prevalence of dental caries for the study population was 95.5%, with a mean decayed, missing, filled teeth (dmft) of 8.53 (+ 5.52 SD). The mean decayed component in the dmft index was the highest among the male participants [8.65(SD+5.54)].

Socio-demographic characteristics: Most of the children in the study came from a poor socio-economic background with nine children (3.3%) belonging to a single-parent family (mother). Approximately 48.2% of the fathers and 41.9% of the mothers of the children in the study had completed secondary school education. Table 1 details the association between dental caries experience of the children and their various socio-demographic characteristics. Regarding the employment status of the parents, 73.2% of the fathers were in formal employment while only 20.2%

of them were in the formal employment.

The highest dmft scores were associated with children whose fathers had no formal schooling, mothers who had less than primary education and fathers whose employment status was not known or were unemployed. The mean missing component of the dmft increased with increasing age of the children (Table 1). However, there was no statistically significant difference in the occurrence of dental caries among the children in the various socioeconomic status ($p > 0.05$). Due to the high prevalence of dental caries recorded, a complete multivariate logistic regression analysis of the socio-demographic variables could not be estimated but the effects of some of the variables assessed produced the results as shown in Table 2. The results showed that male children appeared to have been slightly more likely to get dental caries than the female children with age difference appearing not to have had much effect on the increase in the occurrence of dental caries.

Brushing habits and dental plaque: All the children who participated in the study had plaque, with the majority (55%) of them having been males. The proportion of the males who had more than two thirds of plaque deposits on their teeth was not statistically significantly when related to the female children (Chi-square test, $p = 0.123$). The highest plaque scores were reported among children whose fathers and mothers had completed secondary school (48.2% and 42.0% respectively) and for children whose fathers were in informal employment (73.2% had high plaque scores). However, the difference was not statistically significant (Fisher's exact test, $p > 0.05$). Poor oral hygiene, where a child had more than one third of

the tooth surface covered with plaque, was found to have been associated with a high occurrence of dental caries with the results having been statistically significant. (ANOVA = 3.768, $df = 2$, $p = 0.024$).

The brushing habits of the children who participated in the study are shown in Table 3. The majority of the children in the study had indicated that they brushed their teeth using a toothbrush. Two hundred and sixty four (97.1%) of the children brushed their teeth out of whom 77.2% brushed once a day, 12.9% brushed two or more times a day and 2.9% had never brushed at all. The highest dmft was seen among children who never brushed or brushed their teeth several times a month. However, the difference among the groups was not statistically significant (ANOVA, $p = 0.524$).

Dietary habits: The most frequently consumed cariogenic food/drink by the participants was tea containing sugar (93.7%), followed by jam/honey (37.2%) and the least consumed were soft drinks and fruit juice. The complete list of the commonly consumed cariogenic foods and their effects on dmft is as shown in Table 4. When the intake of cariogenic foods by the children was analyzed and related to their dmft, there were no statistically significant differences amongst them (ANOVA, $p > 0.005$).

Oral health seeking behaviours: Most of the children (59%) had never visited a dentist before the current study. The majority of the children who had visited a dentist (95.5%) had done so because of dental pain. None of the children had visited a dentist for routine check-up.

Table 1

The Association of various components of Dental Caries experience of the children and the parent's socio-demographic characteristics

	dt Mean + SD	mt Mean + SD	ft Mean + SD	dmft Mean + SD
Overall	8.51 + 5.52	0.02 + 0.12	0.00 + 0.06	8.53 + 5.52
Gender				
Male	8.65 + 5.54	0.02 + 1.15	0.00 + 0.00	8.67 + 5.56
Female	8.37 + 5.50	0.01 + 0.08	0.01 + 0.08	8.38 + 5.49
Age				
3 yrs	8.83 + 5.37	0.00 + 0.00	0.02 + 0.15	9.2 + 5.46
4 yrs	8.81 + 5.59	0.00 + 0.00	0.03 + 0.16	8.9 + 5.73
5 yrs	8.50 + 5.38	0.01 + 1.20	0.02 + 0.14	9.1 + 5.59
6 yrs	5.83 + 4.86	0.17 + 0.39	0.00 + 0.00	6.4 + 5.35
			ANOVA = 0.943, df = 3, p = 0.420	
Highest Level of education by Father				
College/University	7.95 + 5.58	0.03 + 1.64	0.00 + 0.00	7.97 + 5.60
Secondary school completed	8.64 + 5.15	0.01 + 0.09	0.01 + 0.09	8.66 + 5.15
Primary school completed	8.34 + 6.01	0.02 + 0.15	0.00 + 0.00	8.36 + 6.03
Less than primary school	9.75 + 7.97	0.00 + 0.00	0.00 + 0.00	9.75 + 7.97
No formal schooling	15.00 + 0.00	0.00 + 0.00	0.00 + 0.00	15.00 + 0.00
No father/legal guardian	8.78 + 5.33	0.00 + 0.00	0.00 + 0.00	8.78 + 5.33
Not known	12.40 + 7.44	0.00 + 0.00	0.00 + 0.00	12.40 + 7.44
			ANOVA = 0.815, df = 6, p = 0.559	
Highest Level of education by Mother				
College/University	8.1 + 4.96	0.58 + 1.09	0.03 + 0.17	8.7 + 5.2
Secondary school completed	8.1 + 5.39	0.43 + 0.89	0.01 + 0.94	8.5 + 5.7
Primary school completed	9.2 + 5.46	0.42 + 0.80	0.03 + 0.19	9.6 + 5.6
Less than primary school	8.7 + 8.62	2.33 + 3.22	0.00 + 0.00	11.0 + 9.2
			ANOVA = 1.097, df = 3, p = 0.351	
Employment Status of father/Male				
Formal employment	7.26 + 5.29	0.00 + 0.00	0.00 + 0.00	7.26 + 5.29
Informal employment	8.74 + 5.56	0.02 + 0.14	0.01 + 0.07	8.76 + 5.56
Unemployed	9.65 + 5.48	0.00 + 0.00	0.00 + 0.00	9.65 + 5.47
Unknown	12.00 + 0.00	0.00 + 0.00	0.00 + 0.00	12.00 + 0.00
			ANOVA = 1.416, df = 3, p = 0.238	

Table 2
Parameter estimates from logistic regression of dichotomised dmft index

Covariate	B	SE	WALD	P value (X ²)
Gender	Male	0.35	0.69	0.26
0.612				
Female#	-	-	-	-
Age				
3	2.85	1.81	2.48	0.116
4	2.86	1.73	2.75	0.098
5	2.59	1.67	2.41	0.122
6#	-	-	-	-

- Baseline

Analysis of the socio-demographic variables could not be estimated due to the high prevalence of dental caries reported.

Table 3
Association between brushing frequency and the dmft of the children who participated in the study.

	dt	mt	ft	dmft
	Mean + SD	Mean + SD	Mean + SD	Mean + SD
Frequency of Brushing teeth				
Several times a month	13.00 + 8.49	0.00 + 0.00	0.00 + 0.00	13.00 + 8.49
Never	11.38 + 6.87	0.00 + 0.00	0.00 + 0.00	11.38 + 6.87
Once a day	8.51 + 5.35	0.02 + 0.14	0.00 + 0.00	8.53 + 5.35
Two or more time a day	7.83 + 5.97	0.00 + 0.00	0.03 + 0.17	7.86 + 5.97
Several times a week	8.31 + 5.66	0.00 + 0.00	0.00 + 0.00	8.31 + 5.66
Once a week	7.25 + 6.34	0.00 + 0.00	0.00 + 0.00	7.25 + 6.34
Total	8.51 + 5.51	0.02 + 0.12	0.00 + 0.06	8.53 + 5.52

ANOVA = 0.837, df = 5, p = 0.524

Table 4
Association between Dental Caries experience of the children by the cariogenic dietary intake

Cariogenic Food/Drink	N	Mean dmft (SD)
Biscuits, Cakes		
Several times a day	13	8.54 (5.62)
Every day	75	8.00 (5.24)
Several times a week	50	8.08 (4.92)
Once a week	42	8.21 (6.21)
Several time a month	56	9.51 (5.57)
Never	35	9.00 (6.02)
ANOVA = 0.606, df = 5, p = 0.695		
Chewing gum		
Several times a day	37	8.26 (4.85)
Every day	42	7.19 (4.76)
Several times a week	53	7.86 (5.87)
Once a week	45	9.47 (4.94)
Several time a month	37	9.44 (5.78)
Never	58	9.00 (6.22)
ANOVA = 1.195, df = 5, p = 0.312		
Jam, Honey		
Several times a day	16	6.86 (5.53)
Every day	85	8.64 (5.38)
Several times a week	26	7.81 (5.04)
Once a week	19	10.21 (4.02)
Several time a month	36	9.77 (6.49)
Never	90	8.07 (5.60)
ANOVA = 1.192, df = 5, p = 0.314		
Juice		
Several times a day	5	11.40 (4.51)
Every day	27	8.78 (6.45)
Several times a week	48	8.20 (5.02)
Once a week	47	8.18 (5.61)
Several time a month	82	8.32 (5.14)
Never	63	8.97 (5.99)
ANOVA = 0.451, df = 5, p = 0.813		
Soft drinks		
Several times a day	1	10.00 (0.00)
Every day	18	8.89 (5.38)
Several times a week	79	7.48 (5.30)
Once a week	57	10.36 (5.60)
Several time a month	72	8.52 (5.60)
Never	44	7.79 (5.42)
ANOVA = 2.00, df = 5, p = 0.079		
Sweets, Chocolates		
Several times a day	44	7.64 (5.02)
Every day	38	8.29 (4.67)
Several times a week	38	7.89 (5.03)
Once a week	50	8.29 (6.21)
Several time a month	40	10.39 (5.43)
Never	62	8.71 (5.98)
ANOVA = 1.235, df = 5, p = 0.293		
Tea with sugar		
Several times a day	217	8.90 (5.64)
Every day	38	6.63 (4.51)
Several times a week	4	10.50 (4.36)
Once a week	1	16.00 (0.00)
Never	12	6.83 (5.20)
ANOVA = 2.274, df = 4, p = 0.062		

DISCUSSION

The prevalence of dental caries in the present study population was the highest (95.5%), when related to the 63.5%, 59.5%, 89.4% and 93.6% found in other studies (7,8,12,13). It does appear that Kenyan children could be having a much higher prevalence of ECC, particularly when related to results obtained in Ghana of 47% (9). Most of the other studies were conducted on children who were either in school or at a hospital attending the facility for a different health problem. Nonetheless, the results obtained from the study and from those other past ones, obviously indicate that ECC appear to be a huge problem.

Cultural, economic and social differences have the potential to positively or negatively influence the behaviour of people in any given society. Past studies have reported socioeconomic status and the oral health practices of a community forming part of the high rate of ECC (14). In the present study more than one indicator was used to determine whether the socioeconomic status of the participants predisposed them to ECC. These were parents' education level, employment status and oral health seeking behaviours. Parental employment status, dental attitude and dental behavior have been shown to have strong influence on the caries status of children (15,16). Further, parent's education level has also been associated with the level of caries experience of their children (17) such that mothers with lower level of basic education, have been associated with higher caries prevalence among their children. The present study showed similar results. The mothers' low level of education was found to have been associated with higher dental caries experience in their children while no such association was seen with the fathers' level of education just as other studies have previously reported (18). The employment status of the father also showed a strong relationship with ECC. Children whose fathers were unemployed or were in informal employment had a higher prevalence of ECC. This could have been due to the fact that these parents were probably unable to afford toothbrushes and access to information and dental facilities. The parents might have been busy trying to get their daily needs and neglected oral health for their children. Notable in the study was the fact that the boys were more vulnerable to getting caries than girls probably due to cultural factors or that parents could be more concerned about the oral health of the girls than boys. Unfortunately this can only be speculation, as it did not form part of the present study.

The majority of the children in the study claimed to brush their teeth daily using fluoridated toothpaste,

yet most of them actually had poor oral hygiene with plaque on the teeth covering more than two thirds of the tooth surface. This compares with a past study by Kassami et al, 2010 (12). The possible reason for this discrepancy could lie in the fact that the tooth brushing done could have been ineffective or that the replies given to the question on brushing might have been untrue. Although confidentiality had been assured, some of the answers by the parents/guardians might have been underestimated due to embarrassment or fear of answering what could be perceived as the correct answer to that question. The poor oral hygiene could have also been as a result of parents' lax attitude when regulating brushing frequency or that youngsters were not assisted in tooth brushing given their tender age. Children younger than 10 years of age lack the motivation as well as the manual dexterity to perform effective tooth brushing (19) consequently they will need parental assistance when brushing, as stated in the policy guidelines on early childhood caries (1). Furthermore, although the education level attained for most caregivers was secondary school level, it would have been reasonable to expect these caregivers to have known the importance of oral hygiene for their children. Probably due to the fact that most of the caregivers were unemployed or in informal employment, they might have found the need for oral health care for their children to have been less important to them than the struggle for other vital daily needs.

In this study, the intake of sugar was high in the form of tea containing sugar and soft drinks. Sucrose is a widely used dietary sugar in most of the consumable food products making it a common, available and accessible substance to a majority of Kenyan children population (20). Urban lifestyles have also been found to have an influence on the dietary patterns of children in Kenya with high consumption of snacks being reported at home and school (7). Foods or drinks containing sucrose have been associated with increased incidence of caries, which might not have been a surprising indicator in the present study. Some of the foods taken by the children might have been provided freely by the parent as sootheners or the parents could also have faced the situation of being unable to control the sugar consumption or snacking by the child while at school.

The results of the present study showed that the caregivers took their children to a dentist only when there was a complaint, mainly dental pain. Dental check-ups were not at all reported. This would obviously support the reasons why the children had a high ECC as they were unlikely to get any preventive

information or early intervention if they were not consulting oral health providers earlier.

The consequences of untreated dental caries are pain, sepsis, space loss, increased treatment costs, risk of new carious lesions and of course effects on growth and development and oral health related quality of life. Most of the subjects who took place in the present study came from a low socioeconomic background. These parents appear to find themselves in a position that is untenable where they have to take care of the oral health of their children at the same time continue with their other daily struggles of life. It is hoped that with the emerging government-backed medical insurance programme in Kenya, through National Hospital Insurance Fund (NHIF), ECC will be considered within the framework of primary health care. Patient-centred and team-based approach would be the better option to adopt if we have to begin changing the pattern of this disease that is becoming rampant among many young children in Kenya as has been demonstrated in this study.

In conclusion, the high prevalence of ECC of 95.5% found among the children who participated in the study has a very prominent association with the socioeconomic and behavioural factors that were considered in the study.

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