Risk factors associated with early childhood caries (ECC) in Nigerian children

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Abstract

Objective: Many factors such as poor oral hygiene, inappropriate feeding habits, low family socio-economic status and low educational level of parents have been suggested as contributory to the occurrence of early childhood caries (ECC). This study was carried out to determine the risk factors associated with ECC in some Nigerian children.
Method: Children aged 71 months and below who presented at three paediatric dental clinics in Lagos were examined. Controls were obtained from the nearby nursery and kindergarten schools after obtaining parents' consent. Sociodemographic variables and past infant feeding, weaning practices and oral hygiene habits were obtained using a self-administered questionnaire given to the parents.
Result: One hundred and forty-two children comprising 45.8% with ECC and 54.2% controls (without caries) participated in the study. The type of infant feeding, duration of feeding and commencement of supplements were not significantly different between the two groups (chi sq 1.8, p=0.4; chi sq 3.2, p=0.52 and chi sq 7.2, p=0.12 respectively). The only significant risk factor for ECC in the ECC group in this study was the type of supplements given to the children. A significant proportion of children in the ECC group were given commercially prepared cereal mixes compared with the controls (p=0.004) while 42.9% of children in the control group were given regular family diet compared with 20% of the ECC group.
Conclusion: The most important risk factor for the occurrence of ECC in the affected children who participated in this study was the consumption of commercially prepared canned cereal given as supplement to infant feeding. Oral health education should be targeted at pregnant and nursing mothers concerning appropriate infant feeding and weaning practices for their children.

Key words: Early Childhood Caries, risk factors, Nigerian children

Introduction

Early Childhood Caries (ECC) is the term used to describe dental caries affecting one or more primary teeth in children up to 72 months of age [1]. It has been defined as 'the presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries) or filled tooth surfaces' in any primary tooth in a child 71 months of age or younger [2]. In children younger than 3 years of age, any sign of smooth surface caries is indicative of severe early childhood caries (S-ECC). From 3 years through 5 years, 1 or more cavitated, missing (due to caries) or filled smooth surfaces in primary maxillary anterior teeth, or a dmf score of ≥4 (age 3), ≥5 (age 4) or ≥6 (age 5) surfaces constitute S-ECC [3].

It is a unique pattern of carious lesion which progresses rapidly, often leading to infection of the pulp and feeding and sleep problems. Earlier terms used for this condition-baby-bottle tooth decay, nursing caries and bottle caries-give the impression of feeding pattern as the major cause. It was associated with prolonged and frequent daytime, naptime, and nighttime bottle-feeding containing milk, fruit juice or other sweetened solutions [4,5]. Prolonged and excessive breastfeeding has also been suspected as a causative factor of ECC [6,7,8]. But the multi-factorial aetiology of dental caries is now well documented. Apart from inappropriate feeding practices, poor oral hygiene and tooth susceptibility have been implicated in its initiation. So, the new broad term reflects the multi-factorial aetiology of the disease as it diverts attention from the dietary causes [9].

The general etiology of ECC appears to be similar to that of other types of caries, that is, the interaction of host pathogenic oral microorganisms, fermentable carbohydrates and susceptible tooth surface. [10] The biology of ECC may be modified by factors unique to young children; the implantation of cariogenic bacteria, immaturity of the host's defense systems and behavioral patterns associated with feeding and oral hygiene in early childhood [11,12]. The aetiology is ascribed to prolonged or frequent contact with sugar containing foods, oral infection with streptococcus mutans and in some cases, enamel hypoplasia that makes the primary teeth more susceptible to demineralization [12,13].

An early prevalence study in 4-5 year old Nigerian children was given as 2.4% [14]. The commonest connection with ECC found in our environment is prolonged bottle feeding, the daily intake of soft fizzy drinks and frequent consumption of fruit juices [14]. It has also been demonstrated to be related to the age at weaning [15]. The mean age of complete weaning in caries-free children was found to be less (12 months) than those with caries (19 months). Parents' educational background and the family socioeconomic class have also been found to have influence on the

occurrence of ECC [16-19].
There is paucity of literature on the epidemiology of early childhood caries in Nigeria. Adequate comparison cannot be made between the few existing studies and those of other countries because of the different definitions and standard of measurement of the condition. This study was carried out to determine the risk factors which may be associated with ECC in children in Lagos, Nigeria, to evaluate the preventive measures for the condition and to educate parents on the risks and prevention in their children and wards.

Materials and Method

Subjects
Participants were children 18-71 months old who attended the paediatric dental clinics of the Lagos University Teaching Hospital, Massey Street Children Hospital and the Lagos State University Teaching Hospital, Lagos. Controls were children without caries matched for age and sex attending the Teaching Hospital crčche, the nursery/ kindergarten and primary schools of the University Staff School and a neighbouring private school. Ethical approval for this study was obtained from the Research, Grants and Ethics Experimentation Committee of the College of Medicine, University of Lagos. Written consent was also obtained from head-teachers and parents prior to administration of questionnaire.
Procedure
A structured questionnaire was given to parents of the children who presented with ECC in the hospitals from June 2007 to July 2008. Questionnaires were also sent to parents of children who were enrolled as controls in the crčche and schools. Twenty questionnaires were used as pre-test, 10 each for study and controls respectively.
Information required include age of child, gender, socio economic class (using mothers' educational level) [20], method of infant feeding (bottle or breastfeeding), duration of feeding, supplementary diet (type, age of commencement and duration), snacking habits, oral hygiene practices and presenting complaint of children in the study group.
Oral examination was conducted by (**MOA and ***MOA) with sterile mouth mirror, explorer and a pair of tweezers in the dental chair in the various clinics for the study group and daylight in a classroom for the controls. Decayed, missing and filled teeth (dmft) were scored using the WHO guidelines [21] and caries was diagnosed if frank cavitation was present on any primary tooth. Oral hygiene was determined using the Simplified Oral Hygiene Index (OHI-S) by Green and Vermillon [22]. Most of the parents were given oral health education after the oral examination.

Data Analysis
Data were analyzed using the Epi info version 6 [23]. Comparisons were made between ECC and such variables as age, gender, socio-economic class, oral hygiene practices and feeding/ dietary habits. Result was subjected to statistical analysis using descriptive statistics, t-test for means of two samples and chi-square test for two categorical variables at $p<0.05$ level of significance.

Results

A total of 142 children aged 18-71 months participated in the study; 65 (45.8%) children in the study (ECC) group, (mean 53.5313.5 months) 77 (54.2%) in the controls group, (mean 55.512.7 months), 59 (41.5%) females and 83 (58.5%) males. Eighty-three (58.5%) mothers had tertiary / University education, 43 (30.3%) had up to secondary school education and 16 (11.3%) had only primary or no education (p=0.52). **(Table 1).**
The mean dmft among children in the ECC group was 5.694.65, with no statistically significant difference between males and females (chi sq - K-Wallis- test 0.28, p=0.59). The mean decayed teeth was 5.104.55, mean missing teeth 0.150.44 and mean filled teeth 0.360.91 **(Table 2).**

Table 1. Socio-demographic characteristics of the study population

Characteristic	Study N (%)	Control N (%)	Total N (%)
Gender			
Female	25 (38.5)	34 (44.3)	59 (41.5)
Male	40 (61.5)	43 (55.8)	83 (58.5)
Age			
Range	18 - 71 months	24 - 71 months	
Mean	53.5±13.5	55.5±12.7	
Mother's Educational level			
Tertiary	35 (53.8)	48 (62.3)	83 (58.5)
Secondary	21 (32.3)	22 (28.6)	43 (30.3)
Primary / None	9 (13.9)	7 (9.1)	16 (11.2) p 52
Total	**65 (45.8)**	**77 (54.2)**	**142 (100.00)**

Table 2. Mean decayed, missing and filled teeth (dmft) according to gender in the study group

	Female	Male	Total Mean
Decayed teeth	4.28±3.96	5.62±4.87	5.10±4.55
Missing	0.16± 0.47	0.15±0.42	0.15±0.44
Filled	0.56±1.0	0.25±0.84	0.36±0.91
Total dmft	**5.16±3.99**	**6.02±5.04**	**5.69±4.65**
K Wallis test	0.28		
P	0.59		

Over 70% of the children were breast-fed while 25.4% were given both breast milk and infant formula. Up to 48.6% were given the chosen infant feed over 12 months, with no statistically significant difference between the two groups. (**Table 3).** Majority (69.2%) of the children in the ECC group were given proprietary canned cereal mixes as supplements, compared with 54.5% of controls. Also, only 20% of children in the ECC group were given regular family diet (pap made from maize, millet, sorghum; cooked rice and beans or bean cakes; meals made from yam, cassava or potato tubers eaten with vegetables) as supplements compared with 42.9% of the controls (p=0.004) **(Table 4).** No statistically significant difference existed between the two groups concerning the time of commencement of supplements (p=0.12) (**Table 4).** Most of the children (74.6%) in the study were given a combination of items

Table 3. Type and duration of infant feeding given to children in the study

	Study N (%)	Control N (%)	Total N (%)	
Type of feeding				
Breast milk	47 (72.3)	53 (68.8)	100 (70.4)	
Infant formula	4 (6.15)	2 (2.6)	6 (4.2)	Chi sq .8
Combination	14 (21.5)	22 (28.6)	36 (25.4)	p 0.4
Duration of infant feeding (months)				
1-3	4 (6.2)	7 (9.1)	11 (7.7)	
4-6	17 (26.2)	12 (15.6)	29 (20.4)	
7-9	7 (10.8)	8 (10.4)	15 (10.6)	
10-12	9 (13.8)	9 (11.7)	18 (12.7)	Chi sq 3.2
>12	28 (43.0)	41 (53.2)	69 (48.6)	p 0.52
Total	**65 (45.8)**	**77 (54.2)**	**142 (100.00)**	

Table 4. Type and commencement of supplementary diet given to children in the study

	Study N (%)	Control N (%)	Total N (%)	
Type of supplementary diet				
Cereal	45 (69.2)	42 (54.5)	87(61.3)	
Regular family meal	13 (20.0)	33 (42.9)	46 (32.4)	*Chi sq 10.64*
Combination	7 (10.8)	2 (2.6)	9 (6.3)	*p 0.004**
Commencement of supplement (months)				
1-3	4 (6.2)	8 (10.4)	12 (8.5)	
4-6	28 (37.7)	29 (39.6)	57 (40.1)	
7-9	23 (35.4)	20 (26.0)	43 (30.3)	*Chi sq 7.2*
10-12	1 (1.5)	9 (11.7)	10 (7.0)	*p 0.12*
>12	9 (13.8)	11(14.3)	20 (14.1)	
Total	**77 (54.2)**	**65 (45.8)**	**142 (100.00)**	

*** Significant**

Table 5. Snacking and oral hygiene habits of children in the study population

	Study N (%)	Control N (%)	Total N (%)	
Type of snacks				
Combination	53 (81.5)	53 (68.8)	106 (74.6)	
Chocolate Beverage	2 (3.1)	5 (6.5)	7 (5.0)	
Biscuits	9 (13.8)	13 (16.9)	22 (15.4)	*Chi sq 4.6*
Fruits	1 (1.5)	6 (7.8)	7 (5.0)	*p 0.2*
Oral hygiene practice				
By Mother	52 (80.0)	68 (88.3)	120 (84.5)	
By father	3(4.6)	4 (5.2)	7 (5.0)	
By maid	5(7.7)	4 (5.2)	9 (6.3)	*Chi sq 4.07*
By self	5(7.7)	1 (1.3)	6 (4.2)	*p 0.25*
Total	77 (54.2)	65 (45.8)	**142 (100.00)**	

chocolate beverage, biscuits and fruits as snacks with no difference between the two groups. (p=0.2) **(Table 5).** Mothers formed the majority of those who cleaned their children's teeth (84.5%). Others were maids (6.3%), fathers (5.0%) and self (4.2%), with no significant difference across the two groups (p=0.25) **(Table 5).** Pain was the most common presenting complaint among the children in the ECC group (46%), followed by cavities (37%) and swelling (11%) **(Figure 1).**

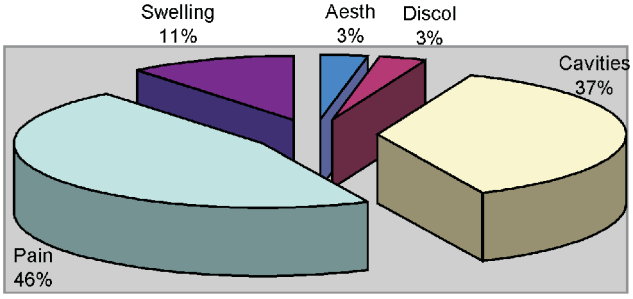

Figure 1. Presenting complaints of children in the study group

Discussion

ECC can be a particularly virulent form of caries, beginning soon after dental eruption, developing on smooth surfaces, progressing rapidly and having a lasting detrimental impact on the dentition [24]. Factors associated with ECC include biological factors such as presence of high levels of mutans streptococci as well as social, demographic and behavioural factors such as lack of access to dental care, lack of dental insurance, low family income and educational level of mother, poor hygiene and dietary habits [25]. All these factors conspire to create a complex ecological imbalance where the oral bio-film on the tooth surface becomes pathogenic and caries result.

In this study, there was no significant difference in mothers' level of education between the ECC group and controls. In Nigeria, there are common socio-cultural beliefs which still exert strong influence on child rearing and health behaviour in spite of education. This finding is supported by some studies which show that while ECC seen in young children occurs in specific pattern, household income and caregiver education are not universally associated with all of the ECC pattern [26]. For example, most mothers still breast-feed their babies exclusively, as observed in this study, where over 70% of the children were breast-fed.

Another factor which was not measured in this study is the age of the mother at the birth of the child. It has been reported that children born to older mothers are at less risk of developing ECC [27] It is suggested that this is due to the child care experience of older mothers.

The 'exclusive breast-feeding' initiative has helped to encourage mothers to breast-feed their babies up to 12 months of age. Studies have shown that breast-feeding is protective of caries development compared with bottle feeding with infant formula [5,28,29]. The protective effect is due to early transfer of maternal immunoglobulins, enzymes and leucocytes and additional specific antibacterial agents such as lactoferrin, interferon and lysozymes from mother to child [30]. Since a significant number of children in the ECC group were breast-fed up to 12 months of age, there could be another significant factor contributing to caries in these children.

In this study, more parents of children in the ECC group supplemented their children's infant feed with commercially prepared cereal mixes compared with children in the control group. The cereal mixes contain added sugar which gives a more appealing taste to children. More children in the control group were also

given regular family meals compared with those in the ECC group. This finding supports the result of a prevalence study of ECC on 12 to 36 month old Brazilian children that caries was more prevalent in children given cariogenic supplemental diet (31.8%) than those without a cariogenic diet (10.7%) with a strongly significant association between the the two variables (p= 0.001) [31].The native Nigerian diet contains more fibre, derived from tubers (yam, potatoes and cassava), grains (rice, millet, maize, sorghum, beans), nuts, fruits and vegetables. When combined reasonably, these make complete nutritious and delicious meals that are very tasty. They contain more roughage for oral clearance of debris and plaque compared with the sticky and sugary proprietary cereal mixes. Although some mothers enjoy the convenience of quick preparation of the cereals, the overall potential health benefits of our native diet cannot be quantified, both on oral and general health. In socioeconomically developing countries, changing from a traditional diet to a western-style diet has led to an increase in the consumption of commercialized food products [32,33].

In this study, the time of commencement of supplements was not significantly different between the two groups. Most of the children started receiving supplements at 4-6 months of age. A study on Australian children concluded that delayed introduction of solids and cup feeding significantly increased the presence of ECC, and that early introduction of solids may help to encourage more even mixing of saliva with food, prevent stasis of cariogenic liquids around the teeth and reduce caries risk [34]. Therefore, in this study, it appears that the type of infant feeding and time of commencement of supplements are not as important as type of supplements given. Parents, especially mothers should be encouraged to utilize the traditional preparation of meals in weaning their babies off infant feeding. This is especially important in developing countries where feeding on commercialized food products is seen as a sign of affluence.

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Snacking habits was not significantly different between the two groups of children, with over 70% having a combination of chocolate beverages, biscuits and fruits, so also the position of the child in the family. This contrasts with the report that child order greater than fourth born in the family was significantly associated with higher ECC prevalence and severity [27]. This difference could be due to the different environments where the two studies were carried out. Majority of children in both groups had their mouths cleaned by mothers. The finding from this study supports that of some authors that there is no difference in tooth brushing frequency between those children with and without dental caries [35,36]. Some others have also shown that increased tooth-brushing frequency and oral hygiene levels and parental involvement are associated with lower decay levels in pre-school children [37,38]. However, it has been reported that the benefits of frequent brushing of teeth did not outweigh the damaging effect of frequent sugar consumption [39].

Most of the children in the ECC group presented in the clinic with pain, cavities and swelling. They would require emergency, restorative and rehabilitation which is obviously more expensive than preventive care. The public health cost of management of ECC has been described as substantial in terms of both the financial and human resources [9]. Oral health education should be targeted at pregnant and nursing mothers in areas of appropriate infant feeding, weaning, snacking and oral hygiene practices and establishment of dental home for early preventive care for their children.

Conclusion

The most important risk factor for the occurrence of ECC in the affected children who participated in this study was the consumption of commercially prepared canned cereals given as supplements. Oral health education should be targeted at pregnant and nursing mothers in areas of appropriate infant feeding and weaning practices for their children.

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