Original Article

Risk Factors of Early Childhood Caries among Children in Enugu, Nigeria

Nneka Kate Onyejaka[1], Emmanuel Obiajulu Amobi[2]

[1]BDS, FWACS, University of Nigeria, Enugu, Nigeria.
[2]BDS, FNPMCN, University of Nigeria, Enugu, Nigeria.

Author to whom correspondence should be addressed: Onyejaka Nneka Kate. Department of Child Dental Health, University of Nigeria, Enugu, Nigeria. Phone: +2348037449279. E-mail: nnekaonyejaka@yahoo.com.

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Abstract

Objective: To determine the prevalence and associated risk factors of early childhood caries (ECC). **Material and Methods:** This was a cross-sectional study of 429 preschool children aged five years and below in Enugu East Local Government Area, Enugu, Nigeria. Data on socio-demographic profile, dental visits, brushing frequency, oral hygiene status and snacking habit of the children were obtained. The presence of dental caries was recorded by using the World Health Organization criteria. **Results:** The prevalence of early childhood caries was 9.8% and the mean dmft score was 0.37. Bivariate analysis showed significant association between age (p<0.001), socio-economic status of the child's family (p=0.04), oral hygiene status (p<0.001), dental visits (p=0.01) snacking (p=0.01) and early childhood caries. Multivariate regression analysis showed that age (OR= 4.3, CI=1.17-15.6; p=0.03), high socioeconomic status (OR= 3.7, CI= 1.46-9.47; p=0.01) and fair oral hygiene (OR= 0.10, CI=0.26-0.39, p=0.001) were significant predictors of early childhood caries in this population. **Conclusion:** The prevalence of ECC was high in this population. Age, high socioeconomic status and fair oral hygiene were risk predictors of ECC. Early and prompt access to oral health education and preventive dental care for children by mothers and caregivers can reduce the occurrence of ECC.

Keywords: Dental Caries; Child; Risk Factors.

Introduction

Early childhood caries is defined as "the presence of one or more decayed (non-cavitated or cavitated lesions), missing teeth (due to caries), or filled tooth surfaces in any primary tooth in a child 71 months old or younger [1]. In children younger than three years old, any sign of smooth-surface caries is indicative of severe early childhood caries (S-ECC). From ages three through five, one or more cavitated, missing teeth (due to caries), or filled smooth surfaces in primary maxillary anterior teeth, or, decayed, missing, or filled score of ≥4 (age 3), ≥5 (age 4), or ≥6 (age 5) surfaces constitute S-ECC [1].

Dental caries is one of the commonest dental diseases [2] in children, although it is a preventable disease. The aetiological factors of dental caries include susceptible tooth, time, cariogenic diet, and plaque [3]. Associated risk factors of dental caries include age of child [4], sex of child [5], socioeconomic strata, childbirth rank, feeding practices, oral hygiene practices and oral health seeking behaviours [6]. Children can be free from caries if these associated risk factors are identified, understood and controlled.

There is an increase in the prevalence of dental caries and this global increase affects children as well as adults, primary as well as permanent teeth, and coronal as well as root surfaces [7]. It affects the quality of life, productivity and educational performance of the child [8]. Parents take time off their jobs to take their children to the dentist and this may have financial implications. Nutrition and eventual growth and development of the child are usually also affected as evidenced by lower body mass index [9].

In developed countries, ECC ranges from 32% to 80% in Poland, Canada and United States [10-12]. In Nigeria, the prevalence of ECC ranges from 6.6% to 23.5%, but the most striking finding in our locality is that the carious lesions remain untreated [6,13-15]. Untreated caries are often associated with pain, infection, difficulty in chewing, premature tooth loss and speech difficulties [16]. The early diagnosis and treatment of caries in young children will lead to better oral health in adulthood.

Enugu metropolis is a cosmopolitan city with no study on early childhood caries. A past study showed that children in the area made symptomatic visits to the dentists [17]. It is therefore imperative to identify the associated risk factors of ECC in the area and initiate ECC preventive programmes.

This study identified the relationship between socio-demographic profile of the children, health seeking behaviour, tooth brushing frequency, snacking and ECC. It also determined the risk predictors of ECC.

Material and Methods

Study Area

The study was conducted in Enugu East Local Government Area (LGA) of Enugu State, Nigeria. Enugu East LGA is one of the three LGAs that make up Enugu metropolis of Enugu State.

It is located in South Eastern Nigeria. Enugu State is one of the 36 states in Nigeria and the total number of children in both private and public kindergarten/ nursery schools was 6, 094 pupils in the school year, 2009/2010 [18]. Enugu East is inhabited mainly by the Igbo tribe. They are mainly civil servants, farmers and traders.

Study Design and Study Population

This was a cross sectional study in which some data were collected from parents at home and the children examined at school. Children aged five years as at last birthday and below attending private and public kindergarten/ nursery schools in the LGA were recruited for the study. Children who were un-co-operative were excluded from the study.

Sample Size Determination

The sample size was calculated using the sample size formula [19], where p is the prevalence, q is (100 - p) and SE is the standard error tolerated. Based on 10.9% prevalence of caries from a previous study [13] and sampling error of 5%, the minimum sample size calculated was 39. The total sample size required to get 39 children with ECC was 358. To accommodate for 10% non responders, the sample size was 358+ 39= 397. It was approximated to 400.

The total number of schools visited was 6,094/400 pupils=16 schools

Pupils were selected from the 16 kindergarten/nursery schools in Enugu East Local Government Area of Enugu State.

Sample Selection

Proportionate representation of the sample between private and public schools

The ratio of private to public kindergarten/nursery schools in Enugu East is 1:0.8. Hence nine private kindergarten/nursery schools and seven public kindergarten/nursery schools were selected from a list of public and private kindergarten/nursery school in Enugu East LGA obtained from the Ministry of Education. Random sampling technique was used to select the schools.

Selection of pupils from the schools by random sampling

Two hundred and twenty two children from private kindergarten/nursery schools and 178 from public schools were selected for the study. Twenty-eight children were selected from each school. From each of the four levels (pre-nursery, nursery 1, 2, 3), seven children were selected to get 28 children. Pupils picked ballot paper written 'yes' or 'no' and each pupil who picked 'yes' participated in the study.

Study Procedure

Ethical approval for the study was obtained from the University of Nigeria Health Research and Ethics Committee (IRB00002323). Permission was also obtained from Ministry of Education

and head teachers in Enugu, in addition to obtaining parental consent. Two paediatric dentists were recruited as field workers and trained on the data collection procedure and details of the study collection tool.

Intra examiner and Inter examiner reliability were assessed by examining 10 children with ECC on two separate occasions in two weeks interval. The result was coded and fed into the computer. The data were then subjected to a Cohen's kappa scores analysis, to determine the intra examiner and inter-examiner variability. The intra-examiner variability score was 0.92 while the inter-examiner variability score for ECC was 0.88.

The data collection tool consisted of the first part (A) which contained questions that elicited information on the socio demographic profile of the child (age of the study participants as at the last birthday, sex, parents' occupation and educational status), snacking, history of past dental visit and information on tooth brushing and frequency. The second part elicited information on status of oral hygiene using the simplified oral hygiene index by Greene and Vermillion [20] and status of caries using the dmft index, and observing the criteria by the World Health Organization [21].

On the day of the study, the children were given informed consent form with the first part of the questionnaire attached to it to give to their parents at home. Teachers assisted by reminding the caregivers of the children when they pick them from school. On the second day of the study, oral examination was conducted on the children with signed informed consent and completely filled questionnaire. They were examined while seated on their school chairs using natural light. Cotton wool was used to clean the debris on the teeth before examining for caries.

Socioeconomic Status of Child's Family

The socio-economic status of each child was based on the index used in a previous study [22]. It was calculated using multiple indices obtained from a scoring index that combined the mother's level of education and occupation of the father. Father's occupation was grouped into; professional (score 1); civil servants (score 2); unskilled, unemployed, civil servants with primary education (score 3) while mother's level of education was categorized into tertiary education (score 0); secondary (score 1) and primary or no school education (score 2). Each child's family social class was obtained by adding the score of the father's occupation to the score of the mother's level of education. A total score of 1 (class 1) was categorized as upper class, total score of 2 (class II) was upper middle class, total score of 3 (class III) middle class, total score of 4 (class IV) the lower middle class, and a total score of 5 (class V) was the lower class. This information was collected from the questionnaire sent to the parents along with the consent form.

Snacking

Information on frequency of snacking was collected: This included consumption of pastries, sugared drinks, juice, licking sweets and chewing gum.

Brushing

Information on use and frequency of tooth brushing and use of fluoride-containing toothpastes was also obtained.

Oral Hygiene

The oral hygiene of the children was assessed using the Oral Hygiene Index–Simplified (OHI-S) by Greene and Vermillion [28]. The Debris Index and Calculus Index were obtained based on six numerical determinations representing the amount of debris or calculus found on the surfaces of index teeth 11, 16, 26, 31, 36, 46 and 51, 55, 65, 71, 75, 85[23] in the permanent and primary dentitions respectively. The total of debris and calculus scores was divided by the number of surfaces scored. The oral hygiene was graded as good, fair, poor if the scores were 0.0–1.2, 1.3–3.0 and > 3.1 respectively.

Caries Assessment:

Caries was observed according to WHO Oral Health Survey methods [21]. The children were seated on their school chairs and with the aid of plain mirror and natural light, their teeth were examined for caries after gross debris was removed. The number of decayed, filled or missing teeth was recorded for each child. The total number of missing teeth, filled teeth and missing teeth as a result of caries was used as the dmft score for the teeth in primary dentition.

Severe ECC was also recorded when there was any sign of smooth surface caries in children younger than three years of age, one or more decayed missing or filled smooth surface caries in primary maxillary anterior teeth in children three to five (3-5) years old; or, one or more decayed, missing or filled smooth-surface caries in primary maxillary anterior teeth in children three to five (3 -5) years old; or one or more decayed, missing or filled tooth greater or equal to four (for children 3 years of age), or to five (for children 4 years of age) or to six (for children 5 years of age) surfaces[1]. For the purpose of analysis, caries was classified as being present or not present.

Data Handling

The age of the children was grouped into < 1 year, 1 year, 2 years, 3 years, 4 years and 5 years. For ease of analysis, the data for socio-economic status in this study was re-grouped into three levels: high (upper and upper middle classes), middle (middle class), and low (lower middle and lower classes). This categorization was used to test associations and for logistic regression analysis. This modality of categorization of socio-economic status was previously used [6].

Data Analysis

The data was analyzed using SPSS version 15. Exploratory analysis was conducted to ensure data consistency. Results were expressed using frequency tables, percentages. Descriptive analysis was conducted using a wide variety of measures of location (mean). Bivariate analysis was

conducted to test the association between the child's age, sex, socio-economic status, snacking, past dental visits, oral hygiene practices and occurrence of ECC. Chi square was used to assess association between variables. Regression analysis was also done to determine the risk predictors of ECC. The effect of all significant factors on occurrence of ECC was inferred at p≤ 0.05.

Results

Four hundred and twenty nine children participated in the study. The mean age was 3.38±1.18 years. One hundred and eleven children (25.9%) were in the five years age group. More males 226 (52.7%) and children in the high socio-economic strata 188(43.8%) participated in the study. As high as 425 (99.1%) of the children had never visited the dental clinic (Table 1).

Table 1. General characteristics of the study participants.

Variables	Frequency N (%)
Age (year)	
<I	6 (1.4)
1	8 (1.9)
2	90 (21.0)
3	110 (25.6)
4	104 (24.2)
5	111 (25.9)
Sex	
Male	226 (52.7)
Female	203 (47.3)
Past dental visit	
Visited	4 (0.9)
Not visited	425 (99.1)
Socio-economic status	
High	188 (43.8)
Middle	84 (19.6)
Low	157(36.6)
Caries	
Present	42 (9.8)
Absent	385 (90.2)
Total	429 (100.0)

Table 2 shows that 42 (9.8%) children had ECC. Mean dmft score was 0.37 and a child had a dmft score of 20. The decay component was 98.8%, 1 (0.63%) tooth was filled and 1(0.63%) tooth was extracted.

There was significant association between age (p<0.001) and ECC (Table 2). Children aged five years as at last birthday had the highest 19 (45.2%) occurrence of ECC. No child aged one year and below had early childhood caries. There was also a significant association between socio-economic status (p=0.04) and ECC. More than half of the children, 23 (54.8%) with ECC were from the high socio-economic class. There was significant association between oral hygiene (p<0.001) and ECC; no child with good oral hygiene had ECC, while all the children (16.7%) with poor oral hygiene had ECC. Past dental visits (p=0.01) and snacking (p=0.01) were significantly associated with ECC.

Majority of the children (95.2%) with ECC had never visited the dentist, while those who snacked at least once a day 19(45.3%) had the highest occurrence of ECC.

Table 2. Association between variables and ECC.

Variables	ECC Present N (%)	Absent N (%)	Total	P value
Age(years)				<0.001
<1	0	6 (1.6)	6 (1.4)	
1	0	8 (2.1)	8 (1.9)	
2	3 (7.1)	87 (22.5)	90 (21.0)	
3	3 (7.1)	107 (27.6)	110 (25.6)	
4	17 (40.5)	87 (22.5)	104 (24.2)	
5	19 (45.3)	92 (23.8)	111 (25.9)	
Sex				0.77
Male	23 (54.8)	203(52.5)	226(52.7)	
Female	19 (45.2)	184(47.5)	203(47.3)	
Socio-economic status				0.04
High	23 (54.8)	165(42.6)	188(43.8)	
Middle	11 (26.2)	73(18.7)	84(19.6)	
Low	8 (19.0)	149(38.5)	157(36.6)	
Oral hygiene				<0.001
Good	0 (0.0)	45 (11.6)	45 (10.5)	
Fair	35 (83.3)	335 (86.6)	370 (86.2)	
Poor	7 (16.7)	7 (1.8)	14 (3.3)	
Dental visit				0.01
Visited	2 (4.8)	2 (0.5)	4 (0.9)	
No visited	40 (95.2)	385 (99.5)	425 (99.1)	
Frequency of brushing				0.70
None	0 (0.0)	2 (0.5)	2 (0.5)	
Once	36 (85.7)	314(81.1)	350 (81.6)	
Twice	5 (11.9)	66 (17.1)	71 (16.6)	
Thrice and more	1 (2.4)	5 (1.3)	6 (1.4)	
Snacking				0.01
None or occasionally	1 (2.4)	13 (3.4)	14 (3.6)	
Once a day	19 (45.2)	244 (63.4)	263 (68.0)	
Twice a day	11 (26.2)	98 (25.3)	109 (28.2)	
Three or more	11 (26.2)	32 (8.3)	43 (11.1)	
Total	42 (100.0)	387 (100.0)	429 (100.0)	

Table 3 shows that twelve (2.8%) children had severe ECC and children aged four years had the highest dmft index (0.86). The mean dmft was 0.37.

Table 3. Distribution of study participants with ECC and S-ECC (N=42).

Age (years)	ECC N (%)	SECC N (%)	Total dmft N (%)	Total children	Mean dmft
Less than 1	0 (0.0)	0 (0.0)	0 (0.0)	6 (1.4)	0
1	0 (0.0)	0 (0.0)	0 (0.0)	8 (1.9)	0
2	0 (0.0)	3 (25.0)	5 (3.1)	90 (21.0)	0.06
3	3 (10.0)	0 (0.0)	5 (2.1)	110 (25.6)	0.05
4	11 (36.7)	6 (50.0)	81 (50.6)	104 (24.2)	0.78
5	16 (53.3)	3 (25.0)	69 (43.1)	111 (25.9)	0.62
Total	30 (100.0)	12 (100.0)	173 (100.0)	429 (100.0)	0.37

Table 4 shows that the mandibular, first left primary molars had the highest occurrence of caries (15.6%) when compared to other carious teeth (N=160).

Table 4. Tooth specific prevalence of ECC.

Tooth Type	Maxillary		Mandibular	
	Right N (%)	Left N (%)	Right N (%)	Left N (%)
Central incisor	10 (6.3)	9 (5.6)	5 (3.1)	3 (1.9)
Lateral incisor	7 (4.4)	6 (3.8)	1 (0.6)	1 (0.6)
Canine	2 (1.3)	1 (0.6)	1 (0.6)	1 (0.6)
First molar	8 (5.0)	5 (3.1)	21 (13.1)	25 (15.6)
Second molar	9 (5.6)	12 (7.5)	12 (7.5)	21 (13.1)
Total	36 (22.5)	33 (20.6)	40 (25.0)	51 (31.9)

Table 5 shows that children aged 5years and those in high socioeconomic status had 430% (CI: 1.17-15.6, p=0.03) and 370% (CI: 1.46-9.47, p=0.01) increased odds of having ECC respectively while children with fair oral hygiene had 90% (CI: 0.03=0.39, p=0.001) decreased odd of having ECC when compared to children with poor oral hygiene.

Table 5. Logistic regression analysis of risk factors associated with ECC.

Variable	N (%)	Multivariate adjusted OR	95% C.I	P value
Age (years)				
2 and below	3(7.1)	1.0		
3	3(7.1)	0.67	0.13-3.5	0.63
4	17(40.5)	3.4	0.19-12.6	0.07
5	19(45.2)	4.3	1.17-15.6	0.03
Socio-economic status				
Low	8(19.0)	1		
Middle	11(26.2)	2.6	0.91-7.23	0.07
High	23(54.8)	3.7	1.46-9.47	0.01
Oral hygiene				
Poor	7(16.7)	1.00		
Fair	35(83.3)	0.10	0.03-0.39	0.001
Dental visit				
No visit	40(95.2)	1.00		
Visit	2(4.8)	2.4	0.22-26.71	0.47
Snacking				
Occasional/none	1(2.4)	1.00		
Once a day	19(45.2)	0.77	0.088-6.77	0.82
Twice a day	11(26.2)	0.90	0.10-8.53	0.93
Three or more a day	11(26.2)	3.13	0.34-29.11	0.32

Discussion

The study found that the prevalence of early childhood caries was high and there was a significant association between age, socio-economic status of the child's family, oral hygiene, dental visits, snacking and early childhood caries. Also, age, high socioeconomic status and fair oral hygiene were significant predictors of early childhood caries in this population

The study showed that the prevalence of ECC was 9.8%. It is lower than the prevalence of 50 to 80% in Canada [10], 51% in Pakistan [24] and 59.5% in Kenya [25]. In Nigeria, it is lower than the prevalence in Lagos (21.2%) [14] and Ibadan (23.5%) [15] which are big cities in the south western part of Nigeria, but it is higher than the prevalence in suburban Nigeria (6.6%)[6]. Also, the prevalence of S-ECC was 2.8% which is lower than that in Italy (6.5%) [26], similar to that in Ibadan, Nigeria (2.2%)[21] and higher than that from sub urban Nigeria (0.8%) [6]. These variations may be as a result of the level of development of these cities and the regional variations associated with dental caries. It may also be as a result of the different age ranges used in the studies.

Older children had ECC more than younger children as seen in past studies by [6,14,26]. This is because their teeth have been exposed to the oral environment more than the teeth of younger children. This study however did not find any significant association between sex, frequency of brushing and ECC.

In this study, ECC occurred more in children from the high socio-economic class which is similar to prior studies in Nigeria [13,14], but contrary to finding from a developed country [27]. Parents in the high socio-economic class can afford preventive dental care while in developing countries, parents of children in the high socio-economic class can afford cariogenic diet for their children when compared to those from low socio-economic class.

The study also found that oral hygiene was a risk factor to ECC. All the children with poor oral hygiene had ECC, while all those with good oral hygiene did not have any ECC because poor oral hygiene is characterized by heavy debris accumulation which can in turn initiate caries [28]. Also, pain associated with caries might have hindered the child from brushing adequately resulting in more plaque and calculus accumulation. This is similar to the findings from a prior study [6].

The association between oral health seeking behavior and occurrence of dental caries was also a significant finding in this study. Only a few children utilized the dental services probably because caregivers often delayed dental treatment due to their poor understanding of oral health challenges, and poor interpretation of oral health problems in their children [29]. This non-health seeking behavior may also be used to explain the greater percentage of untreated ECC in the study population.

Snacking was also significantly associated with ECC in this study, this is similar to prior studies [6,14]. Frequent consumption of cariogenic diet results in decrease in pH, resulting in demineralization of the teeth. However, it was not a predictor of ECC in this study.

The mandibular, first left primary molar had the highest occurrence of caries because of its morphology and when compared to the second molar, it erupts earlier. This is contrary to findings from a previous study [15] in which the second molar had the highest occurrence.

It is recommended that oral health programmes, especially oral health education for parents be organized so that they can assess preventive or curative care in dental centers. Caregivers should perform or assist the children during brushing to reduce the debris score with resultant improvement in oral hygiene.

Our study had limitations: First, there may be difficulty in getting accurate information from parents because it is based on the power of recall. Second, some carious lesions may be missed out because the teeth were not air dried to detect early carious lesions and radiographs were not taken for diagnosis.

Conclusion

ECC was high in the study area with most of the lesions untreated. Age, high socioeconomic status and fair oral hygiene are significant predictors of ECC in the study population.

Acknowledgement

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