

Impact of Infant Feeding Practices on Caries Experience of Preschool Children

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Aim: This study investigated the association between breastfeeding, bottle feeding, night feeding, age, and sex of the child on the caries experience. **Method:** Information was collected from the mothers of preschool children. Information included the age of the child, sex of the child, form of breastfeeding (whether exclusive, almost exclusive or mixed), duration of breastfeeding, night feeding habits of the child, and duration and content of bottle feeding. Intraoral examination was done to assess the dmft. The impact of the variables on the caries experience (rampant caries, no caries and the dmft) was then assessed. **Results:** The duration of breast feeding ($p=0.002$), and form of breast feeding ($p=0.03$) were significant predictors of the dmft. The dmft was highest in children who were breastfed for longer than 18 months and highest for children who were exclusively breastfed. There is a strong association between rampant caries and duration of breast feeding only ($p<0.001$). The risk of having rampant caries increases by 10% ($p = 0.012$) with every month increase in the duration of breastfeeding. **Conclusion:** The duration of breastfeeding increased the risk for rampant caries in preschool children in Nigeria. The longer the duration, the higher the risk for caries.

Keywords: Breastfeeding, night feeding, caries, preschool, Nigeria

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INTRODUCTION

Dental caries may be defined as a post eruptive pathological process of external origin, involving the softening of the hard dental tissues and proceeding to cavity formation.¹ It is a complex and dynamic process involving a physiochemical process associated with the movement of ions across the interface between the tooth and the external environment. It also involves biological processes where there is an interaction of bacteria in dental plaque with the host defense mechanism.²

It is a multifactorial disease with as many as fifty factors associated with the disease.^{3,4} These factors include the oral hygiene status,⁵⁻⁷ efficiency of tools used for tooth cleaning, the use of bottle feeding, the bottle feeding content, the duration of bottle feeding, and night feeding.^{8,9}

A 1994 Conference at the Centers for Disease Control and Prevention¹⁰ recommended the use of a less specific term, such as “early childhood caries” (ECC) when describing any form of caries in infants and preschool children, including rampant caries. The rationale was that such a term would better reflect the multifactorial etiologic process involved in this disease.¹¹ The new term describes caries in children less than 36 months¹² though the AAPD Council on Clinical Affairs defined ECC as the presence of one or more decayed (cavitated or non-cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a child 71 months or younger.¹³

The etiology of ECC is similar to that of other types of coronal and smooth surface caries.¹⁴ The ECC process may be modified by several factors unique to young children which are related to the implantation of cariogenic bacteria, immaturity of the host defense systems, as well as behaviour patterns associated with feeding and oral hygiene in early childhood. For example, the continuous feeding of sugars at night-time when flow rate of saliva is lowest increases the caries risk of the infant significantly.²

In Nigeria, data on caries for any age group are sparse.¹⁵ Studies on caries in children are generally confined to children of school age. This study aims at investigating the possible associations between infant feeding practices and the caries experience of children aged 6 months to 71 months old in the Lagos Metropolis in Nigeria. Specifically, it looks at the association between breastfeeding, bottle feeding, and night feeding on the caries experience of the child.

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METHOD

The study was carried out in three randomly selected Local Government Areas from the list of 20 local government areas in Lagos State, Nigeria. The Local government areas were designated urban, periurban, or rural areas. In the urban and periurban areas, the pediatric out-patient clinics were used for clinical examination while in the rural site, the community town hall used for the clinical examination. A Table of random numbers was used in random selection of the hospitals used in the urban and periurban local government areas. Permission to conduct the research was granted by the Ethical Committee, Lagos University Teaching Hospital, Lagos and the health authorities of the two hospitals used the study. Consent was also obtained from the patients parents.

A questionnaire was administered and clinical oral examinations conducted. One of the authors carried out all examinations. A calibrating examination was carried out earlier on a group of pre-selected children who possess the same characteristics to be assessed in the main survey in order to assess intra-examiner reproducibility of the study. This involved a group of 23 primary school students who were examined and re-examined a week later by the same examiner. Necessary adjustments were made to the questionnaire and ambiguities corrected through a pilot testing of the questionnaire before the final survey.

The pre-tested structured questionnaire consisted of demographic information of the child and the feeding practices. The age of the child was calculated from the date of birth in months. Information as to the infant feeding pattern was obtained from the mother. The mother was questioned on the duration and content of bottle feeding, duration, and form of breast feeding and night feeding pattern. Breast-feeding was classified as exclusive when the mother gave only breast milk without any other supplements, almost exclusive when the mother fed the child on breast milk with water supplement, and partial/mixed breast feeding when there was complimentary feeding to the breast feeding.

During the intra-oral examination, each participant's dentition was assessed in the following sequence: the teeth present and dentition status of the child. A tooth was considered present in the mouth when any part of the tooth is visible.

Intraoral examination was conducted using a dental mirror under natural light. Radiographs were not used in the study. Gross debris was cleared with gauze where necessary before examination of each tooth. Caries diagnosis was based on the recommendation of the WHO Oral Health Survey methods.¹⁶ The dmft index was used in this study. A diagnosis of Rampant caries, Caries or No Caries was made. Rampant caries was diagnosed on the basis of caries affecting one or more maxillary incisors with or without involvement of the primary molars.¹⁷ Caries was diagnosed when there are carious lesions affecting a tooth or teeth exclusive of the maxillary anterior tooth/teeth. A diagnosis of No Caries was made when the mouth was free of any visible carious lesion.

Statistical analysis was done with Intercooled STATA

(release 10) for windows. Simple proportions were computed. Linear regression was used to determine the associations of the form of breast feeding, duration of bottle and breast feeding, content of the feeding bottle, and night feeding with the dmft score. Logistic regression was used to determine the effect of the form of breast feeding, duration of bottle and breast feeding, content of the feeding bottle, and night feeding on the occurrence of Rampant Caries, or Caries.

For cross tabulations and logistic regression, dependent variables were dichotomised. Rampant caries was dichotomised into present (1) or absent (0); Caries was dichotomised into present (1) or absent (0); No caries was dichotomised into present (1) or absent (0).

Statistical significance was inferred at $p < 0.05$. A non parametric test (Kruskal-Wallis equality-of-populations rank test) was used to test for associations.

RESULTS

Three hundred and ninety six observations were recorded of which 217 were males and 179 were females. The age of the study participants ranged from 6 months to 71 months. Nineteen (4.8%) children had Rampant Caries, 22 (5.5%) had Caries, 355 (89.2%) had No Caries while two (0.5%) children had no teeth. See table 1.

Two hundred and thirteen children (53.8%) were exclusively breastfed for a period ranging from 1 to 36 months; the modal period being 6 months (25.4%). Ninety eight (24.7%) and 83 (21.0%) children were also almost exclusively breastfed or partially breastfed respectively. Two (0.5%) children were not breastfed in any form. Table 2 shows a summary of the infant feeding pattern of the study participants.

One hundred and eight children (27.2%) were bottle fed for a period ranging from 2 months to 36 months. The content of the bottle varied from infant formula (35.2%), to cereals (6.2%), sweetened milk (4.7%), plain water (3.6%), fresh fruit juice (0.9%), soft drinks (0.5%), and packed fruit juice (0.3%).

Night feeding was practiced in 104 (26.3%) children. Of these, 74 (71.2%) were fed on breast milk during the night feeding.

Table 3 shows an analysis on the impact of age, sex, night feeding, duration of breast feeding, form of breast feeding, and the duration of bottle feeding on the dmft scores of the

Table 1. Caries pattern in study population

Age Distribution	Rampant Caries	Caries	Caries free
≥ 12 months	0	0	31
13 – 24 months	4	1	138
25 – 36 months	8	2	69
37 – 48 months	1	7	62
49 – 71 months	6	12	55
Total	19	22	355

*2 children had no erupted teeth

child. The duration of breast feeding (p=0.002), and form of breast feeding (p=0.03) were significant predictors of the dmft in this study population. The dmft was highest in children who were breastfed for longer than 18 months and

highest for children who were almost exclusively breastfed (Table 4).

Table 2. Infant feeding practice by study participants

Form of breastfeeding		Number
1	Exclusive	213 (53.8%)
2	Almost exclusive	98 (24.7%)
3	Mixed feeding	83 (21.0%)
4.	No breastfeeding	2 (0.5%)
Total		396 (100.0%)
Bottle feeding		
1	Yes	108 (27.3%)
2	No	288 (72.7%)
Total		396 (100.0%)
Night feeding		
1	Yes	104 (26.3%)
2	No	292 (73.7%)
Total		396 (100.0%)
Duration of breast feeding		
1	≥ 6 months	39 (9.8%)
2	7 – 12 months	148 (37.4%)
3	13 – 18 months	142 (35.9%)
4	> 18 months	40 (10.1%)
5	Cannot recall	27 (6.8%)
Total		396 (100.0%)

Table 3. Linear regression model result – dmft as outcome

Term	Coefficient	95% CI	p-value
Duration of breast feeding (in months)	0.02	0.002 - 0.010	0.002*
Age (in months)	0.01	0.004 - 0.017	0.12
Form of breast feeding	0.14	0.011 – 0.262	0.03*
Night feeding	0.06	-0.158 - 0.281	0.58
Duration of bottle feeding (in months)	-0.004	-0.020 - 0.009	0.51
Female	-0.06	-0.251 - 0.136	0.56

*Statistically significant

Table 4. Breastfeeding and dmft of preschool children

Breast feeding	Mean dmft	Standard deviation	No of children
Form of breastfeeding			
Exclusive	0.23	0.83	213
Almost exclusive	0.46	1.42	98
Mixed	0.24	0.25	83
Duration of breastfeeding			
>6 months	0.15	0.49	39
7-12 months	0.26	1.01	148
13-18 months	0.25	0.80	142
<18 months	0.73	1.71	15

There was no significant association between the form of breastfeeding, Rampant caries (p=0.46), and Caries (p=0.38). There was also no significant association between the duration of breastfeeding for Caries (p=0.69) and No caries (p=0.055). There was however a significant association between the duration of breastfeeding and Rampant caries (p=0.02). This is shown in Table 5.

Table 6 outlines the risk factors for Rampant caries, Caries and No caries. There is a strong association between Rampant caries and duration of breast feeding only (p<0.001). The risk of having Rampant caries increases by 10% (95% CI 2% to 19%) p = 0.012 with every month increase in the duration of breastfeeding.

Also, the risk of having Caries increased by 7% (95% CI 4% to 10%) p<0.001 for every month increase in age. This is 7 times higher in children older than 3 years old (95% CI 1.27 to 32.23) p=0.025 and 6 times higher (95% CI 0.04 to 0.10) p=0.018 in the presence of night feeding.

The risk for No Caries decreased by 6% (95% CI -9% to -3%) p<0.001 for every month increase in age.

This model can however explain less than 10% of the variability of dmft (adjusted R-square = 0.05).

DISCUSSION

The form and pattern of infant feeding in the etiology of early childhood caries is of interest. Understanding the relationship between infant feeding practices and caries risk is important for a country like Nigeria where prolonged breastfeeding is practiced and promoted.

This study identifies the duration of breastfeeding as a

Table 5. Form of breast feeding, duration of feeding, and caries experience

Breastfeeding form	Caries		X ²	P value
	Yes	No		
1 Exclusive breastfeeding	9	193	1.93	0.38
Almost Exclusive breastfeeding	6	86		
Mixed feeding	7	74		
Rampant caries				
2 Exclusive breastfeeding	11	191	1.59	0.46
Almost Exclusive breastfeeding	6	86		
Mixed feeding	2	79		
Duration of breastfeeding				
4. No Caries	Mean	SD	X ²	P value
Yes	15.66	8.38	3.69	0.055
No	13.01	4.97		
5 Rampant caries			5.28	0.02
Yes	13.03	4.94		
No	18.21	11.25		
6 Caries			0.16	0.69
Yes	13.17	5.53		
No	15.21	5.22		

Table 6: Risk factors for rampant caries, caries, and no caries

Term	Odds ratio	95% CI	p-value
Rampant caries			
Duration of breast feeding (in months)	0.10	0.017 - 0.187	0.02*
Age (in months)	0.03	0.007 - 0.074	0.11
Form of breast feeding	0.08	-0.778 - 0.931	0.93
Night feeding	0.48	-0.860 - 1.809	0.49
Duration of bottle feeding (in months)	0.005	-0.090 - 0.100	0.91
Female	0.12	-1.159 - 1.400	0.11
Caries			
Duration of breast feeding (in months)	0.02	-0.050 - 0.104	0.49
Age (in months)	0.08	0.039 - 0.112	0.00*
Form of breast feeding	0.51	-0.139 - 1.151	0.12
Night feeding	0.73	-0.325 - 1.775	0.18
Duration of bottle feeding (in months)	-0.02	-0.099 - 0.055	0.58
Female	-0.56	-1.160 - 0.473	0.29
No caries			
Duration of breast feeding (in months)	-0.06	-0.123 - 0.002	0.06
Age (in months)	-0.07	-0.093 - -0.034	0.00*
Form of breast feeding	-0.32	-0.847 - 0.199	0.23
Night feeding	-0.78	-1.624 - 0.062	0.07
Duration of bottle feeding (in months)	-0.001	-0.060 - 0.057	0.96
Female	0.32	-0.505 - 1.149	0.45

*Statistically significant

risk factor for early childhood caries. This is similar to other reports^{18,19} which found prolong breastfeeding increased the risk for ECC. Other studies have also noted that prolonged feeding by itself may not be a risk factor for caries. It becomes a risk factor when the dietary habit of the child is unsuitable (is highly cariogenic)²⁰ or when breastfeeding was 'at will.'^{21,22} While there is increasing evidence to show that prolonged breastfeeding may play a role in ECC, other studies have found no such association.^{23,24} Epidemiological studies do however suggest that frequent breastfeeding is associated with a caries prevalence of around 5%–10%.¹³

This study equally identifies prolong duration of breastfeeding as a risk factor for rampant caries in preschool children. The longer the duration, the higher the risk of rampant caries. Similar observations were made in Papua New Guinea²⁵ and China.²⁶ There are currently very few studies reporting on predisposing factors to rampant caries in preschool children.

While other study data points to an association between prolonged breast feeding and caries experience in preschool children, the present study could only identify prolong breast feeding as a risk factor for rampant caries. Caries was only

associated with age. That is, as the age of the child increases, the risk for caries also increases. The few reports on caries prevalence in pre-school children had equally reported a steep increase in caries experience with age.^{27,28}

The results of this study point to the importance of different etiological factors for the different forms of caries. The study design has an inherent weakness. The information depended on the ability of the mothers to recall details of infant feeding practices. Li et al²⁹ noted that the reliability and validity of the mother's recall on breastfeeding data was high for the first 36 months. The reliability and validity of such recall data decreases after that. The reliability and validity of mother's recall ability on other feeding practice was also low. A longitudinal study may better be able to determine the role, impact, and importance of these infant feeding practices on children's caries experience.

There is also a need to further study the role of the oral hygiene status in the etiology of ECC in children who are breastfed for a protracted period. Including the oral hygiene status in the study would improve the predictability for caries. This could help explain part of the 90% dmft variability this study could not account for.

CONCLUSIONS

This study showed the relationship between the duration of breastfeeding, form of breastfeeding, and age on the caries experience of Nigerian preschool children. Prolonged breast feeding and exclusive breast feeding are risk factors for ECC. Prolonged duration of almost exclusive breastfeeding was identified as a risk factor for rampant caries.

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