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ORIGINAL ARTICLE

BREAST FEEDING, BOTTLE FEEDING AND CARIES EXPERIENCE IN CHILDREN AGED 6 MONTHS TO 5 YEARS IN LAGOS STATE, NIGERIA

C. A. Sowole, E. O. Sote
Department of Child Dental Health, Lagos University Teaching Hospital,
Idi-Araba, Lagos, Nigeria.

ABSTRACT

Objective: To determine the relationship between breast feeding, bottle feeding pattern and caries experience in young children.
Methods: Children aged 6 months – 5 years from 3 randomly selected local governments in Lagos State were examined intraorally. Structured questionnaire were administered to the mothers to inquire about the feeding pattern of their children.
Results: The prevalence of dental caries amongst the children was 10.5%. The group most affected with caries was among the predominantly exclusively breast fed (14.6%) compared to 9.4% of those who were exclusively breast fed. No cause and effect relationship was established between the duration of breast-feeding and dental caries, however the longer the duration of breast-feeding the higher the caries prevalence among them. The prevalence of caries also increased with the longer duration of bottle feeding till 18 months after which it declined. Mode of putting child to sleep rather than the bottle content was statistically associated with caries prevalence. ($p < 0.05$)
Conclusion: The multifactorial nature involved in cariogenesis is further demonstrated. The mode of putting the child to sleep is a strong factor in the caries process in young children.

Key words: Breast-feeding, bottle-feeding, caries

INTRODUCTION

The benefits of breast-feeding from the nutritional, immunologic, and psychosocial standpoint are well documented.[1, 2] Breast-feeding is a sure means of attaining optimal nutrition in infants. It also protects young children against infections thereby reducing morbidity and mortality.[3] In recognition of these gains the WHO/ UNICEF recommended exclusive breast-feeding during the first six months of life, to be followed by appropriate and adequate complementary foods and continual breast feeding up to the age of two years and beyond.[4]

Studies on infant feeding practices in different parts of Nigeria indicate an upward trend in exclusive breast-feeding

Correspondence: Dr. C. A. Sowole
Department of Child Dental Health
Lagos University Teaching Hospital,
Idi-Araba, Lagos, Nigeria.
E-mail: ayomidecoker@yahoo.com

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rate since the introduction of the Baby Friendly Hospital Initiative in 1991 [5-7.] However, none of these studies addressed the relationship between infant feeding pattern and dental caries.

Caries in infants and young children has been attributed to infant-feeding pattern.[8-11] Specifically, prolonged and frequent day-time and night-time bottle feeding has been implicated.[8, 9, 12] Furthermore, some researchers have suggested that the predominant factors determining nursing caries may relate to whether a child is given a bedtime bottle and falls asleep with the nipple in the mouth rather than the bottle content, milk or juice [13.] There are conflicting reports regarding breast feeding and its association with caries in young children because there is insufficient knowledge to assume cause and effect. [10, 11, 14]

Early childhood caries affects the primary molars and maxillary incisors most frequently.[15]

The four maxillary incisors in particular are most severely affected, since they are among first teeth to erupt and therefore have the longest exposure to cariogenic challenge Moreover, the nursing liquid always pools around these teeth. [16, 17]

Data on caries experience in preschool age children are less numerous than those in older children because preschool children are usually not accessible for examination. Nonetheless some studies have reported the prevalence of caries to be 0.5-2.0 percent of children at approximately 1 year of age, 7.7-26.3 percent at two years of age and 28.0-36.6 percent at three years of age, thus showing a steep increase with age. [18, 19] The pre-school age is an especially important time in the child's physical and psychological development.[20]

In order to fully appreciate the gains of breast feeding and infant feeding practices generally in children, their overall well-being should be taken into consideration, their oral health inclusive. Thus this study aims to determine the dental caries experience of children aged six months to five years and to investigate how it relates to their breast and bottle feeding practices.

Definition of terms [WHO 1990[21]]

- Exclusive breast feeding (EBF): An infant is exclusively breast fed if fed with human milk only on demand for the first six months of life to achieve optimal growth, development and health.
- Predominant breast feeding (PBF): refers to the use of only water or other non-nutritive liquids in addition to otherwise exclusive breast-feeding.
- Mixed feeding (MF): is used to indicate mixed feeding with breast-milk and other sources of energy and nutrient.

MATERIALS AND METHODS

Approval for the study was obtained from the Research Ethics Committee of the Lagos University Teaching Hospital, Lagos. Written and verbal consent was obtained from the Health Authorities of the two hospitals and the community leader in the areas used for the study. Lagos State, the former capital of Nigeria was chosen for the study because Lagos is a cosmopolitan city whereby there are mixed population of different ethnic groups thus giving a good representation of what may exist in the country. Two urban (Ikeja, Surulere) and one rural (Badagry) local government areas randomly selected were used.

In the urban areas two hospitals were used. Due to lack of such facilities in the rural area, mothers were persuaded to bring their children to the town hall

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where they were examined. All the children presenting at the Paediatric Outpatient Clinics of the two hospitals and the Town hall on the days of visit were included to enhance sample size. The sample size was based on a test prevalence selected to be 50%. This would enable detection of a difference at a 5% level of significance and with a power of 95% confidence.
Four hundred and ten children aged 6 months to 5 years participated in the study. This age bracket was chosen because tooth eruption starts at about 6 months in many children, and exclusive breastfeeding are usually not encouraged beyond 6 months of age. Moreover at 5 years of age the primary dentition would have had long enough exposure to cariogenic challenge in the oral cavity.

All the children were examined by one examiner in natural light with the children seated either on the mother's lap or ordinary chair using sterile mouth mirrors and dental probes to remove debris and refute doubtful diagnosis. Diagnosis criteria were those recommended by WHO.[22]

Mothers of the children were interviewed using a structured questionnaire consisting of demographic information on the child, feeding practices, practices related to oral health and the socioeconomic status (SES) based on a composite of two indices mothers' education and father's occupation as described by Olusanya.[23] The fathers occupation was classified according to Olojugba and Lenon.[24] For the children of single parents, socio-economic classification was based on the occupation of either parent the child was staying with.

Indices

		*Score
A.	**Father's occupation**	
	Professional	1
	Middle level	2
	Unskilled	3
B.	**Mother's education**	
	University	0
	Secondary/Post secondary (Below University)	1
	Primary/Nil	2

* Each child's social class (I-V) was obtained by adding A and B above.

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Data analysis was done using the Epi info version 6[25]. The responses to each questionnaire item were computed. The proportions of those with caries in the various groups were determined and compared across groups. Associations were subjected to the Chi square test and significance was defined as p less than or equal to 0.05. T-test was also used as appropriate.

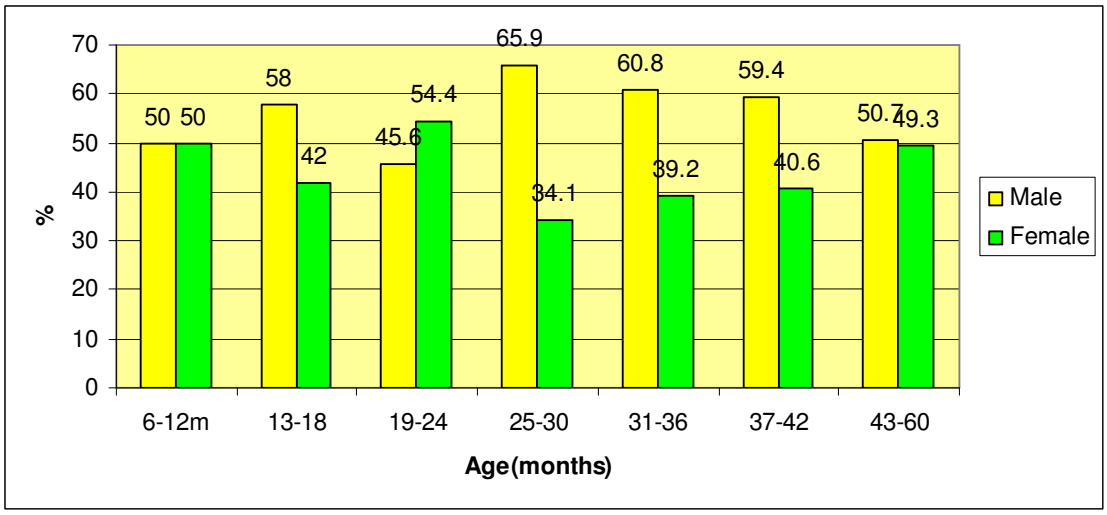
RESULTS

Out of 410 questionnaires 390 that were adequately completed were analysed. There were 141, 140 and 109 children for Surulere, Ikeja (urban) and Badagry (rural) Local Government Areas respectively.

Socio-demographic profile

The age of the children ranged from 6 to 60 months with a mean of 33.2 months (+/- 15.2 months). There were 217 (55.6%) boys and 173 (44.4%) girls (Figure 1).

Figure 1. DISTRIBUTION OF CHILDREN ACCORDING TO AGE AND GENDER



The mean age of the boys was 33.6 months (+/- 14.7 months) while that of girls was 32.9 months (+/- 15.8 months). The difference between the genders was not statistically significant $X^2 = 0.36$, df = 1, $p > 0.05$ ($p = 0.5$). Figure 1 shows the distribution of children according to age and gender. Males in the 25-30 months age bracket constitute the highest proportion (65.9%). There were more females (54.4%) than males (45.6%) only among the 19-24 months age bracket.

Three hundred and forty nine children (89.5%) were caries free, showing caries prevalence of 10.5% in the study population. Of the 41 children with caries 13 had a dmft of 1 while 14 had a dmft of 2. One child had a dmft of 8. (Table 1).

Table 1. Caries experience among the Children.

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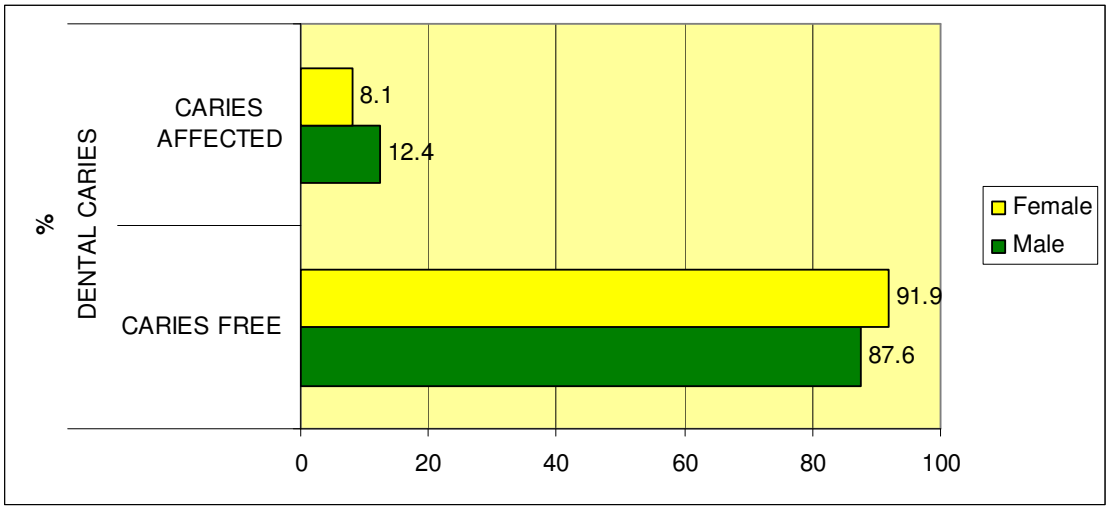
dmft VALUES	FREQUENCY	%
0	349	89.5
1	13	3.3
2	14	3.6
3	6	1.5
4	3	0.8
5	2	0.5
6	1	0.3
7	1	0.3
8	1	0.3
TOTAL	**390**	**100.0**

A higher proportion of girls 159 (91.9%) than boys (190; 87.6%) boys were caries free. There was no statistical difference among both genders in relation to the prevalence of caries. X^2=1.94, df=4, and P > 0.05 (P=0.16). (Figure 2)

Figure 2. Proportion of children with dental caries according to gender



Breast-feeding and caries

Two hundred and three children (52.1%) were exclusively breast fed for the first 6 months of life. Among these 203 children that were exclusively breast fed, 19 (9.4%) had caries. The highest caries prevalence 13 (14.6%) was recorded amongst those who were predominantly exclusively breast fed. In the mixed breast fed group comprising 82 children 9 (11%) had dental caries. The prevalence of dental caries was not statistically related to the feeding pattern. X^2=1.75, df=2, and P>0.05 (P=0.42) (Table 2).

Table 2: Feeding pattern and caries experience

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Feeding Pattern

1. Pattern of feeding	Caries free		Caries Affected		Total	
	Freq	%	Freq	%	Freq	%
Exclusive BF	184	90.6	19	9.4	203	52.1
Predominant exclusive BF	76	85.4	13	14.6*	89	22.8
Mixed	73	89.0	9	11.0	82	21.0
No BF	16	100.0	0	0.0	16	4.1

2. Breast-feeding duration and caries experience

Duration (months)	Caries free		Caries Affected		Total	
	Freq	%	Freq	%	Freq	%
6	36	97.3	1	2.7	37	11.5
07-12	119	88.8	15	11.2	134	41.6
13-18	101	84.9	18	15.1	119	37.0
>18	26	81.3	6	18.8	32	9.9

In all the social classes majority of the children were exclusively breast fed for the first six months of life. More children from the high socioeconomic status were exclusively breast fed. The association between the SES and infant feeding practices was not statistically significant. X^2 =23.91, df=15 and P > 0.05(p=0.06) (Table 3)

Table 3: Overall feeding pattern of children in relation to the Socio-Economic Status (SES)

SES	FEEDING PATTERN									
	EBF		PREDOMINANT EBF		MIXED		BOTTLEFEEDING ONLY		TOTAL	
	Freq	(%)	Freq	(%)	Freq	(%)	Freq	(%)	Freq	(%)
I	18	46.2	9	23.1	9	23.1	3	7.7	39	10.0
II	64	61.5	14	13.5	21	20.2	5	4.8	104	26.7
III	32	52.5	13	21.3	15	24.6	1	1.6	61	15.6
IV	50	44.2	38	33.6	21	18.6	4	3.5	113	29.0
V	25	47.2	14	26.4	13	24.5	1	1.9	53	13.6
Unspecified	14	70.0	1	5.0	3	15.0	2	10.0	20	5.1
Total	**203**	**52.1**	**89**	**22.8**	**82**	**21.0**	**16**	**4.1**	**390**	**100.0**

X^2 = 23.91 df =15 P = 0.00

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Three hundred and twenty-two (82.6%) children in the study had stopped breast feeding. Out of these, 32 (9.9%) were breast fed for over 18 months, 6 (18.8%) of which had dental caries. Overall 50 (12.8%) were breast fed over 18 months. The boys were breast fed for a longer duration than the girls. The overall means for the boys was 2.49 +/- 0.81 while that of the girls was 2.40 +/- 0.83. The difference between the means however was not statistically significant t test > 0.05(p=0.08) (Table 4).

Table 4: **Overall duration of breast- feeding**

Duration	Boys		Girls		Total	
(MONTHS)	Freq	%	Freq	%	Freq	%
0-6	19	51.4	18	48.6	37	11.5
07-12	71	53	63	47	134	4.6
13-18	71	59.7	48	40.3	119	37
>18	18	56.3	14	43.8	32	9.9

Overall means (boys) = 2.49 SD +/- 0.81
Overall means (girls) = 2.40 SD +/- 0.83
t test = 0.08

Only fifty–two (13.3%) children were still being breast-fed as at the time of this study. Nine (17.3%) children were still being breast fed in the 31 to 36 months age range, the oldest child 36 month old male from Badagry, a rural area.Majority of the children from Badagry 45(47.4%) and Surulere 54(48.6%) were breast fed for 13-18 months while in Ikeja they were mostly 63(54.3%) breast fed for 7-12 months. The association was statistically significant with more children from Surulere and Badagry being breast fed for a longer time. A statistically significant association was found between duration of breast feeding among the children by geographical location with the highest proportion of children from Surulere (urban area) spending a longer time breast feeding than those from Badagry(rural) and Ikeja(urban).X^2=38.8,df=6,and P<0.05 (P=0.00). (Table 5)

Table 5. Duration of breast-feeding among the children by geographical location

DURATION (MONTHS)	BADAGRY		IKEJA		SURULERE		TOTAL	
	Freq	(%)	Freq	(%)	Freq	(%)	Freq	(%)
0-6	9	9.5	23	19.8	5	4.5	37	11.5
07-12	32	33.7	63	54.3	39	35.1	134	41.6
13-18	45	47.4	20	17.2	54	48.6	119	37.0
>18	9	9.5	10	8.6	13	11.7	32	9.9
Total	**95**	**100**	**116**	**100**	**111**	**100**	**322**	**100**

X^2 = 38.8 df = 6 p = 0.00

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Table 6a: Feeding-bottle content and caries experience

Feeding-bottle content and caries experience						
Content	**Caries Free**		**Caries Affected**		**Total**	
	Freq	**%**	**Freq**	**%**	**Freq**	**%**
Sweetened milk, soft drinks, fresh and packed juices	25	100.0	0	0.0	25	10.3
Formula	124	90.5	13	9.5	137	67.5
Plain water	15	88.2	2	11.8	177	8.4
Cereal	20	83.3	4	16.7	24	11.8
X^2=4.40 df=3 p=0.22						

Out of 162 children who were bottle fed 18 (11.1%) of them had dental caries. Sixteen (4.1%) of the children were reported to have been wholly bottle-fed because the mothers died immediately post delivery. None of them had caries. There was an increasing trend in the caries prevalence the longer the duration of bottle feeding up to 18 months after which it declined. However, the duration of bottle-feeding was not found to be statistically related to the prevalence of dental caries. X^2=2.19, df=3, and P > 0.05 (P=0.53) (Table 6)

Table 6b: Bottle feeding and caries experience

Bottle-feeding duration and caries experience						
Duration (months)	**Caries free**		**Caries Affected**		**Total**	
	Freq	**%**	**Freq**	**%**	**Freq**	**%**
6	18	90	2	10	20	12.3
07-12	75	90.4	8	9.6	83	51.2
13-18	27	81.4	6	18.2	33	20.4
>18	24	92.3	2	7.7	26	16.1
X^2=2.19 df=3 p=0.53						

Of 137 children who had infant formula as the bottle content, 13 (9.5%) had dental caries. Two (11.8%) of those whose mother claimed to have water in their feeding bottle had dental caries. In the children whose feeding bottle had cereal, 4(16.7%) had caries. Bottle content was found not to be statistically associated with caries prevalence. X^2=4.40, df=3, and P>0.05 (P=0.22) (Table 6)

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Among 284 children who were reportedly put to sleep at night with nothing in the mouth, 25 (8.8%) had caries. Out of the 137 children who had infant formula in their feeding bottle, 12 were put to sleep with the bottle and one (8.3%) had dental caries. The study showed that dental caries was found in one child of each of the following groups that slept with a bottle of sweetened formula, juice or water and pacifier users. The only child that slept with the habit of plain water in the bottle also had caries. A substantial proportion 12(14.8%) of those that nursed at the breast had caries. The mode of putting the child to sleep was statistically related to dental caries. X^2=11.95, df=5, and P<0.05(P=0.03) (Table 6)

Complementary feeding

Concerning the mode of complementary feeding, most of the children, 188 (48.2%) were introduced to complementary foods between the ages of 4-6 months. Eighty-nine (22.8%) had complementary food before the age of 4 months while 113(28.9%) started complementary foods after 6 months.

Complementary foods were given using cup and spoon exclusively in 187 (49.5%) of the children, bottle exclusively in 166 (42.6%) of children, and 37 (9.5%) used the bottle, cup and spoon. The mode of complementary feeding was not statistically related to dental caries. X^2 = 0.70, df=2 and p > 0.05 (p=0.70) (Table 7) The association between the time of introduction of complementary foods and dental caries was not statistically significant.

Table 7a. Mode of complementary feeding and caries

Mode of putting child to sleep and caries experience						
Mode of putting child to sleep	**Caries Free**		**Caries Affected**		**Total**	
	Freq	**%**	**Freq**	**%**	**Freq**	**%**
Nothing in the mouth	259	91.2	25	8.8	284	72.8
Bottle of formula	11	91.7	1	8.3	12	3.1
Bottle of Sweetened Milk, Formula, Juice Water	7	87.5	1	12.5	8	2.1
Pacifier Only	3	75	1	25	4	1
Bottle Of Water	0	0	1	100	1	0.3
Nursing At Breast	69	85.2	12	14.8	81	20.8
X^2=11.97 df=5 p=0.03						

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Table 7b. Complementary feeding and dental caries

Complementary feeding mode	Caries Free		Caries Affected		Total	
	Freq	%	Freq	%	Freq	%
Cup and spoon	165	88.2	22	11.8	187	49.5
Bottle	151	91.0	15	9.0	166	42.6
Both	33	89.2	4	10.8	37	9.5

X^2=0.00 df=2 p=0.70

Discussion

Findings of this study need to be carefully interpreted because the data relied on the recollection, memory and honesty of the mothers in the completion of the questionnaires. Nonetheless, the exclusive breast feeding rate of 52.1% shows an improvement over the 22.9% reported in Calabar[6], 38.0% reported in Benin City[5] and 40.9% in Jos[7]. The improvement in the rate confirms previous reports and could be ascribed to the influence of the Baby Friendly Hospital Initiative promotion in the designated hospitals in the country.

Although the feeding pattern and socioeconomic status was not statistically significant, more children in the high socioeconomic status were exclusively breast fed compared to those in the low socioeconomic status. This is in consonance with other Nigerian studies [5, 6] It cannot be concluded from this study whether mothers breast fed longer duration in the urban or rural area. Even though other studies suggested that the duration was longer in the urban area due to the fact that the mothers were on paid maternity leave[6].

The highest caries prevalence (14.6%) was recorded amongst children who were predominantly exclusively breast fed, followed by those who had mixed breast-feeding (11%). However, the infant-feeding pattern was not statistically associated with caries prevalence. This finding agrees with that of Roberts et al [26] where the pattern of breast-feeding was unrelated to nursing caries among South African children. In contrast to the report of Al-Dashti et al[10] where the highest prevalence of caries (80%) was amongst children who were wholly bottle fed. None of the children wholly bottle fed in our study had caries.

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Amongst the children studied, 50(12.8%) had prolonged breast feeding for over 18 months and 6(18.8%) had dental caries. Although there was an increase in the prevalence of dental caries the longer the duration of breast-feeding, no cause and effect relationship was established in the present study. This finding is similar to that of Tsuboshi et al [20] who found that breast-feeding for over 18 months enhanced the prevalence of caries. The proportion of children with prolonged breast-feeding was lower (2%) among Swedish children.[14] Hence prolonged breast-feeding should be considered a caries risk if dietary habit is unsuitable. In contrast Weerheijm et al [27] concluded that prolonged breast-feeding on demand did not lead to higher caries prevalence. They found over 40% of their sample size still breast-feeding at 24 months during the day or night, in spite of this only 9% of the entire sample had nursing caries.

Amongst those that were bottle fed the prevalence of caries was highest in those that bottle fed for 13 to 18 months. Thereafter the prevalence declined. This is to be expected as children would be taking more of family foods during this period. This observation is similar to other studies[28, 29] in which most children reportedly remained caries free in spite of the fact that majority were given the bottle past twelve months. The finding that infant formula which is basically milk was the most common content of the bottle is consistent with other reports. [13, 28, 30] Seow [31] noted that there is a growing body of evidence to show that milk may protect the teeth from caries.

This agrees with the finding of the present report but in contrast to others [30, 32] This observation further suggests that other dietary habits are more important in determining dental caries development than bottle feeding. There is a growing body of evidence to show that interplay of several other risk factors such as microbiological status of the child, oral hygiene practices and dietary habits and not just the practices related to baby bottle usage are implicated in early childhood caries.[31]

An unusual finding in this study showed that two children who had dental caries claimed to have plain water as the bottle content. There is no cariogenic challenge if the bottle content is water. [33] This claim underscores the limitation of questionnaire study. The reliability of the mother's responses of the child's feeding habit may be uncertain if she is not the primary caregiver. Moreover responses to the questionnaire might be affected by the mother's dental awareness and by the potential of recall bias.

In agreement with others the feeding bottle content was not associated with risk of dental caries in this series [34-36] .This is in contrast to some other studies that found a positive association between sweetened milk in the bottle and caries.

CONCLUSIONS

1 Children that were predominantly exclusively breast fed experienced caries the most.

2 The longer the duration of breast-feeding the higher the prevalence of caries, thus prolonged breast feeding could be an enhancing factor in early childhood of caries.

3 The prevalence of early childhood caries amongst children who were bottle fed increased until the age of

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18 months after which it declined, indicating that bottle feeding after 18 months of age may not pose a serious caries risk.

There is no association with bottle content and the prevalence of dental caries. Rather the mode of putting the child to sleep was the strongest factor associated with dental caries.

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