

Early childhood caries in infants and toddlers

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ABSTRACT

Objective: This study aimed to perform a preliminary assessment of early childhood caries (ECC) in infants and toddlers accessing medical care at various community health centres in Trinidad, to identify any risk factors (nutritional or hygiene factors) that may be associated with early childhood caries, to determine oral health knowledge of parents or caregivers of children within this age group and to utilise this information to promote the early implementation of dental care programmes to diminish the impact of dental caries in children.

Methods: A cross-sectional study was conducted involving 215 toddlers under three years of age attending immunisation clinics at health centres in north Trinidad. Data was collected using a structured questionnaire administered through an interview with attending mothers and clinical examination was performed using a mirror and blunt probe by calibrated examiners. Data analysis was performed using SPSS with statistical significance set at $p < 0.05$.

Results: The prevalence of ECC was found to be 12.5% for cavitated lesions and 25.1% if both cavitated and non-cavitated lesions were considered. Maternal level of education, bottle feeding practices and the use of fluoridated toothpaste were contributory to ECC in this age group.

Conclusion: ECC is a disease that significantly affects this age group in Trinidad and Tobago. Early presentation to the dental setting for preventive care advice, as well as large scale public health education campaigns can help reduce the experience of ECC and its associated comorbidities in this population.

INTRODUCTION

Caries remains to date one of the most chronic diseases affecting young children in both developed and developing countries.¹ As seen in many other developing countries, there is a high prevalence of caries in children in Trinidad and Tobago, with 62% of 6-year-olds and 50% of 3 to 5-year-olds having caries, of which, the latter group, 52.3% have a severe form of the condition.^{2,3}

Early childhood caries (ECC) is defined by the American Academy of Pediatric Dentistry (AAPD) as the presence of one or more decayed cavitated and non-cavitated lesions, missing (because of caries) or filled tooth surfaces in any primary tooth in a child under the age of 6. Severe ECC in children under the age of 3 years is defined as any sign of smooth surface caries.⁴

The aetiology of caries primarily involves a time-dependent interaction of teeth, microorganisms and fermentable carbohydrates, however, there are several environmental factors such as oral hygiene practices, socioeconomic factors and level of education, that appear to be predictors of caries risk.⁵

Dietary practices, such as prolonged and frequent nighttime bottle feeding with cariogenic beverages like milk and infant formula have been associated with increasing the risk of caries.⁶ These dietary practices that promote caries are usually established by 12 months of age and maintained throughout childhood.^{1,7,8} Dental visits have been recommended by the American Academy of Pediatrics (AAP) and AAPD to take place by a child's first birthday and the practice of oral hygiene measures should ideally be initiated with the eruption of the first primary tooth.^{9,10} A failure to implement good dental health practices can contribute to dental disease development and progression. The resultant dental pain and infection can in turn impact negatively on a child's quality of life.^{11,12} Children with caries as infants or toddlers also have a much greater probability of subsequent caries in both the primary and permanent dentitions.¹³

In Trinidad and Tobago, while infants and toddlers have good access to medical care services from birth, their access to dental care services is severely limited. Although dental services are mainly offered through public dental clinics from the age of 3 years, perception around limited patient cooperation at this age often encourages parents to attend only when children have all their primary teeth at 5 years.¹⁴ Infants and toddlers who may require care before this age must often seek care through private

clinics or medical hospital facilities at significant financial costs for sedation or general anaesthesia services.¹⁵

There is a lack of data in the Caribbean region regarding the prevalence of caries in children under 3 years. The purpose of this study was to perform a preliminary assessment of early childhood caries in infants and toddlers accessing medical care at various community health centres in Trinidad, to identify any risk factors (nutritional or hygiene factors) that may be associated with early childhood caries, to determine oral health knowledge of parents/caregivers of children within this age group and to utilize this information to promote the early implementation of dental care programmes to diminish the impact of dental caries in children.

METHODS

The study was a preliminary analysis of oral health and nutrition data in infants and toddlers derived from a community-based survey. This study and extension requests were approved by the University of the West Indies, St Augustine Campus Research & Ethics Committee, and the Ministry of Health of Trinidad and Tobago. Data collection occurred between July 2014 and December 2015.

A convenience sample of infants and toddlers was used from parents/ guardians of patients (with teeth) younger than 36 months who attended the immunisation clinics of various randomly selected health centres throughout north Trinidad. Verbal consent was obtained from all parents/ guardians and only the children for whom consent was obtained were examined.

The study utilised a structured questionnaire administered via interview as the investigation instrument, together with a non-invasive clinical examination. The questionnaire, which was developed by the authors and examiners (T.P and J.E), included information about patient and parent demographics, parental educational level and attitude to dental care as well as the child's dietary, feeding and oral hygiene habits.

The clinical examination involved visual and tactile assessment of the dentition and soft tissues using a disposable mouth mirror, blunt probe, torch light and tongue spatula. Oral hygiene status was assessed using a modification of the simplified oral hygiene (OHI-S) index (1973).¹¹ The facial and lingual surfaces of all erupted teeth were examined. The debris scores were added and divided by the number of surfaces assessed. Oral hygiene

was classified as good when the debris scores ranged from 0.0 to 1.0 and poor when scores were greater than 1.0. Sterile gauze was then used to dry the teeth. Teeth were scored for caries using the WHO (1979) criteria for decayed, missing, or filled teeth DMFT index and non-cavitated or early white spot enamel lesions were also recorded.⁴

The sample size determination for the study was obtained by using the formula by Daniel, 1999 where $n = Z^2 P (1-P) / d^2$ (with n = sample size; Z = Z statistic for level of confidence; P = expected prevalence or proportion and d = precision). For the level of confidence of 95%, which is conventional, Z value is 1.96.¹⁶

As no data was available for children younger than three years, the prevalence was estimated to be 50%, $d = 0.05$. The sample size for this group was therefore determined to be 384 patients.

Calibration of the examiners (T.P and J.E) was carried out prior to the clinical examinations on a separate group of twenty (20) preschool children who attended the University of the West Indies Dental School, Child Dental Health Emergency clinic. The Kappa coefficient for intra-examiner and inter-examiner reliability was 0.91 and 0.89, respectively.

Microsoft Excel was used to create a database before exporting to Statistical Package for the Social Sciences (SPSS) version 21.0 (IBM Corporation, Armonk, NY, USA) software for statistical (quantitative) data analysis. Both descriptive and inferential statistics methods were used for data analysis and all hypotheses were tested at the 5% significance level. Descriptive methods included forming frequency and percentage distribution tables and summary statistics (point estimates of single proportions and means with corresponding standard deviations). Inferential methods included hypothesis testing (chi-squared tests of association and test of equality of proportions using Fisher's Exact test).

RESULTS

Demographics

Two hundred and fifteen (215) children were examined, 115 (53.5%) were male and 100 (46.5%) were female. The mean age of children examined was 22 months, SD 8.2. Using the WHO index only, the caries prevalence was 12.1% (26/215) and when white spot lesions were

included, the caries prevalence was 25.1% (54/215). The mean number of decayed, missing and filled teeth was 4.80, SD 3.109. Children under the age of 23 months were statistically less likely to have ECC in this sample. Children of Afro-Trinidadian descent were more likely to have ECC in this sample (Table 1).

Maternal Factors and Dental Exposure

Only 16.7% (36/215) of mothers interviewed reported a visit to the dentist during pregnancy and only 7% (15/215) reported the child having a dental visit up to the time of examination. Twelve (12) out of 15 children attended for a check-up, 1 child for trauma and 2 for oral pathology. Three (3) children had a history of toothache prior to dental examination but none of these ever attended a dentist. Only 3/215 (1.4%) children attended a dental visit by their first birthday. Six children (6/215, 2.8%) attended at 18-24 months and 3/215 (1.4%) at 30-35 months.

Most mothers reportedly received no oral care advice. There was also no statistically significant association seen between maternal age /maternal dental visits and an infant/ toddler's caries experience; however, the mother's level of education and an infant or toddler's caries experience did appear to have a significant correlation. Children whose mothers completed secondary and tertiary level education were less likely to have ECC (Table 2).

Dietary Practices

A combination of breast and bottle feeding was the most common dietary practice in this age group (78.6%). Exclusive breastfeeding and exclusive bottle feeding occurred in 6.9% (15/215) and 14.4 % (31/215) of children respectively. Milk with cereal was the most common bottle content in this group, 78.6% (169/215) and there was statistical significance only with children who were still bottle feeding at the time of examination and ECC. 62.7% (32/51) of children over 14 months were still breastfeeding and 71.4 % (110/154) were still bottle feeding at the time of examination (Table 3).

Oral Hygiene Practices

There was statistical significance noted in children with poor oral hygiene practices in this group ($p = 0.001$) and the use of fluoridated children's toothpaste ($p = 0.025$) and ECC (Table 4). There were no associations between the frequency of brushing and ECC. The mean age at which brushing started was 11.2 months $\pm$ 4.4 SD in this group.

Table 1. Demographics of infants and toddlers with and without early childhood caries (ECC)

Demographics	n (%) (n = 215)	No Caries n = 189	ECC n = 26	p value
Gender				
Male	115 (53.5%)	99 (46%)	16 (7.4%)	0.253
Female	100 (46.5%)	90 (41.9%)	10 (4.7%)	
Ethnicity				
African	83 (38.6%)	68 (31.6%)	15 (7.0%)	0.004**
East Indian	33 (15.3%)	28 (13.0%)	5 (2.3%)	
Mixed	99 (46%)	93 (43.3%)	6 (2.8%)	
Age				
< 12 months	16 (7.4%)	16 (7.4%)	0	<0.001**
12- 23 months	101 (47.0%)	97 (45.1%)	4 (1.9%)	
24-35 months	98 (45.6%)	76 (35.3%)	22 (10.2%)	

** Values were statistically significant ($p < 0.05$)

Table 2. Maternal demographics of infants and toddlers with and without early childhood caries (ECC)

Maternal Factors	Respondent n (%)	No Caries n (%)	ECC n (%)	p value
AGE (years)				
<20	4 (1.9%)	3 (1.4%)	1 (0.5%)	-
20–29	94 (43.7%)	82 (38.1%)	12 (5.6%)	0.166
30-39	109 (50.7%)	99 (46.0%)	10 (4.7%)	-
>40	8 (3.7%)	5 (2.3%)	3 (1.4%)	-
EDUCATION LEVEL				
Primary School	1 (0.5%)	1(0.5%)	0 (0%)	-
Part Secondary	13 (6.1%)	8 (3.7%)	5 (2.4%)	0.003**
Secondary	89 (41.4%)	81 (37.7%)	8 (3.7%)	-
Vocational Training	10 (8.2%)	7 (3.3%)	3 (1.4%)	-
University/Tertiary	102 (47.4%)	92 (42.8%)	10 (4.7%)	-
DENTAL VISITS				
No	179 (83.3%)	158 (73.5%)	21 (9.8%)	-
Yes	36 (16.7%)	31 (14.4%)	5 (2.3%)	0.717
ORAL CARE ADVICE				
No	155 (72.1%)	136 (63.3%)	19 (8.8%)	0.700
Yes	55 (25.6%)	48 (22.3%)	7 (3.3%)	

** Values were statistically significant ($p < 0.05$).

Table 3. Dietary practices of infants and toddlers with and without early childhood caries (ECC)

Feeding Practices	Response	n	No Caries n (%)	ECC n (%)	p value
Breast Feeding	No	31	26 (12.1%)	(42.3%)	0.456
	Yes	184	163 (75.8%)	21 (9.8%)	-
Slept at breast	No	48	43 (20.0%)	5 (2.3%)	0.643
	Yes	138	122 (56.7%)	16 (7.4%)	-
Still Breast Feeding	No	132	118 (54.9%)	14 (6.5%)	0.737
	Yes	51	44 (20.5%)	7 (3.3%)	-
Breast Feeding Frequency	<6	77	70 (32.6%)	7 (3.3%)	0.758
	≥6	110	96 (44.7%)	14 (6.5%)	-
Bottle Feeding	No	14	11 (5.1%)	3 (1.4%)	0.509
	Yes	201	178 (82.8%)	23 (10.7%)	-
Still Bottle Feeding	No	47	40 (18.6%)	7 (3.3%)	0.019**
	Yes	154	139 (64.7%)	15 (7.0%)	-
Botte Feeding Frequency (x/day)	<6	159	142 (66.0%)	17 (7.9%)	0.476
	≥6	38	33 (15.4%)	5 (2.3%)	-
Added sweetener to bottle contents	No	177	160 (74.4%)	17 (7.9%)	0.093
	Yes	24	18 (8.4%)	6(2.8%)	-
Sleeping with Bottle	No	145	133 (61.9%)	13(6.0%)	0.099
	Yes	56	46 (21.4%)	10(4.7%)	
Feeding at night/ early morning	No	47	43 (20%)	4(1.9%)	0.066
	Yes	160	141(65.6%)	19(8.8%)	
Consumed pre-chewed food	No	182	162 (75.3%)	20 (9.3%)	0.244
	Yes	33	27 (12.6%)	27 (2.8%)	-

DISCUSSION

The findings of this study revealed a caries prevalence in this infant and toddler community of 12.1% with cavitated lesions only and 25.1% if both cavitated and non-cavitated lesions are considered. This prevalence was significantly lower than those reported in studies that looked at 11-14 months old (57.5%) and 15-19 months old (82.8%) and in 25- to 36-months-olds (46%).^{17,18} There was no association with gender, however, there was an association with ethnicity and ECC ($p=0.004$). This can be attributed to the predominance of persons of African descent residing in this region of the island rather than a true ethnic predisposition.

The inclusion of white spot lesions may contribute to the increase in the prevalence of caries at 50% noted in 3–5-year-old age group in this population.³ The presence of white spot lesions in patients who may not practice good plaque control can lead to the progression of lesions as the patient ages.

The mean age at which toothbrushing started was closer to 1 year in this group. This is later than what is recommended at the eruption of the first tooth which usually occurs at 6 months. This late initiation of toothbrushing habits can contribute to the presence of caries in this group. The children in this group with high plaque scores were also found to have more caries experience. This is consistent with other study findings that suggest a positive association between plaque accumulation on primary teeth and ECC risk.^{19,20}

Table 4. Oral hygiene practices of infants and toddlers with and without early childhood caries (ECC)

Oral Hygiene Practices	Response	No Caries	ECC	<i>p</i> value
Toothbrushing frequency	1×/day	80 (37.2%)	10 (4.7%)	-
	≥2×/day	103 (47.9%)	16 (7.5%)	0.745
Good	-	132 (61.4%)	9 (4.2%)	0.001**
Poor	-	57 (26.5%)	17 (7.9%)	
Brushing Agents				
Nothing	No	177 (82.3%)	25 (11.6%)	0.391
	Yes	9 (4.2%)	0 (0%)	
Children’s fluoride-free toothpaste	No	138 (64.2%)	19 (8.8%)	0.713
	Yes	48 (22.3%)	6 (2.8%)	
Children’s fluoride toothpaste	No	111 (51.6%)	8 (3.7%)	0.025**
	Yes	75 (34.9%)	17 (7.9%)	
Adult fluoride toothpaste	No	175 (81.4%)	24 (11.2%)	0.675
	Yes	11 (5.1%)	1 (0.5%)	
Other (e.g. glycerine)	No	138 (64.2%)	20 (9.3%)	0.598
	Yes	48 (22.3%)	5 (2.3%)	

The low percentage of mothers (16.7%) who had dental visits during pregnancy and children who had dental visits at the time of examination (7%) appears to be consistent with similar findings in several studies.²¹⁻²³ This highlights a lack of awareness of early dental assessment as a caries preventive measure. The AAPD and BSPD (British Society of Paediatric Dentistry) recommendations of establishing a dental home and a visit by age one year, were reportedly unknown to many parents.^{24,25} This was reflected by the 1.4% of cases that attended by their first birthday for dental assessment. Observed low attendance at immunisation clinics and significant refusal rates by parents to participate in dental assessment not only contributed to lower-than-desirable subject numbers but also highlighted perceptions that dental assessment should occur when children are older. This pattern of dental attendance was also seen in parents of the 3-5-year group in this population. This is of particular importance as dental caries early in the primary dentition is a risk predictor for future caries experience, not only in childhood years, but also through adulthood.²⁶ This therefore warrants an aggressive oral education campaign to increase awareness of early professional assessment, prevention and intervention in early childhood caries management.

The only specific maternal factor that influenced caries prevalence in this population was educational level. Mothers with lower levels of education had children with higher levels of ECC which was comparable with other studies.^{27, 28} The non-discriminatory presentation of ECC should ensure that more wide-reaching oral health education programmes be established. This is particularly important in this community as most mothers (72.1%) reported not receiving any oral care advice prior to the examination.

While there is no universally accepted time to discontinue breast and bottle feeding, many studies have shown that prolonged breastfeeding for more than 12 months increases the risk of caries.²⁹ The average recommended time to wean a child from breast and bottle feeding is 12-15 months.^{30, 31} The significant number of children older than 14 months who were still breast and bottle feeding suggests either a lack of awareness about the recommendation, or that these practices may be difficult to discontinue. This practice of 'prolonged' breastfeeding combined with the use of sweetened bottle contents such as infant cereals/ formula, or sweet snack consumption can also contribute to the caries experience in this population. This study also concurs with other studies that

have shown that there is a significant association between ECC and children who were still bottle-feeding.³²

There was no association found between the frequency of tooth brushing and caries experience in this sample, however, there was an association between the use of fluoridated toothpaste and caries experience in this group. The findings of this study suggest that subjects who used children's fluoridated toothpaste were more likely to have ECC. Interpretation of this should be done with caution as the observed poor recall of information about oral hygiene practices and inability to give precise information during the interview about the use of low fluoride-containing toothpastes may introduce elements of bias.

The findings of this research study are subject to several limitations. The study was a cross-sectional study with a small sample size. Despite several extensions to the research time, there were delays in approval from participatory institutions/clinics, challenges with scheduling, low attendance at immunization clinics on assessment days and noteworthy participation refusal by parents. These contributed to lower-than-desired patient numbers which may lead to Type 1 errors.

Information regarding socio-economic status was also not assessed in this study due to a general reluctance of parents to share such information. These limitations can affect the interpretation of information.

The age of the data presents another limitation of this study. Data collection was done ten years ago and the reason for delay in publication was multifactorial. The findings, however, are still deemed relevant and fills a prevailing gap, adding to the very limited existing literature on early childhood caries in Trinidad and Tobago. Additionally, the existing dataset can be used to make comparisons with future research conducted to determine trends in the experience of early childhood caries before and after the Covid-19 pandemic.

CONCLUSION

This study revealed that there is a fair level of dental caries in the infant and toddler population. The caries is associated with factors such as prolonged bottle feeding and poor oral hygiene practices. Dental health awareness regarding children and toddlers is poor. Policies that promote early professional dental assessment and more broad-based oral health education programmes for early childhood caries are required. These programmes can help in the

prevention and limit the progression of ECC in children in this population.

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Author contributions: T.P. conceived the idea; T.P and J.E collected the data; B. Sa, T.P and J.E analysed the data and T.P and J.E. prepared the manuscript.

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