



Oral Hygiene Practices and Bottle Feeding Pattern Among Children with Early Childhood Caries: A Preliminary Study

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ABSTRACT

The purpose of this study was to assess the association of bottle feeding and oral hygiene practices with the severity of caries among 3 to 5-year-old children with Early Childhood Caries (ECC). This cross-sectional study was carried out on pediatric dental patients with ECC attending a public university hospital. The parents or guardians were interviewed for the bottle-feeding pattern and oral hygiene practices followed by a clinical dental examination of their children with ECC. Data analysis was done using Chi squared test. Out of 32 children, 69% had severe early childhood caries with mean dft of 8.88. In this study, 87.5% of the subjects had a history of bottle feeding, with 53.1% still being bottle fed at the time of study. Current bottle-feeding habit was found to be statistically significant with the severity of caries ($p=0.021$). Majority (69 %) of the children were introduced to tooth brushing only after 1 year of age. About 40% of the children consumed either pre-chewed rice and/or shared spoons or feeding utensils with their parents or siblings but there was no significant association with the severity of caries ($p=1.00$). Because of its association with ECC, prolonged bottle feeding is significantly associated with the severity of caries in our study population. Besides, vertical and horizontal transmission of bacteria was also a risk factor for ECC, but it did not show any significant association with severity of ECC.

Keywords: Bottle-feeding, dental caries, decayed, filled, dft, Early Childhood Caries, feeding pattern, nursing bottle, oral hygiene practices.

Introduction

Early Childhood Caries (ECC) is a virulent form of dental caries affecting babies and preschool children worldwide. It is a multifactorial disease most commonly associated with poor dietary and poor oral health habits (1, 2). A more alarming form of ECC is termed as severe-ECC (S-ECC) depending on the age and number of teeth affected (3). Associated risk factors include microbiological, dietary and environmental (4). ECC can be prevented by decreasing the bacterial count of the child's caregiver (mother), minimizing bacterial transmission causing tooth

decay and by oral health education of the parents (1). Maternal oral hygiene is important for prevention of vertical transmission. Some studies also noted a horizontal transmission of infection from fathers, siblings and other members of the family (2, 5).

Prolonged and frequent consumption of formula milk, breast milk or sugary beverages are primary dietary risk factors in ECC. Use of nursing bottle and "Sippy cups" enhances the exposure to lactose (2). Night time bottle feeding increases the risk of caries as the salivary flow decreases during sleep and the oral clearance is low. Thus, an anterior caries pattern

is commonly observed in children using a bottle (6, 7). Many studies showed that milk-bottle feeding at night is a strong risk factor for the development of ECC (2, 7). In a Southeast Asian population, the consumption of sugars and pre-chewed rice, nocturnal breastfeeding after the age of 12 months posed a risk for developing ECC (8). Regional differences in oral hygiene and feeding practices due to existing cultural beliefs can lead to variations in caries patterns and severity (9).

Environmental factors affecting the severity of ECC include caregiver social status, poor economic conditions, ethnicity, and education level (4, 10). There was an inclination towards consuming increased sugary foods among children living in poor socio-economic areas (1). Based on National Oral Health Plan for Malaysia 2011-2020, the prevalence of dental caries among school children (5 years-old) has decreased from 87.1% in 1995 to 76.2% in 2005(11). However, the mean dft (decayed, missing and filling) did not show significant changes; from 5.8 in 1995 to 5.5 in 2005 (12). This indicates high prevalence and severity of dental caries among young children in Malaysia (11) (12). Parents showed relatively good knowledge, but poor attitude and practice towards the oral health of their children (13). In another study, habits of allowing infants to sleep with breast nipple in the mouth and late start of tooth brushing were associated with the prevalence of ECC in Malaysia (14). More detailed information on bottle feeding and oral hygiene practices in children with ECC is needed to understand the cultural habits in this region.

The aim of this study was to identify the oral hygiene practices and the feeding pattern of children with ECC and their association with the severity of caries.

Materials and Methods

A close-ended questionnaire consisting of 32 items addressing bottle feeding pattern and oral hygiene practices among children aged 3-5 years was designed. The questionnaire included a section on socio-demographic data to assess the socioeconomic status, educational level and occupation of the parent. The questionnaire was constructed in English and later translated into Bahasa Melayu, the local language and back-translated to English. The questionnaire was pretested on 5 randomly selected subjects before conducting the study.

In this cross-sectional study, a convenient sample of 32 parents accompanying children aged 3-5 years with early childhood caries attending the Primary care unit of a public university hospital for a routine dental checkup from June - August 2015

were invited to participate in the study. Children of the same age group who had sound primary dentition or medical problems were excluded from the study. After obtaining written consent from the parent, the questionnaires were handed out to be completed by the parent/caregiver and collected immediately. Parents who required help in reading were assisted. The child was clinically examined by trained post graduate students and the dft score was recorded using the WHO criteria (15). Ethical clearance was obtained from the Ethics Committee of the University.

The data was recorded and analyzed using Statistical Package for Social Sciences version 12.0.1 software (SPSS Inc., Chicago, IL, USA). Patients were categorized into 2 groups based on severity of ECC, which was classified as ECC <5 and S-ECC ≥6. Descriptive statistics included computation of percentages, means, and standard deviations. The association between the variables and the severity of ECC was also analyzed using chi-square test. Fisher’s Exact test was used to analyze the data if the assumptions for chi-square test were not met.

Results

Demographic characteristics of the parents are shown in Table 1. Most of the parents who completed the questionnaire were mothers of children and aged more than 30 years. Most of the parents were employed outside the home and specified college/university as their highest education level.

Table 1: Demographic Characteristics of Parents

| Variables | | n | (%) |
|---|--------------------|----|---------|
| Parents who completed the questionnaire | Father | 9 | (28.1%) |
| | Mother | 23 | (71.9%) |
| Age | 21-30 years old | 6 | (18.7%) |
| | 31-40 years old | 22 | (68.8%) |
| | >40 years old | 4 | (12.5%) |
| Education | Secondary | 8 | (25%) |
| | College/University | 24 | (75%) |
| Occupation | Homemaker | 6 | (18.8%) |
| | Working | 26 | (81.3%) |
| No. of children in family | 1 | 5 | (15.6%) |
| | 2 | 14 | (43.8%) |
| | 3 | 8 | (25%) |
| | >3 | 5 | (15.6%) |

Demographic characteristics of the children are shown in Table 2. Most of the children were 5 years-old, predominantly boys. In addition, 75% of the

children had another significant caregiver and about half of them were the eldest in the family.

Table 2: Demographic Characteristics of Children

| Variable | n | (%) |
|-------------------------------|-------------|------------|
| Age | 3 years old | 10 (31.3%) |
| | 4 years old | 9 (28.1%) |
| | 5 years old | 13 (40.6%) |
| Gender | Boy | 19 (59.4%) |
| | Girl | 13 (40.6%) |
| Ethnicity | Malay | 28 (87.5%) |
| | Chinese | 3 (9.4%) |
| | Indian | 1 (3.1%) |
| Another significant caregiver | None | 8 (25%) |
| | Relative | 6 (18.8%) |
| | Baby sitter | 11 (34.4%) |
| Position in the family | Preschool | 7 (21.9%) |
| | Eldest | 17 (53.1%) |
| | Middle | 8 (25%) |
| | Last | 7 (21.9%) |

Current feeding habits of the children are shown in Table 3. Half of the children were still bottle fed, while all of them had started eating solid food. Besides, 22 out of 32 children had dft more than 5.

Table 4 shows the bottle-feeding pattern of the children. A total of twenty-eight children had experienced bottle feeding, 17 of whom were bottle feeding at the time of the study, while 11 children had

stopped the habit at the time of the study. Most of them were introduced to bottle feeding before their first birthday. In addition, most of them were given milk in a bottle 3 times or more times daily and at night time before sleep. Besides, half of them took 10 to 30 minutes to complete one feed from a bottle. Among all respondents that had history of bottle feeding, 11 of them had stopped bottle feeding, most of them being weaned off at the age of 5.

Oral hygiene practices of the children are shown in Table 5. Half of the respondents started tooth brushing between ages 1 and 2 with majority brushing every day and being supervised by their parents. Most of them had no oral hygiene practice after consuming milk/ sugary drinks and never shared a spoon or bottle with other siblings. Most of the variables showed no significant association with dft (severity of caries) except the current bottle-feeding habits which was significantly associated to the severity of caries ($p=0.02$).

Discussion

The mean dft in this study was 8.88 which was higher compared to the national mean dft of children in Malaysia (12), and most other countries reporting ECC (9, 16-19) (Table 7). Since the sample for this study was taken from patients attending a hospital setting, it was more likely for them to have a higher burden of dental disease. Similar sample selection was noted in other studies (19, 20). However, many other studies have compared children from both high and low caries risk population (21-24). Based on

Table 3: Current Feeding Habits and dft among the children

| Variables | 3 years old (n =10) | | 4 years old (n = 9) | | 5 years old (n = 13) | | Total (N=32) | | |
|----------------------------|------------------------|--------|------------------------|---------|-------------------------|---------|-----------------|---------|---------|
| | n | (%) | n | (%) | n | (%) | | | |
| Breastfeeding | 2 | (20%) | 3 | (33.3%) | 2 | (15.4%) | 7 | (21.9%) | |
| Bottle feeding | 5 | (50%) | 5 | (55.6%) | 7 | (53.8%) | 17 | (53.1%) | |
| Breast and bottle feeding | 3 | (30%) | 2 | (22.2%) | 4 | (30.8%) | 9 | (28.1%) | |
| Trained using cup | 10 | (100%) | 9 | (100%) | 13 | (100%) | 32 | (100%) | |
| Solid food | 10 | (100%) | 9 | (100%) | 13 | (100%) | 32 | (100%) | |
| Introduction to solid food | <1-year-old | 1 | (10%) | 2 | (22.2%) | 4 | (30.8%) | 7 | (21.9%) |
| | 1 to <2 years old | 8 | (80%) | 5 | (55.6%) | 7 | (53.8%) | 20 | (62.5%) |
| | 2 to <3 years old | 1 | (10%) | 2 | (22.2%) | 2 | (15.4%) | 5 | (15.6%) |
| Pre-chewed food | 2 | (20%) | 4 | (44.4%) | 3 | (23.1%) | 9 | (28.1%) | |
| Blended food | 1 | (10%) | 5 | (55.6%) | 1 | (7.7%) | 7 | (21.9%) | |
| dft | <5 | 3 | (30%) | 2 | (20%) | 5 | (50%) | 10 | (31.3%) |
| | ≥6 | 7 | (31.8%) | 7 | (31.8%) | 8 | (36.4%) | 22 | (68.8%) |

Table 4: Bottle Feeding Pattern among the children

| Variables | n | (%) | Total (N=28) | (100%) | |
|--|------------------------|-----|--------------|--------|--------|
| Introduction to bottle feeding | <6 months | 11 | (39.3%) | 28 | (100%) |
| | 6 months - <1-year-old | 12 | (42.9%) | | |
| | 1 year old- 2-year-old | 5 | (17.9%) | | |
| Frequency of giving breast/formula milk daily | Never | 0 | (0.00) | 28 | (100%) |
| | Occasionally | 2 | (7.1%) | | |
| | Once | 0 | (0.00) | | |
| | Twice | 1 | (3.6%) | | |
| | 3 times | 5 | (17.9%) | | |
| | >3 times | 20 | (71.4%) | | |
| | Never | 9 | (32.1%) | | |
| Frequency of giving water drink daily | Occasionally | 5 | (17.9%) | | |
| | Once | 0 | (0.00) | | |
| | Twice | 3 | (10.7%) | | |
| | 3 times | 2 | (7.1%) | | |
| | >3 times | 9 | (32.1%) | | |
| Frequency of giving juice/sugary drink | Never | 11 | (39.3%) | 28 | (100%) |
| | Occasionally | 7 | (25%) | | |
| | Once | 4 | (14.3%) | | |
| | Twice | 1 | (3.6%) | | |
| | 3 times | 1 | (3.6%) | | |
| Frequency of putting child to sleep using bottle | >3 times | 4 | (14.3%) | 28 | (100%) |
| | Never | 7 | (25%) | | |
| | Sometimes | 5 | (17.9%) | | |
| | Every night | 16 | (57.1%) | | |
| Frequency of feeding the child in the middle of the night using bottle | Never | 6 | (21.4%) | 28 | (100%) |
| | Sometimes | 13 | (46.4%) | | |
| | Every night | 9 | (32.1%) | | |
| Time to complete one feed | <10 minutes | 11 | (39.3%) | 28 | (100%) |
| | 10-30 minutes | 14 | (50%) | | |
| | >30 minutes | 3 | (10.7%) | | |
| Has the child stopped bottle feeding? | Yes | 11 | (39.3%) | 28 | (100%) |
| | 1 year old | 1 | (3.6%) | | |
| | 2 years old | 1 | (3.6%) | | |
| | 3 years old | 4 | (14.3%) | | |
| | 4 years old | 2 | (7.1%) | | |
| | 5 years old | 3 | (10.7%) | | |
| Expected age to wean off bottle | No | 17 | (60.7%) | 28 | (100%) |
| | 3 years old | 2 | (7.1%) | | |
| | 4 years old | 3 | (10.7%) | | |
| | 5 years old | 7 | (25%) | | |
| | 6 years old | 5 | (17.9%) | | |

Table 5: Oral Hygiene Practices of the children

| Variables | | 3 years old (n = 10) | | 4 years old (n = 9) | | 5 years old (n = 13) | | Total (N=32) | |
|---|---------------------------|-------------------------|--------|------------------------|---------|-------------------------|---------|-----------------|---------|
| | | n | (%) | n | (%) | n | (%) | n | (%) |
| Introduction to tooth brushing | 6 months- <1- years-old | 5 | (50%) | 2 | (22.2%) | 3 | (23.1%) | 10 | (31.3%) |
| | 1 years old- <2 years old | 4 | (40%) | 6 | (66.7%) | 6 | (46.2%) | 16 | (50%) |
| | 2 years old-<3 years old | 1 | (10%) | 0 | (0.00) | 1 | (7.7%) | 2 | (37.5%) |
| | 3 years old-4 years old | 0 | (0.00) | 1 | (11.1%) | 3 | (23.1%) | 4 | (12.5%) |
| Frequency of tooth brushing | Rarely | 0 | (0.00) | 1 | (11.1%) | 0 | (0.00) | 1 | (3.1%) |
| | Once in 2-3 days | 1 | (10%) | 2 | (22.2%) | 1 | (7.7%) | 4 | (12.5%) |
| | Every day (once) | 3 | (30%) | 3 | (33.3%) | 2 | (15.4%) | 8 | (25%) |
| Supervised tooth brushing | Every day (twice) | 6 | (60%) | 3 | (33.3%) | 10 | (76.9%) | 19 | (59.4%) |
| | Never | 0 | (0.00) | 0 | (0.00) | 2 | (15.4%) | 2 | (6.3%) |
| | Sometimes | 3 | (30%) | 3 | (33.3%) | 3 | (23.1%) | 9 | (28.1%) |
| Normal practice after consuming milk | Every day | 7 | (70%) | 6 | (66.7%) | 8 | (61.5%) | 21 | (65.6%) |
| | No particular practice | 6 | (60%) | 6 | (66.7%) | 8 | (61.5%) | 20 | (62.5%) |
| | Drink water | 4 | (40%) | 2 | (22.2%) | 4 | (30.8%) | 10 | (31.3%) |
| Normal practice after consuming sweet food/ beverage | Brush teeth | 0 | (0.00) | 1 | (11.1%) | 1 | (7.7%) | 2 | (6.3%) |
| | No particular practice | 6 | (60%) | 3 | (33.3%) | 6 | (46.2%) | 15 | (46.9%) |
| | Rinse mouth | 1 | (10%) | 1 | (11.1%) | 1 | (7.7%) | 3 | (9.4%) |
| Type of toothpaste | Drink water | 3 | (30%) | 5 | (55.6%) | 5 | (38.5%) | 13 | (40.6%) |
| | Brush teeth | 0 | (0.00) | 0 | (0.00) | 1 | (7.7%) | 1 | (3.1%) |
| | Adult toothpaste | 0 | (0.00) | 0 | (0.00) | 4 | (30.8%) | 4 | (12.5%) |
| Other aid to clean teeth | Children toothpaste | 10 | (100%) | 9 | (100%) | 9 | (69.2%) | 28 | (87.5%) |
| | No other aid | 10 | (100%) | 9 | (100%) | 11 | (84.6%) | 30 | (92.8%) |
| Spoon/bottle sharing without washing between child and parents/siblings | Mouthwash | 0 | (0.00) | 0 | (0.00) | 2 | (15.4%) | 2 | (6.3%) |
| | Dental floss | 0 | (0.00) | 0 | (0.00) | 0 | (0.00) | | |
| | Never/ Rarely | 8 | (80%) | 8 | (88.9%) | 9 | (69.2%) | 25 | (78.1%) |
| Sharing toothbrush with other siblings | Once in 2-3 days | 0 | (0.00) | 0 | (0.00) | 2 | (15.4%) | 2 | (6.3%) |
| | Every day (once) | 1 | (10%) | 0 | (0.00) | 1 | (7.7%) | 2 | (6.3%) |
| | Every day (twice) | 1 | (10%) | 1 | (11.1%) | 1 | (7.7%) | 3 | (9.4%) |
| | | 1 | (10%) | 0 | (0.00) | 0 | (0.00) | 1 | (3.1%) |

our study, age, occupation and parental education had no significant association with severity of ECC ($p > 0.05$). Elsewhere, parental education level was a major risk factor for ECC (22). In Australia, there was a significant increase in the prevalence of ECC in children of younger mothers, less than 24 years (9). Prevalence and severity of ECC significantly increased with fourth or higher order children while we found no association between child order and severity of caries (9).

There was an increase in prevalence of caries in children with prolonged bottle feeding beyond two years of age (9, 16). In our study, 87.5% of the

children had a history of bottle feeding with 53.1% still being bottle fed despite being trained to eat solid food and use a cup (Table 3). Current bottle-feeding habit was statistically significant with the severity of caries in our study ($P < 0.05$). Among children that had history of bottle feeding, only 39.3% had stopped with the mean age at weaning being 3.45 ± 1.29 years, indicating prolonged bottle-feeding habit in this sample. Similar age at weaning was observed in Bangpakong, Thailand (3.1 ± 0.6 years old) (25) and Philippines (26). This implies that most parents/caretakers either did not follow or were not aware of the recommended weaning time. According to the

Table 6: Association between dft and Demographic Characteristics/Bottle Feeding Pattern/Oral Hygiene Practices

| Variables | p | Significance |
|--|-------|--------------|
| Age of parents | 0.142 | NS |
| Parent's education | 1.000 | NS |
| Parent's occupation | 0.346 | NS |
| Caregiver | 0.218 | NS |
| Position of child in family | 0.450 | NS |
| Current feeding habit: bottle feeding | 0.021 | S |
| Current habit: pre-chewed food/tooth brushing or spoon sharing | 1.000 | NS |
| Age to start bottle feeding | 0.668 | NS |
| Frequency of giving milk in bottle daily | 0.551 | NS |
| Frequency of giving juice/sugary drink in bottle daily | 0.357 | NS |
| Night time bottle feeding | 0.574 | NS |
| Time to complete one feed | 0.668 | NS |
| Weaned from bottle | 0.076 | NS |
| Age to stop bottle feeding | 0.455 | NS |
| Age to start tooth brushing | 1.000 | NS |
| Supervised tooth brushing | 0.703 | NS |
| Frequency of tooth brushing | 0.155 | NS |
| Normal practice after consuming milk/sweet drink | 1.000 | NS |

Table 7: Comparison of Mean dft from different nations

| Countries | Mean dft |
|-----------------------|--|
| China | 9.2± 3.6 |
| Malaysia | 1995 2005 1988 1997 2007 5-year-old 6-year-old 5.8 5.5 5.7 4.1 3.6 |
| Australia | 1.4 ± 2.77 |
| India | 2.03 ± 2.99 |
| Nigeria | 0.735 ± 2.07 |
| Malaysia (this study) | 8.8 |

Ministry of Health, Malaysia, bottle feeding should be discontinued by 12 to 14 months of age. The most common reason of prolonged bottle feeding is

the child's refusal to wean (25). There is a need for oral health promotion strategies that include specific messages regarding time for weaning the bottle and practical advice for parents /caregivers of children with prolonged bottle feeding.

According to AAPD, the risk for ECC is related to repetitive breast-feeding times and prolonged exposure to fermentable carbohydrates (3). Similar effects can be extrapolated to bottle feeding. Among children with history of bottle feeding in this study, 71.4% consumed milk using bottle more than 3 times a day, 72 % practiced night time bottle feeding which was higher than the study done in Thailand (25). Current night time bottle feeding habits in our study reflected the attitude among parents elsewhere in Malaysia, where majority of the parents disagreed that night time bottle feeding, and prolonged, frequent bottle feeding can cause tooth decay (27). Of those children who bottle fed at night, 64.28% had dft more than 5. Besides, 60.7% drank sugary drink/ juice using the bottle daily which was also higher than Kelantan, South Africa (19), Brazil (24), China (18) and north Brisbane (7). This ascertains that majority of the parents followed high caries risk practices and were probably unaware of the detrimental nature of these habits (18). Regarding time taken to finish one feed from the bottle, majority of the children took 10 to 30 minutes in our study, another factor increasing the risk for caries.

Among all the children in our study, only 31.3% started brushing their teeth before they turned one-year old. However, there was no significant association with the severity of caries ($p>0.05$). In a study by Hallett et al, the ECC experience of children who started tooth brushing earlier (at age of 12 months) was significantly lower compared to those who started tooth brushing at the age of 13 months or later (9). Ministry of Health Malaysia recommends that children should practice regular tooth brushing as soon as they have teeth, twice daily (28). Regarding frequency of tooth brushing in our study, 84.4% of the children were found to brush their teeth at least once every day while 59.38% brushed twice daily, with 65.6% being supervised. Brushing frequency was also not significantly associated with the severity of ECC in this study, similar to the findings in Kanpur, India (16), Latvia (29) and Kerala, India (30), China, Southern Brazil (24) and Lagos, Nigeria (17). On the contrary, low frequency of tooth brushing and improper tooth brushing technique among the children was significantly associated with S-ECC in another study (31). In addition, the low frequency of tooth brushing among the children was also significantly associated with low frequency tooth brushing habits of the caretakers (31). The number of children that had no particular oral hygiene

practice after consumption of milk sweet drinks or food was 43.8%, compared to that in Taiwan where it was 95% (31). About 40% of the children consumed pre-chewed rice and/or shared spoons or feeding utensils with their parents or siblings daily. This allows both horizontal and vertical transmission of bacteria, additionally increasing the risk for caries in these children (3). Based on study in Kelantan, Malaysia, most parents did not know that tooth decay may be caused by bacteria transmission through sharing feeding utensils (27). Similar practice of pre-chewing of rice was also found in other studies in the Asian region (8). Cultural practices and social beliefs of a region account for an important aspect in determining oral health status (9). Certain practices are followed for generations and remain persistent, overlooking the relevant information available in reliable resources.

There were several high-risk factors in this group of children with SECC and ECC. However, only one significant risk factor was identified between the ECC and S-ECC group due to majority being in the S-ECC group. Since dental caries is a multifactorial disease, many other risk factors such as snacking patterns and active dental diseases in caregivers were not recorded and analysed, therefore being a limitation in the study. Being a preliminary study with a small sample, further studies should enquire whether similar habits are observed in larger samples of children with and without ECC and reasons for prolonged feeding habits. In addition, studies regarding the knowledge and perception of the parents towards feeding habits of their child and its effects on oral health may also be conducted.

Conclusion

In this study, prolonged bottle-feeding habit is a major risk factor for early childhood caries. Besides bottle feeding, a number practices with high risk for caries were also noted, including factors promoting vertical and horizontal transmission of bacteria. However, many factors did not show any significant association with the severity of ECC.

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