

# Early Childhood Feeding Practices and Its Association with Early Childhood Caries

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**Abstract** Early childhood caries (ECC) is one of the most prevalent dental diseases among children and is related to their early feeding practices. This multi-factorial disease involves susceptible tooth and host, fermentable carbohydrates in the diet, cariogenic micro-organisms and time (American Academy of Pediatric Dentistry, 2008). Thus, this study aimed to identify the associations between bottle-feeding and weaning practices, and ECC formation. By using convenience sampling, 201 children were recruited from the IIUM Outpatient Dental Clinic and ten kindergartens around the area of Kuantan, in the state of Pahang (Malaysia). Examination for caries was conducted visually to determine caries status (with or without caries). The caregivers were requested to fill in a questionnaire regarding feeding practices of their children. The findings of the study indicated that 67% of the children identified with caries practiced bottle-feeding in bed either sometimes or always (every night/day) ( $p=0.005$ ). The prevalence of ECC was also significantly ( $p<0.001$ ) the highest (48.5%) among children who had been bottle-feeding for the longest duration ( $>4$  years) among the study population. In addition, the mean intake of sweetened drinks among children with ECC was significantly higher than those with no ECC (5.4 vs. 3.1 servings/week,  $p=0.001$ ). The results of this research indicated that the increased frequency and prolonged duration of bottle-feeding practices, as well as high consumption of sweet drinks during weaning, could be associated with the formation of ECC. In conclusion, these findings would increase the awareness particularly among parents regarding bottle-feeding practices and weaning diet contents and its potential implication on their children's oral health.

**Keywords:** early childhood caries, dental caries, breastfeeding, bottle-feeding, weaning

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## 1. Introduction

Early childhood caries (ECC) can be defined as the presence of decayed (non-cavitated or cavitated lesions), missing (due to caries), or filled primary tooth (DMFT) in a child aged between birth and 71 months [1]. The Oral Health Division of Malaysia, Ministry of Health, has reported that ECC was prevalent among 76.2% of among preschool children in this country [2]. Early childhood caries occurs due to the interaction between bacteria *Streptococcus mutans* and sugary foods which are present on tooth enamel [3]. It is characterized by the presence of one decayed tooth or more in primary dentition as soon as an infant's teeth erupt [4]. The ECC occurs when acidogenic microorganisms in dental plaque metabolize the fermentable carbohydrates on the tooth surfaces causing an acidic environment in the mouth [5]. The acid will then demineralize the tooth surface and cause dental caries.

The ECC is considered as the most common chronic disease during childhood and is also known as 'baby bottle decay'. This is found to be a norm among infants and children who are allowed to consume sugar (sucrose or lactose) regularly throughout the day and night. Consumption of sucrose plays an important contributing role in the caries process [6]. The risk of having dental caries is higher when children are given sugar-sweetened beverages or fruit juices in a bottle during the day or bedtime after their teeth have erupted [7]. The tooth decay usually involves the upper anterior and sometimes posterior teeth. Rapid development of carious lesions in primary anterior teeth is one of the characteristics of ECC.

The presence of ECC may affect children's quality of life [8]. Some children may experience emergency clinic visits and hospitalization. According to Petersen et al., 2005, Children's quality of life can be seriously affected by severe caries because of pain and discomfort which could lead to disfigurement, acute and chronic infections, and altered eating and sleeping habits, as well as risk of

hospitalization, high treatment costs, and loss of school days with the consequent diminished ability to learn [9]. Furthermore, ECC is also associated with reduced growth and reduced weight gain due to insufficient food consumption to meet the metabolic and growth needs of children less than two years old. ECC may also lead to early tooth extraction which can further cause malocclusion in permanent dentition [10].

Studies from India had found that children who sleep with nursing bottles had a higher risk to get dental caries [11]. Likewise, a study conducted in Jeddah (Saudi Arabia) showed that children who bottle-fed in bed had 9% higher risk to get caries compared to children who did not [12]. Similar findings in South-West Germany indicated a significant correlation between the usage of nursing bottles in bed and severe ECC [13]. However, two studies conducted in Universiti Sains Malaysia Hospital and Boston (United States), showed no correlation between bottle-feeding in bed practice and ECC [14,15].

According to the policy statement of the AAP (2011), infants should be weaned from bottle-feeding between 12 to 18 months of age. Parents should be encouraging their children to start drinking from cups as they approach the 1<sup>st</sup> birthday [16]. Prolonged use of bottle-feeding beyond one year was responsible for increasing exposure of fermentable carbohydrates on primary teeth. A study conducted by Senesombath, Nakornchai, Banditsing, & Lexomboon (2010) in Laos, also found that children who had bottle-fed for over one year were more prone to have higher (DMFT) scores than those who were bottle-fed for less than 12 months [17]. Similarly, children who practised prolonged bottle-feeding beyond two years of age were significantly associated with caries [18]. Nevertheless, in a study done in Brazil by Martins-Júnior et al. (2013), no significant association was found between the duration of bottle-feeding for more than two years with ECC development [19].

Although some studies have demonstrated the link between bottle-feeding practice and the development of caries among young children, some other findings were inconclusive. Furthermore, research in this area is still scarce in this country. Therefore, this study aimed to investigate whether the frequency of night time bottle-feeding, duration of bottle-feeding, and weaning diet, were associated with the ECC prevalence among pre-school children in the area of Kuantan, Pahang, Malaysia.

## 2. Materials and Methods

### 2.1. Study Area & Population

A cross-sectional study was carried out among pre-school children in Kuantan, Pahang, from March until May 2014. The inclusion criterion was children aged below six years with primary dentition. The data collection took place at the Dental Outpatient Clinic, Kulliyah of Dentistry, IIUM, and ten kindergartens in Kuantan, Pahang. Ethical approval and written permission for this study were obtained from relevant authorities (approval reference KAHS/RES-APP/12MARCH2014-24). Written informed consent was provided by all participating caregivers, prior to the study commencement.

### 2.2. Data Collection

A dual-language (Malay and English) self-administered questionnaire was developed. Its content was reviewed by field experts and a pilot study had been conducted. The questionnaire which consisted of demographic data such as age, sex, nationality, race, religion, parent's educational level, and socioeconomic status, was completed by the parents. Information regarding bottle-feeding practices including the frequency of bottle-feeding in bed, duration of bottle-feeding, frequency of bottle-feeding per day, and weaning, was also obtained. Visual examination for caries detection was conducted under natural light. The children were divided into two groups according to their caries status (with or without caries).

### 2.3. Statistical Analyses

SPSS® software version 25.0 was used for statistical analyses. The frequency with mean scores and standard deviations (SD) were calculated. Chi-Square analysis was performed to examine differences in feeding practices among children with and without ECC. The level of significance was set at  $p \leq 0.05$ .

## 3. Result

A total of 201 participants aged between one to five years participated in this study (Table 1). Among the participants, 167 of them (83%) had caries while the rest had no caries. Out of 201 participants, almost half (48%) were males and a majority (96.5%) of the participants were Malay. Most (84%) of the parents had either secondary or tertiary level of education while 72% of the parents earned RM 2,001 or more per month.

**Table 1. Demographic characteristics of the study participants (n= 201)**

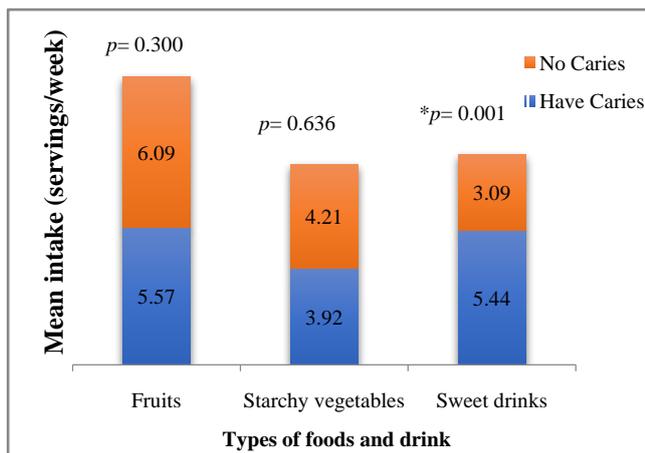
No	Characteristic	Frequency (%)	
1	ECC	Yes	166 (82.6)
		No	35 (17.4)
2	Age	1	4 (2.0)
		2	8 (4.0)
		3	15 (7.5)
		4	25 (12.4)
		5	149 (74.1)
3	Gender	Male	96 (47.8)
		Female	105 (52.2)
4	Race	Malay	194 (96.5)
		Chinese	2 (1.0)
		Indian	1 (0.5)
		Others	4 (2.0)
5	Parent's Education Level	No education	2 (1.0)
		Primary School	4 (2.0)
		PMR	22 (10.9)
		SPM/ STPM	88 (43.8)
		University	80 (39.8)
	Others	5 (2.5)	
6	Household Income	< RM 1000	15 (7.5)
		RM1001-RM 2000	41 (20.4)
		RM2001-RM 3000	47 (23.4)
		RM3001- RM4000	54 (26.9)
		RM4001-RM5000	18 (9.0)
	>RM5001	26 (12.9)	

Based on Table 2, bottle-feeding practice in bed could be significantly ( $p=0.005$ ) linked to ECC status. About two thirds (67%) of the participants who had caries practiced bottle-feeding in bed either sometimes or always (every night/day). On the other hand, among those who never bottle-fed in bed, a higher percentage of them did not have caries (41%) compared to those who did (33%). Prevalence of ECC was also significantly the highest among children who had been bottle-feeding for the longest duration (>4 years). Meanwhile, more participants with the shortest duration of bottle-feeding (<1 year) had no ECC (32.4%) compared to those who did (22.8%).

**Table 2. Breastfeeding and bottle-feeding practices between children with and without ECC**

	Caries status		p value
	With caries (N=167)	Without Caries (N=34)	
Frequency of bottle-feeding in bed:			$p=0.005$
Never	55 (32.9%)	14 (41.2%)	
Always: Every night/day	81 (48.5%)	7 (20.6%)	
Sometimes	31 (18.6%)	13 (38.2%)	
Duration of bottle-feeding practice (years)			$p<0.001$
0-1	38 (22.8%)	11 (32.4%)	
2-3	48 (28.7%)	20 (58.8%)	
>4	81 (48.5%)	3 (8.8%)	

Figure 1 demonstrated the mean consumption of foods and drink (servings per week) between participants with and without ECC during weaning. There were no significant differences of the mean intakes of fruits and starchy vegetables between these groups. However, the mean intake of sweet drinks of the children with ECC was found to be significantly higher than those consumed by the children with no ECC (5.4 vs. 3.1 servings/week,  $p=0.001$ ).



**Figure 1.** Mean consumption of foods and drink (servings/week) of children with and without caries during weaning diet (n=201)

## 4. Discussion

Inappropriate use of bottle-feeding among children plays a central role in the etiology and severity of ECC. A number of studies had found significant correlations between ECC and prolonged bedtime use of bottles with

sweetened content [11,12]. In the current study, it has been demonstrated that prolonged duration and high frequency of bottle-feeding may indeed induce the ECC occurrence.

Frequent bottle-feeding practice is highly associated with caries status. A study conducted by Sunitha, Chandu, Pushpanjali, Jayashree, & Shafiulla (2018) found that bottle-feeding at least once per day, especially before going to bed at night, would contribute to the development of ECC [20]. This study identified that children with ECC had longer years of bottle-feeding practice. According to the American Academy of Pediatrics, most children who are seven or eight months of age no longer need to feed during the night. Besides, giving the child a bottle while they are lying down may place them at risk of getting ear infections. However, bottle-feeding at night is a common practice used by parents not only to feed, but also to stop their children from crying during the night, or help the children to go to sleep faster [21]. It has been reported that practising frequent bottle-feeding in bed promotes early colonization by *Streptococcus mutans* and increases the number of these bacteria in dental plaque and saliva [11]. One of the contributors is due to high consumption of sweet drinks among ECC children [18]. In addition, for every one gram of sugar intake, the risk of having ECC would increase by 2% [22]. This finding was consistent with a study among Brazilian children, which showed that the odds for ECC were greater in those with higher total sugar exposure [23].

The types of foods consumed in the weaning diet may influence the dental health of children. For instance, some parents may feed their children with fruit juices frequently thinking that these are healthy options for their children. However, regular consumption of fruit juice may promote an acidic condition in the mouth which could eventually induce a prolonged drop in oral pH and cause dental erosion. This condition is more prone to occur among young children due to their immature tooth enamel [24].

According to Moynihan & Petersen (2004), when an individual consumes starchy food, it would be broken down into glucose, maltose, and maltotriose, by salivary amylase [25]. This would later be metabolized by oral bacteria which would produce acids. However, raw starch does not cause demineralisation of the teeth compared to cooked starch. Meanwhile, a mixture of starch and sucrose is more cariogenic than starch alone. The higher the sucrose concentration in the mix, the more caries it would develop. In addition, the practice of feeding children sweetened beverages through bottle would increase their risk of developing caries, and should be prevented [26,27].

## 5. Conclusion

From the current study, it can be concluded that high frequency and prolonged duration of bottle-feeding practice (in years), as well as high consumption of sweet drinks during weaning were linked with the formation of ECC. Other than healthy oral practice, oral health awareness programs especially among caregivers should also highlight proper bottle-feeding practice and healthy nutrition for oral health in order to minimize the ECC prevalence among young children.

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## References

- [1] American Academy of Pediatric Dentistry. (2008). Definition of Early Childhood Caries (ECC). Retrieved from [http://www.aapd.org/assets/1/7/d\\_ecc.pdf](http://www.aapd.org/assets/1/7/d_ecc.pdf).
- [2] Oral Health Division. (2005). Dental Epidemiological Survey of Pre-school Children in Malaysia.
- [3] Dülgergil, Ç., Dalli, M., Hamidi, M., & Çolak, H. (2013). Early childhood caries update: A review of causes, diagnoses, and treatments. *Journal of Natural Science, Biology and Medicine*, 4(1), 29. <https://doi.org/10.4103/0976-9668.107257>
- [4] Dogan, D., Dülgergil, Ç., Mutluay, A., Yildirim, I., Hamidi, M., & Çolak, H. (2013). Prevalence of caries among preschool-aged children in a central Anatolian population. *Journal of Natural Science, Biology and Medicine*, 4(2), 325.
- [5] Kawashita, Y., Kitamura, M., & Saito, T. (2011). Early childhood caries. *International Journal of Dentistry*, 2011, 725320.
- [6] Casamassimo, P. S., Fields Jr, H. W., McTigue, D. J., & Nowak, A. (2013). *Pediatric dentistry: infancy through adolescence*. 4nd ed. St Louis Missouri: Mosby.
- [7] Asawa K, Sen N, Bhat N, Tak M, Sultane P, Patil V. *Association of sugary foods and drinks consumption with behavioral risk and oral health status of 12- and 15-year-old Indian school children*. J Educ Health Promot. 2018; 7: 19.
- [8] Naidu R, Nunn J, Donnelly-Swift E. *Oral health-related quality of life and early childhood caries among preschool children in Trinidad*. BMC Oral Health. 2016; 16: 128.
- [9] Petersen, P. E., Estupinan-Day, S., & Ndiaye, C. (2005). WHO's action for continuous improvement in oral health. *Bulletin of the World Health Organization*, 83(9), 642.
- [10] Bansal M., Gupta N., Gupta P., Arora V., Thakar S. (2017). Reasons for extraction in primary teeth among 5-12 year school children in Haryana, India- A cross-sectional study. *J Clin Exp Dent*.
- [11] Prakash, P., Subramaniam, P., Durgesh, B. H., & Konde, S. (2012). Prevalence of early childhood caries and associated risk factors in preschool children of urban Bangalore, India: A cross-sectional study. *European Journal of Dentistry*, 6(2), 141-152.
- [12] Almushayt, A. S., Sharaf, A. A., El-Meligy, O. A., & Tallab, H. Y. (2009). Dietary and Feeding Habits in a Sample of Preschool Children in Severe Early Childhood Caries (S-ECC). *Medical Sciences*, 16(4), 13-36.
- [13] Bissar, A., Schiller, P., Wolff, A., Niekusch, U., & Schulte, A. G. (2014). Factors contributing to severe early childhood caries in south-west Germany. *Clinical Oral Investigations*, 18(5), 1411-1418.
- [14] Witjaksono, W., Tin Oo, M. M., & Kechik, K. A. (2006). Nursing habits and early childhood caries in children attending Hospital University Science Malaysia (HUSM). *Dental Journal (Majalah Kedokteran Gigi)*, 39(2), 54.
- [15] Johansson, I., Lif Holgerson, P., Kressin, N. R., Nunn, M. E., & Tanner, A. C. (2010). Snacking Habits and Caries in Young Children. *Caries Research*, 44(5), 421-430.
- [16] American Academy of Pediatrics. Bright Future: Nutrition. Retrieved from <https://brightfutures.aap.org/Bright%20Futures%20Documents/BF%20Nutrition3rdEdPocketGuide.pdf>.
- [17] Senesombath, S., Nakornchai, S., Banditsing, P., & Lexomboon, D. (2010). Early childhood caries and related factors in Vientiane, Lao PDR. *The Southeast Asian Journal of Tropical Medicine and Public Health*, 41(3), 717-725.
- [18] Begzati, A., Berisha, M., & Meqa, K. (2010). Early childhood caries in preschool children of Kosovo - a serious public health problem. *BMC Public Health*, 10(1), 788.
- [19] Martins-Júnior, P. A., Vieira-Andrade, R. G., Corrêa-Faria, P., Oliveira-Ferreira, F., Marques, L. S., & Ramos-Jorge, M. L. (2013). Impact of Early Childhood Caries on the Oral Health-Related Quality of Life of Preschool Children and Their Parents. *Caries Research*, 47(3), 211-218.
- [20] Sunitha, Chandu, G., Pushpanjali, K., Jayashree, S., & Shafiulla, M. (2018). Journal of the Indian Association of Public Health Dentistry. *Journal of Indian Association of Public Health Dentistry (Vol. 4)*. Medknow Publications and Media Pvt Ltd. Retrieved from <http://www.jiaphd.org/article.asp?issn=2319-5932;year=2006;volume=4;issue=7;spage=39;epage=42;aulast=Sunitha;type=0>.
- [21] Harris R, Nicoll AD, Adair PM, Pine CM. *Risk factors for dental caries in young children: a systematic review of the literature*. Community Dent Health. 2004 Mar; 21(1 Suppl):71-85.
- [22] Evans, E. W., Hayes, C., Palmer, C. A., Bermudez, O. I., Cohen, S. A., & Must, A. (2013). Dietary intake and severe early childhood caries in low-income, young children. *Journal of the Academy of Nutrition and Dietetics*.
- [23] Parisotto, T. M., Steiner-Oliveira, C., Duque, C., Peres, R. C. R., Rodrigues, L. K. A., & Nobre-dos-Santos, M. (2010). Relationship among microbiological composition and presence of dental plaque, sugar exposure, social factors and different stages of early childhood caries. *Archives of Oral Biology*, 55(5), 365-373.
- [24] Chu, C. H., Pang, K. K. L., & Lo, E. C. M. (2010). Dietary behavior and knowledge of dental erosion among Chinese adults. *BMC Oral Health*, 10, 13.
- [25] Moynihan, P., & Petersen, P. E. (2004). Diet, nutrition and the prevention of dental diseases. *Public Health Nutrition*, 7(1a), 201-226.
- [26] Edelstein, B. L. (2006). The dental caries pandemic and disparities problem. *BMC Oral Health*, 6 Suppl 1(Suppl 1), S2.
- [27] Pahel, B. T., Rozier, R. G., & Slade, G. D. (2007). Parental perceptions of children's oral health: The Early Childhood Oral Health Impact Scale (ECOHIS). *Health and Quality of Life Outcomes*, 5, 6.



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