

THE ASSOCIATION BETWEEN NOCTURNAL MILK FEEDING AND EARLY CHILDHOOD CARIES IN CHILDREN AGED 18 TO 48 MONTHS AT DA NANG HOSPITAL FOR WOMEN AND CHILDREN

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Abstract - This study investigated the current situation and association between nocturnal milk feeding and the prevalence of early childhood caries (ECC) in children aged 18 to 48 months. A cross-sectional study was conducted on 322 children aged 18 to 48 months who presented at the Dental Clinic of Da Nang Hospital for Women and Children. The results showed that the prevalence of ECC was 58.7%. The figure increased with age at first dental examination and when children only visited for dental care when experiencing pain. However, no significant association was identified between nocturnal milk feeding and ECC occurrence in children. It is necessary to strengthen parental education about the importance of early dental visits and to encourage regular dental checkups for children.

Key words - early childhood caries; ECC; nocturnal milk feeding; related factors

1. Introduction

Dental caries is one of the most common diseases in children worldwide, affecting approximately 50% of children [1]. According to the American Academy of Pediatric Dentistry (AAPD), early childhood caries is one of the most common diseases in young children and is characterized by the presence of one or more carious lesions (cavitated or non-cavitated), missing primary teeth (due to caries), or filled primary teeth in children under 6 years of age [2]. From 1990 to 2019, an estimated 1.15 billion cases of untreated caries in primary teeth were reported [3]. Based on studies published from 2006 to 2015 in Southeast Asian countries, the average prevalence of early childhood caries among children aged 5 to 6 years was as high as 79%, and the dmft index was 5.1 [4]. In Vietnam, the prevalence of early childhood caries is even more severe. A survey on oral diseases in Vietnam conducted from 1999 to 2001 by the Hanoi National Hospital of Odonto-Stomatology in collaboration with the Australian Research Centre for Population Oral Health showed that the prevalence of dental caries in primary teeth among children aged 6 to 8 years was 84.9% [5]. Dental caries in children continues to progress, and if not treated early, the condition may become more severe, making treatment more difficult and possibly requiring hospitalization and treatment under general anesthesia, thereby increasing treatment costs. The immediate consequences include pain and impairment of daily activities such as eating, sleeping, speaking, and playing. Children with early childhood caries in the primary dentition also face the risk of adverse effects on the development of their permanent dentition later in life [6].

Nocturnal milk feeding refers to frequent feeding during the night or feeding/drinking milk before bedtime, including both breast milk and formula milk [7]. Many studies have shown that, in addition to risk factors for early childhood caries such as enamel hypomineralization, a high-sugar diet, and poor oral hygiene, nocturnal milk feeding is also a risk factor for early childhood caries [8–11]. In young children, nocturnal milk feeding, prolonged bottle-feeding without nutritional purpose, or the use of sweetened pacifiers, especially during sleep, may have detrimental effects on dental health [9]. A study by Peres et al. on 1,303 children in Brazil showed that nighttime feeding not only affected the maxillary anterior teeth but could also extend to other teeth [10]. According to Nakayama and Mori, a study conducted on 1,675 children aged 18–23 months showed a significant association between early childhood caries and nighttime breastfeeding [11]. Early childhood caries often appears before 3 years of age [12]. At this age, children are often unable to care for their oral health independently and usually depend on their parents and family. Therefore, families need to better understand the consequences of early childhood caries and the risk factors for dental caries in children in order to proactively choose appropriate preventive measures to protect their children's primary dentition.

Currently in Vietnam, with the development of the economy in general and the healthcare sector in particular, oral healthcare for children has received increasing attention. Many studies have reported that nocturnal milk feeding may increase the risk of dental caries in children [13, 14]. Many young children are lulled to sleep by sucking on a milk bottle or a pacifier containing sweeteners without subsequent oral cleaning. This results in prolonged exposure of the primary dentition to sugars. Children usually sleep for about 8–10 hours each night, during which only a small amount of saliva is secreted, which is insufficient to clear the residual sugars adhering to the teeth, thereby increasing the risk of dental caries [8]. A study by Nguyen Thi Thuy Duong [13] on 432 children aged 2–4 years in Da Nang and a study by Bui Huu Tuan [14] on 1,540 three-year-old children in Hoa Binh, Lang Son, and Bac Kan provinces both showed that nocturnal milk feeding was associated with early childhood caries in children. In contrast, another study by Quach Huu Thinh conducted on 168 three-year-old children in Ho Chi Minh City concluded that there was no statistically significant association between nocturnal milk feeding and the

occurrence of early childhood caries in children [15]. Thus, the association between nocturnal milk feeding and dental caries in young children remains inconsistent across studies. To better understand the association between nocturnal milk feeding and early childhood caries in children, we conducted this study with the following two specific objectives:

- To determine the prevalence of early childhood caries among children aged 18 to 48 months who attended the Dental Clinic of Da Nang Hospital for Women and Children in 2024.
- To investigate factors related, particularly the habit of nocturnal milk feeding, to the occurrence of early childhood caries in the study population above.

2. Methods

2.1. Study participants

- Inclusion criteria: All children aged 18 to 48 months who attended the Dental Clinic, Da Nang Hospital for Women and Children, from April 2024 to June 2024.
- Exclusion criteria: Children with systemic diseases directly affecting oral health status, including diabetes mellitus, cleft lip and palate, and ectodermal dysplasia.

2.2. Research methods

2.2.1. Study design

A cross-sectional study.

2.2.2. Study setting

The study was conducted at the Dental Clinic, Da Nang Hospital for Women and Children, a specialized unit responsible for the care and treatment of oral diseases in children from birth to 15 years of age. From April to June 2024, 322 children aged 18 to 48 months attended the clinic and met the inclusion criteria for the study.

2.2.3. Study period

From April 2024 to June 2024.

2.2.4. Sample size and sampling technique

The sample size was calculated using the formula for estimating a proportion as follows [16]:

$$n = Z_{(1-\alpha/2)}^2 \frac{p(1-p)}{d^2}$$

In this case, the p-value=0.744 was taken from the study by Ngo Khanh Linh conducted in 2015 on 593 children aged 1 to 6 years in Ho Chi Minh City and Da Nang City, which reported a dental caries prevalence of 74.4% [17]; with a significance level of $\alpha=0.05$, corresponding to a 95% confidence level, $Z_{(1-\alpha/2)}=1.96$; d is the absolute precision ($d=5\%$). Substituting these values into the formula yielded a required sample size of 293 children. In addition, to account for incomplete data collection forms, an extra 10% was added, resulting in a required sample size of 322 children for this study. A total of 322 children were ultimately included in the study.

Convenience sampling was used: all children aged 18 to 48 months who attended the Dental Clinic, Da Nang Hospital for Women and Children, and met the inclusion criteria from April to June 2024 were included.

2.2.5. Data collection instruments

A structured interview questionnaire was developed based on the survey form of Patricia Ondine Lucaciu et al. [18]. The questionnaire was divided into two main parts: (1) demographic information and the child's oral hygiene practices; and (2) the child's clinical oral examination form.

After pilot testing on 20 parents, the research team received feedback and comments regarding the questionnaire. The questionnaire was then revised and adjusted to ensure appropriate wording and ease of understanding before the formal survey was conducted.

2.2.6. Data collection procedures

Before data collection, members of the research team were trained by licensed clinicians with extensive experience in pediatric dentistry on examination posture, examination methods, identification of dental caries, and the criteria for recording early childhood caries. After that, the investigators examined 20 children, equivalent to 400 primary teeth, based on the agreed criteria for comparison with the gold standard examiner. The examination results of each investigator were recorded, and the Kappa index was calculated to assess reliability. The Kappa values were 0.93 and 0.91, respectively, indicating excellent agreement ($Kappa > 0.81$) [19].

All parents of children aged 18 to 48 months who met the inclusion criteria and attended the Dental Clinic, Da Nang Hospital for Women and Children, were informed about the study and invited to participate.

For each child participating in the study, data were collected by two investigators:

- One investigator assisted the parent in completing the form on demographic information and the child's oral hygiene practices. Any questions from the parent regarding the questionnaire were explained and clarified by that investigator. All participant information was coded to ensure anonymity and confidentiality. After the form had been completed, the investigator reviewed it to ensure completeness of the data.

- Another investigator examined and assessed the child's dental caries status under the supervision and guidance of a dentist at the clinic. After determining the dmft index, the investigator completed the child's oral health examination form.

2.2.7. Data analysis

a. Variable definitions

Main exposure variable: A child was classified into the nocturnal milk feeding group if he or she had one of the following habits: being breastfed or given other types of milk (bottle milk, powdered milk, boxed milk) before bedtime at a frequency of four to five times or more per week; going to sleep with a feeding bottle; or waking up during the night and being breastfed or given other types of milk to be soothed back to sleep.

Outcome variable: A child was diagnosed with dental caries when the dmft index was greater than 0.

Dental caries status was recorded based on the decayed-

missing-filled teeth index (dmft) according to the WHO criteria (2013): for each study participant, the decayed (d-t), missing (m-t), and filled (f-t) components were calculated as follows: $dmft = d-t + m-t + f-t$ [20].

- Sound tooth: a tooth with no clinical evidence of treated or untreated caries. The following defects were also considered sound teeth:

- + White opaque spots, discolored spots, or rough areas without soft dentin on probing.

- + Enamel fractures or stained cracks without evidence of undermining or softening of the wall or floor on probing.

- + Dark, shiny, hard, pitted areas of enamel showing signs of dental fluorosis.

- + Lesions caused by attrition.

- Decayed tooth (d-t): a lesion in a pit and fissure or on a smooth surface with an unmistakable cavity, undermined enamel, or a softened floor or wall detectable with a probe. Teeth with only roots remaining, teeth with temporary fillings, or filled teeth with recurrent caries were also classified in this category.

- Missing tooth (m-t): a tooth extracted due to severe caries with an indication for extraction before the natural exfoliation age.

- Filled tooth (f-t): a tooth that had been restored or crowned due to caries.

b. Data analysis

Data were entered using Microsoft Excel 365. Missing values, outliers, and coding errors were checked. For variables with missing values, handling was performed as follows:

- Cases with missing data due to data entry or coding errors were reviewed and corrected based on the data collection forms.

- Variables with a missing data rate below 5% were handled using casewise deletion; variables with a missing data rate of 5% or higher were excluded from the analysis or handled using appropriate imputation methods.

Data were analyzed using SPSS version 29.0. The statistical techniques used included:

- Calculation of frequencies and percentages.

- The Chi-square test was used to assess associations between variables, with $p < 0.05$ considered statistically significant. Variables with $p < 0.05$ in univariate analysis were included in the multivariable logistic regression model to identify factors independently associated with early childhood caries after controlling for confounding factors.

- The dependent variable was early childhood caries status (yes/no). Independent variables included routine dental visit habits, first dental visit, and oral hygiene practices. The results were presented as adjusted odds ratios (aORs) with 95% confidence intervals, and $p < 0.05$ was considered statistically significant.

2.3. Research ethics

All participants who agreed to participate in the study participated voluntarily and were free to withdraw at any

time without obligation during the participation process.

The study was approved by the Scientific Committee of the Faculty of Medicine and Pharmacy on February 27, 2024.

3. Kết quả

3.1. General characteristics of the study participants (n=322)

Table 1. General characteristics of children

Characteristics		n (%)
Gender	Male	172 (53.4)
	Female	150 (46.6)
Age in months*		32.99 ± 10.46
Living area	Urban	206 (64.0)
	Rural	116 (36)
* Mean ± standard deviation		

Among the 322 children included in the study, 172 were boys (53.4%), and 206 children (64.0%) lived in urban areas. The mean age of the study participants was 33 months (Table 1).

3.2. Prevalence of early childhood caries among children aged 18 to 48 months who attended the Dental Clinic, Da Nang Hospital for Women and Children

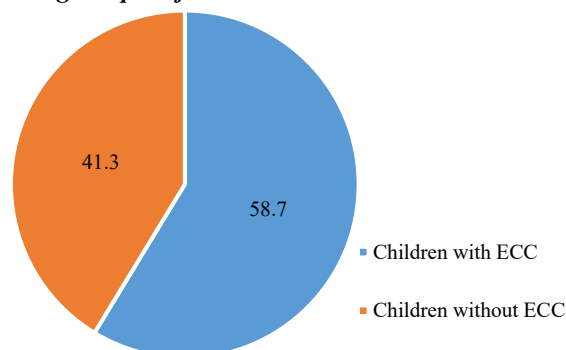


Figure 1. Prevalence of early childhood caries among examined children aged 18 to 48 months (n=322)

The prevalence of early childhood caries among the 322 children who presented the clinic was 58.7% (Figure 1). The highest proportion of children with decayed, missing, or filled teeth was observed in the maxillary anterior region (47.8%), while the lowest was found in the mandibular anterior region (14.3%) (Figure 2).

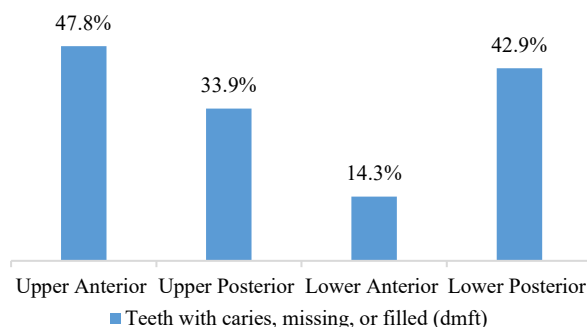


Figure 2. Prevalence of early childhood caries by tooth region (n=322)

3.3. Association between nocturnal milk feeding habits and early childhood caries in children

The prevalence of early childhood caries was higher in the group with nocturnal milk feeding than in the group without nocturnal milk feeding. However, this difference was not statistically significant (χ^2 test; $p = 0.400$).

The prevalence of early childhood caries was highest in the group using sweetened milk at 63.0%, followed by the group using unsweetened milk at 60.9%, and lowest in the breast milk group at 45.5%. However, the differences among these proportions were not statistically significant ($p = 0.150$) (Table 2).

Table 2. Association between nocturnal milk feeding and early childhood caries status in children ($n=322$)

Nocturnal milk feeding habits		With ECC	Without ECC	p (χ^2 test)
		n (%)	n (%)	
No nighttime milk feeding		34 (54.0)	29 (46.0)	0.40
Nighttime milk feeding		155 (59.8)	104 (40.2)	
If yes	Sugar-free milk	14 (60.9)	9 (39.1)	0.15
	Sweetened milk	121 (63.0)	71 (37.0)	
	Breast milk	20 (45.5)	24 (54.5)	

Table 3. Multivariate analysis of the association between dental visit habits, oral hygiene practices, and the prevalence of early childhood caries in children ($n = 322$)

Variables		With ECC (N=189)	Without ECC (N=133)	aOR	95% CI	p-value
		n (%)	n (%)			
Regular dental visit	≤6 months	12 (44.4)	15 (55.6)	1		
	Never	104 (51.5)	98 (48.5)	2.73	0.84 – 8.83	0.094
	Only when there is pain	55 (87.3)	8 (12.7)	4.45	1.21 – 16.28	0.024
	>6 months	18 (60.0)	12 (40.0)	1.88	0.53 – 6.74	0.331
Age at first dental visit	0 - 11 months	11 (36.7)	19 (63.3)	1		
	Never	66 (42.9)	88 (57.1)	0.91	0.34 – 2.45	0.853
	12 - 23 months	35 (64.8)	19 (35.2)	2.70	0.97 – 7.53	0.058
	24 - 35 months	34 (87.2)	5 (12.8)	10.88	2.96 – 39.92	< 0.001
	36 - 48 months	43 (95.6)	2 (4.4)	17.93	3.27 – 98.41	< 0.001
Oral hygiene measures	Brushing without toothpaste	17 (40.5)	25 (59.5)	1		
	No oral hygiene	14 (60.9)	9 (39.1)	1.37	0.41 – 4.53	0.609
	Tongue cleaning or saltwater rinsing only	16 (30.2)	37 (69.8)	0.61	0.23 – 1.62	0.321
	Brushing with toothpaste	142 (69.6)	62 (30.4)	2.60	1.19 – 5.65	0.016

*aOR: adjusted odd ratio, ** $p < 0.05$

4. Discussion

4.1. Prevalence of early childhood caries among children aged 18 to 48 months who attended the Dental Clinic, Da Nang Hospital for Women and Children

Our study was conducted on 322 children aged 18 to 48 months who attended the Dental Clinic, Da Nang Hospital for Women and Children, through clinical examination for decayed, missing, and filled teeth and interviews with their parents using a structured questionnaire. The study population comprised 53.4% males and 46.6% females. The male-to-female ratio was 1.15, which is comparable to the national sex ratio in the 0–4-year age group according to the 2019 national population census, reported as 110.3 males per 100 females [21]. The study focused on children aged 18 to 48 months.

3.4. Association between early childhood caries and several other factors

The results of the multivariable logistic regression analysis showed that:

- Compared with children who had routine dental visits at intervals of less than or equal to 6 months, children who visited only when experiencing pain had 4.45 times higher odds of early childhood caries (aOR=4.45; 95% CI: 1.21 – 16.28; $p = 0.024$).

- Compared with children whose first dental visit occurred before 1 year of age, children whose first dental visit occurred from 2 years to under 3 years of age had 10.88 times higher odds of early childhood caries (aOR=10.88; 95% CI: 2.96 – 39.92; $p < 0.001$) and children whose first dental visit occurred from 3 to 4 years of age had 17.93 times higher odds of early childhood caries (aOR=17.93; 95% CI: 3.27 – 98.41; $p < 0.001$).

- Compared with children who brushed their teeth without toothpaste, children who brushed their teeth with toothpaste had 2.60 times higher odds of early childhood caries (aOR=2.60; 95% CI: 1.19 – 5.65; $p = 0.016$).

The mean age of the children who attended the clinic was 33.0 ± 10.5 months. This age range has been widely used in previous studies investigating early childhood caries, such as the study by Maladevi et al. conducted in India [22] and the study by Congiu et al. carried out among preschool children living in Italy [23]. This is an important age group for studying early childhood caries because children at this stage are undergoing rapid oral development and beginning to establish dietary and personal hygiene habits. Studying this age group facilitates the identification of risk factors and evaluation of preventive interventions to protect children's oral health, while also providing important data for developing appropriate intervention strategies.

The prevalence of early childhood caries in this study was 58.7%. This finding is consistent with the study by

Grasesser et al., which included 1,845 children aged 3–5 years and reported an early childhood caries prevalence of 56.6% [24]. Similarly, the prevalence of early childhood caries in the study by Chen in 5-year-old children was 55% [25]. This prevalence is lower than that reported in some studies conducted in Vietnam, such as the study by Ngo Khanh Linh et al. on children aged 1–6 years in Ho Chi Minh City and Da Nang (74.4%) [17] and the study by Tran Tan Tai et al. on children aged 3–5 years in Hue (77.2%) [26]. This difference may be due to the time when the studies were conducted as well as the age range of the study participants, from 1.5 to 4 years of age. In addition, the selection of study participants limited to children attending Da Nang Hospital for Women and Children may not fully reflect the characteristics of the entire pediatric population, thereby limiting the generalizability of the study findings. However, the findings of these studies all indicate that the prevalence of early childhood caries remains high [24–26].

In this study, we found that among children who presented the clinic, the proportion with caries in the maxillary anterior teeth was the highest (47.8%), whereas the proportion with caries in the mandibular anterior teeth was the lowest (14.3%). This result is similar to the studies by Thwin [27] and Singh [28], both of which reported the highest caries prevalence in the maxillary incisor group and the lowest in the mandibular incisor group. Primary incisors are the first teeth to erupt and are more susceptible to caries than other primary teeth. This may be explained by the habit of retaining food or milk in contact with these teeth, as they are directly exposed to these substances [12], together with inadequate oral hygiene in children at this age. During sleep, the salivary flow rate decreases to a minimum, thereby reducing the protective effect of saliva to the greatest extent; milk and food components retained around the teeth can rapidly damage the maxillary anterior teeth. Owing to the combined effects of the lower lip, the tongue, the sequence of tooth eruption, and changes in oral care habits, the remaining teeth may be better protected against the risk of caries. The lips and tongue help remove plaque, while changes in care habits help reduce prolonged exposure to sugary liquids [29].

4.2. Association between nocturnal milk feeding and early childhood caries in children

Among the 322 children who attended the clinic, the prevalence of early childhood caries in the nocturnal milk feeding group was 59.8%, which was higher than that in the group without nocturnal milk feeding. However, we did not find a statistically significant association between nocturnal milk feeding and early childhood caries ($p > 0.05$; χ^2 test). The study by Iida et al. [30] also concluded that breastfeeding and breastfeeding duration were not associated with the risk of caries in young children ($p > 0.05$). Nunes et al. also concluded that breastfeeding was not a risk factor for early childhood caries after adjustment for several confounding factors ($p > 0.05$) [31]. However, the findings of these studies are not entirely consistent with those of several other studies. The study by Peres on 1,303 children in Brazil and the study by Nakayama on 1,675 children in Japan both showed a significant association between early

childhood caries and nighttime breastfeeding [10, 11]. The failure to detect a statistically significant association in our study may be due to heterogeneity in the study sample and differences in oral care habits and dietary patterns among the study groups. Young children often sleep with a bottle or pacifier during both the day and the night; therefore, habits related to feeding during sleep in general, rather than only at night, should be investigated in order to accurately assess the duration of milk accumulation on the tooth surfaces. A more detailed analysis of oral care, diet, and environmental factors, as well as the frequency and duration of milk exposure, would help clarify the factors influencing the risk of early childhood caries [30–32].

4.3. Association between early childhood caries and several other factors

We used a multivariable logistic regression model to identify variables associated with early childhood caries in children after excluding confounding factors ($p > 0.05$; χ^2 test) (Table 3). The results showed that, compared with children who had routine dental visits at intervals of less than or equal to 6 months, children who visited only when experiencing pain had 4.45 times higher odds of early childhood caries (aOR=4.45; 95% CI: 1.21 – 16.28; $p = 0.024$). According to the results of the multivariable logistic regression analysis, compared with children whose first dental visit occurred before 1 year of age, children whose first dental visit occurred from 2 years to under 3 years of age had 10.88 times higher odds of early childhood caries (aOR=10.88; 95% CI: 2.96 – 39.92; $p < 0.001$) and children whose first dental visit occurred from 3 to 4 years of age had 17.93 times higher odds of early childhood caries (aOR=17.93; 95% CI: 3.27 – 98.41; $p < 0.001$). The study by Yazdani et al. [33], conducted on 500 children aged 4–6 years in Iran, reported similar results. Children who visited the dentist for reasons such as pain had 6.86 times higher odds of early childhood caries than children who had routine dental visits (95% CI: 4.45–10.58, $p < 0.001$). Children whose first dental visit occurred at 1 year of age or older had 2.42 times higher odds of early childhood caries than those whose first visit occurred before 1 year of age (95% CI: 1.38–4.25, $p = 0.02$) [33]. Our study also showed that children who brushed their teeth with toothpaste had 2.60 times higher odds of early childhood caries (aOR=2.60; 95% CI: 1.19 – 5.65; $p = 0.016$). This finding is contrary to the retrospective study by Holta et al. [34] in preschool children, which showed that the group of children who brushed without toothpaste had a higher risk of dental caries. This difference may be related to the fact that our study did not fully assess the age at which children started using toothpaste, whether the toothpaste contained fluoride, and the children's toothbrushing technique [35]. In summary, the findings from our study together with those from previous studies all emphasize the necessity of early and regular dental examinations as an effective measure to reduce the risk of early childhood caries in children. Policies and community education programs should focus on encouraging parents to take their children for dental examinations early, beginning when the first primary tooth erupts or before 1 year of age, and to maintain regular dental

visits in order to improve oral health and prevent serious oral problems in the future [36, 37].

5. Conclusion

The prevalence of early childhood caries among children aged 18 to 48 months who attended the Dental Clinic, Da Nang Hospital for Women and Children was high (58.7%). Factors associated with early childhood caries included the age at the first dental visit, routine dental visit habits, and oral hygiene practices. No statistically significant association was found between early childhood caries and nocturnal milk feeding in children

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