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## ASSESSING EARLY CHILDHOOD CARIES AND UNTREATED DENTAL CARIES AMONG CHILDREN AGED 3 TO 5 YEARS IN CAN THO CITY, VIETNAM

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### ABSTRACT

**Background:** Oral health is a crucial determinant of an individual's quality of life, especially for children during their developmental years. Early childhood caries (ECC) is one of the most common diseases in children. The prevalence of ECC varies across regions, and understanding these regional differences is essential for the implementation of targeted public health interventions.

**Objectives:** To report the prevalence of ECC and the clinical consequences of untreated dental caries (UDC) among preschool children from urban and rural areas of Can Tho city. **Materials and methods:** A cross-sectional descriptive study was conducted in Ninh Kieu district (urban area) and Vinh Thanh district (rural area) through random selection. A purposive sampling technique was employed, with a total sample size of 487 children. ECC was assessed using the dmft index, while UDC was evaluated using the pufa index. Oral hygiene status was assessed using the Silness & Loe plaque index (PI). The Mann-Whitney U test and Kruskal-Wallis test were used to analyze differences between age and gender groups. The correlation between the dmft, pufa and PI indices was assessed using Spearman's correlation coefficient. **Results:** The prevalence of ECC in children aged 3–5 years in Can Tho City was 89.5%, while the prevalence of UDC was 25.1%, with no statistically significant difference between genders. The mean dmft score was  $8.27 \pm 5.72$ , and the mean pufa index was  $0.75 \pm 1.89$ . The mean significant caries index (SiC) was  $14.88 \pm 2.62$ . The correlation between the dmft, pufa, and PI indices was significantly positive ( $p < 0.001$ ). **Conclusions:** The prevalence of ECC within this population is notably high, underscoring the critical need for early detection and intervention. Policymakers should prioritize the identification and mitigation of key risk factors associated with ECC.

**Keywords:** ECC, dmft index, pufa index, preschool, children.

### I. INTRODUCTION

Despite advancements in preventive dentistry leading to improvements in the global prevalence of dental caries, the World Health Organization (WHO) continues to regard early childhood caries (ECC) as a significant public health problem in many industrialized countries [1]. The American Academy of Pediatric Dentistry defines ECC as the presence of tooth decay in children under the age of 6 [2]. According to the 2015 Global Burden of Disease Study, dental caries in primary teeth ranked as the 12th most prevalent disease worldwide, affecting over 560 million children of all ages [3].

Primary teeth play a vital role in children's ability to digest food by cutting, chewing, and crushing it. Children with early caries are at a higher risk of developing new caries in both primary and permanent teeth, potentially impacting their future quality of life [4]. According to a systematic review and meta-analysis on early childhood caries using global data, the highest prevalence of Early Childhood Caries (ECC) globally is found in Southeast Asia, with the

Philippines reporting a rate of 98%. Following closely is Vietnam, with a prevalence of 89.1%, while Japan has the lowest rate at 20.6% in Asia. In North America, the USA had the highest prevalence at 53.0%, while in South America, Argentina reported a prevalence of 85.8%. In Europe, Albania led with 84.1%, and in Africa, Angola had a significant prevalence of 57.9%. These variations highlight the diverse impact of ECC across different regions and countries. [5].

Under the guidelines of WHO, the decayed, filled, missing teeth index (dmft/DMFT) has been widely used to evaluate caries experience to date. However, this index has limitations, particularly in its failure to account for the clinical consequences of untreated dental caries (UDC). To address these limitations, the pufa/PUFA index was introduced in 2010 to complement the dmft/DMFT index, providing a more comprehensive reflection of caries status and its associated clinical outcomes [6]. Therefore, the present study aims to report the prevalence of ECC and UDC among preschool children of Can Tho city, as well as to examine the correlation between the dmft, pufa, and plaque indices.

## II. MATERIALS AND METHODS

### 2.1. Materials

The study included children aged 36 to 71 months who attended two kindergartens in Can Tho City during the 2024-2025 academic year.

- **Inclusion criteria:** The inclusion criteria were that participants had to be aged 36–71 months and of Vietnamese nationality at the time of the clinical oral examination. Additionally, parental consent for participation was required, and demographic data were collected through a questionnaire.

- **Exclusion criteria:** The exclusion criteria included children in early mixed dentition (i.e., children with any erupting permanent teeth, such as the first permanent molar) and children with significant health conditions or disabilities, including major systemic diseases.

### 2.2. Methods

- **Study design:** A cross-sectional descriptive study was conducted at two public kindergartens selected through random sampling: Vang Anh Kindergarten, located in the central area (Ninh Kieu district), and Vinh Thanh Township Kindergarten, located in the suburban area (Vinh Thanh district). Neither of the selected schools had implemented a school-based oral health program at the time of the study.

- **Study content:** The sample size was calculated using the formula for estimating a proportion, with a z-score of 1.96 for a 95% confidence level, a margin of error of 4%, and a design effect of 2. The expected prevalence of ECC was assumed to be 89.1%, based on a previous study conducted in Vietnam [7]. Consequently, a theoretical sample size of 467 children was determined. In practice, data were collected from 487 children.

Prior to the visual inspection for oral examination, children were instructed to clean their teeth with toothbrushes and then dry the tooth surfaces with cotton or gauze. Plaque status was assessed using the Silness & Loe plaque index (PI) in 1964, with scores ranging from 0 to 3. Following this, the dental caries status of each surface of all erupted teeth was examined in accordance with the guidelines proposed by Evans *et al.* in 2018 [8]. ECC was defined according to the AAPD guidelines, and the dmft and significant caries index (SiC) were calculated. The clinical consequences of UDC were assessed using the pufa index, with criteria and codes outlined by Monse *et al.* in 2010 [6].

All diagnostic findings were directly recorded by an assistant onto a printed chart sheet for accurate documentation. The oral examinations were conducted using standard equipment, including disposable dental probes, plain mouth mirrors, single-use wooden oral examination spatulas, and LED headlights. In cases of child non-cooperation, the knee-to-knee position was employed to facilitate a more effective examination.

Six trained and calibrated examiners, each paired with an assistant or data recorder, conducted the oral examinations. Prior to data collection, a pediatric dentistry specialist served as the gold standard during the calibration process. A calibration session was conducted with the examiners, the first author, and the specialist, using a sample of 30 preschool children aged 36 to 71 months (who were not included in the study population) for the pilot study. The examination was repeated after one hour to assess intra-examiner reliability. The calibration training focused on precise, surface-by-surface plaque level assessment, accurate diagnosis of early childhood caries (ECC), and distinguishing ECC from other lesions with similar clinical appearances, such as developmental defects, abnormalities, or non-carious opacities (e.g., deciduous molar hypomineralization, demarcated opacities, and enamel hypoplasia). The calibration process involved calculating Kappa coefficients for both inter-examiner and intra-examiner reliability. With excellent inter-examiner and intra-examiner reliability ( $\geq 0.85$ ), the examiners were deemed fully qualified to conduct the epidemiological survey.

- **Statistical analysis:** Statistical analysis was conducted using SPSS version 22.0 (IBM Corp., Armonk, NY, USA). The Mann-Whitney U test and Kruskal-Wallis test were employed to analyze differences between age and gender groups. Spearman's correlation coefficient was used to assess the relationship between the dmft, pufa, and PI indices. A p-value of  $\leq 0.05$  was considered statistically significant. Data visualization was carried out within Jupyter Notebook (version 7.2.2) running on the Anaconda Navigator 2.6.5 environment.

- **Ethics approval:** Written informed consent was obtained from the parents in Vietnamese prior to the children's participation in the survey. All identifiable personal information was anonymized to ensure participant confidentiality. Ethical approval for the study was granted by the Ethics Committee of Can Tho University of Medicine and Pharmacy (No. 23.005.NCS/PCT.HĐĐĐ) and was conducted in accordance with the guidelines of the Declaration of Helsinki.

### III. RESULTS

Table 1. The dmft, pufa components, and SiC index among 487 children

Indices	Frequency (n)	Prevalence (%)	Mean	Standard deviation (SD)	Range
dt	434	89.1	8.13	5.68	0-20
mt	18	3.7	0.05	0.30	0-3
ft	18	3.7	0.09	0.57	0-6
dmft	436	89.5	8.27	5.72	0-20
SiC	162	33.3	14.88	2.62	11-20
p	85	17.5	0.47	1.42	0-11
u	16	3.3	0.12	1.05	0-20
f	31	6.4	0.10	0.46	0-5
a	13	2.7	0.05	0.36	0-5
pufa	122	25.1	0.74	1.89	0-20

The prevalence of ECC was 89.5% among the 487 children with a mean age of  $4.27 \pm 0.78$  years. The mean dmft and SiC scores were 8.27, and 14.88, respectively. Pulpal involvement was observed in the primary teeth of 85 (Table 1).

Table 2. Distribution of caries indices by gender in 239 boys and 248 girls

Indices	Frequency (n, %)		Mean $\pm$ SD		Z	$p^*$
	Boys	Girls	Boys	Girls		
dt	213 (49.1)	221 (50.9)	$8.35 \pm 5.59$	$7.91 \pm 5.77$	- 0.99	0.322
mt	11 (61.1)	7 (38.9)	$0.06 \pm 0.30$	$0.04 \pm 0.29$	- 1.03	0.303
ft	10 (55.6)	8 (44.4)	$0.07 \pm 0.38$	$0.12 \pm 0.70$	- 0.51	0.613
dmft	214 (49.1)	222 (50.9)	$8.48 \pm 5.64$	$8.07 \pm 5.80$	- 0.90	0.371
p	49 (57.6)	36 (42.4)	$0.54 \pm 1.48$	$0.41 \pm 1.37$	- 1.71	0.088
u	6 (37.5)	10 (62.5)	$0.14 \pm 1.35$	$0.10 \pm 0.64$	- 0.92	0.357
f	12 (38.7)	19 (61.3)	$0.07 \pm 0.32$	$0.13 \pm 0.56$	- 1.20	0.229
a	5 (38.5)	8 (61.5)	$0.04 \pm 0.34$	$0.05 \pm 0.37$	- 0.77	0.442
pufa	64 (52.5)	58 (47.5)	$0.79 \pm 2.04$	$0.69 \pm 1.73$	- 0.84	0.399

\* *Mann-Whitney U test*

Table 2 shows that the prevalence of ECC was slightly higher in girls than in boys, while the percentage of UDC was lower in girls. However, no statistically significant gender differences were observed in the dental caries indices.

Table 3. Distribution of dmft and pufa indices by age groups

Age groups	Total	dmft	$p^\dagger$	Pufa	$p^\dagger$
	n (%)	Mean $\pm$ SD		Mean $\pm$ SD	
3 years	101 (20.7)	$6.21 \pm 5.79$	< 0.001	$0.32 \pm 1.32$	< 0.001
4 years	154 (31.6)	$7.91 \pm 5.80$		$0.61 \pm 2.10$	
5 years	232 (47.7)	$9.41 \pm 5.37$		$1.01 \pm 1.92$	

$^\dagger$  *Kruskal -Wallis H test*

47.7% of the children in this study were 5 years old, while only 20.7% were 3 years old. The findings indicate that 5-year-old children had significantly higher dmft and pufa scores compared to those aged 3-4 years, as summarized in Table 3.

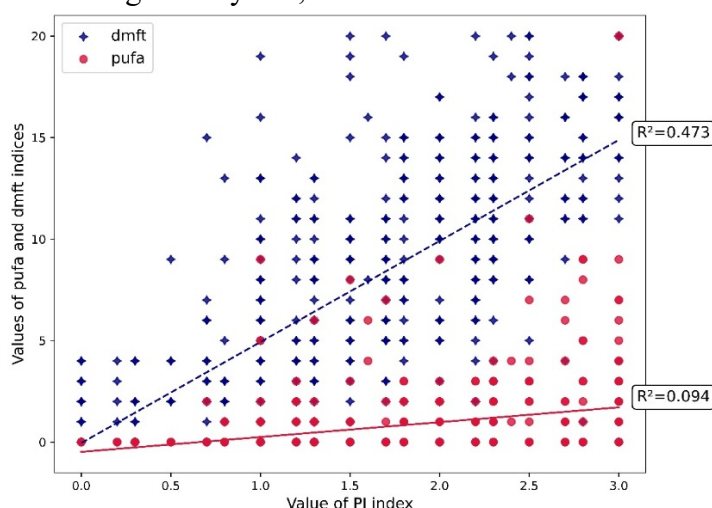


Figure 1. The correlation between dmft, pufa, and PI indices

Figure 1 illustrates the positive correlation between the pufa, dmft, and PI indices, with a weak correlation observed for the pufa index ( $r_s = 0.355$ ,  $p < 0.001$ ) and a moderate correlation for the dmft index ( $r_s = 0.689$ ,  $p < 0.001$ ).

#### IV. DISCUSSIONS

This study reported a high prevalence of ECC at 89.5% among preschool children in Can Tho city, located in the Mekong Delta region. This prevalence was higher than that found in the northern (78.0%) and central (75.9%) regions of Vietnam [9], [10]. However, it was similar to the rate observed in the study from Myanmar (87.1%) [11], lower than in Indonesia (91.8%) [12], and also lower than the prevalence reported five years ago [13]. ECC is a common oral health issue affecting children, influenced by various factors. Diet, in particular, has been shown to have a strong correlation with the development of ECC, significantly increasing the risk of caries.

Due to the greater dissemination of information regarding the etiology and impacts of ECC through social platforms, a remarkable decrease in caries experience among preschool children was expected. However, despite being lower than five years ago, it is noteworthy that early childhood caries prevalence and experience remain significantly high, with the SiC score at 15, nearly twice as high as the dmft score. The frequent consumption of sweet foods or snacks before bedtime is considered a significant etiological factor contributing to the development of dental caries in children. Other contributing risk factors include enamel hypoplasia, inadequate oral hygiene practices, limited caregiver supervision, low socioeconomic status, and lower levels of parental education. Notably, approximately one-third of children presenting with severe dental caries continue to require comprehensive dental rehabilitation. Early identification and intervention are essential to address their oral health needs and to prevent further complications.

The overall prevalence of UDC among children was 25.1%, with the component “p” being the most prevalent at 17.5%. The clinical consequences of UDC can notably affect a child's quality of life, leading to pain, discomfort, poor diet, and sleep disturbances. Moreover, UDC in primary teeth can result in developmental defects in the permanent teeth. In this study, the clinical consequences of UDC were evaluated using the pufa index, which provides both qualitative and quantitative data on the burden of UDC in population studies. These findings highlight a clear lack of awareness regarding oral health among parents, along with limited accessibility and affordability of oral healthcare services, which raises important concerns.

Another important aspect of the caries problem is the oral hygiene status of children. The findings show that the oral hygiene status among the children could predict 47.3% of caries risk, making it a strong indicator for controlling caries status. The oral hygiene behaviors of children are influenced by the adults around them, particularly parents or guardians, who set an example for their children in the early stages of life. At a very young age, children need support from their caregivers during dental care practices, and as they grow older, they still require supervision to maintain proper oral hygiene habits.

Although the distribution of participants was not evenly across age groups, the large sample size of this study in both urban and suburban areas allows the findings to be generalized to the broader population. Furthermore, the included schools were stratified and randomly selected by a non-dental administrator to achieve a representative sample. The 3-

5-year age group was chosen for this study because all primary teeth have erupted by this age, ensuring an accessible approach and consistency in sampling. The prevalence of ECC can be easily identified using the protocol of Evans *et al.* and can be attributed to the preventive programs implemented locally. Additionally, it should be emphasized that oral health behaviors should receive greater attention from caregivers, and the implementation of school-based oral health programs should be prioritized for this population, particularly focusing on those at high caries risk.

## V. CONCLUSIONS

The findings of this study show that the prevalence of ECC in this area was high with the clinical consequences of untreated early childhood caries reaching 25.1%. This underscores the urgent need to shift the focus of both dental professionals and parents toward the care of deciduous teeth. Early detection and intervention should be prioritized by policymakers through the identification of risk factors. Moreover, the utilization of the pufa index could serve as a valuable and relevant tool in addressing the neglected issue of untreated caries and its associated consequences.

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