

Association of Early Childhood Dental Caries with Malnutrition in Children Admitted to a Nutritional Rehabilitation Home of Pokhara, Nepal

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Abstract

Introduction: Early Childhood Dental Caries (ECC) is a global public health concern, particularly in resource-limited settings. ECC affects oral health and overall well-being, while malnutrition complicates outcomes due to its impact on immunity and nutritional intake. This study explores the correlation between ECC and malnutrition among children aged 1–5 years admitted to the Nutritional Rehabilitation Home (NRH) at the Pokhara Academy of Health Sciences, Nepal.

Methods: This analytical cross-sectional study included 150 children aged 1–5. A trained pedodontist conducted oral health assessments using WHO's oral health survey guidelines, recording decayed and filled teeth (dft) in primary dentition. Nutritional status was determined based on WHO criteria for severe acute malnutrition (SAM) and moderate acute malnutrition (MAM). Behavioral and socioeconomic data were collected via caregiver interviews. Statistical analysis identified associations between ECC prevalence and various demographic, behavioral, and nutritional factors.

Results: ECC prevalence was 27.33%, with a mean of 1.15 decayed teeth and 1.63 decayed tooth surfaces. ECC prevalence increased significantly with age ($p < 0.001$). Children with mouth-rinsing habits ($p = 0.013$) or tooth-brushing habits ($p = 0.006$) exhibited higher ECC prevalence. No significant associations were observed between ECC and sex ($p = 0.828$), socioeconomic status ($p = 0.572$), or nutritional status ($p = 0.293$).

Conclusion: The findings highlight the multifactorial nature of ECC, emphasizing the importance of oral hygiene education and preventive dental care. Public health interventions addressing age-specific risk factors and promoting integrated oral health-nutrition strategies are essential to reducing the burden of ECC in resource-limited settings.

Keywords: Early Childhood Caries, Malnutrition, Nutritional Rehabilitation Home.

Introduction

Early childhood dental caries (ECC) is among the most prevalent chronic conditions globally affecting children under six years. It is characterized by one or more decayed, missing, or filled tooth surfaces in primary teeth.¹ ECC impacts oral health and significantly threatens a child's overall growth, development, and quality of life. Children suffering from ECC often experience pain, sleep disturbances, and feeding difficulties, which can

interfere with their nutritional intake and overall well-being.²

Malnutrition, defined as deficiencies, excesses, or imbalances in a person's energy and/or nutrient intake, remains a critical public health concern worldwide. Malnutrition affects over 45 million children under five years old globally, with South Asia bearing a significant proportion of this burden.³ Malnourished children often exhibit weakened immunity, making them more susceptible to various infections, including those affecting oral

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health.⁴

The relationship between ECC and malnutrition is bidirectional and complex. Malnutrition can impair a child's immune response, increasing susceptibility to oral infections and reducing the quality of tooth enamel.⁵ Conversely, ECC can exacerbate nutritional deficiencies by causing pain and difficulty in eating, thus affecting dietary intake.⁶ This interplay is particularly pronounced in resource-limited settings, where access to preventive and curative dental care is constrained.

Pokhara, Nepal, serves as an important context for studying the association between ECC and malnutrition. The Nutritional Rehabilitation Home (NRH) at the Pokhara Academy of Health Sciences provides essential care for children with severe malnutrition. Despite the growing recognition of the link between dental health and nutrition, there is a paucity of research exploring the correlation between ECC and malnutrition in rehabilitative settings in Nepal.

This study aims to investigate the correlation between early childhood dental caries and malnutrition in children admitted to the Nutritional Rehabilitation Home of the Pokhara Academy of Health Sciences. By exploring this relationship, the research seeks to emphasize the need for integrated healthcare strategies that address oral health as an essential component of child nutrition programs.

Methods

This analytical cross-sectional study was done on children aged 1-5 years admitted to the NRH of the Pediatric ward, PoAHS, Pokhara. The Nutritional Rehabilitation Home (NRH) is the sole dedicated nutritional care facility in Kaski district, Nepal. With a heartfelt mission to combat child malnutrition, NRH plays a pivotal role in improving the health and well-being of undernourished children across Gandaki Province. Through comprehensive care, nutritional support, and community education, this center is a beacon of hope, nurturing young lives toward a healthier and brighter future. All children aged between 1 to 5 years who were admitted to NRH from Baisakh 1st, 2079 B.S. (2022 April 14) to Ashoj 1st, 2079 B.S. (2022 September 17) and who met the eligibility criteria were

included in this study, provided that informed consent was obtained from their parents or guardians. A whole population sampling technique (census method) was employed to ensure comprehensive inclusion of all eligible participants during the study period.

Children below 1 year and above 5 years, children whose parents refused to give consent, and children who had exfoliation, trauma, and missing teeth were not included in the study.

Ethical clearance was obtained from the Pokhara Academy of Health Sciences (PoAHS) institutional review committee (Ref No 82/078).

The data was collected by the pedodontist herself, doing the proper oral examination and filling the proforma after taking consent from the mother. Trained nurses of NRH carried out anthropometric measures, and SAM and MAM were established as per WHO criteria. A single well-trained and calibrated pedodontist did oral health examinations with a mouth mirror and a No. 23 explorer under good operating light. The World Health Organization's basic methods for oral health surveys were used for dental caries scoring.⁷ Only the decayed and filled teeth were recorded (dft: sum of decayed and filled teeth).

The data was entered into Microsoft Excel 2013 and exported into SPSS for analysis. Chi-square tests/Fisher's exact test were applied to find the association of ECC with various variables. The level of statistical significance was set at $p < 0.05$.

Results

The participants had a mean age of 2.44 ± 1.53 years, ranging from 1 to 5 years. The mean decayed teeth was 1.15 ± 2.59 , ranging from 0 to 14 teeth. The mean number of decayed tooth surfaces was 1.63 ± 5.21 , ranging from 0 to 39 surfaces. None of the children had filled teeth. The prevalence of dental caries was 27.33% (95% CI: 20.4%–35.2%).

The prevalence of ECC was slightly higher among males (28.17%) than females (26.58%), but there was no statistically significant difference ($p = 0.828$) (Table 1). ECC prevalence increased with age, and the difference was statistically significant ($p < 0.001$) (Table 1).

Table 1: Association of ECC with sex and age (N= 150)

Variables	No ECC	ECC present	Chi-square value	P value
Sex				
Male	51 (71.83%)	20 (28.17%)	0.047	0.828
Female	58 (73.42%)	21 (26.58%)		
Total	109 (72.67%)	41 (27.33%)		
Age category				
12-23 months	36 (87.80%)	5 (12.20%)	25.53	<0.001
24-35 months	45 (84.91%)	8 (15.09%)		
36-47 months	19 (57.58%)	14 (42.42%)		
≥48 months	9 (39.13%)	14 (60.87%)		

ECC prevalence showed no statistically significant variation across income categories ($p = 0.572$) (Table 2).

Table 2: Association of ECC with education and income (N= 150)

Education of mother	No ECC	ECC present	Chi-square value	P value
Upto class 10	55 (73.33%)	20 (26.67%)	-	NA
Undergraduate	53 (72.60%)	20 (27.40%)		
Postgraduate	1 (50.00%)	1 (50.00%)		
Average monthly income				
<15,000	14 (66.67%)	7 (33.33%)	2.003	0.572
15000-30000	47 (78.33%)	13 (21.67%)		
31,000-50,000	24 (66.67%)	12 (33.33%)		
>50,000	24 (72.73%)	9 (27.27%)		

Children without a mouth-rinsing habit had significantly lower ECC prevalence (15.09%) than those with the habit (34.02%) ($p = 0.013$) (Table 3). ECC was more common in children who brushed their teeth (39.34%) compared to those who did not (19.10%), a statistically significant difference ($p = 0.006$) (Table 3). ECC was more prevalent among children who visited the dentist (66.67%) than those who did not (26.53%), which was not statistically significant (Table 3).

Table 3: Association of ECC with oral hygiene practices (N= 150)

Mouth rinsing habit	No ECC	ECC present	Chi-square value	P value
Yes	64 (65.98%)	33 (34.02%)	6.181	0.013
No	45 (84.91%)	8 (15.09%)		
Tooth-brushing habit				
Yes	37 (60.66%)	24 (39.34%)	7.467	0.006
No	72 (80.90%)	17 (19.10%)		
Brushing frequency				
0	72 (80.90%)	17 (19.10%)	7.750	0.021
1	24 (58.54%)	17 (41.46%)		
2 or more	13 (65.00%)	7 (35.00%)		
Visit to dentist				
Yes	1 (33.33%)	2 (66.67%)		0.181*
No	108 (73.47%)	39 (26.53%)		

ECC prevalence was slightly higher among children with moderate acute malnutrition (MAM) (30.86%) compared to severe acute malnutrition (SAM) (23.19%), but this difference was not statistically significant ($p = 0.293$) (Table 4).

Table 4: Association of ECC with nutritional status (N= 150)

Nutritional status	No ECC	ECC present	Chi-square value	P value
Moderate Acute Malnutrition (MAM)	56 (69.14%)	25 (30.86%)	1.10	0.293
Severe Acute Malnutrition (SAM)	53 (76.81%)	16 (23.19%)		

The mean number of decayed teeth was 1.41 ± 3.05 in the MAM group, which was slightly higher than in the SAM group (0.86 ± 1.89), and this difference was not statistically significant. (Table 5)

Table 5: Association of ECC with nutritional status using an independent t-test (N= 150)

Nutritional status	Mean decayed teeth	p-value	Confidence interval	
			Lower limit	Upper limit
Moderate Acute Malnutrition (MAM) (N= 81)	1.41 ± 3.05	0.179	-0.286	1.391
Severe Acute Malnutrition (SAM) (N= 69)	0.86 ± 1.89			

Discussion

The findings of our study reveal important insights into the prevalence and risk factors associated with Early Childhood Caries (ECC) in a population of young children aged 1 to 5. The prevalence of ECC was 27.33%, with a mean number of decayed teeth and decayed tooth surfaces of 1.15 and 1.63, respectively. Several demographic, behavioral, and nutritional factors were explored to understand their association with ECC, leading to both expected and novel observations. Although males had a marginally higher prevalence of ECC (28.17%) compared to females (26.58%), the difference was not statistically significant. The study done in Kathmandu, Nepal, showed similar findings in Severe ECC.⁸ The statistically significant increase in ECC study with age in this study aligns with established findings that older children have more prolonged exposure to cariogenic factors such as dietary sugars and suboptimal oral hygiene practices which is similar to that of the study done in Kathmandu, Nepal where the prevalence of ECC found to be in decreasing order with increasing age.⁸ This aligns with previous research done in Mexico, indicating that sex alone may not be a strong determinant of ECC risk, suggesting that behavioral and environmental factors are more critical in its development and ECC.⁹ ECC prevalence did not vary significantly with average monthly income, suggesting that within this sample, income levels were not the primary determinant of oral health disparities. This finding contrasts with some studies that have identified low socioeconomic status as a risk factor for ECC.¹⁰ The results indicate homogeneity in access to oral health education and resources within the study population.

ECC was significantly more prevalent among children with a mouth-rinsing habit (34.02%) compared to those without (15.09%) ($p = 0.013$). Similarly, children who brushed their teeth (39.34%) were more likely to develop ECC than those who did not (19.10%) ($p = 0.006$). This counter intuitive finding could be attributed to inadequate or improper brushing techniques, a phenomenon also reported in previous studies. The association between frequency and ECC ($p = 0.021$) further supports the importance of proper brushing practices rather than frequency alone, as in another study done in the non-fluoridated African-American community in Uniontown, Alabama, USA.¹¹

This study showed that children who visited the dentist had a higher prevalence of ECC (66.67%) than those who did not (26.53%), although the difference was not statistically significant. This is likely because dental visits in this population may be reactive (e.g., seeking treatment for existing caries) rather than preventive. The study done in Hong Kong showed that most children with untreated ECC (71%, 164/231) had never visited a dentist.¹²

The Nutritional Status and ECC study found no statistically significant difference in ECC prevalence between children with moderate acute malnutrition (30.86%) and severe acute malnutrition (23.19%). However, children with better nutritional status may still have better overall oral health, as suggested by some studies done in India and elsewhere. A study done in India showed that low BMI for age is a risk factor for dental caries, whereas a study done in Nigeria showed that

malnourished children had poorer oral hygiene status than normal children.^{13,14} The lack of significance in this study may be due to sample size or other confounding variables.

A major strength of this study is the comprehensive assessment of multiple factors influencing ECC in a well-defined population. However, the study is not without limitations. Its cross-sectional design limits the ability to establish causal relationships, and the reliance on self-reported data for certain variables may introduce response bias. Future research should consider longitudinal approaches to more accurately explore the causal pathways involved in the development of ECC.

Conclusions

This study highlights the multifactorial nature of Early Childhood Caries (ECC), emphasizing the significant roles of age, oral hygiene practices, and dental visits in influencing its prevalence. Interestingly, the study found no association between ECC and malnutrition.

The findings underscore the critical importance of early preventive interventions and community-level education in reducing the burden of ECC among young children. Targeted public health strategies should prioritize oral hygiene education, with a particular focus on promoting proper tooth-brushing techniques and reducing cariogenic dietary habits. Furthermore, encouraging preventive dental visits is essential to identify and address potential issues before caries can develop.

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