

Analysis of the relationship between stunting and dental caries patterns in children aged 6–12 years

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Abstract

Objective: This study aimed to evaluate the association between stunting and dental caries patterns among children aged 6–12 years in Gowa Regency, Indonesia.

Material and Method: This observational analytical study employed a cross-sectional design and included 96 children (mean $\pm$ SD, 8.68 ± 1.817 years old) elementary school children in Gowa Regency, Indonesia. Stunting status was determined using height-for-age measurements based on World Health Organization growth standards. Sociodemographic characteristics and oral health-related behaviors were collected through structured questionnaires.

Results: The analysis showed no significant association between stunting status and overall dental caries patterns ($p > 0.05$). However, stunted children tended to present with more advanced carious lesions, particularly in mandibular molars.

Conclusion: Stunting was not significantly associated with dental caries patterns in children aged 6–12 years. Nonetheless, the tendency toward more severe caries among stunted children suggests that chronic nutritional deficits may influence caries progression, highlighting the importance of integrating nutritional and oral health interventions in pediatric public health programs.

Keywords: Child, Dental caries, Dental caries activity test, Stunting
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Introduction

Stunting is a global health problem that indicates impaired growth and development in children due to chronic malnutrition, recurrent infections, and inadequate psychosocial stimulation. According to the World Health Organization (WHO), stunting is identified based on the height-for-age (H/A) indicator with a z-score value of less than -2 standard deviations.^{1,2} Stunting not only affects physical growth, but can also cause impaired cognitive and motor development, and increase susceptibility to disease. This condition is an important indicator in assessing the nutritional and health status of children and the success of a country's development.³ The problem of stunting can be caused by various interrelated factors, ranging from the quality and quantity of nutritional intake since pregnancy, recurrent infectious diseases, to the socio-economic conditions of the family.⁴ The impacts are very broad, including increased risk of death, impaired brain development, and stunted growth and learning abilities in children.⁵ Based on the WHO report in 2022, the global prevalence of stunting reached 22.3% or around 148 million children under five, with Asia and Africa as the highest contributors.⁶ In the Southeast Asia region, Indonesia is in third place with the highest prevalence of stunted children, thus confirming that stunting is still a major challenge in national health development.⁷

In Indonesia, although there is a downward trend in stunting rates from year to year, the prevalence is still relatively high. The 2022 Indonesian

Nutritional Status Survey (SSGI) recorded a prevalence of stunted children of 21.6%, indicating that one in five children in Indonesia is stunted.⁸ In South Sulawesi Province, this figure is even higher, reaching 27.2%, with Gowa Regency as one of the areas with the highest prevalence at 33.0%.⁸ In addition to stunting, dental health problems such as caries are also a concern. Stunting has the potential to affect children's dental and oral health, especially in terms of the development and function of the salivary glands.⁹ Children with stunting experience a decrease in the quality and quantity of saliva which plays an important role in the self-cleansing process and the oral cavity buffer system, thereby increasing susceptibility to caries.¹⁰ Caries itself is a chronic infectious disease that develops due to the interaction between teeth, microorganisms, and food intake containing sugar. An imbalance of these factors will cause progressive tooth demineralization.¹¹ When a child experience stunting, disorders in the body's systems including the oral system will increase the risk of a typical caries pattern.

Based on the high rates of stunting and caries that occur simultaneously, especially in Gowa Regency, this study was conducted to analyze the relationship between stunting and caries patterns in children aged 6–12 years. This study is important to identify whether stunting can be a risk factor in the development of dental caries in children, as well as to understand the extent to which chronic nutritional conditions can impact dental and oral health. The results of the study are expected to be the basis for

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Table 1. Dental caries patterns on the upper right first molar.

	No Disease	Initial Lesion	ICDAS N (%) Moderate Lesion	Extensive lesion	Total	p-value
Stunting	12	27	6	3	48	0.244
Non	(25%)	(56%)	(13%)	(6%)	(100%)	
stunting	15	22	5	6	48	
n*	(31%)	(46%)	(10%)	(13%)	(100%)	
	27	49	11	9	96	
	(28%)	(51%)	(12%)	(9%)	(100%)	

Table 2. Dental caries patterns in the upper left first molar.

	No Disease	Initial Lesion	ICDAS N (%) Moderate Lesion	Extensive lesion	Total	p-value
Stunting	10	25	9	4	48	0.927
Non	(21%)	(52%)	(19%)	(8%)	(100%)	
stunting	13	22	9	4	48	
n*	(27%)	(46%)	(19%)	(8%)	(100%)	
	23	47	18	8	96	
	(25%)	(51%)	(20%)	(4%)	(100%)	

Table 3. Dental caries pattern on the lower left first molar.

	No Disease	Initial Lesion	ICDAS N (%) Moderate Lesion	Extensive lesion	Total	p-value
Stunting	4	13	3	28	48	0.165
Non	(8%)	(27%)	(6%)	(58%)	(100%)	
stunting	7	11	16	14	48	
n*	(15%)	(23%)	(33%)	(29%)	(100%)	
	11	24	19	42	96	
	(11%)	(25%)	(20%)	(44%)	(100%)	

Table 4. Dental caries pattern in the right lower first molar.

	No Disease	Initial Lesion	ICDAS N (%) Moderate Lesion	Extensive lesion	Total	p-value
Stunting	3	11	5	29	48	0.113
Non	(6%)	(23%)	(11%)	(60%)	(100%)	
stunting	5	11	13	19	48	
n*	(10%)	(23%)	(27%)	(40%)	(100%)	
	8	22	18	48	96	
	(8%)	(23%)	(19%)	(50%)	(100%)	

formulating holistic health interventions, which not only focus on physical growth but also on children's oral health.

Material and Methods
Study Design

This study is an observational analytical study with a cross-sectional approach conducted on children aged 6–12 years in elementary schools in Gowa Regency in 2024. The purpose of this study was to analyze the relationship between nutritional status (stunting and non-stunting students) and dental caries patterns based on the International Caries Detection and Assessment System (ICDAS) classification.

Ethical approval and consent to participate

This study was approved by the Ethical Committee of the Faculty of Dentistry, Hasanuddin University, Indonesia (approval number: 031/KEPK FKG-RSGMP UH/EE/X/2024). Written informed consent was obtained from the parents or legal guardi-

ans of all participating children prior to data collection, and assent was obtained from the children. All procedures were conducted in accordance with the Declaration of Helsinki.

Participants

The study subjects were 96 children (mean±SD are 8.68±1.817), consisting of 48 (mean±SD are 8.94 ± 1.89) children categorized as stunting and 48 (mean±SD are 8.56 ± 1.779) children as non-stunting. The inclusion criteria in this study included children aged 6–12 years who were domiciled in Gowa Regency, in good health, and parents or guardians of the child were willing to participate in the study and had signed an informed consent. The exclusion criteria were children who did not live in Gowa Regency or were sick and absent from school during the examination.

Procedures

The research procedure was carried out in three stages. First, at the preparation stage, the researcher made a research permit letter to the relevant health center, recorded students according to stunting and non-stunting groups, and distributed questionnaires and informed consent to parents. Second, at the implementation stage, socialization was carried out to students regarding the objectives and procedures of the research, then continued with the collection of completed questionnaires and the implementation of objective examination of the oral cavity based on the ICDAS classification. The examination was carried out by trained health workers with the results of the examination recorded on a prepared form. Third, at the data collection stage, all data were summarized using Microsoft Excel and the nutritional status of children was analyzed using WHO AnthroPlus to determine the category of stunting or non-stunting.

Statistical Methods

Data processing and analysis were carried out using the latest version of the SPSS application. The collected data are presented in the form of tables and bar charts to facilitate visualization of the relationship between stunting and caries. The statistical test used was the Pearson Chi-square test to determine the relationship between the stunting status variable and the pattern of dental caries.

Results

In the upper right first permanent molar, initial carious lesions were the most prevalent finding in both groups, observed in 56% of stunted children and 46% of non-stunted children, while extensive lesions were least frequent. Pearson Chi-square analysis showed no significant association between stunting status and caries depth patterns in this tooth (p = 0.244; table 1).

Similarly, in the upper left first permanent molar, initial lesions predominated in both stunted

(52%) and non-stunted (46%) children, with extensive lesions representing the lowest proportion in both groups. No significant association was identified between stunting and caries patterns in this region ($p = 0.927$; [table 2](#)).

In contrast, mandibular first permanent molars showed a higher prevalence of advanced carious lesions. In the lower left molar, extensive lesions were most common among stunted children (58%), whereas non-stunted children most frequently presented with moderate lesions (33%). However, the association between stunting status and caries depth was not statistically significant ($p = 0.165$; [table 3](#)).

A similar pattern was observed in the lower right first permanent molar, where extensive lesions predominated in both stunted (60%) and non-stunted (40%) children. Pearson Chi-square analysis again demonstrated no significant association between stunting and caries patterns ($p = 0.113$; [table 4](#)).

Overall, Pearson Chi-square analysis across all first permanent molars indicated no statistically significant association between stunting status and dental caries depth patterns, although stunted children consistently exhibited a higher proportion of extensive lesions in mandibular molars.

Discussion

This study examined the association between stunting and dental caries depth patterns in first permanent molars among children aged 6–12 years in Gowa Regency. Overall, no statistically significant association was observed between stunting status and caries depth patterns in either maxillary or mandibular first molars. However, a consistent tendency toward more severe carious lesions in mandibular molars among stunted children was noted, suggesting potential clinical relevance despite the absence of statistical significance.

In the maxillary first permanent molars, initial carious lesions predominated in both stunted and non-stunted children. This finding indicates that caries in the maxilla was generally detected at an early stage, allowing opportunities for preventive and minimally invasive interventions. The lack of significant differences between groups suggests that stunting alone may not be a decisive factor in the early development of caries in permanent teeth. In contrast, mandibular first permanent molars showed a higher prevalence of extensive lesions, particularly among stunted children. Although Pearson Chi-square analysis did not demonstrate a significant association, this pattern is clinically important. Mandibular molars erupt earlier, possess deeper pits and fissures, and are more prone to plaque accumu-

lation, making them more susceptible to caries progression, especially in children with suboptimal oral hygiene and limited access to dental care.^{12,13}

Previous studies have reported mixed findings regarding the relationship between stunting and dental caries. A longitudinal study in Peru demonstrated that stunting increased the risk of caries development in permanent teeth over time.¹⁴ Conversely, studies from Saudi Arabia and Nigeria reported lower caries prevalence among stunted children compared with children experiencing other forms of malnutrition, such as overweight.^{15–17} These inconsistencies suggest that caries development is influenced by multiple interacting factors, including diet, oral hygiene behaviors, fluoride exposure, socioeconomic status, and parental education.^{18–20}

Evidence also supports a bidirectional relationship between stunting and dental caries. Severe caries can impair mastication, reduce appetite, and cause chronic inflammation, thereby contributing to poor nutritional intake and growth impairment.²¹ Conversely, chronic undernutrition may compromise enamel development, salivary flow, and immune function, increasing susceptibility to caries progression rather than initiation.²² Several studies from Indonesia have likewise reported a high burden of dental caries among stunted children, consistent with the clinical trends observed in the present study.^{23–26}

From a public health perspective, these findings highlight the importance of integrated strategies addressing both nutritional status and oral health. Community-based interventions combining nutritional support, oral health education, promotion of effective toothbrushing practices, fluoride use, and improved access to dental services are essential to reduce the dual burden of stunting and dental caries in vulnerable pediatric populations.

Conclusion

In this cross-sectional study, stunting was not significantly associated with dental caries patterns among children aged 6–12 years. However, stunted children tended to present with more advanced carious lesions, particularly in mandibular first permanent molars. Although these differences did not reach statistical significance, the observed distribution suggests a clinically relevant pattern that may reflect increased vulnerability to caries progression. These findings highlight the importance of integrating nutritional assessment with preventive oral health strategies, especially for early management of permanent molars in school-aged children.

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None.

Conflict of Interest

The authors report no conflict of interest.

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