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The relationship between dental caries and stunting among children in a rural Indonesian Subdistrict: Evidence from Krueng Barona Jaya, Aceh Besar

Hubungan antara karies gigi dan stunting pada anak di wilayah pedesaan Indonesia: Studi kasus di Kecamatan Krueng Barona Jaya, Aceh Besar

Diana Setya Ningsih[1*], Nani Safuni[2], Subhaini[3], Rahma Annisa[4]

[1] Department of Dental Materials, Faculty of Dentistry, Syiah Kuala University, Banda Aceh, Indonesia.
E-mail: diana.setya@usk.ac.id
[2] Department of Medical Surgical Nursing, Faculty of Nursing, Syiah Kuala University, Banda Aceh, Indonesia.
E-mail: safuni@usk.ac.id
[3] Department of Dental Materials, Faculty of Dentistry, Syiah Kuala University, Banda Aceh, Indonesia.
E-mail: subhaini@usk.ac.id
[4] Student of Faculty of Dentistry, Syiah Kuala, University, Banda Aceh, Indonesia.
E-mail: rahma33@mhs.usk.ac.id

***Correspondence Author:**
Department of Dental Materials, Faculty of Dentistry, Syiah Kuala University, Banda Aceh, Indonesia.
E-mail: diana.setya@usk.ac.id

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Abstract

Stunting is a significant global health issue and is particularly prevalent in certain regions, including the Krueng Barona Jaya Subdistrict, Aceh Besar, Indonesia. One contributing factor to stunting is inadequate nutrient intake, which may be linked to oral health problems such as dental caries that impair a child's ability to chew and consume food. This study aimed to analyze the relationship between dental caries and stunting in children aged 0 – 5 years in Krueng Barona Jaya. A cross-sectional study involving 44 children was conducted between July and October 2024. Anthropometric measurements were taken using the WHO child growth standards to assess nutritional status, and dental caries were recorded using the decayed, missing, and filled teeth (DMFT) index and assessed based on criteria established by the International Caries Detection and Assessment System (ICDAS). The results showed that 54,5% of the stunted children had to 1-3 caries (33,3%) or more than six caries (29,2%), with (79,2%) classified as having a high risk of caries. Statistical analysis revealed a significant relationship between the number of carious teeth (p=0,006) and caries risk level (p=0,013) with stunting. These findings suggest that dental caries and a high caries risk may contribute to poor nutritional outcomes in early childhood, increasing the likelihood of stunting. Therefore, early prevention and management of dental caries are essential for reducing the prevalence of stunting.

Keywords: Caries risk, early childhood caries, stunting

Abstrak

Stunting merupakan masalah kesehatan global yang signifikan dan sangat umum terjadi di beberapa wilayah tertentu, termasuk Kecamatan Krueng Barona Jaya, Aceh Besar, Indonesia. Salah satu faktor yang berkontribusi terhadap stunting adalah asupan nutrisi yang tidak memadai, yang mungkin berkaitan dengan masalah kesehatan gigi dan mulut seperti karies gigi yang dapat mengganggu kemampuan anak untuk mengunyah dan mengonsumsi makanan dengan baik. Penelitian ini bertujuan untuk menganalisis hubungan antara karies gigi dan stunting pada anak usia 0–5 tahun di Krueng Barona Jaya. Penelitian ini merupakan studi potong lintang yang dilakukan pada Juli hingga Oktober 2024, dengan melibatkan 44 anak. Pengukuran antropometri dilakukan menggunakan standar pertumbuhan anak dari WHO untuk menilai status gizi, sementara karies gigi dicatat menggunakan indeks gigi berlubang, tanggal, dan ditambal (DMFT) serta dinilai berdasarkan kriteria dari *International Caries Detection and Assessment System* (ICDAS). Hasil penelitian menunjukkan bahwa 54,5% anak yang mengalami stunting memiliki 1–3 karies (33,3%) atau lebih dari 6 karies (29,2%), dengan 79,2% diklasifikasikan memiliki risiko karies yang tinggi. Analisis statistik menunjukkan adanya hubungan yang signifikan antara jumlah gigi yang mengalami karies (p=0,006) dan tingkat risiko karies (p=0,013) dengan kejadian stunting. Temuan ini menunjukkan bahwa karies gigi dan risiko karies yang tinggi dapat berkontribusi terhadap hasil gizi yang buruk pada

masa kanak-kanak awal, sehingga meningkatkan kemungkinan terjadinya stunting. Oleh karena itu, pencegahan dan penanganan dini terhadap karies gigi merupakan strategi penting dalam menurunkan prevalensi stunting.

Kata Kunci: Anak usia dini, karies gigi, resiko karies, stunting

Introduction

Stunting is a condition in which a child has a length and height less than his age. This condition is also a form of malnutrition in children, and is most common throughout the world, including Indonesia. According to the World Health Organization (WHO) data, the global stunting rate reached 33,5%, while in Indonesia, the stunting rate in 2022 reached 33%, showing a decrease of 9,4% (from 40%) compared to 2020 (World Health Organization, 2022). Stunting data according to the (SSGI) decreased from 24,4% in 2021 to 21,6% in 2022, and Aceh Province ranked fifth among provinces with the highest stunting prevalence in Indonesia (31,2%) (Kementerian Kesehatan Republik Indonesia, 2022). Almost all districts and municipalities in Aceh Province, including Aceh Besar (27%), have stunted children (Wijaya, 2023). Based on data from the Aceh Besar district government, the target number for the stunting prevention program is 33,423 toddlers, with 4,486 toddlers (13,4 percent) stunted (Kabupaten Aceh Besar, 2023). Data from the Aceh Besar Health Service in Krueng Barona Jaya (unpublished) show that one of the main target villages for stunting prevention is Meunasah Papeun, which has 45 identified stunted children.

In addition to nutritional problems, stunting is also closely related to oral health issues. Studies have shown that children with stunting tend to have a higher incidence of dental caries than non-stunted children, which can lead to difficulties in chewing food and hinder nutrient absorption (Putri et al., 2023; Sari et al., 2022). Poor oral health, which is common in children with stunting, exacerbates this issue (Dimaisip-Nabuab et al. 2018). Salivary hypofunction and heavy plaque accumulation can further contribute to dental problems such as gingivitis and delayed tooth eruption. Stunted children also tend to receive less attention in maintaining oral hygiene, making them more susceptible to dental infections such as caries (Alanazi et al., 2022; Dimaisip-Nabuab et al., 2018; Sadida et al., 2022; Sari et al., 2022).

Dental caries is the demineralization of the cementum, dentin, and enamel of both permanent and deciduous teeth caused by a variety of factors (Neel et al., 2016; Warreth, 2023). Boustedt et al. (2020) identified significant predictors of caries prevalence at age five, including brushing teeth less than twice a day and having difficulty doing so during the early preschool years. In addition to poor oral hygiene, several studies have shown that frequent consumption of foods that appear not sweet but contain high sugar content, such as bread and cereals as substitutes for rice, can increase the incidence of dental caries in children (Butera et al., 2022; Elidrissi & Naidoo, 2016). According to basic health research in 2018, the prevalence of dental caries among 5-6 years old children in Indonesia reached 67,3%, with 8,43% of 5-year-old children having a DMFT score of ≥ 6, categorized as having severe early childhood caries (Kemenkes RI, 2018).

While several studies in Indonesia, including Aceh, have examined the relationship between stunting and oral health, most have focused on school-aged children. However, children aged 0–5 years are in a critical period of growth and development, when both nutritional intake and oral health practices begin to take shape. The lack of studies specifically examining the association between dental caries and stunting in this vulnerable age group, especially at the village level, represents an important research gap. This study contributes to filling this gap by focusing on early childhood caries and their potential role in stunting among toddlers living in high-risk areas for malnutrition. Therefore, this study aimed to analyze the relationship between dental caries and stunting among children aged 0–5 years in Meunasah Papeun Village, Krueng Barona Jaya Subdistrict, Aceh Besar.

Methods

This cross-sectional study was conducted in the Krueng Barona Jaya District, Aceh Besar, Indonesia, from July to August 2024. The study population comprised children aged 0-5 years who attended the Integrated Healthcare Center (Posyandu) in the area. A total of 44 children were selected using purposive sampling based on the following inclusion criteria: aged 0–5

years, had at least one erupted tooth, and were accompanied by a parent or guardian who agreed to participate. This study was approved by the Health Research Ethics Committee of Poltekkes Kemenkes Aceh (No. LB.02.03/KEPK/036/2024). Written informed consent was obtained from all parents or guardians prior to participation.

Anthropometrics Measurements

The assessment of children's nutritional status was based on anthropometric data collected at the Posyandu Ceria Meunasah Papeun, Krueng Barona Jaya, and Aceh Besar. Anthropometric indicators were computed using an online calculator (https://psgbalita.com/kalkulator) to ascertain z-scores for height-for-age (stunting). Children are classified as stunting if their weight-for-age z score is below -2,0, and -2,0 SD for normal (Monga et al., 2023; Al Rahmad et al., 2023).

Caries Risk

Dental caries were assessed through oral examinations using the decayed, missing, and filled teeth (DMFT) index, recorded by a trained dental professional. Caries severity was also classified based on the International Caries Detection and Assessment System (ICDAS) criteria to ensure diagnostic consistency.

Caries were divided into D1–D6 categories. D1: When the tooth dries, changes in the enamel layer are visible. D2: Alterations in the enamel layer are evident even when the teeth are moist. D3: Enamel caries or damage to enamel without visible dentin. D4: Although dentin shadows may be seen in the cavity, the caries has only progressed to the dentine-enamel junction and has not yet reached the dentin. D5: Dentin caries spread to the dentin layer; D6: Caries damage to the pulp (Ekstrand et al., 2018; Kim & Kim, 2023).

The risk variables were evaluated based on whether nighttime bottle feeding, between-meal sweets snacking, food sucking, and tooth brushing habits were presented; data from caries examinations and risk factors were then categorized based on the classification into caries risk: low (if there are no cavities and risk factors), moderate (if there are no cavities but there are risk factors or vice versa), and high (if there are cavities and risk factors)(Kirthiga et al., 2019).

Data Analysis

The data were analyzed using SPSS version 25.0. Descriptive statistics were used to summarize the participant characteristics. Chi-square tests were conducted to evaluate the association between stunting and the number of caries and caries risk levels. Statistical significance was set at $p < 0,05$.

Result and Discussion

This study was conducted in the Krueng Barona Jaya subdistrict, Aceh Besar, with 44 child respondents. Based on the frequency distribution (Table 1), slightly more than half were female (52.3%), and the rest were male (47,7%).

Table 1. Characteristics of respondent

Characteristics	n	%
Sex		
Male	21	47,7
Female	23	52,3
Age		
0-1 years	13	29,5
1-2 years	17	38,6
2-3 years	2	4,5
3-4 years	8	18,2
4-5 years	4	9,1
Stunting		
Yes	24	54,5
No	20	45,5
Caries Risk		
Low	6	13,6
Moderate	9	20,5
High	29	65,9

The respondents were primarily in the 1-2 years age group (38,6%), followed by 0-1 year (29,5%), 3-4 years (18,2%), 4-5 years (9,1%) and 2-3 years (4,5%), A total of 24 children (54,5%) were classified as stunted (54,5 %), and 29 children (65,9%) had a high risk of caries.

Analysis of the association between nutritional status and the number of carious teeth (Table 2) showed that only one child with stunting was caries-free (4,2%) compared with 10 children who were caries-free (50,0%). In contrast, children with more than six carious teeth had the highest proportion of stunting (29,2%), followed by those with three to six carious teeth (33,3%) and one to three carious teeth (33,3%).The

chi-squared test indicated a statistically significant correlation between stunting and dental caries (p = 0,006), Children with stunting had 17 times higher odds of having dental caries than children without stunting (OR = 17,0, 95% CI: 2,59–204,60).

Table 2. Relationship between caries and stunting on children in Krueng Barona Jaya Subdistrict

Caries (Teeth)	Stunting				Total		p-value
	Yes		No				
	n	%	n	%	n	%	
>6	7	29,2	3	15,0	10	22,7	0,006
3-6	8	33,3	3	15,0	11	25,0	
1-3	8	33,3	4	20,0	12	27,3	
Non Caries	1	4,2	10	50,0	11	25,0	

This study found an association between stunting and dental caries in children, consistent with previous research in Indonesia and other low-income and middle-income countries (Khanh et al., 2015; Sari et al., 2022; Zahid et al., 2020). Children with normal weight had a significantly higher percentage of caries-free teeth than did stunted children. This could be attributed to the age of the children in this study, which primarily covers those under the age of three. At this age, the deciduous teeth of children begin to erupt fully. According to various studies, the eruption age of deciduous teeth ranges from 5-7 to 26-36 months (Jain & Rathee, 2023; Ogodescu et al., 2022; Verma et al., 2017). At this age, the risk of children developing cavities is relatively low because the cavity process occurs over a long period. However, the cavity process had already begun.

This study found that children at a high risk of caries experience weight loss and qualify in the stunting category. Stunted children generally had a higher risk of caries than normal children (Table 3). The chi-square test showed a statistically significant relationship between stunting and the risk of dental caries in children in Krueng Barona Jaya District, Aceh Besar, with a *p-value* of 0,013 (p < 0,05). One possible explanation is the high consumption of milk and sugary foods among these children, as was also reported by Sari (2022). This food often causes an increase in tooth plaque and cavities (Ugolini et al., 2025). Caries on teeth also prevent children from chewing, resulting in a continual process of demineralization due to weakening of the oral cavity cleaning mechanism and a decrease in saliva output as a natural rinse in the oral cavity. The infant's weight is affected if this condition continues, increasing the risk that the child may be categorized as stunted.

White lesions on the tooth surface indicate early caries (Jandu et al., 2021). Carious cavities develop that extend to the pulp if these early caries persist. Children's preference for sweet, sticky foods, such as chocolate and candy, is closely related to demineralization and caries. Children under six who age with primary dentition and severe early childhood caries are more prone to eating milk, sugary drinks, and snacks (Zahid et al., 2020; Rachmawati et al., 2024). This study also confirms that as children age, their chances of having caries increase. Children with increased caries have trouble eating, which leads to weight loss and approaches the Z-score of stunted children (Table 1). Severe caries can cause malnutrition by suppressing a child's appetite and growth, causing tooth structure loss that impairs the child's ability to chew nutritious food and increasing the child's consumption of non-nutritious candy to reduce chronic pain. This is similar to the findings of Khanh et al. (2015) and Zahid et al. (2020), who revealed a correlation between the food ingested by children and weight reduction in children.

Table 3. Relationship between caries risk and stunting on children in Krueng Barona Jaya Subdistrict

Caries (Teeth)	Stunting				Total		p-value
	Yes		No				
	n	%	n	%	n	%	
Low	0	0,0	6	30,0	6	13,6	0,013
Moderate	5	20,8	4	20,0	9	20,5	
High	19	79,2	10	50,0	29	65,9	

Several mechanisms might explain the association between caries and stunting. Children with many cavities often experience pain or discomfort when chewing, which limits the type of food consumed (Colak et al., 2013). This can lead to a preference for softer but less nutritious foods (Tinanoff 2005). Untreated caries can also impair salivary function and oral immunity, increase the risk of mouth infection, and reduce appetite (Ekstrand et al., 2018). Over time, these effects can lead to inadequate nutrient intake and contribute to growth problems (Colak et al. 2023).

Although sweet food consumption is a known risk factor for caries, it is not the only cause. Socioeconomic conditions, parental education levels, poor oral hygiene habits, and limited access to dental care also play important roles (Almajed et al., 2024; Anil & Anand, 2017; Ellakany et al., 2021). Addressing these social and behavioral determinants is essential for effective prevention.

This study had several limitations. The cross-sectional design prevents the determination of whether caries cause stunting or whether stunting increases the risk of caries. The relatively small sample size (44 children) limited the generalizability of the results. The use of weight-for-age (WAZ) instead of height-for-age (HAZ) to classify stunting may have led to misclassifications. In addition, factors such as household income, dietary diversity, and detailed oral hygiene practices were not included in the analysis.

These findings have important public health implications. Interventions should integrate nutritional programs with oral health promotion, particularly for young children. Education for parents on proper feeding and toothbrushing practices, basic dental check-ups in community health services, and the promotion of diets low in added sugars could reduce both stunting and caries. Strengthening community dental services and improving access to preventive care are essential for supporting children's growth and overall health.

Conclusion

This study found a statistically significant relationship between stunting and risk of dental caries in early childhood. Children with adequate nutritional status were more likely to be caries-free than their stunted peers, who often consumed more cariogenic foods, such as sweet, sticky, and liquid items, such as milk and candies. Persistent caries can impair chewing ability, reduce food intake and contribute to malnutrition.

These findings highlight the need for early dental screenings starting from the eruption of primary teeth, targeted education for parents and caregivers on healthy feeding practices and oral hygiene, and integration of oral health services into stunting prevention programs and policies. Strengthening these measures can help to reduce the dual burden of stunting and dental caries in children.

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