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Original Article

Oral Hygiene Practices and Caries Increment among Stunted Children: A Cross-Sectional Study in Sukajadi District, Bandung, Indonesia

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ABSTRACT

Stunting is a form of long-term malnutrition occurring from pregnancy through early childhood that results in impaired physical and cognitive growth. This condition influences the formation and health of oral tissues and raises susceptibility to oral problems, including dental caries. Growth limitations in children with stunting, combined with parents' understanding of oral care, may interfere with maintaining adequate oral hygiene. This study was conducted to describe oral hygiene behaviours and caries progression among children experiencing growth stunting. This research used a quantitative descriptive design with a Secondary Data Analysis method, utilising dental examination findings based on the ICDAS criteria to determine the presence of caries, along with questionnaire data on oral hygiene habits. A total of 113 stunted children living in Sukajadi district, Bandung, were included. A majority of the stunted participants (60.2%) showed a low level of caries increment, and 70.8% demonstrated inadequate oral hygiene practices. Among them, 50 children (44.3%) reported poor oral hygiene yet still exhibited a low caries increase, while 18 children (15.9%) maintained good hygiene practices and also presented low caries increment. Although most stunted children in Sukajadi district, Bandung displayed poor oral hygiene routines, their caries increment levels generally remained low.

Keywords: Oral hygiene, Caries, Children, Indonesia

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Introduction

Data from the Ministry of Health of the Republic of Indonesia indicated that the national prevalence of stunting in 2017 reached 29.6% [1], surpassing the 20% threshold recommended by the World Health Organization (WHO) [2]. Basic Health Research findings also showed a persistently high stunting burden among Indonesian children under five [3]. In 2013, the prevalence was 37.2% (18% severely stunted and 19.2% moderately stunted), while in 2018 it had decreased to 30.8% (11.5% severely stunted; 19.3% moderately stunted), indicating that roughly one-third of Indonesian children continued to have inadequate nutritional status [1]. Furthermore, the Indonesian Child Nutrition Status Survey (SSGBI) in 2019 reported a stunting prevalence of 26.2% in West Java, and the Indonesian Nutrition Status Survey (SSGI) in 2021 documented a rate of 24.5% for the same province [4].

Stunting represents a chronic nutritional deficit, marked by reduced height based on height-for-age z-scores (HAZ). This indicator is used to assess linear growth in children under two years old [1]. WHO defines stunting as height falling more than two standard deviations (SD) below the median reference [2, 5]. Biologically, stunting results from inadequate nutrition beginning during fetal development, causing long-term deficits in both physical and neural growth [6]. Additional features of stunted children can include lower height and weight velocity, delayed tooth

eruption, and slower motor milestones [7]. Poor motor functioning in chronically malnourished children is linked to delayed maturation and progressive impairment of muscle performance [8]. Because stunting arises from prolonged nutrient shortages and repeated infections during the first 1,000 days of life, its effects cannot be reversed. Consequently, stunting poses a substantial public health challenge due to its association with increased disease susceptibility, impaired psychological and motor development, and—even if untreated—higher mortality risks [5].

From a dental standpoint, stunting can disrupt oral cavity development and compromise oral tissue resilience, thereby heightening the likelihood of oral diseases [9, 10]. Dental caries is among the most frequently observed conditions, reflecting overall oral health decline and its connection with stunted growth. Nutritional deficits characteristic of stunting can reduce salivary flow, which in turn diminishes buffering capacity and self-cleaning mechanisms, making teeth more vulnerable to bacterial colonisation [9]. Enamel defects associated with poor nutrition also contribute to greater caries susceptibility, as weakened enamel allows easier penetration by cariogenic microorganisms [9, 11, 12]. A longitudinal study by Delgado-Angulo in Peru found that stunted children experienced a marked rise in caries over a three-and-a-half-year period compared with their non-stunted peers [13].

Dental caries develops from interactions involving acidogenic bacteria, tooth structure, dietary substrates, and time. Caries detection systems such as ICDAS, along with WHO indices like DMF-T or def-t, are used to assess severity and activity [14, 15]. Supporting earlier findings by Rahman (2016), the def-t index was significantly higher in stunted children compared to those without stunting, emphasising the need for preventive programmes aimed at reducing caries progression in this vulnerable group [16].

The findings underline the critical need to address caries occurrence among children affected by stunting and reinforce the value of preventive strategies to limit future caries development. Strengthening oral hygiene routines is one practical approach to counter the notable rise in caries rates. Oral hygiene practices refer to a series of behaviours or actions aimed at preserving oral cleanliness and preventing mouth and dental conditions that may negatively affect daily functioning and overall well-being [17, 18]. Developmental motor delays commonly observed in stunted children may influence how well they carry out these hygiene tasks [7]. In addition, parents' understanding of oral care has a major influence on shaping children's hygiene habits [6]. Proper hygiene routines include brushing teeth multiple times per day, choosing the correct timing for brushing, eating foods that are less harmful to teeth, and attending dental check-ups regularly—behaviours that should ideally be instilled early in life [17, 18]. This research seeks to describe oral hygiene behaviour and the progression of caries among children with stunting.

Materials and Methods

This investigation used a quantitative descriptive design with a Secondary Data Analysis (SDA) framework, drawing from documentation collected under the Academic Leadership Grant (ALG) project titled "Dental Health Aspects and Family Approaches in Stunting Prevention," carried out in the Sukajadi Sub-District, Bandung City, from 2020 to 2022. The study population included 113 children (ages 1–3 years, representing various stages of tooth eruption and primary molar development), with secondary data covering caries evaluation using the ICDAS system and results from an oral hygiene practice questionnaire in Sukajadi Sub-District, Bandung City. The oral hygiene index used was the debris index [19], which measures the presence of soft deposits—such as food residue and plaque—on tooth surfaces. Scoring ranges from 0 to 3, as follows:

- 0: No visible debris or staining.
- 1: Soft deposits covering up to one-third of the tooth surface.
- 2: Soft deposits covering more than one-third but not exceeding two-thirds of the tooth surface.
- 3: Soft deposits covering more than two-thirds of the tooth surface.

Oral hygiene performance is divided into two groups. Scores above the computed mean indicate "good" hygiene practice, while scores below the mean are categorised as "poor." This binary classification helps evaluate oral hygiene effectiveness and encourages awareness of healthier routines [20].

A total sampling procedure was applied, meaning all eligible individuals were included. Inclusion criteria consisted of children with birth lengths of ≤50 cm and participants with complete data, while those with incomplete questionnaires or missing information were excluded. The data collection period was January–February 2023.

Research tools included Microsoft Excel, SPSS software, and secondary data, such as questionnaire responses on oral hygiene and caries findings from

2020 to 2022. The cumulative scores from the hygiene questionnaire were sorted into two categories: "good" if the score was at or above the mean, and "poor" if it fell below the mean. Caries increment scores—from the first through the third year—were grouped similarly: "low" for values below the mean and "high" for scores equal to or above the mean. Organised datasets were coded in SPSS and examined using descriptive statistical techniques. These included frequency distributions, percentages, and cross-tabulations, with outputs presented in table format. Ethical approval for this study was granted by the Research Ethics Committee of Universitas Padjadjaran, Bandung, under document number 134/UN6.KEP/EC/2022.

Results and Discussion

Analysis was conducted on data from 113 participants. Oral hygiene behaviours were evaluated through eight components summarised in **Table 1**. The outcomes revealed that 71 children (62.8%) brushed their teeth daily, all 100% possessed their own toothbrush, 67 children (59.3%) used toothpaste containing fluoride, and 70 children (61.9%) continued to drink breast milk or bottled milk at night. Additionally, 78 children (69%) brushed for less than 2 minutes, 100 children (88.5%) brushed only once daily, 56 children (49.6%) brushed in the afternoon, and 64 children (56.6%) used horizontal brushing strokes. Information on caries increment between the first and third years for stunted children is presented in **Table 2.**

Table 1. Distribution of oral hygiene practice questionnaire findings among stunted children in Sukajadi Sub-District, Bandung City.

No	Oral Hygiene Practice	Response	Frequency (n)	Percentage (%)
1	Regular tooth brushing	Yes	71	62.8
		No	42	37.2
2	Possession of a personal toothbrush	Yes	113	100
		No	0	0
3	Use of toothpaste during brushing	Yes	67	59.3
		No	46	40.7
4	Falling asleep with a pacifier or while breastfeeding/nursing	Yes	70	61.9
		No	43	38.1
5	Duration of tooth brushing	≥2 minutes	35	31.0
		<2 minutes	78	69.0
6	Daily frequency of tooth brushing	Once a day	100	88.5
		Twice a day	12	10.6
		Uncertain	1	0.9
7	Timing of tooth brushing	Morning only	42	37.2
		Noon only	56	49.6
		Night only	3	2.7
		Morning and noon	6	5.3
		Morning and night	4	3.5
		Noon and night	2	1.8
8	Brushing technique/movement	Horizontal	64	56.6
		Vertical	28	24.8
		Circular	21	18.6
Total			**113**	**100.0**

Table 2. Caries increment data from year one to year three in stunted children

Increment	Frequency	%
0	4	3.5
1	8	7.1
2	16	14.2
3	23	20.4

4	17	15.0
5	22	19.5
6	11	9.7
7	6	5.3
8	4	3.5
9	2	1.8
Total	113	100

Table 2 indicates that a caries increment score of three appears most frequently, recorded in 23 children (20.4%). Only four children (3.5%) showed no increase in caries between the first and third years, while the highest recorded increment—reaching nine—was observed in 2 children (1.8%). The combined distribution of oral hygiene practices and caries increment among stunted children is presented in **Table 3.**

Table 3. Distribution of oral hygiene practices and caries increment among stunted children

Oral Hygiene Status	Caries Increment: Low		Caries Increment: High		Total	
	Frequency (n)	%	Frequency (n)	%	Frequency (n)	%
Good	18	15.9	15	13.3	33	29.2
Poor	50	44.3	30	26.5	80	70.8
Total	**68**	**60.2**	**45**	**39.8**	**113**	**100**

According to **Table 3**, the majority of participants (60.2%) experienced a low increase in caries across the three-year period. The table further shows that 70.8% of the children demonstrated poor oral hygiene routines. The largest group comprised those with poor hygiene and low caries increment, totalling 50 children (44.3%), whereas 18 children (15.9%) demonstrated good oral hygiene with a low increment score.

Chronic nutritional deprivation associated with stunting can influence children's ability to care for their oral health, impacting both motor abilities and parental involvement [6, 7]. In this study, 62.8% of participants reported brushing their teeth daily. This finding corresponds with Husna's research, where 91.4% of subjects also brushed their teeth each day [21]. Establishing consistent brushing routines early in life helps children adopt the habit [22]. Furthermore, all participants in this study owned their own toothbrush, aligning with Mukhbitin's findings showing that every respondent used an individual toothbrush [23]. Maintaining a personal toothbrush is important to avoid cross-contamination within households [24].

A majority of the children (59.3%) used fluoride-containing toothpaste. This outcome resembles observations from Deinzer's study, where most participants also brushed with toothpaste [25]. Fluoride-containing products are strongly recommended because of their effectiveness in lowering caries rates and inhibiting plaque development [25, 26]. Reduced saliva activity during sleep increases caries susceptibility, making nighttime brushing with fluoride especially important [27].

Additionally, 61.9% of the participants continued consuming breast milk or bottle-fed milk at night. Therefore, feeding schedules and duration require attention, as prolonged nighttime milk intake may elevate caries risk [28]. Consistent with findings by Dianegianty *et al*., 86% of children still drank milk before bed, which heightens the likelihood of caries due to extended exposure to milk sugars [29]. During sleep, saliva production decreases, enabling bacteria to accelerate plaque formation, particularly at night [28].

Regarding brushing duration, 69% of children brushed for under two minutes. This aligns with Khan's research, which reported that only 4% brushed for more than two minutes, while the remainder brushed for insufficient periods [30]. Standard brushing guidelines recommend brushing twice a day for 120 seconds, yet only a small portion of children in this study followed these recommendations [25]. Short brushing time may reduce plaque removal effectiveness, thereby influencing caries occurrence [22]. Moreover, 88.5% of participants brushed their teeth only once each day. These results differ from Ningsih *et al*., who found that 79.4% of children brushed twice daily [31]. Ideally, brushing should occur at least twice per day—once in the morning and once before sleep [22, 27]. Nearly half (49.6%) of the participants brushed only during the afternoon. Similar findings were reported by Diyanata *et al*., revealing that many children brushed at improper

times, such as skipping brushing after breakfast or before bedtime [32]. Inconsistency in brushing times, even with correct daily frequency, may still increase caries risk [29].

More than half of the sample (56.6%) used a horizontal brushing technique. Khan's study similarly showed that 55% of children applied horizontal strokes [30]. This preference may arise because the method is simple to perform, especially among children who have not received extensive instruction on proper brushing techniques [33]. It is also commonly taught to children due to its ease of learning and compatibility with their developing motor skills [22, 33]. However, despite its popularity, the horizontal technique is less effective for plaque removal and, over long-term use, may contribute to cervical abrasion, dentin sensitivity, or gingival recession [34].

Oral hygiene practice

A primary objective of oral hygiene routines is to prevent the build-up of food debris and plaque on tooth surfaces, which are major contributors to dental caries [35]. The analysis shows that the average oral hygiene practice score among stunted children in the Sukajadi district is 3.24, suggesting that, on average, each child performs only 3 out of 8 recommended oral hygiene behaviours correctly. The results also reveal that a large proportion (70.8%) demonstrated poor oral hygiene practices. Comparable outcomes were noted by Diyanata, who found that most respondents exhibited low levels of oral health behaviour [32]. This situation may be closely linked to parental knowledge, as cognitive understanding plays an essential role in shaping daily habits [6].

Children depend heavily on parents for supervision, including guidance in maintaining their oral health. Limited parental understanding may heighten the likelihood of increased caries in children because proper hygiene practices may not be adequately reinforced. Early parental involvement is important so that children develop consistent oral hygiene habits [6]. During growth, stunting can negatively affect fine motor development, psychomotor functioning, neurosensory coordination, and disease resistance, ultimately reducing overall capability [7]. Training and encouragement can help strengthen motor abilities and contribute positively to children's skill development [22]. Therefore, the role of parents—and their knowledge—remains crucial in preventing plaque accumulation and caries in children. To address these challenges, Indonesia must expand dental health programs that improve oral hygiene outcomes across all populations [6].

Caries increment

This study's findings show that the average caries increment among stunted children in the Sukajadi district from year one to year three is 4.94, meaning each child developed approximately four to five additional carious teeth. Deinzer's analysis similarly highlighted that improper brushing behaviours were strongly associated with higher caries prevalence [25]. Based on the distribution of oral hygiene practices and caries increment, a notable proportion of the children (44.3%) showed low caries increment despite having poor oral hygiene scores. The data also illustrate that caries continued to increase even among children with good hygiene practices, although the rise was comparatively smaller than in the poor-hygiene group. Improper brushing tendencies appear to contribute to caries risk, yet other underlying factors also influence their development. Husna's 2019 study revealed that oral health behaviour in stunted children remains inadequate [21]. One explanation is that long-term malnutrition may reduce cognitive performance, as chronic nutrient deficiency can trigger metabolic alterations in the brain, leading to lower intelligence levels [36].

Multiple factors may explain why some children with good hygiene practices still experienced high caries increments. Biological vulnerability in stunted children—such as weakened tooth structure resulting from prolonged nutritional insufficiency—may contribute. In addition to suboptimal hygiene practices, increased caries may also stem from abnormal salivary acidity or frequent intake of sugary foods commonly preferred by children, such as biscuits, candies, ice cream, and chocolate [33]. Each contributing factor increases susceptibility to dental caries. The high number of children with marked caries increments is likely related to various behaviours found in this study, such as nighttime consumption of milk or breast milk, brushing for under 2 minutes, brushing only once daily rather than twice, and the continued use of less effective brushing methods. Biological factors caused by inadequate nutrient consumption, socioeconomic limitations, and low awareness of proper daily oral hygiene can also elevate caries risk [28, 29].

Although most children displayed poor hygiene practices, many still recorded relatively low caries increments. This suggests that an increase in caries continues to occur, but at a minimal rate. Oral hygiene routines represent only one component influencing caries development. The authors believe that several other determinants—although not examined in this study—affect this community. Potential factors include eating patterns and the frequency of dental visits. In

Bandung, access to information and dental care facilities is generally attainable, which may help limit the progression of dental caries by encouraging healthier diets and regular dental check-ups for children.

Dental health promotion programs have been implemented using a range of communication strategies and media platforms [27]. Inadequate oral hygiene behaviours can trigger various dental problems. When dental issues in stunted children remain unmanaged, they may worsen nutritional deficits and negatively affect their quality of life. Parents must devote greater attention to the oral and dental care of stunted children compared to those who are well nourished. Their involvement is reflected in the ways they guide, supervise, teach, and encourage children to maintain healthy oral habits [37]. For this reason, dental professionals, public health workers, and related stakeholders should collaborate in assessing and strengthening community-based health initiatives. These efforts might include educating young people about choosing nutritious foods to support overall health and providing information on fluoride use as a preventive tool for populations with a high risk of caries.

This study has several limitations, including reliance on previously recorded data, which restricted changes such as modifying the caries assessment timeframe or adjusting the caries index. The research offered only a descriptive snapshot and did not explore associations between variables. Future studies should examine how different components of oral hygiene behaviour relate to caries increment in stunted children. It is also advised that parents regularly oversee key elements of their children's oral health routines and adapt toothbrushing practices to make them enjoyable and suitable for each child's personality.

Conclusion

The findings indicate that poor oral hygiene behaviour is highly prevalent among stunted children in Sukajadi Bandung. Although most children reported brushing their teeth, the brushing duration, regularity, and techniques were often insufficient. Many still consume breast milk or bottled milk before sleeping, increasing their likelihood of developing dental caries. The research also revealed a notable rise in caries increment among stunted children, reinforcing the need for better preventive strategies and improved oral hygiene routines.

These results underline the critical role of parents in fostering healthy oral hygiene habits in stunted children. Parental guidance and motivation are essential for encouraging good dental practices. Hence, comprehensive oral health promotion activities aimed at educating parents, raising awareness about effective brushing techniques, promoting routine dental checkups, and encouraging healthier eating behaviours are recommended.

The study highlights the importance of conducting further investigations into how various components of oral hygiene behaviour contribute to caries progression in stunted children. Future research should also consider additional influences, including socioeconomic background and nutritional patterns, to better understand oral health disparities within this group.

In summary, the research stresses the urgency of addressing oral health concerns in stunted children to prevent further declines in overall health and enhance their quality of life. Strengthened preventive programs, active parental support, and community-focused initiatives are essential for lowering caries rates and improving oral health outcomes among stunted children.

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