Majalah Kedokteran Gigi Indonesia
Vol 10 No 3 – December 2024
ISSN 2460-0164 (print), ISSN 2442-2576 (online)
Available online at https://jurnal.ugm.ac.id/mkgi
DOI: http://doi.org/10.22146/majkedgiind.88996

RESEARCH ARTICLE

Is breastfeeding duration associated with caries in stunted toddlers? a cross-sectional study

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Submitted: 13rd September 2023; Revised: 13rd August 2024; Accepted: 30th November 2024

ABSTRACT

Stunting remains a significant nutritional concern in Indonesia, potentially affecting physical and cognitive development. Stunting may lead to oral health issues, specifically dental caries, due to salivary gland atrophy in malnourished children. While dental caries have multiple contributing factors, breast milk contains protective proteins and antibacterial properties that may influence caries development. This study aims to investigate the association between breastfeeding duration and dental caries occurrence in stunted and non-stunted toddlers. An analytical observational study with a cross-sectional approach was conducted using quota sampling of 30 toddlers attending Sumingkir Village Posyandu. Spearman correlation analysis showed no significant correlation between breastfeeding duration and caries in both stunted ($p = 0.68$) and non-stunted groups ($p = 0.66$). Independent T-test revealed no significant mean differences between the groups ($p < 0.05$). However, the Mann-Whitney test demonstrated a significant median difference in caries ($p = 0.006$) between stunting (4(0-6)) and non-stunting groups (0(0-18)). This study concludes that breastfeeding duration showed no correlation with caries in either stunted or non-stunted toddlers; however, nutritional status (stunting) appeared to influence caries occurrence in toddlers.

Keywords: breastfeeding; caries; stunting; toddlers

INTRODUCTION

Stunting is one of the nutritional problems highlighted in Indonesia. According to Riskesdas (2018), the prevalence of stunting in Indonesia is 30.8%.[1] Children with stunting are at a higher risk of developing various oral health problems, including delayed eruption of deciduous teeth and salivary gland atrophy, which leads to reduced saliva production. These conditions can increase the risk of dental caries in children.[2] Moreover, stunting has adverse effects such as a higher risk of morbidity and mortality, a weakened immune system, and increased vulnerability to infections. Long-term effects that occur in stunted children include decreased cognitive and physical abilities that affect future performance and socioeconomic status. Stunted children are prone to central fat accumulation and insulin resistance due to decreased fat oxidation. These conditions lead to an increased risk of developing degenerative diseases such as hypertension, diabetes, dyslipidemia, and reproductive disorders.[3]

Central Java is a province with a stunting prevalence of 28.5%, and Purbalingga is one of the 11 districts with priority for stunting.[1,4] Kutasari Sub-district recorded the highest number of stunted children under five,[2,5] while Sumingkir Village had a significant number of stunted cases among children under five between April and June 2020.[6] Moreover, stunting is associated with an increased risk of dental caries. The prevalence of childhood caries in Indonesia, according to Riskesdas in 2018, is high at 54%.[1] Without proper treatment, caries can cause various complaints, including pain, masticatory disorders, sleep disorders, speech disorders, decreased frequency of class attendance, and lack of self-confidence. In addition, caries also cause malnutrition, which results in impaired growth both physically and mentally, so that it can affect the general health and quality of life of children.[7,8,9]

Breast milk is the best source of nutrition in the early years of an individual's life. The World Health Organisation (WHO) states that breastfeeding is one of the most significant strategies for reducing malnutrition and infant mortality.[5] Breast milk contains various proteins and antibacterial substances that can protect teeth and the oral cavity from infectious attacks, including dental caries.[10] Caries are caused by multifactorial interrelationships, namely the tooth as a host, substrate, microorganisms, and time. The state of caries lasts chronically and develops over several months and even years. Caries can attack both deciduous and permanent teeth, but deciduous teeth are more susceptible to attack, given their structure and morphology.[11,12]

Breast milk contains lactose, which is the sugar in milk. Long-term breast milk consumption that is not properly cleaned, specifically when the child is decaying, will cause a pool of milk on the teeth. Sugar in milk will stick to the teeth to form plaque; over time, the plaque will be fermented by bacteria to produce acids that cause demineralization of the teeth, which, if not immediately addressed, causes caries.[13] Breastfeeding for more than one year at night or before bedtime is associated with increased caries in children. WHO recommends exclusive breastfeeding until 6 months, followed by up to 2 years. The American Academy of Pediatric also recommends that infants are breastfed at least until 12 months of age and may continue thereafter.

Exclusive breastfeeding for 6-17 months exhibits protective effects against dental caries.[14] Extended breastfeeding through 13-23 months demonstrates no adverse effects on dental caries development.[15] However, another research shows that children who are breastfed for 12 months or more show a higher susceptibility to early childhood caries (ECC).[16] Shrestha also stated that children breastfed ≥6 months showed higher dental caries rates than those breastfed <6 months, and breastfeeding beyond 12 months significantly increased dental caries risk.[17] Prolonged breastfeeding practices exceeding 12 months were significantly associated with increased incidence of dental caries.[18] Given these conflicting findings about breastfeeding duration and dental caries, coupled with the high prevalence of stunting in Indonesia, investigating their relationship becomes crucial for developing targeted oral health interventions. To our knowledge, this is the first study to specifically examine the association between breastfeeding duration and dental caries in the context of stunting status among toddlers. Various studies have explored the relationship between breastfeeding duration and dental caries, while stunting—currently a major concern for the government—is also suspected to increase the risk of dental caries. These factors have motivated researchers to investigate the association between breastfeeding duration and dental caries among stunted and non-stunted toddlers in Sumingkir Village.

MATERIALS AND METHODS

The study employed an analytical observational design with a cross-sectional approach. The target population consisted of toddlers aged 0–59 months residing in Sumingkir Village, Kutasari District, Purbalingga Regency, Central Java, who visited Posyandu Sumingkir during the study period from July to August. Data collection was conducted simultaneously at six Posyandu locations within Sumingkir Village. The study subjects included both stunted and non-stunted (normal) toddlers with erupted teeth. Sampling of stunted and non-stunted toddler respondents using quota sampling technique which means non-probability sampling technique wherein the population is divided into subgroups according to specific attributes, and a quota (minimum sample sizes are 10–30 per subgroup) is then established for each segment to all toddlers who come and willing to be examined to Posyandu in Sumingkir Village during the study period.[19,20] Forty-nine toddlers were attending the Posyandu, but the number of subjects who met the requirements and were willing to become research subjects was 30 toddlers, including 15 stunting toddlers and 15 non-stunting toddlers.

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ISSN 2460-0164 (print)
ISSN 2442-2576 (online)

The Purbalingga District Health Service provided secondary data on toddler stunting for each sub-district in 2019 and 2020, validated in April–June 2022. Validation of body length for age (PB/U) measurements using an infantometer board calibrated for infants and toddlers 24 months of age or younger who are unable to stand upright at this time. Once more, validation was done by measuring the height of kids over 24 months or who could stand up straight using a calibrated stadiometer to measure their height for age (TB/U). The midwife and nutritionist performed measurements at the neighborhood health center during Posyandu services throughout the research period. Using electronic community-based nutrition recording and reporting tool (e-PPGBM), the findings of TB/U and PB/U measurements for toddlers are recorded, and stunting status is then assessed. The length and height of stunted toddlers have a z-score of less than -2 SD relative to their age, while non-stunted toddlers have z-scores ranging from -2 SD to +3 SD.

The examination of pediatric dental caries included children whose primary teeth had erupted and who did not consume formula milk. Dentists from the local health center conducted dental assessments for both stunted and non-stunted toddlers. A sonde and mouth mirror are put into the oral cavity during the examination to count the number of primary teeth that the patient has lost due to caries, had restorations placed on them, or both. The dmf-t score is calculated for each toddler by summing together the d (decay), m (missing), and f (filling) variables. Through conversations with the respondent's parents, information on the length of breastfeeding in months was gathered and categorized into two groups: ≤ 12 months and > 12 months of breastfeeding duration.

People who are willing to participate in this research and meet the study's criteria are considered research subjects. Before the study, parents or guardians signed an informed consent form on behalf of the willing respondents. The Unsoed Faculty of Medicine's medical committee issued research authorization, number 012/KEPK/PE/VI/2022.

The normality test was conducted using *Saphiro Wilk* because subjects < 50, and homogeneity test used *Levene* on the research data. The test results indicated that the breastfeeding duration variable followed a normal distribution; therefore, the data were analyzed using an Independent T-test. The results of the DMF-t scores showed that they were not normally distributed and not homogeneous, so the data were analyzed using the non-parametric Mann-Whitney test to determine the effect of stunting conditions on caries incidence in toddlers. Spearman's correlation was used to examine the

Table 1. Characteristics of gender, nutritional status, duration of breastfeeding and dmf-t category of subjects

Category types	Total	
	n	%
Gender		
Male	17	56.67
Female	13	43.33
Total	30	100
Nutritional Status		
Stunting	15	50
Non stunting	15	50
Total	30	100
Duration of breastfeeding (month)		
Stunting		
≤ 12	5	16.67
>12	10	33.33
Non stunting		
≤ 12	4	13.33
>12	11	36.67
Total	30	100
dmf-t category		
Very low (0-1.1)	9	30
Low (1.2-2.6)	3	10
Moderate (2.7-4.4)	10	33.33
High (4.5-6.5)	3	10
Very high (>6.6)	5	16.67
Total	30	100

Notes:
n: number of subjects

correlation between breastfeeding duration and DMF-T scores in both stunted and non-stunted toddlers.

RESULTS

The study was conducted for two months on toddlers who visited Posyandu Sumingkir during the study. Table 1 shows the data on the characteristics of research subjects. Although there are slightly more male subjects (approximately 56.67%) than female subjects, the gender distribution is relatively balanced. The subjects' nutritional condition was distributed equally. The majority of subjects, 33.33% and 36.67%, who were breastfed for more than a year were either stunted or not. The proportion of research subjects with moderate DMF-T scores was 33.33%. Table 2 presents the test results for the duration of breastfeeding with caries in toddlers.

Table 2. Mean ± standard deviation, median value (minimum-maximum) breastfeeding duration and p value of dmf-t scores of subjects between stunting and non-stunting subjects with independent t-test and mann whitney test and results of spearman correlation test between duration of breastfeeding and dmf-t scores on stunting and non-stunting subjects

Nutrition status	Duration of breastfeeding (months)	p value	dmf-t scores		p value	p Value duration of breastfeeding to dmf-t
	Mean ± SD		Mean ± SD	Median (Min-Max)		
Stunting	17.67 ± 9.63	0.075	6.47 ± 5.21	4 (0-18)	0.006*	0.68
Non-stunting	17.73 ± 9.5		1.93 ± 2.23	0 (0-6)		0.66

Notes:
P : Significance value
SD: Standard Deviation
* : Significantly different p < 0.05

(A) (B)

Figure 1. Caries condition in the subject's oral cavity: (A) in stunted toddlers, (B) in non-stunting toddlers.

Table 2 shows that the significance value of P is 0.075 (> 0.05) with an Independent T-test, which means that there was no significant difference between the stunting condition (nutrition status) and duration of breastfeeding. However, there was a difference wherein the duration of breastfeeding in non-stunted subjects was longer than in stunted subjects. Meanwhile, based on the Mann-Whitney test, there was a significant difference between stunting conditions and the incidence of caries in toddlers (p < 0.05). The differences in dental caries manifestation between stunted (A) and non-

Majalah Kedokteran Gigi Indonesia. December 2024; 10(3): 226-233
ISSN 2460-0164 (print)
ISSN 2442-2576 (online)

stunted children (B) are depicted in Figure 1. The mean and median value DMF-T score of stunted subjects was higher than non-stunted subjects. The Spearman correlation test results show no correlation between the duration of breastfeeding and DMF-T scores, both in stunted (p = 0.68) and non-stunted toddlers (p = 0.66).

DISCUSSION

Stunting is a condition of growth failure characterized by short or very short stature based on length/height for age. Based on the WHO standard child growth curve, stunting is at a position less than -2SD. Stunting is caused by chronic undernutrition. It is often associated with socioeconomic conditions, dietary intake, maternal health status, history of recurrent illness in under-fives, and inappropriate feeding practices. Stunting can cause obstacles in physical and cognitive growth as it increase the risk of morbidity in children.[21] Aulia et al.'s research in 2023 showed a significant relationship between stunting and the number of caries in children.[22]

Results demonstrates no discernible difference between the stunting and non-stunting groups in terms of the mean length of breastfeeding. WHO recommends exclusive breastfeeding and continues until the child is 2 years old. Breast milk benefits teeth by protecting them from caries.[23,24] The content of lactoferrin, lysozyme, and secretory immunoglobulin A (sIgA), the largest proportion in breast milk, protects against Streptococcus mutans, the main bacteria that cause caries. This bacteria cannot multiply due to lactoferrin, which binds iron. The bacterial cell wall is broken down by lysozyme while the initial colonization stage of *Streptococcus mutans* is inhibited by sIgA.[12,13,25] The incidence of caries in children who consume breast milk and complementary foods from 6 months to 12 months is lower when compared to those who do not.[16] The sIgA content in breast milk is high in colostrum and decreases in the first 4 weeks postnatal. At 6 months old, the lowest sIgA concentration is observed and the value increases slightly thereafter. Then, the infant has a fixed concentration for 2 years of breastfeeding. Up to 18 months of breastfeeding, sIgA concentration in breast milk stabilizes at ± 1.8 g/L.[26] Breastfeeding for 12 months after birth is recommended by the American Academy of Pediatric Dentistry. The benefit of breast milk as a non-cariogenic food is that it does not decrease enamel pH. Enamel can be remineralized due to micronutrients such as calcium and phosphate in breast milk.[23,24]

Children with severe dental caries are more likely to experience stunting later in life. Conversely, children with stunting suffer from high severity of primary dental caries. A relationship has been observed between dental caries in primary teeth and stunting in children. This is consistent with the findings of the present study, which showed that stunted toddlers had a higher mean (6.47 ± 5.21) and median (4 [0-18], moderate) DMF-T scores compared to non-stunted toddlers (mean 1.93 ± 2.23, median 0 [0-6], very low). The difference between the two groups was statistically significant, with a p-value < 0.05. Based on this research, children who are stunted have a significant caries rate.[22] This issue is linked to a reduction in saliva flow observed in stunted children, which occurs due to the atrophy of the salivary glands. As a result, stunted children are more prone to developing dental cavities.[27] There is a decrease in saliva's ability to act as a buffer and self-cleanse, which increases the risk of dental caries.[2]

Furthermore, stunting is largely caused by poor nutrition. It is crucial for parents to determine infants dietary intake in accordance with the graph to support growth to ensure that there are no factors causing growth disruptions underdevelopment.[28] Growth problems can significantly impact dental development, as they may cause anomalies in cell growth, leading to enamel hypoplasia. This condition increases the risk of dental caries.[27] Malnutrition, including stunting, can increase the risk of dental caries due to impaired salivary secretion. Children with poor nutritional status experience impaired salivary gland growth, namely salivary gland atrophy, so salivary secretion decreases, which causes the function of saliva as a buffer and antibacterial to be

less than optimal. In addition, a decrease in saliva quantity will result in quality; namely, the important components contained in saliva are reduced, increasing the risk of caries.[2]

Although physically stunted children have a decrease in the quality and quantity of saliva as a protective agent against caries, good parenting and parents' role in maintaining children's diet and oral hygiene will reduce the risk of caries in children. Dental caries in young children are strongly influenced by parental history, which includes bottle feeding at night and maternal tooth cleaning. Children who are fed at night have a 3.98 times higher caries risk compared to children who do not eat at night. Toddlers still need parents to help brush their teeth. It is associated with caries in young children.[18,29]

The statistical test results demonstrate there was no significant difference between the length of breastfeeding and the incidence of caries in both stunted and non-stunting children under the age of five, based on the research findings shown in Table 2's p=0.068 on stunting and p = 0.066 on non-stunting toddlers (p > 0.05). This aligns with the 2016 study by Nirunsittirat et al., which found no correlation between dental caries and breastfeeding duration.[30] The health status and diet of children greatly affect the risk of caries.[31] Caries in toddlers are caused by multifactorial factors, including diet, socioeconomics, parenting patterns, and dental and oral hygiene practice. The higher the frequency of milk consumption, the higher the risk of rampant caries.[32] A clean oral cavity is one factor that reduces the risk of caries. Cleaning plaque in the oral cavity and brushing teeth properly and correctly are efforts to maintain oral hygiene and health. The role of parenting is crucial, specifically in teaching children how to brush their teeth and rinse their mouths well and correctly.[33]

Despite providing some preliminary insights into the relationship between breastfeeding duration and the incidence of dental caries in toddlers, this study has a few limitations. The small sample size may limit the ability to detect more nuanced connections between the investigated factors. However, the use of a quota sampling strategy ensures that both stunted and non-stunted toddler groups are fairly represented, which enhances the reliability of comparisons between these two groups. Additionally, this study used well-calibrated measurement instruments and data that was verified by seasoned experts, resulting in dependable findings. Because cross-sectional research methods are limited to documenting interactions at a single point in time, they are unable to verify cause-and-effect relationships. Future studies should use bigger sample sizes to improve statistical power and enable better generalization to a wider population to address these shortcomings. Furthermore, longitudinal studies are recommended to monitor changes in caries incidence and nutritional status over time, providing a better understanding of the causal relationship between breastfeeding duration and caries occurrence. Reducing the risk of caries requires interventions to improve the nutritional status of children under five, particularly those who are stunted, since nutritional status plays a major role in avoiding caries.

CONCLUSION

The study's findings conclude that there is no significant connection between breastfeeding duration and the prevalence of dental caries in toddlers, regardless of their stunting status. On the other hand, compared to toddlers who are not stunted, toddlers who are stunted typically have higher caries scores. The findings suggest that the occurrence of caries is more influenced by nutritional status (in this case, stunting) than by the duration of breastfeeding.

ACKNOWLEDGMENT

No outside involvement or influence in this study would have affected our approach, analysis, or findings. It was independently conducted and conducted with the utmost scientific integrity.

CONFLICT OF INTEREST

The authors declare no conflicts of interest with the data contained in the manuscript.

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