Iran J Public Health, Vol. 54, No.2, Feb 2025, pp.265-272

Review Article

The Updated Trend of Association between Dental Caries and Stunting in All Age Groups: A Systematic Review

Darmawan Setijanto [1], Abdullah Sherf Hemadi [2], Iwan Dewanto [3], Melissa Adiatman [4], Kartika Andari Wulan [5], Valendriyani Ningrum [6], Armelia Sari Widyarman [7], Tince Arniati Jovina [8], Naneu Retna Arfani [9], Indra Rachmad Dharmawan [10], Sri Nuraini [9], Ammara Nabiila Mahrunisa [11], Marvin Hidayat [11]

1. *Department of Dental Public Health, Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia*
2. *Pediatric Dentistry, Taiz University, Taiz, Yemen*
3. *Department of Dental Public Health, Faculty of Dentistry, University of Muhammadiyah Yogyakarta, Yogyakarta, Indonesia*
4. *Department of Preventive and Public Health Dentistry, Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia*
5. *Department of Prosthodontics, Faculty of Dentistry, Universitas Brawijaya, Malang, Indonesia*
6. *Department of Preventive and Public Health Dentistry, Faculty of Dentistry, Universitas Baiturrahmah, West Sumatra, Indonesia*
7. *Department of Microbiology, Faculty of Dentistry, Trisakti University, West Jakarta, Indonesia*
8. *Health Policy Agency, Ministry of Health, Jakarta, Indonesia*
9. *Directorate of Primary Health Services, Ministry of Health, Jakarta, Indonesia*
10. *Directorate General of Health Services, Ministry of Health, Jakarta, Indonesia*
11. *Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia*

***Corresponding Author:** Email: r-darmawan-s@fkg.unair.ac.id

(Received 15 Jul 2024; accepted 30 Sep 2024)

Abstract

Background: Stunting has a negative impact on the growth and development of children, which include their susceptibility to dental caries. Caries in primary teeth have been consistently related to malnutrition. Having a history of severe caries was connected with slower childhood growth. We aimed to explain the updated trend of association between stunting and dental caries among all age groups.

Methods: A review was done using PRISMA. PubMed and Science Direct was used as database from Jan 2022 to Jan 2023. Studies obtained using specific keywords was 1.748 then filtered. All of the studies that were obtained using specific keywords about stunting and DMFT and or PUFA index. There is no limited year in this systematic search. Endnote software was used to help with the inclusion process; data was extracted into a table that had been prepared.

Results: There were 10 included studies in this systematic review. Eight studies that reported higher dental caries in stunting children than the normal children. Two studies showed a connection between developing stunting malnutrition and severe dental caries. Early childhood caries may increase vulnerability to dental caries by causing odontogenesis to fail, delayed tooth eruption and changes in the salivary glands. Children's ability to eat and sleep may be negatively impacted by untreated caries pain. It might result in decreased nutrient intake and poor appetite, while sleep disturbances might prevent growth hormones from being secreted.

Conclusion: There was a correlation between dental caries and growth stunting because of a decrease in the composition of saliva and defects in tooth formation in children suffered stunting. Thus, there were oral functional limitations and a decrease in food intake since severe dental caries.

Keywords: Dental caries; Children; Malnutrition; Medicine; Stunting

DOI: 10.18502/ijph.v54i2.17898

Introduction

Stunting occurs in about 155 million children worldwide (1). According to data from Indonesian health studies, up to 30.8% of toddlers in Indonesia have stunted growth as of 2018 (2). Stunting is a condition in which a person's height or length is -2 Standard Deviation (SD) below the median for their age (3). It denotes persistently low development potential in children due to insufficient nutrient intake (1). Undernutrition has a negative impact on education levels, intellectual capacity, child growth, and susceptibility to infection (4). Several variables, particularly in Indonesia, may contribute to stunting, including mother education and knowledge, family socioeconomic position, incorrect baby and toddler feeding patterns, such as not exclusively breastfeeding children up to age 6, infection rates, and rates of infancy (1,5).

Malnutrition might have an irreversible impact on growing oral hard and soft tissue during a time of fast development, such as during pregnancy and the first few times of life (6). Child malnutrition is one of the important factors that lead to disability in children under the age of five in underdeveloped nations and may result in a number of illnesses, including dietary and dental problems (3). Various chronic infections, pain, and loss of function due to caries infection, in addition to loss of appetite are also thought to be the basic mechanisms that mediate the relationship between caries and human growth and development (7). Children chronically undernourished will have less saliva production, which will increase the risk and severity of caries (1). Stunting may disturb the eruption of teeth, impede the development of enamel, and delay the eruption of deciduous teeth (3).

Dental caries is a process that causes tooth tissue to be destroyed (8). It results from cariogenic bacteria's effect on fermentable carbohydrates, which causes demineralization (9). The prevalence of caries in Southeast Asia is highest among the world, with a percentage of 79% to 98% in children at age of six-year-old (10). Caries in children with age of three to four and five to 9 yr old had a prevalence of 81.5% and 92.6%, respectively, with a def-t mean index of 8.1 among children under 5 yr old, according to the Indonesian basic health research data (1,11). If a caries lesion is not treated, it will spread to important structures and cause irreversible damage (7). Untreated severe dental caries can result in oral inflammation and infection, which can cause mouth pain (8). Dental pain has been repeatedly shown to negatively affect kids' daily lives, including their ability to sleep, eat, clean their teeth, focus in class, complete their schoolwork, play, avoid participating in recreational activities, and attend school (12). Many people have the misconception that primary teeth are just transient and will be replaced by permanent teeth, leading them to believe that primary tooth injury is not something that has to be taken into concern (11).

Recent research indicated that caries has association with overweight. However, dental caries has an association with underweight, stunting, and failure to thrive (10). Its association may also be explained by the impact of socioeconomic status and insufficient utilization of dental services, both of which contribute to the progression of already existing dental caries (13). According to epidemiological data, morbidity can also result from the causative relationship between malnutrition and caries. Children's oral health will improve due to preventing and treating early childhood caries (3). This review explain the association between dental caries and stunting.

Material and Methods

Study Design

This is a systematic review with the aim to collect, conclude, and synthesize studies related to dental caries and stunting.

Search Strategy

We searched online in certain database with specific keywords. We used PICO (Population, intervention, comparation, and outcome) modal to

help determine the keywords we used in this. Keywords for our systematic review were modeled to combine the keyword to obtain the desired keywords. The keywords for this systematic review were:
"dental caries" OR "rampant caries" OR "Early childhood caries" AND "stunting children" OR "stunted children" NOT "nutrition" NOT "treatment" NOT "diet". The database that we searched for this review were PubMed and Science Direct.

Study Selection

There were 4 authors carried out study selection using a chart based on the preferred reporting items for systematic reviews and meta-analyses (PRISMA) (Fig.1). After searching of the studies in the database, authors then compiled the article based in the exclusion criteria and also inclusion criteria. Then, all the authors reviewed all of the articles then appraised each article using a specific table until the data were saturated. Endnote was used to eliminate the duplicate and ease the process of inclusion and exclusion. The criteria of inclusion were as follow; 1. All types of original article, 2. Written in English, 3. No duplicate studies, 4. Without any intervention, 5. Study subjects/exposure: stunting, 6. longitudinal studies and cross sectional, 7. DMFT, deft, or PUFA were used as outcomes measurement. The exclusion criteria were a narrative review and/or any other review. The systematic search was conducted by the authors from Jan 2022 to Jan 2023. The limited date of publication in this systematic searching was 2023, but there were no initial years of publication.

The authors then extracted the results, and then two authors did the extraction to minimize the bias.

Data Extraction

The authors then extract the data from the included studies that contain certain information such as 1. Research title; 2. Author and year of publication; 3. Aim of the study; and 4. Result of the study. In included studies we searched for correlation between dental caries and stunting. The outcomes of the included studies must use DMFT, DMFT in primary teeth, or PUFA as outcomes measurement.

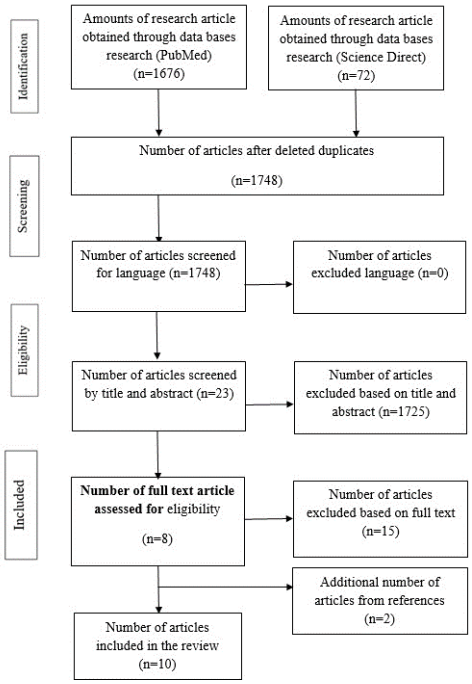

Fig: 1: PRISMA flow chart of study selection

Results

After inclusion of the title, abstract, and full paper there were included studies for data extraction. Ten journals, there are 7 articles with cohort study design and 3 cross sectional study design. From all data extraction, there are 8 articles reported that the risk factor of caries increment was stunting and 2 article stated that severe caries was associated with stunting. From 4 articles, there was a correlation between caries and stunting. The caries increment of stunting group differed significantly from the control group. Thus, the degree of dental caries is influenced by the condition of stunting. Despite having a higher caries (def score) than the well-nourished group in another investigation, only stunted and wasting children's differences were shown to be statistically significant.

After adjusting for sex, age, and oral hygiene, the association between stunting in children aged 7-9 yr has been associated with net DMFS increment, sugary snacks between meal time, and permanent tooth caries experience. On the other hand, dental caries experience occurs in the beginning years of life and may be more severe in future life. This condition found in children with a history of neonatal developmental delay. Early malnutrition can increase the vulnerability of children towards caries three to four years later when the primary teeth are developing.

According to the Fit for School project's findings, stunting malnutrition was more common among eight to ten-year-old children who had worse dental caries. Children who had significant dental decay had nearly twice as much of a chance of becoming chronically malnourished. There is an association between untreated caries and stunting mediated through pain and inflammation (1,8). (Table 1).

Table 1: Result of extracted study

Ref. No.	Authors and years	Aim	Age	Country	Result
19	Alvarez et al., 1993	To evaluate the impact of a single episode of malnutrition during infancy on dental caries in the primary teeth.	6-11 months, 1 year, 1.5 yr, 2 yr, 2.5 yr, 3 yr, and 4 yr	Peru	The number of children with stunting has a very high caries, especially at age 4 was significantly higher (17.2%). While only 3.4% of stunting children who had fewer than 3 def teeth. It showed that the children with stunting had high prevalence of dental caries.
4	Delgado-Angulo et al., 2012	To investigate the relationship between caries growth in permanent teeth over 3.5 yr and stunting	7-9 yr old	Peru	The adjusting study for oral hygiene, sex, age, dental caries in primary and permanent teeth, and sugary snacks between meals, it showed that stunting was associated with DMFS increment.
6	Muhammad et al., 2015	To investigate nutritional status in 4 and 5-year-old preschool children by anthropometric measurement in Sulaimani City, and to determine the prevalence and severity of dental caries, dental plaque gingivitis, and dental calculus and enamel defect of primary teeth in relation to age, sex and nutritional status	4-5 yr old	Iraq	The number of children with malnutrition was higher among females than males, and the frequency of dental caries was 69.3%, 72.8%, and 65.1% respectively for group of underweight, stunted, and wasted children. Despite being underweight, wasted, and stunted children experienced more dental caries (dmfs) than groups that were well-nourished, although these changes were only found to be significant for children who were stunting or wasting.
10	Dimaisip-Nabuan et al., 2018	To determine the relationship between nutritional status, such as underweight, 5normal weight, overweight, and stunting, and dental caries in the primary and permanent denti-	6-7 yr old	Cambodia	Children stunted and underweight had considerably higher levels of caries and odontogenic infections in their primary dentition than children who were overweight. Children aged six to seven who had dental caries had significantly higher of being underweight and stunted for two years later. Odontogenic infec-

Table 1: Continued …

		tion in children from Cambodia, Indonesia, and the Lao PDR over a two-year period			tion and caries in the permanent dentition did not always show these correlations. The number of permanent teeth eruption was substantially correlated with being underweight and stunted in children when they were at age of 6 to 7 and two years later.
20	Achmad et al., 2020	To examine the incidence of caries and gingivitis in stunting children in the Makassar city (Tamalanrea district)	2-5 yr old	Indonesia	According to the study's findings, an average def-t index of normal children was 5.37, however a stunted child's average def-t index was 7.37. According to these findings, stunted children have a higher def-t index than normal children.
13	Shen et al., 2020	To determine if baseline rates of underweight or stunting and the incidence of dental caries among preschoolers in Liaoning Province, China, are related.	0-2 yr old	China	In the fully adjusted model, its showed the association of the stunting prevalence with the severe caries incidence (odds ratios 2.88; 95 percent confidence interval (CI): 1.01, 8.27.
17	Rego *et al.*, 2020	To investigate the connection between dental caries and nutritional status in 12-year-old low-income children	12 yr old	Brazil	Compared to children with normal weight, children with underweight have more untreated caries and more have clinical effects of untreated dental caries.
8	Renggli et al., 2021	To examines the association between severe dental caries and anthropometric changes over a one-year period, in children under 2 yr of age at baseline	<24 months	Cambodia	In the beginning, 25.6% of the kids showed signs of growth stunting, and there were 14.4% of the children who had severe dental caries. Throughout the observation period, The number of children (17.6%) from a healthy condition to a low height-for-age. Children who had severe dental caries also had a nearly twice increased probability of going through malnutrition (OR = 1.8; CI 1.0-3.0).
7	Turton et al., 2022	To test the relationship between ECC and linear and ponderal growth trajectories.	< 5 yr old	Cambodia	This study showed that there was a tendency for those with one or more caries to have lower Z-scores within each class group (HAZ or height for age Z-score while WHZ or weight for height Z-score group). It also showed an association between caries exposure and belonging to WHZ groups with lower Z-scores, with children exposed to caries more likely to do so.
1	Yohana et al., 2022	To analyze the dental caries experience in stunting children with also a history of neonatal stunting	0-59 months old	Indonesia	There was no appreciable differences in the decayed, extracted, and filled teeth (def) among any of the four groups until age 3 yr. Decay, missing, and filling teeth (Dmft) was in the intermediate category at baseline and fell into the high category (5.16) at 1-year follow-up. When compared to the other three groups, children stunted and wasted at infancy displayed a considerably higher number of def at age 4.

Discussion

Oral cavity is thought to be a reflection of one's nutritional state (5). According to the findings of this research, stunted children had a much greater incidence of dental caries than healthy children. Immunological deficits brought on by undernutrition are a significant element in the etiology of chronic multifactorial infectious illnesses (4). One of the reasons that may contribute to the high number of caries in underweight children is reduced the level of salivary flow, which might lead to carious diseases in primary dentition stage (14). Reduced salivary buffering, components, self-cleansing, antisolvent, and antibacterial properties can result from salivary gland atrophy (1). It may also have an impact on how debris and calculus develop in teeth (15). In addition, low levels of vitamins A and D, a lack of protein, and deficiencies in other micronutrients like vitamins, zinc, and iron all seem to have an impact on how effective saliva is at preventing dental caries (13). Protein in saliva also serves a variety of purposes because it can both benefit and harm the host (16). Untreated dental caries and the symptoms that result from it, such as dental discomfort and oral infection, can have a direct or indirect impact on a child's nutritional condition, resulting in underweight, malnutrition, and growth failure (17).

Dental caries can interfere with chewing ability and lead to poor oral hygiene (OH) and tooth morphology, which can diminish nutritional intake and impair immunological function (18).

Before age three, there were no appreciable variations in any of the four groups' tooth def (decayed, extracted, and filled) counts. When compared to the other three groups, children with stunting and wasted children at infancy displayed a considerably higher def at age 4. This longitudinal study has demonstrated that a single episode of moderate malnutrition in an infant or child under the age of one results in increased susceptibility to dental caries three to four years later, possibly as a result of a negative impact on the early development of tooth enamel (19). According to an examination, significantly, a high plaque index was discovered in children with stunted growth when compared to the well-nourished group (6). Dental caries were more common in stunted children than in their nourished counterparts, and vice versa in children with underweight and wasted children, however only stunted and wasted children were shown to have a significant dental caries experience (dmfs) (6). Compared to children stunted and underweight, those wasted had the highest caries experience (dmfs) (6). The higher rate of dental caries in the stunted group may be explained by the fact that chronic malnutrition had a longer-lasting effect on tooth emergence than acute starvation, which meant that caries would manifest later in life (6). The dental caries experience in hypoplastic children with a history of neonatal developmental delay begins in the first year of life (1).

Early starvation episodes can increase a person's susceptibility to dental caries because of odontogenesis abnormalities, delayed tooth eruption, and changes to the salivary glands (14). In addition, inadequate nutrition may result in dental caries due to poor oral health and hygiene practices, including inappropriate or infrequent brushing and mother-child bacterial transmission (13). There is a significant difference in the level of dental caries in normal and stunting children (P=0.001) in Tamalanrea Community Health Center, Tamalanrea Subdistrict, Makassar City (20). Among Peruvian children, over the 3.5 yr of follow-up, the stunted children experienced more dental caries than healthy kids (4). Due to its effects on the development of enamel and children's chewing abilities, undernutrition can also result in tooth decay. Additionally, undernourished children frequently have poor appetites, consume little portions of food, or eat slowly. To help their children's appetites, parents may give them foods that are high in sugar (13). In particular, inadequate nutrition during the first 1000 days of infancy might result in stunting and a higher risk of caries (20).

In several country like Cambodia, Indonesia, Laos and other study in China also show an association between malnourished children and primary caries (10,13). These studies showed a positive and significant correlation between the incidence of severe dental caries and undernutrition, as evaluated by the prevalence of stunting (10,13). Children who were underweight had a mean amount of decaying teeth that was 60% higher and a mean amount of PUFA/PUFA that was 2.8 times greater than children who had appropriate nutritional status (17). The variables include socioeconomic traits, sedentary habits, and psychosocial issues. However, it was not connected to the results of dental caries. Financial resources and bad behavioural choices, such as consuming a lot of sweets, increase the risk of dental caries (17). Early longitudinal studies, however, revealed a correlation between dental caries and undernutrition in low-income or developing nations because of poor living conditions, restricted access to dental healthcare services, poor oral hygiene, and uneducated parents (13).

The results of the Fit for School project are in contradiction to those of the LCA analysis. Stunted malnutrition was more common in 8 to 10-year-old children who had more severe dental caries (7). The timing of the exposure to dental caries, the stage of dental development, and the lag time for the onset of stunting in children may all help to explain the divergent findings between the current analysis and the prior analysis (7). The odds of developing chronic malnutrition were

nearly doubled in children with severe dental caries, according to a secondary study of longitudinal data in Cambodian children under the age of 2 at baseline and one year later at follow-up (8). Since severe dental caries can impair food intake, leading to malnutrition and an increased risk of infections, and finally in underweight, the direct impacts are related to oral functional limits (17). Due to pulpitis and severe caries, chronic inflammation may have an impact on growth through immunological and metabolic processes (10). The discomfort brought on by dental caries might disrupt sleep, which in turn affects glucocorticoid synthesis and growth (18). Interleukin-1 is one of the inflammatory cytokines that can decrease erythropoiesis, which in turn can suppress erythrocyte formation and hemoglobin levels, resulting in chronic anemia (10). The term "indirect effects" refers to how the body reacts to tooth discomfort and mouth infection through endocrine and metabolic changes, such as a child's appetite fading and reduced food intake (17).

Conclusion

There is a close correlation growth stunting and caries because of a decrease in the composition of saliva and defects in tooth formation in children who suffered stunting. On the other hand, there were oral functional limitations and a decrease in food intake since severe dental caries. This study only discusses the association between stunting and dental caries specifically using the index of DMFT and PUFA, it is different from other studies that might discuss more about the association between general oral health and stunting.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

Source of Funding

There is no supported funds, grants, or other support received for this study.

Conflict of interest

None

References

1. Yohana S, Indriyanti R, Suryanti N, Rahayuwati L, Juniarti N, Setiawan AS (2023). Caries Experience among Children with History of Neonatal Stunting. *Eur J Dent*, 17(3):687-692.
2. Asriani R, Ode Salma W, Jurusan Kesehatan Masyarakat P, Halu Oleo U (2022). Analisis Faktor Risiko Kejadian Stunting Pada Anak Baduta (6-24 bulan) Di Wilayah Kerja Puskesmas Mowila. *Nurs Updat J Ilm Ilmu Keperawatan*,13(3):115–22.
3. Abdat M, Usman S, Chairunas C, Suhaila H (2020). Relationship between stunting with dental and oral status in toddlers. *J Dentomaxillofacial Sci*, 5(2):114-119.
4. Delgado-Angulo EK, Hobdell MH, Bernabé E (2013). Childhood stunting and caries increment in permanent teeth: A three and a half year longitudinal study in Peru. *Int J Paediatr Dent*,23(2):101–9.
5. Badruddin IA, Muthia K, Darwita RR, et al (2021). Relationship between Oral Health Status and Stunting in 5-Year-Old Children in Indonesia. *J Int Dent Med Res*,14(3):1039–43.
6. Omer Muhammad N, Ali Al-Obaidi D, Mohammad Amen D (2015). Prevalence of dental caries, gingival status, and enamel defect and its relation to nutritional status among kindergarten children in Sulaimani city. *IOSR J Dent Med Sci Ver II,* 14(12):2279–861.
7. Turton B, Chher T, Hak S, et al.(2022). Associations between dental caries and ponderal growth in children: A Cambodian study. *J Glob Health*,12:04046.
8. Renggli EP, Turton B, Sokal-Gutierrez K, et al.(2021). Stunting malnutrition associated with severe tooth decay in cambodian toddlers. *Nutrients*, 13(2):290.

9. Javed F, Feng C (2017). Incidence of early childhood caries : A systematic review and meta- analysis. *J Investig Clin Dent,* 8(4). doi: 10.1111/jicd.12238.
10. Dimaisip-Nabuab J, Duijster D, Benzian H, et al (2018). Nutritional status, dental caries and tooth eruption in children: A longitudinal study in Cambodia, Indonesia and Lao PDR. *BMC Pediatr*, 18(1):300.
11. Setijanto D, Alkadasi Ba, Nurrobi Law, et al (2023). Caregiver perception of children s dental caries and experience of accessing dental health services for their children. *Brazilian Dent Sci*,26(2):e3749.
12. Setijanto D, Ramadhani A, Olivia KL, et al (2020). Dental pain among children and adolescents. *Syst Rev Pharm*,11(5):616–8.
13. Shen A, Bernabé E, Sabbah W (2020). Undernutrition is associated with change in severe dental caries. *J Public Health Dent*, 80(3):236–43.
14. Vieira KA, Rosa-Júnior LS, Souza MAV, et al (2020). Chronic malnutrition and oral health status in children aged 1 to 5 years: An observational study. *Medicine (Baltimore)*, 99(18):e19595.
15. Abdat M, Chairunas C. (2022) Analysis of Status of Oral Stunting in Toddlers and Its Relationship with Mother's Parenting. *Proc 2nd Aceh Int Dent Meet 2021 (AIDEM 2021)*.;48(Aidem 2021):122–7.
16. Sadida ZJ, Indriyanti R, Setiawan AS (2022). Does Growth Stunting Correlate with Oral Health in Children?: A Systematic Review. *Eur J Dent*, 16(1):32–40.
17. Rego IN, Cohen-Carneiro F, Vettore MV, et al (2020). The association between nutritional status and dental caries in low-income children: A multilevel analysis. *Int J Paediatr Dent*, 30(5):607–18.
18. Setijanto D, Bramantoro T, Anggraini ND, et al (2020). The correlation analysis of dental caries, general health conditions and daily performance in children aged 2–5 years. *Dent J*, 53(3):122–5.
19. Alvarez JO, Caceda J, Woolley TW, et al (1993). A longitudinal study of dental caries in the primary teeth of children who suffered from infant malnutrition. *J Dent Res*, 72(12):1573–6.
20. Achmad H, Handayani H, Singgih MF, et al (2020). Analysis of dental caries & gingivitis with the occurrence of stunting in children in Makassar city (Tamalanrea subdistrict). *Syst Rev Pharm*, 11(6):371–6.