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Scoping Review

The Association of Neonatal Stunting Undernutrition With Early Childhood Dental Caries

[1]Dewa Made Wedagama, [2]I Gusti Ayu Ari Agung, [3]Ilma Yudistian, [4]Ni Putu Idaryati, [5]I Gusti Agung Ayu Hartini, [6]Ni Putu Widani Astuti, [7]Dewi Farida Nurlitasari

[1,3,5]Conservation Dentistry Department, Faculty of Dentistry Universitas Mahasaraswati Denpasar, Indonesia
[2,4]Public Dental Health and Prevention Department, Faculty of Dentistry, Universitas Mahasaraswati Denpasar, Indonesia
[6]Department of Pediatric Dentistry, Faculty of Dentistry, Universitas Mahasaraswati Denpasar, Bali, Indonesia
[7]Prosthodontics Department, Faculty of Dentistry, Universitas Mahasaraswati Denpasar, Indonesia

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ABSTRACT

Introduction: Early childhood dental caries (ECDC) is a major public health problem affecting up to 90% of children worldwide and is related to diet and nutrition. Early childhood undernutrition, including fetal stunting, and stunting, is a global problem. Undernutrition in neonatal stunting could be the cause associated with ECDC. This scoping-review aims to understand the linkage mechanism behind neonatal stunting undernutrition to ECDC. This concept is expected to generate further research to help prevent both growth, stunting undernutrition and ECDC.

Review: This study uses the PRISMA method, with the steps: (1) Question framework (literature study); (2) Search for articles in databases (on PubMed, ProQuest, Google Scholar), and journal data bases with articles published from 2017 to 2024; (3) Selection of relevant research; (4) Data extraction; (5) Synthesis with narrative method. The study obtained 5 articles to be reviewed, proving that pregnant women who experience chronic undernutrition (mainly deficiency of protein, vitamins A, B, C, D, E, minerals Fe, Ca, P and Zn), will contribute to giving birth to undernutrition stunting neonatal, with severe ECDC in 1 article; 1 articles analyzing the strong relationship between chronic neonatal stunting undernutrition with enamel hypoplasia, low quality and rate of saliva, an important cause of ECDC; and 3 article analyzing the neonatal stunting undernutrition is associated with severe ECDC.

Conclusion: Chronic undernutrition in pregnant women and subsequent neonatal stunting significantly contribute to the risk of severe ECDC.

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Corresponding Author:
I Gusti Ayu Ari Agung
Public Dental Health and Prevention Department
Faculty of Dentistry, Universitas Mahasaraswati Denpasar, Indonesia
Email: ayuariagung@unmas.ac.id

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INTRODUCTION

Early Childhood Dental Caries (ECDC) is the most common non-communicable disease and most commonly attacks children in the world.[1] Global Burden of Disease 2017 data estimated that over 530 million children worldwide are affected by ECDC.[2] The results of Basic Health Research state that the prevalence of ECDC in Indonesia is still very high, namely around 93% .[3] ECDC is defined as the presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a preschool child between birth and 71 months of age. In children younger than 3 years of age, any sign of smooth-surface caries is indicative of severe early childhood caries (S-ECDC).[4]

The World Health Organization (WHO) states that stunting in Indonesia is still high.[5] The decline in the prevalence of stunting has been slow in the last ten years.[6] Stunting is the main cause of morbidity and death due to malnutrition in children.[7] Supported by data from research results, the prevalence of stunting in children under five in Indonesia remains high.[3] Stunting is chronic malnutrition characterized by short stature, measured by height indicator for age (HAZ). This parameter assesses linear growth in children under two years old years of age to determine stunting status. According to WHO, stunting is when the child's height is below two standard deviations (SD) from the median growth standard.[5] The Ministry of Health of the Republic of Indonesia declared that the prevalence of stunting in Indonesia reached 29.6% in 2017,[6] exceeding the threshold set by the World Health Organization (WHO) of 20%.[5] Supported by data from Basic Health Research, the prevalence of stunting among children under five in Indonesia remains significantly high.[3] Stunting is a condition of malnutrition in children from the womb to the early life stage that causes growth failure in the body and brain. Stunting influences the development and integrity of the oral cavity and increases the risk of developing diseases in the oral cavity, such as dental caries.[8]

Neonatal stunting, also known as stunting at birth, is a type of chronic malnutrition experienced by children, mainly related to prenatal malnutrition that persists and continues into the following years.[9] The main cause of neonatal stunting malnutrition is long-term nutritional deficiency or reduced nutritional intake, which results in stunted development and delayed growth. The research results report that there is a significant relationship between the presence of early childhood caries in neonatal stunting malnutrition. This occurs because the salivary glands in neonatal stunting malnutrition experience atrophy, causing a decrease in salivary secretion.[10] This scoping review investigates the association between neonatal stunting due to undernutrition and the development of ECDC, aiming to elucidate the mechanisms involved and propose directions for future research

REVIEW

This study uses the PRISMA method,[11] with the following steps: (1) Frame questions from case studies and literature; (2) Run a search (on PubMed, ProQuest and Google Scholar), with articles published from 2017 to 2024; (3) Selection of relevant articles; (4) Data extraction; (5) Synthesis of the results with the narrative method. Search articles using the keywords “Early childhood caries”, “Neonatal”, "Stunting, “Undernutrition”. The way to use keywords is the “Boolean searching” method,[12] namely “Stunting neonatal AND undernutrition AND caries”.

The articles selected in this review were based on the following inclusion criteria: studies conducted in humans, subjected to stunting neonatal undernutrition, published in the last 7 years between May 2017 and May 2024, and published in English, available in full text. All of the unmatched articles were excluded from the study. The search was adjusted according to the inclusion category, the articles suitable for this study were: (1) objectives: neonatal stunting undernutrition, (2) results: the association of neonatal stunting undernutrition with early childhood dental caries, (3) research methods: systematic literature review, qualitative and quantitative, (4) research written in English, and (5) free full text available. While the exclusion criteria were articles that

were not suitable for this study were: (1) purpose: babies over 1 years old, (2) outcome: not the association of neonatal stunting undernutrition with early childhood dental caries, (3) research method: in outside the systematic literature review, qualitative and quantitative (4) research written outside English, and (5) free full text is not available.

The search results for articles in the database, namely PubMed, ProQuest, and Google scholar, have identified 224 articles, consisting of 1 cohort article, 2 cross-sectional article, and 2 systematic literature review articles, from 2 countries, namely Indonesia and Equador. The PRISMA flow diagram for selecting articles is shown in Figure 1.

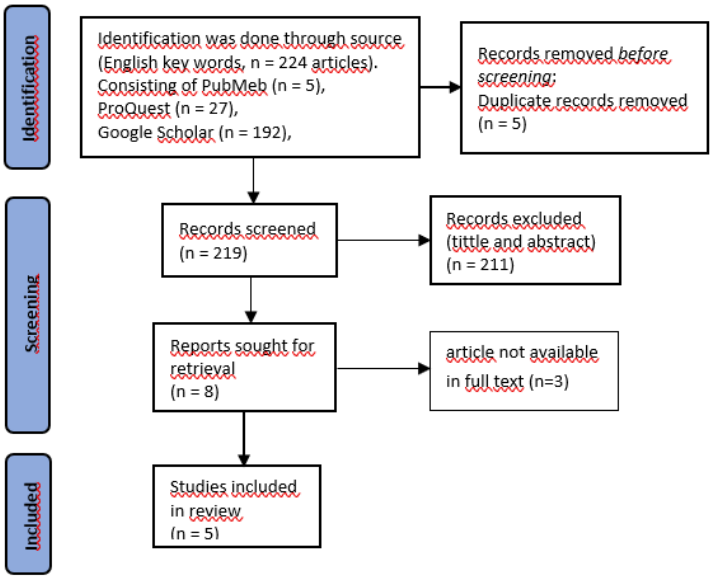

Figure 1 The PRISMA flow diagram for selecting articles

The selection results of the 5 articles reviewed proved that pregnant women who are chronically undernutrition will give undernutrition stunting neonatal, with severe ECDC in 1 article; 1 article analyzing strong association between chronic neonatal stunting undernutrition with enamel hypoplasia, low quality and rate of saliva, an important cause of ECDC; and 3 articles analyzing the neonatal stunting undernutrition is associated with severe ECDC. A summary of research article search results on association of neonatal stunting undernutrition with ECDC is presented in Table 1.

Table 1 Summary of Search Results Research Articles

No	Author and Reference	Methods	Results/Conclusions
1	Setiawan et al. (2022)[13]	Systematic review	Pregnant women who experience chronic undernutrition (mainly deficiency of protein, vitamins A, D, minerals Fe, Ca, P and Zn), will contribute to giving birth to undernutrition stunting neonatal, with severe ECDC.
2	Yohana et al. (2023)[15]	Cohort	There is a strong association between chronic neonatal stunting undernutrition (mainly deficiency of the micronutrients Fe, Zn and vitamin A) with enamel hypoplasia, low quality and rate of saliva, an important cause of ECDC
3	Aulia et al. (2023)[20]	Systematic review	Neonatal stunting undernutrition is associated with severe ECDC
4	Folayan et al. (2020)[21]	Cross-sectional	Neonatal stunting undernutrition is associated with severe ECDC
5	So et al. (2017)[22]	Cross-sectional	Neonatal stunting undernutrition is associated with severe ECDC

This study is the first rapid review to identify the association between neonatal stunting undernutrition and ECDC in developing countries. The review analyzed five key studies, each contributing to a comprehensive understanding of how maternal and neonatal nutrition impacts ECDC. The findings can be elaborated as follows:

Impact of Maternal Undernutrition on Neonatal Health: One study highlighted that chronic undernutrition in pregnant women, particularly deficiencies in protein, vitamins A and D, and minerals such as Fe (iron), Ca (calcium), P (phosphorus), and Zn (zinc), can lead to neonatal stunting. This stunting is closely associated with severe ECDC in infants. Maternal nutrition directly influences fetal development, and deficiencies can have long-lasting effects on a child's dental health.[13] According to the authors, maternal nutrition significantly affects fetal growth, especially in developing countries.[14] This is confirmed by research results that the majority of stunted neonates are born to mothers who experience chronic undernutrition.[9]

Chronic Neonatal Stunting and ECDC: Another study demonstrated a strong relationship between chronic neonatal stunting and the development of enamel hypoplasia.[15] Enamel hypoplasia, characterized by defective enamel formation, results in teeth that are more vulnerable to decay. Enamel hypoplasia results from nutritional deficiencies during critical periods of tooth development. Essential nutrients like vitamins A and D, and minerals such as calcium and phosphorus, are necessary for proper enamel formation. Without these nutrients, enamel is poorly formed and more susceptible to decay. This condition creates an environment conducive to the rapid progression of dental caries. This condition can also reduce the quality and quantity of saliva, a crucial factor in oral health, thereby increasing the risk of ECDC.[10] According to the authors, there is a significant positive correlation between ECDC and iron deficiency anemia.[16,17] The risk factor for ECDC is host susceptibility (immunity) due to chronic vitamin C deficiency, and an additional factor is enamel damage.[18,19] Adequate nutrition is essential for a robust immune system. Nutritional deficiencies can impair immune function, reducing the body's ability to fight off infections, including those causing dental caries. A compromised immune system in undernourished children means that their bodies are less capable of combatting the bacteria responsible for dental caries, leading to higher rates of severe ECDC.[19]

Severe ECDC and Nutritional Deficiencies: Three studies consistently showed that neonatal stunting due to chronic undernutrition correlates with severe ECDC.[20,21,22] This relationship underscores the critical role of adequate prenatal and neonatal nutrition in preventing dental caries. Children born to undernourished mothers are at a higher risk of developing severe dental caries due to compromised dental structures and immune function.[19] According to the authors, there is a vitamin D deficiency may be a potential risk factor for ECDC,[23,24,25] because the salivary glands experience atrophy, causing a decrease in salivary secretion, so that it has a low salivary condition causing low self-cleaning power. This is the main factor that triggers caries.[9,10] Malnutrition in neonatal stunting can also be a cause related to ECDC, because teeth begin to form during the mother's pregnancy. Defective intrauterine formation of primary tooth enamel in malnutrition pregnant women.[13] According to the authors, there is a nutrient deficiencies such as vitamins A, B , C, D, E in clinical and experimental studies lead to impaired tooth growth and development.[9,10] Vitamin D deficiency leads to a decrease in mucosal immunity of the oral cavity, the multiplication of pathogenic microorganisms, which in turn, releasing various metabolites, including cytokine-like substances, aggravate the pathological process and intensify carious lesions.[26]

The findings of this scoping review have significant implications for public health strategies aimed at reducing the prevalence of ECDC. To address this issue, interventions should focus on improving maternal and neonatal nutrition through a multifaceted approach:

Nutritional Education. Educating pregnant women about the importance of a balanced diet rich in essential vitamins and minerals can help prevent undernutrition and its associated risks. Nutritional education programs should emphasize the critical nutrients needed during pregnancy and their impact on fetal development and oral health. The research results confirm that nutritional education for parents can make a significant difference in preventing ECDC.[17]

Supplementation Programs. Implementing supplementation programs for at-risk populations can ensure adequate intake of critical nutrients during pregnancy and early childhood. Providing supplements such as multivitamins, iron, calcium, and zinc can help

mitigate the risks associated with maternal undernutrition. According to the authors, it is important to note that patients reported to be vitamin D deficient are increasing among children, therefore adequate vitamin D levels should be considered during pregnancy, as one of the strategies for preventing ECDC.[23] Findings indicate that shortages in vitamins A and D lead to enamel issues and a higher susceptibility to dental diseases, vitamin E assists in treating oral mucositis. Deficits in B and vitamin C result in enamel hypomineralization and soft tissue ailments, including aphthous stomatitis and gingival petechiae. Additionally, a lack of vitamin B compromises the immune response, increasing oral candidiasis risk. Therefore, vitamin deficiencies markedly affect children's oral health, highlighting the need for joint efforts between dental professionals and caregivers for effective pediatric care. Addressing vitamin deficiencies through supplementation and tailored dental care emphasizes the significance of nutritional health in children's overall and dental well-being, advocating for a collaborative approach to achieve optimal health outcomes.[18]

CONCLUSION

This scoping review highlights a clear association between neonatal stunting due to undernutrition and the development of ECDC. Chronic undernutrition (mainly deficiency of vitamins A, B, C, D, E, and minerals Fe, Ca, P, Zn) in pregnant women and subsequent neonatal stunting significantly contribute to the risk of severe ECDC. Addressing maternal and neonatal nutrition is therefore crucial in preventing ECDC and promoting overall child health. Public health strategies should focus on improving nutritional education, implementing supplementation programs to mitigate the impact of undernutrition on dental health.

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