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LITERATURE REVIEW

Stunting and Periodontal Disease

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Abstract
Background: Stunting is a condition where a child's height is insufficient for their age. Stunting in children under the age of five, which can be caused by chronic malnutrition, poses a danger of death. **Objective:** Stunting may be impacted by poor oral and dental health. This study will investigate how the prevalence of stunting is affected by periodontitis. **Discussion:** Periodontal disease can have an impact on pregnant women's fetal growth such as premature birth and low birth weight babies both directly and indirectly. Subsequently, premature babies can increase the risk of stunting. The identification of changes in bacterial variations between stunted and unaffected children was one of the reasons for stunting. Oropharyngeal bacteria, such as *Porphyromonas gingivalis* usually found in severe periodontitis, were detected in pregnant women which is likely to disrupt the host's immune homeostasis. Disorders in pregnant women can interfere with the process of tooth development in the fetus. **Conclusion:** Stunting may have a negative impact on dental and oral health, and vice versa. Periodontitis may increase the risk of adverse pregnancy outcomes which could ultimately enhance the risk of having children born stunted.

Keywords: Stunting, Periodontitis, Pregnancy

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INTRODUCTION

Children's natural growth and development are impaired by stunting. The stunting condition in children is characterized by a length or height that is smaller than their age. The WHO defines this condition as a length or height that is less than the median standard of growth for children, plus or minus two standard deviations. Stunting may result from direct factors like inheritance from people who are shorter or early-life events like inadequate nutrition, recurrent illnesses, and insufficient psychosocial stimulation. Direct causes include heredity from individuals who are shorter comparing the average high.[1, 2]

In Indonesia, the prevalence of stunting is relatively high, exceeding the WHO limit of 20% by 27.67% in 2019.[1, 3] 155 million children under the age of five are affected by stunting worldwide, or 25% of all children.[4] WHO data showed that Indonesia's 2020 stunting rate is 31.8%, higher than the region's average of 27.4% for Southeast Asia.[5]

Many variables, including socioeconomic circumstances, maternal nutrition during pregnancy, illnesses in infancy, and inadequate nutritional intake in infants, can contribute to malnutrition. Stunted children have a lower chance of surviving, are more likely to get sick or infected, lose their ability to learn, and perform poorly in school.[6] Stunted children may not grow to their full potential as adults and may struggle to develop physically, mentally, and productively, which causes them to become socially and economically unproductive adults.[3, 7] Stunting is essential because it is typically irreversible, meaning that if a child is short, he cannot grow to his full height like those who are underweight do when they reach their normal weight.[2] Long-term studies have established a connection between stunting and dental health, showing that both conditions might affect one other. Stunting has negative effects on dental and oral health, including higher dental caries risks, delayed tooth eruption, and poor oral hygiene.[8-10] However, poor oral and dental health may also contribute to stunting. For instance, severe dental caries might result in malnutrition because it makes it harder to chew. Through the influence of pregnant women, dental and oral health has an impact on the prevalence of stunting as well. Pregnant women who have periodontal tissue disease are reported to experience poorer fetal growth. The risk of premature birth and low birth weight (LBW) newborns can increase in cases of severe periodontitis. LBW or prematurely born infants, however, are at risk of stunting.[11] The relationship between periodontitis and stunting has not been well studied, so this study will also look at how periodontitis impacts the prevalence of stunting in conjunction to the relationship between stunting and oral health.

DISCUSSION

Stunting and Dental Health

Dental caries that affects milk teeth in children younger than six years old are referred to as early childhood caries (ECC). These kids' severe caries may constrain their development, growth, and general well-being. If left untreated, this ECC will deteriorate the infant teeth's condition, causing pain in the mouth and interfering with eating and sleeping. The same etiological variables that cause malnutrition also cause early childhood caries, such as bad eating habits (cariogenic food), insufficient food intake, and low socioeconomic status.[12, 13] The risk of developing chronic malnutrition is doubled in cases of severe caries, according to studies from Nigeria and Cambodia.[14, 15] Studies on ECC and malnutrition with a larger country population resulted in distinct findings, demonstrating that ECC was more closely related to obesity and anemia than stunting.[15]

Research on kids aged 0-59 months revealed the impact of stunting on milk teeth. The findings demonstrate that, as compared to children who are not stunted, the eruption of milk teeth can be delayed.[16] Apart from having an impact on milk teeth, stunting can also cause a delay in the eruption of the permanent premolars compared to children who are not stunted [8]. Future

stunted boys also face the risk of getting fewer teeth than non-stunted kids, but this is not the case for girls.[17]

The effect of stunting on children's teeth also occurs in the incidence of dental caries. Long-term studies in Peru have shown that stunting is a significant caries risk factor in permanent teeth independently of any known caries risk factor.[9] This relationship can go both ways because children with severe dental caries are associated with slower child growth as a contributing factor to stunting.[18] Stunted or less than normal growth is associated with untreated dental caries and delayed eruption of permanent teeth is seen in Cambodian, Indonesian and Lao children. These findings confirm the role of dental health in the overall growth and development of children.[19] The mechanism between dental health and stunting is presented in Figure 1.

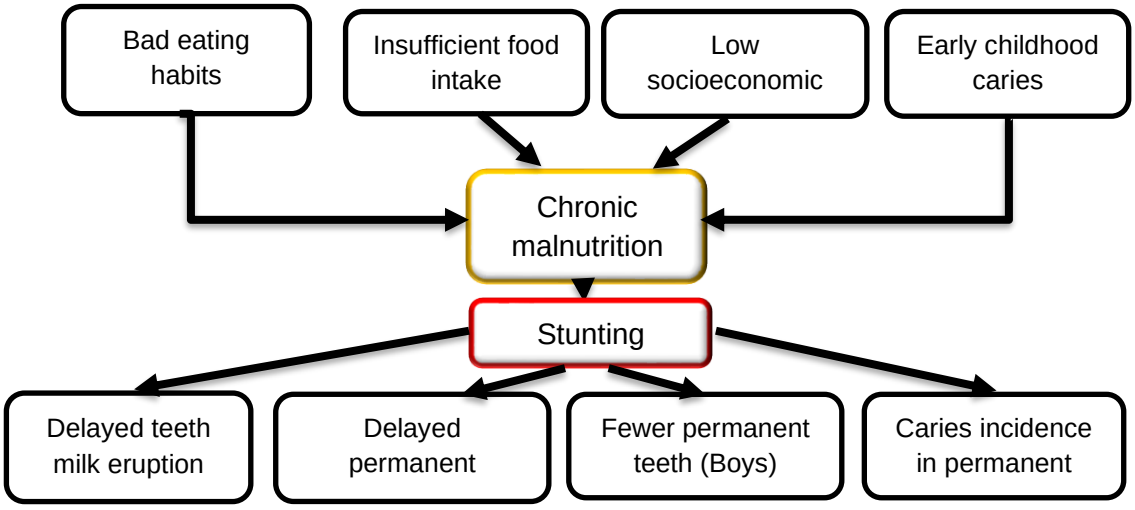

Figure 1. The effect of stunting in dental health and vice versa

Periodontitis and Pregnancy

Fetal growth might be affected by malnutrition during the pregnancy. There is a critical need for nutrition to promote rapid growth and development. Moreover, recurrent infections or long-term illnesses can restrict or impair a child's growth throughout the first two years of life.[7] Pregnant women with poor oral and dental health disorders like periodontitis run the risk of having premature babies or babies with low birth weight. Offenbacher et al. explored the connection between the two in 1996 and found a significant link between periodontitis and an adverse pregnancy outcome (OR 7.9).[11]

A chronic inflammatory condition known as periodontal disease damages the teeth supporting tissues. Gingivitis, which is periodontal disease that only affects the gingiva, is treatable or reversible if detected early. Periodontitis, an irreversible condition marked by edema and bleeding in the gingiva, loss of gingival attachment, and destruction of the alveolar bone can lead to tooth loss. Periodontal disease is generally caused by plaque releasing substances that can trigger the inflammatory mechanisms associated with preterm birth. The association of periodontal disease with the incidence of unwanted pregnancies shows a relationship between the two.[20] Periodontal disease is a risk factor for premature birth, low birth weight babies, pre-eclampsia, and premature and low birth weight babies. The mechanism can occur due to the migration of bacteria from the periodontal tissue into the blood circulation thereby stimulating the production of inflammatory mediators which are responsible for the timing of birth.[21, 22]

Periodontal disease is associated with chronic gram-negative infection of the periodontal tissues which results in long-term increases in pro-inflammatory cytokines and prostaglandins and increases in these inflammatory mediators at the systemic level. Periodontal disease has the potential to negatively impact babies. Direct mechanism occurred when bacterial interference with the amnion which may lead to premature birth and low birth weight babies.[23]

Pregnancy and Stunting

Stunting risk can be increased by premature birth, low birth weight, fetal growth retardation, or intrauterine growth restriction (IUGR).[24-26] Stunted fetuses have a 4.2-fold increased risk of being stunted between the ages of 3 months and 2 years.[27] The odds ratio (OR) for stunting is 4.98 (3.76–6.55) for small for gestational age and premature birth.[28]

According to research conducted in Banten, LBW is a predictor of stunting in children under the age of five.[29] According to this research, there is a connection between LBW and stunting, which was also discovered in Ethiopia and Lampung.[30, 31]

Stunting and Periodontitis

The first study which indicates the relationship between height and inflammation and periodontitis, investigated by Meisel et al. in 2007. Those individuals who are born with a high susceptibility to infections and inflammatory disorder may suffer from diseases in childhood that can impair height. In adulthood, growth becomes stagnant and the individual's susceptibility for inflammation remains. Smaller (shorter) people are more likely to develop severe periodontitis.[32]

The difference in bacteria between stunted and normal children may contribute to the mechanism for stunting. Oro-pharyngeal species were discovered in the stomach or duodenum and feces of stunted children, according to microbial investigation on the upper gastrointestinal tract in 2–5-year-old sub-Saharan African children. The bacterium *Porphyromonas gingivalis*, which is found in pregnant women, is one of these oropharyngeal bacteria.[4] In addition to other bacteria that may be present in periodontitis patients, such as *Aggregatibacter actinomycetemcomitans*, *Fusobacterium nucleatum, Tannarella forshythia, Prevotella intermedia*, and *Treponema denticola, Porphyromonas gingivalis* bacteria are frequently identified in these individuals. *Porphyromonas gingivalis* plays a significant role in the pathogenesis of periodontitis by disturbing the host's immunological homeostasis, which is caused by oral microbial dysbiosis.[20, 33]

Research evidence suggested that specific bacterial counts are associated with malnutrition or poor growth in the first 1000 days. During pregnancy, lower bacterial diversity and rich Lactobacillus microbiota were found to be high in normal pregnancies, while more diversity was found for *Prevotella spp, Gemella spp* and *Corynebacterium* bacteria which were associated with smaller baby length relative to gestational age. Periodontitis is one of the factors that play a role in pregnant women who are malnourished compared to healthy pregnant women.[34] The proposed mechanism between periodontitis and stunting is presented in Figure 2. Environmental factors can affect tooth development and subsequent tooth eruption during the early, critical (prenatal) phases, according to empirical research on the relationship between pregnancy and dentition. In most cases, tooth development begins between six and eight weeks after conception. The mineralization of baby and permanent teeth occurred before and after birth. The canines and first premolars are susceptible during the first postnatal year, whereas the second premolars and molars are susceptible 2 or 3 years later. Malnutrition during this period can cause stunting and tooth decay and delay tooth eruption.[17]

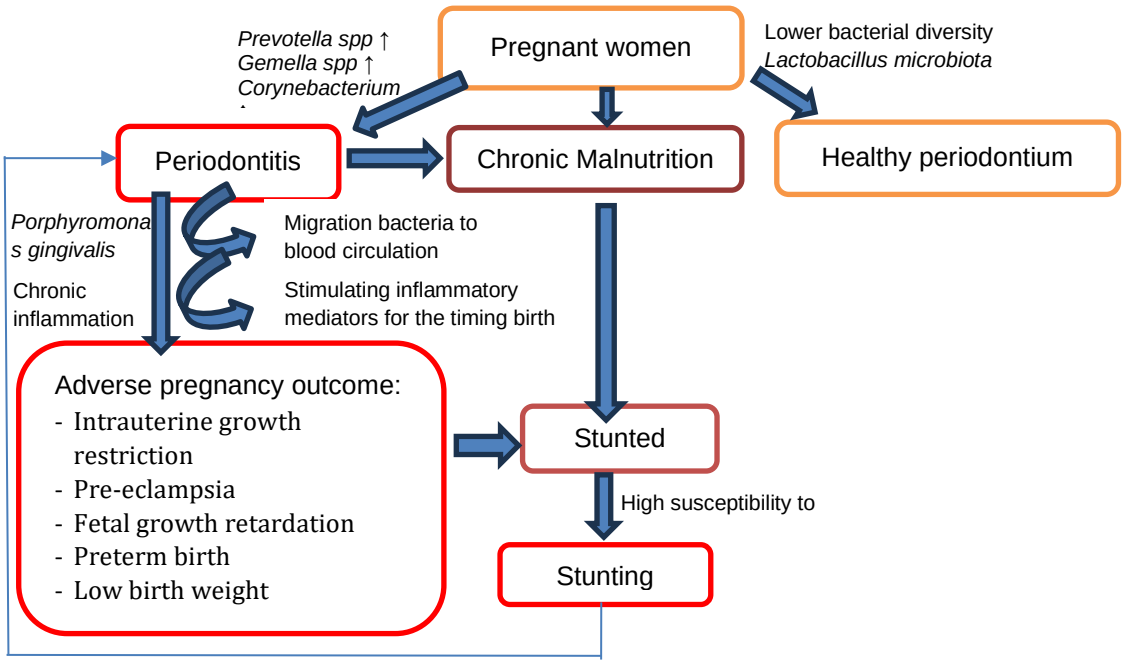

Figure 2. Proposed mechanism of periodontitis in pregnant women and stunting

Stunting Prevention with Dental and Oral Care

By 2025, the WHO hopes to reduce stunting in children under the age of five by up to 40%.[35] Dental treatment for children and pregnant women can help lower the incidence of stunting. Pregnant women receive treatment to ensure that there are no recurring infections which might damage the developing fetus. Studies on the relationship between the risk of IUGR and periodontal treatment performed right after delivery have shown that, as compared to pregnant women without periodontitis, the risk of IUGR is much higher when periodontitis is present and untreated during pregnancy.[36]

Periodontal treatment during the second trimester of pregnancy, shows a reduced risk of adverse events in pregnancy.[37] C-reactive protein levels were statistically lower after periodontal therapy in the second trimester. This treatment is not only safe for the fetus and mother but also beneficial for pregnancy and embryo-fetal development, thereby reducing morbidity and mortality in preterm fetuses.[38] However, the effectiveness of preventing periodontal disease in pregnant women cannot be fully determined, because the success of treatment is also determined by the criteria for diagnosing periodontitis, microbial composition, disease severity, treatment strategy, treatment efficiency and the right time during pregnancy, so further multicenter research is needed.[39] Moreover, periodontal disease and adverse pregnancy, share the same risk factors such as smoking, poor social status, diabetes, obesity and others which cannot be eliminated by periodontal treatment alone.[40]

CONCLUSION

Dental and oral health is related to stunting and stunting can also affect dental and oral health. Stunting can cause delays in the eruption of milk and permanent teeth, reduce the number of permanent teeth, and increase the risk of caries. On the other hand, severe dental caries has a risk of stunting. Pregnant women with periodontitis have the risk of having babies who are premature, have low birth weights, or are susceptible to infection because of their condition.

Susceptibility to infection in childhood can lead to stunting. In addition, growth and development restriction can also affect the development of milk and permanent teeth. By avoiding periodontitis and ensuring that pregnant mothers' teeth and gingiva are healthy, we can reduce the likelihood of birth defects indirectly.

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