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Relationship Between Stunting and Dental Caries in Children at Working Area of the I Ulu Health Center Palembang

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ABSTRACT

Background: Stunting is a condition where the body length or height of the child is not appropriate for their age. Dental caries is a multifactorial disease that affects dental hard tissue starting with the process of demineralization of the tooth layer. Stunting can disrupt oral cavity development, leading to dental caries in children due to decreased salivary flow and pH and tooth structure abnormalities.

Method: This research was an analytical observational study with a cross-sectional design. Samples were selected by purposive sampling, consisting of 32 children who met the inclusion criteria. Data were collected through clinical examinations using the def-t index for dental caries in children, and children's height was obtained from secondary data at the I Ulu Health Center Palembang. Data were analyzed using SPSS with the chi-square test.

Results: The results of measurements with def-t index in severely stunting child showed 4.8, which is higher than the stunting child showed 3.3. The results of the Chi-Square test presented a p-value = 0.028 ($p < 0.05$).

Conclusion: There is a significant relationship between stunting and the number of dental caries in children aged 3-5 years in the working area of the I Ulu Health Center Palembang.

Keywords : Child, def-t, Dental Caries, Stunting

INTRODUCTION

Stunting, or short nutritional status, is a condition in which a child's height does not correspond to their age. This condition is the most common form of malnutrition in children.[1] Stunting Stunting is measured using the height-for-age (HFA) indicator according to the World Health Organization (WHO); the growth standard for children is defined as an HFA z-score of <-2 SD (Standard Deviation). The classification criteria are: non-stunting (z-score 0–1 SD), mild stunting (z-score < -2 SD), and severe stunting (z-score < -3 SD).[2]

The World Health Organization (WHO) reported in 2020 that 22% or approximately 149.2 million of the world's children under five were stunted. Indonesia is the country with the third-highest prevalence of stunting in the Southeast Asia Region (SEAR).[1,3] Results from the 2022 Indonesian Nutrition Status Study (SSGI) indicate a stunting prevalence of 21.6% in Indonesia, with a prevalence of 18.6% in South Sumatra Province, while in Palembang City it reached 14.3%.[4] The results of the 2019 Nutrition Surveillance Dissemination by the

Palembang City Health Office stated that Seberang Ulu I District had 253 cases of stunting, which is above the Palembang City average (219 cases of stunting). This indicates that the stunting situation in Seberang Ulu I District is classified as having a high prevalence, exceeding the average prevalence in Palembang City.[5]

Stunting can lead to developmental disorders in children, including oral cavity disorders such as atrophy of the salivary glands, which causes changes in saliva characteristics such as a decrease in flow rate and pH, as well as dental structural abnormalities such as hypoplasia, making stunted children more susceptible to dental caries.[2] Saliva flow helps with the self-cleaning process in the oral cavity, buffering (maintaining pH balance in the oral cavity), and the remineralization process stimulated by fluoride. If the pH drops below a critical level, the tooth surface begins to undergo demineralization, which is the loss of calcium and phosphate minerals. Over time, when demineralization exceeds remineralization, dental caries lesions develop.[6]

Dental caries is a multifactorial disease that affects the hard tissues of the teeth, beginning with the demineralization of the tooth enamel due to an acidic environment.[7] Four factors generally influence the development of dental caries, which are host factors (tooth), agents (microorganisms), substrate, and time.[8] Stunting is correlated as a host factor associated with the development of caries lesions, particularly in cases of dental structural abnormalities and salivary gland abnormalities. Tooth structural abnormalities, such as hypoplasia, have the potential to make a child's oral cavity cariogenic due to increased demineralization of the thin protective enamel.[9] The assessment of caries experience in permanent teeth uses the DMF-T index (Decayed, Missing, and Filled Teeth), while the index used for primary teeth is the def-t index (Decayed, Extracted, and Filled Teeth).[1,8]

According to 2018 data from the World Health Organization, dental caries in children accounted for 60–90% of cases. The 2018 Riskesdas results indicate that the prevalence of caries among children aged 5 years in Indonesia remains very high, at approximately 92%. The prevalence of dental caries in children in South Sumatra is 45.1%, while the prevalence of caries in Palembang City is 47.17%.[10,7] A study by Abadi et al. states that there is a significant association between stunting and risk factors for caries.[7] A study by Abdat et al. found a significant association between stunting and oral health status among toddlers in Pidie Regency, Aceh.[2] A study by Rahman et al. found an association between stunting and the prevalence of dental caries among students at Kertak Kindergarten in Banjar Regency.[8]

Based on this background, the researchers aim to conduct a study on the relationship

between stunting and dental caries in children at the working area of the I Ulu Health Center, as it is located in the Seberang Ulu I subdistrict, which is one of the subdistricts with a high prevalence of stunting in the city of Palembang, and no previous research has been conducted on this topic.

METHODS

This study is an analytical observational study designed to examine the association between stunting and dental caries in children using a cross-sectional study design. The study was conducted in the working area of the I Ulu Health Center on March 9, 2024.

The study population consisted of children aged 3–5 years who were identified as stunted based on medical records from 2020 to 2023, as per surveys showing 110 stunted toddlers in 2020, 69 in 2021, 41 in 2022, and 42 in 2023. Inclusion criteria: stunted children aged 3–5 years in the working area of the I Ulu Health Center Palembang. Willingness to participate in the study with parental consent. Exclusion criteria: stunted children with a history of systemic disease.

Preparation Phase

The researchers obtained research permits from the Department of Dentistry and Oral Medicine at the Faculty of Medicine, Sriwijaya University, and the 1 Ulu Health Center, and secured an ethical clearance letter issued by the Health Research Ethics Committee of the Faculty of Medicine, Sriwijaya University. The researchers conducted initial data collection at the 1 Ulu Health Center in accordance with the inclusion criteria.

Procedure

The participants' parents completed an informed consent form as a sign of their agreement and willingness to participate in this study. Participants were required to be accompanied by a parent who had provided informed consent throughout the research procedure. The researchers and the team explained the procedure to the participants on the day of the research and instructed them to rinse their mouths first before the examination. The researcher and team washed their hands, put on gloves and masks before and during the examination of the participants, then conducted the def-t index examination using diagnostic tools and recorded the results on the def-t index sheet. Participants were instructed to rinse their mouths after the examination. The used equipment was then transferred to a separate container.

Data analysis in this study utilized univariate and bivariate analyses. Univariate analysis was conducted to determine the frequency distribution of the study subjects based on the study

variables by analyzing the characteristics of the dependent variable. Bivariate analysis was performed to determine the relationship between one variable and another. The processed data were analyzed using the chi-square test to examine the relationship between stunting and the prevalence of dental caries in children.

RESULTS

This study consisted of 32 participants. Based on age, there were 15 participants (46.9%) aged 3 years, which was more than the number of participants aged 4 and 5 years, who numbered 12 and 5, respectively, as shown in Table 1.

Table 1. Frequency Distribution of the Study Sample's Ages

Age	Frequency	Percentage(%)
3 years	15	46.9%
4 years	12	37.5%
5 years	5	15.6%
Total	32	100%

The sample was categorized based on stunting status, and it can be concluded that there were more children with stunting (z-score < -2 SD) than those who were severely stunted (z-score < -3 SD) (Table 2). Based on the results of the def-t index examination of stunted children in Table 6, it was found that stunted children with a very high level of dental caries were the most numerous, namely 17 children (53.1%), followed by stunted children with a low level of caries (6 children), and moderate and high levels of caries (5 and 4 children, respectively). This indicates that more than half of the sample had a very high dental caries index (Table 3).

Table 2. Frequency Distribution of the Study Sample's Nutritional Status (Stunting)

Nutritional Status	Frequency	Percentage(%)
Low	17	53.1%
Very Low	15	46.9%
Total	32	100%

Table 3. Frequency Distribution of the def-t Caries Index in the Study Sample

Karies	Frequency	Percentage(%)
Very low	0	0%
Low	6	18.8%
Medium	5	15.6%
High	4	12.5%
Very high	17	53.1%
Total	32	100%

The sample distribution based on the severity of primary tooth caries and age was obtained by summing the def-t scores across all categories and then dividing by the total

number of children examined. The average def-t index for stunted children was 3.3, classified as moderate, and the average def-t index for severely stunted children was 4.8, classified as high.

The number of children with very high caries levels was eight children aged 3 years, eight children aged 4 years, and one child aged 5 years. The number of children with high caries levels was two children aged 3 years and one child each aged 4 and 5 years. The number of children with moderate caries levels was three children aged 3 years, and one child each aged 4 and 5 years. The number of children with low caries levels was 2 children in each of the ages 3, 4, and 5 year-old groups (Table 4).

Table 4. Frequency Distribution of the Study Sample by Dental Caries Level, Stunting Status, and Age

Stunted (*z-score* <-2)				**Severely stunted (*z-score* <-3)**			**Age (years)**		
Caries	**n**	**%**	**def-t**	**n**	**%**	**def-t**	**3**	**4**	**5**
Very low	0	0	0	0	0	0	0	0	0
Low	5	29.4%	10	1	6.7%	2	2	2	2
Moderate	4	23.5%	16	1	6.7%	4	3	1	1
High	1	5.9%	6	3	20%	17	2	1	1
Very high	7	41.2%	72	10	66.7%	130	8	8	1
Total	17	100%	104	15	100%	153	15	12	5

A chi-square correlation test was conducted, yielding a p-value of 0.028 ($p < 0.05$), indicating a significant association between stunting and dental caries in children (Table 5).

Table 5. The Relationship Between Stunting and Dental Caries in Children

Nutritional Status (TB/U)	**Dental Caries**					**P Value**
	Low		**High**		**Total**	
Frequency		**%**	**Frequency**	**%**		
Stunted	9	52.9%	8	47.1%	17	0.028
Severely Stunted	2	13.3%	13	86.7%	15	

DISCUSSION

The results of a study of stunted children in the working area of the I Ulu Health Center indicate that more than half of the stunted children in the sample had a very high caries index, at 53.1%. These findings are consistent with a 2022 study by Normansyah et al. in Jember Regency, which reported that 53.3% of stunted children had a very high caries index.[45] A study by Simorangkir et al. also reported that 54% of stunted children had a high caries index.[46] This is further supported by a study by Rahman et al., which stated that 66.6% of stunted children had high and very high levels of caries.[8]

The distribution of samples based on the severity of primary tooth caries using the def-

t index shows that stunted children experience moderate to severe caries, the average caries experience among stunted children is 3.3, which is classified as moderate, while the average caries experience among severely stunted children is 4.8, which is classified as severe. These findings align with a study conducted by Simorangkir et al. in 2018 in Deli Serdang Regency, which stated that the average severity of primary tooth caries in stunted children falls into the moderate to high categories, with only a few cases classified as low.[46]

A 2019 study by Ningtias et al. also found that 81.25% of stunted children had moderate to severe dental caries, while the remaining 18.75% had mild dental caries. This suggests that stunted children tend to have high rates of dental caries, which may be due to the fact that stunting is correlated with host factors associated with the development of dental caries lesions.[9]

The prevalence of dental caries in stunted children tends to be higher because malnutrition can lead to oral developmental disorders, such as atrophy of the salivary glands, resulting in a decrease in the self-cleansing and buffering functions of saliva. A decreased ability of saliva to self-clean and act as a buffer can disrupt its function in removing pathogens from the teeth and mucosal surfaces, as well as disrupt the oral cavity's pH balance in neutralizing acids and minimizing the time required for demineralization to occur. Deficiencies in protein and other micronutrients can affect the volume and composition of saliva, thereby limiting its protective effects.[9]

Decay in primary teeth can disrupt a child's nutritional status and exacerbate stunting. Untreated dental decay can lead to infection, causing tooth pain, disruptions in eating and sleeping patterns, and affecting the child's growth and development.[42] Tooth decay frequently leads to abscesses, which may require tooth extraction, thereby reducing chewing function and causing discomfort during chewing, which can result in reduced nutrient intake and negatively impact nutritional status, increasing the risk of stunting.[43] This aligns with research by Putri et al., which states that children with dental caries tend to select or avoid certain foods, leading to inadequate nutrient intake and consequently affecting their nutritional status.[47]

A study by Simorangkir et al. found that children with a high prevalence of dental caries are 2.15 times more likely to experience stunting than children with a low prevalence of dental caries.[46] This finding is supported by a study by Dimaisip-Nabuab et al., which also found that children with a high prevalence of dental caries at ages 6–7 have a high probability of experiencing underweight and stunting two years later. Dental caries is a causative factor of stunting associated with the occurrence of infections in children. Infections can lead to decreased appetite and reduced nutrient absorption, which in turn results in lower levels of

micronutrients in the body. This makes children with high caries experience more at risk of developing stunting later in life compared to children without such experience.[48]

Dental caries in children can affect nutrient intake, leading to a low body mass index that impacts cognitive development and ultimately results in a reduced quality of life.[46] The findings of Apro et al. explain that children with dental caries have a poorer quality of life compared to those without dental caries. The impact can cause disruptions in growth and development as well as daily activities, which in turn affect the child's social environment.[39] This aligns with a 2019 study by Elfarisi et al. on oral health and its relationship to the quality of life of 4–5 year old children in the village of Cilayung, which stated that oral health significantly impacts the quality of life of 4–5 year old children, with a percentage of 34.03%.[49]

This study reports that there are more children with stunting than those who are severely stunted. There were 17 children with stunting and a z-score < -2 SD, while there were 15 severely stunted children with a z-score < -3 SD. These findings are consistent with a study in Ethiopia that reported 68 stunted children (z-score < -2 SD) and 46 severely stunted children (z-score < -3 SD).[50] This may be influenced by parents' educational level, as a 2020 study by Soekatri et al. found that children's z-scores were significantly higher among parents with higher levels of education. An increase in parents' formal education is associated with a 3–5% reduction in the risk of stunting in children.[51]

The distribution of samples by caries level and age shows that the highest frequency of samples was found in the very high caries category. The highest frequency of stunted children in this category was 8 children each in the 3-4 age group, accounting for a total of 50%. A study of a sample of 3-5 year olds in Aceh by Abdat et al. reported that stunted children aged 3 years showed a high level of caries and those aged 4 years showed a very high level of caries. This is thought to be due to the influence of time-related factors in caries formation. The time in question refers to the rate of caries formation, duration, and frequency of substrate adhesion to the tooth surface.[2]

This study found that there is a significant association between stunting and dental caries in children aged 3–5 years in the working area of the I Ulu Palembang Health Center. These findings are supported by studies conducted by Abdat et al. in 2020 and Rahman et al. in 2019, which reported a significant relationship between stunting and dental caries in children.[2,8] This finding is supported by a study by Abadi et al. on the relationship between stunting and risk factors for dental caries in Pontianak. The study's findings indicate that there is a relationship between risk factors and the caries index in individuals with stunting.[7] Tooth decay can affect

nutritional status, leading to digestive problems and difficulty eating, which explains the relationship between tooth decay and children's nutritional status.[45]

Children with stunting are associated with high rates of dental caries, which is linked to the underlying causes of malnutrition in both mothers and children during the first 1,000 days of life (HPK), leading to stunting. Nutritional deficiencies during this period can disrupt the growth and development of primary teeth and salivary glands. Therefore, stunted children tend to be more susceptible to dental caries than normal children due to enamel hypoplasia and changes in saliva characteristics, such as a decrease in saliva flow rate and pH. This is supported by research by Normansyah et al., which explains that hypoplasia has the potential to create a cariogenic oral environment due to increased demineralization of thin protective enamel, and that saliva is considered very important for self-cleansing.[45]

A 2020 study by Vieira et al. in Brazil on stunting and oral health status in children aged 1–5 years also found that stunted children may experience a reduced saliva flow rate due to hypofunction of the salivary glands, which increases their risk of dental caries.[41] Saliva flow rate is directly linked to the development of dental caries because saliva acts as an oral clearance mechanism that helps remove viruses, bacteria, and fungi from the oral cavity.[9]

CONCLUSION

The results of this study indicate a significant relationship between stunting and dental caries in children aged 3–5 years in the working area of the I Ulu Health Center Palembang ($p < 0.05$). Stunted children aged 3–5 years in the working area of the I Ulu Health Center Palembang with stunted children had a higher prevalence (53.1%) compared to those with severely stunted (46.9%). More than half of the stunted children had a very high caries index. The average def-t index for children with stunting was included in the moderate category, while the average def-t index for severely stunted children was included in the high category.

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