

ORIGINAL ARTICLE

The Relationship Between Stunting and Teeth Eruption in 9-12 Year Old Children in Tuah Negeri Sub-district

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ABSTRACT

Introduction: Stunting can cause malnutrition in children and affect bone growth. Bone growth in stunted children will be inhibited, including periodontal bone maturation. Delay in maturation of the periodontal bone will delay tooth eruption. This study analyses the relationship between stunting and children characteristics that consists of age, gender, parental education, occupation, and income to teeth eruption status in 9-12 years old children in Tuah Negeri sub-district. **Methods:** This study is a cross-sectional study with 110 children aged 9-12 years old from elementary schools in Tuah Negeri District as samples. Stunting was determined based on anthropometric measurements by measuring height by age. Oral examination was carried out to see the teeth eruption in children according to their age group. The rest of characteristics data were obtained through questionnaires. Data were analyzed with chi-square test and logistic regression. **Results:** 36 children (32.7%) were stunted and out of them, 23 (63.9%) experienced delayed teeth eruption. The bivariate analysis showed $p = 0.000$ and $OR = 5.932$ for the relationship between stunting and teeth eruption status. Multivariate analysis showed that significantly related children's characteristics to tooth eruption were nutritional status and parental income with $p=0.000$ and $OR=6.944$ for stunting and $p=0.002$ and $OR=4.861$ for parental income. **Conclusion:** Nutritional status and parental income are significantly related to tooth eruption. Stunted children are 6.9 times more likely to experience delayed tooth eruption and children with low-income parents are 4.8 times more likely to experience delayed tooth eruption.

Keywords: Stunting, Nutritional status, Family characteristics, Tooth eruption.

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not consuming exclusive breastfeeding, incomplete immunization, and family characteristics in the form of parental education, parental occupation, and family economic status (2).

INTRODUCTION

Stunting is a condition of a short or very short body that is not in accordance to the children's age, which occurs due to malnutrition and repeated diseases for a long time in the fetus until the first 2 years of a child's life. Short toddlers or stunting can be detected if their length or height has been measured, then compared with the standard, and the results are below normal (1). This condition can be caused by two factors, namely direct factors and indirect factors. Direct factors that cause toddlers to experience stunting are children experiencing low birth weight (LBW), consuming foods that contain low energy and protein, diarrhea, ARI. As for the indirect factors that cause stunting, children are

The data from World Health Organization (WHO) stated that Indonesia has the third highest prevalence rate of stunting in south east asia. There is 36.4% prevalence average of stunted children under five years old in 2005 to 2017. The results of research conducted by SEANUTS (South East Asia Nutrition Surveys) in 2011 related to child nutrition problems in Indonesia, Malaysia, Thailand, and Vietnam found that the height measurement of Indonesian children was the shortest among the four other countries. For school-age children aged 5-12 years, stunting was found to be 24.1% for boys and 25.2% for girls. School-age children suffering from stunting in the very short category were 5.9% for boys and 4.9% for girls (3). In South Sumatra, the percentage of stunting in the last six years experienced a

downward trend but slightly increased in 2017. In 2012 it was 27.6%, increased to 28.4% in 2013, decreased to 26.3% in 2014, then decreased to 24.5% in 2015, fell again to 19.30% in 2016 and rose again to 22.8% in 2017 (4).

Data from the South Sumatra Provincial Health Office in 2018 stated that the incidence of stunting in children under five in Musi Rawas Regency was 34.6%. Musi Rawas Regency is one of the underdeveloped districts in South Sumatra. Low food security and low economic status seem to have an impact on the high stunting rate in Musi Rawas Regency. There are 14 sub-districts in Musirawas Regency. In 2019 the incidence of stunting in the working area of the Muara Beliti Health Center, Tuah Negeri District, was 16.1% (5).

The local community, especially parents, considers that stunting is not a serious problem. Parents believe that their child will grow and develop according to his age because they are still a toddler. But in reality, if a child is proven to be stunted at least before the age of 2 years and is not detected early, they will experience delays for improving nutrition the following year (6). The incidence of stunting in children under five requires special attention because it is related to decreasing children's intellectual abilities, productivity, and increasing the risk of degenerative diseases in the future (7).

Malnutrition conditions for a long time in stunted children will affect bone growth. Intake of calcium, phosphorus, vitamin C and vitamin D is very important, so that a lack of these substances can inhibit bone growth, including tooth development and delayed time of tooth eruption (8). The stunted bone growth will affect the process of maturation of the periodontal bone that supports the teeth, thus children can experience delayed tooth eruption (9). Deciduous teeth are different from permanent teeth. Permanent teeth have longer roots and a stronger structure. Delayed tooth eruption, in addition to causing increased risk of tooth decay due to thinner and weaker enamel in deciduous teeth, will also cause children have an inadequate tooth structure for their diet as they begin to eat foods with a variety of textures and more complex than usual food eaten as a baby or toddler which will then affect the child's diet. Therefore, further research is needed to analyzes the relationship between stunting and children characteristics that consist of age, gender, parental education, parental occupation, and parental income to teeth eruption status in 9-12 years old children in Tuah Negeri sub-district.

MATERIALS AND METHODS

This study is an analytic observational study with a cross-sectional design. Variables in this study consisted of teeth eruption as dependent variable, nutritional status as independent variable, and age, gender, nutritional

status, parental education, occupation, and economic status as the confounding variables.

The research sample was children aged 9-12 years because at this age, children are in the mixed dentition period when the deciduous teeth begin to fall out and are replaced with permanent teeth. The study sample size was obtained using a stratified random sampling technique and a two-proportion difference formula with a sample of 110 children from elementary school children in Tuah Negeri District. From 19 working areas of the health center in Musi Rawas Regency, the working area of the Air Beliti Health Center in Tuah Negeri District with the stunting percentage (12.77%). Then from 23 elementary schools in Air Beliti Health Center working area, a random selection of elementary schools was carried out and used as research sites. From the selected elementary schools, the attendance data of students aged 9-12 years were obtained and then randomized to be selected as samples.

Determination of nutritional status based on anthropometry using Anthro 1.02 software. Height was measured and grouped according to the Z-score into stunting (≤ 2 SD) and not stunting (≥ 2 SD). Oral examination was carried out to see the eruption of teeth on children's permanent teeth according to their age group and recorded in the odontogram. Other data on the characteristics of children were obtained through questionnaires filled out by parents.

The obtained data were then analyzed with SPSS ver. 22. Univariate analysis was used to see the characteristics of students based on age, gender, nutritional status, parental education, occupation, and economic status. Bivariate analysis was used to see the relationship between stunting and tooth eruption, using the chi-square test, by looking at the p value on the Fisher exact test. Multivariate analysis was used to determine the most dominant factors associated with the status of tooth eruption in children by logistic regression test. The size of the association of the dependent variable with the status of tooth eruption will be assessed based on the prevalence odd ratio.

This research has received ethical approval from the Ethics Commission of the Faculty of Public Health, Sriwijaya University. 090/UN9.FKM/TU.KKE/2021.

RESULT

The data on the characteristics of children shows that 43.6% of children fall into the 9-10 year age group and 56.4% fall into the 11-12 year age group. Children consist of 42.7% boys and 57.3% girls. 32.7% of children experienced stunting and 40% of children experienced delayed tooth eruption. Data on parental characteristics shows that most parents have low education, which is equivalent to graduating from junior high school (62.7%

fathers and 60% mothers), almost all fathers work as farmers (55.5%), most of the mothers are working mothers (90%) and 60.9% of low-income parents, which is less than 1,000,000 rupiah per month (Table I). The results of the chi-square statistical test for age characteristics showed that in the 9-10 year age category there were 43.8% of children who experienced delayed tooth eruption, while in the 11-12 year age category there were 30.6% of children who experienced delayed tooth eruption. Based on the statistical test, the value of $p = 0.168$ ($p > 0.05$) showed that there was no significant relationship between the age group and eruption status (Table II).

Table I. Frequency Distribution of Child and Parent Characteristics Data

Frequency Distribution	n	%
1. Age		
a. 9-10 year	48	43.6
b. 11-12 year	62	56.4
2. Gender		
a. Boy	47	42,7
b. Girl	63	57.3
3. Stunting		
a. Stunting	36	32,7
b. Not Stunting	74	67,3
4. Tooth Eruption		
a. Normal Eruption	70	63,6
b. Late Eruption	40	36,4
5. Father's Education		
a. Low	69	62,7
b. High	41	37,3
6. Mother's Education		
a. Low	66	60,0
b. High	44	40,0
7. Father's occupation		
a. Farmer	61	55,5
b. Not Farmer	49	44,5
8. Mother's occupation		
a. Employed	99	90,0
b. Unemployed	11	10,0
9. Family Income		
a. 1.000.000/month	67	60,9
b. >1.000.000/month	43	39,1

*age, gender, parental education, occupation, and economic are confounding variables

In the stunting analysis (table III), it was found that 63.9% of stunted children experienced delayed tooth

Table II Relationship of Age with Tooth Eruption Status

Age	Tooth Eruption Status				P
	Delayed Eruption		Normal Eruption		
	N	%	n	%	
9-10 year	21	43.8	27	56.3	0.168
11-12 year	19	30.6	43	69.4	

eruption, while in children who were not stunted, only 23% of children who were stunted found delayed tooth eruption. Based on the statistical test, the value of $p = 0.001$ ($p < 0.05$) showed that there was a significant relationship between stunting and the status of tooth eruption.

Table III. Relationship between Stunting and Tooth Eruption Status

Stunting	Tooth Eruption Status				P	OR	CI (95%)
	Delayed Eruption		Normal Eruption				
	n	%	n	%			
Stunting	23	63.9	13	36.1	0.000	5.932	2.487-14.151
Not Stunting	17	23.0	57	77.0			

In children with fathers with low education, it was found that the eruption delay was 39.1%, and in children with fathers with high education it was 31.7%. Based on the statistical test, the value of $p=0.539$ ($p > 0.05$) showed that there was no significant relationship between father's education and tooth eruption status, while in children with mothers with low education, the eruption delay was found to be 40.9%, and in children with fathers with higher education it was 29.5%. Based on the statistical test, p value = 0.312 ($p > 0.05$) indicates no significant relationship between maternal education and the status of tooth eruption (table IV).

Table IV. Relationship of Parents Education with Tooth Eruption Status

Parents	Education level	Tooth eruption Status				P
		Delayed Eruption		Normal Eruption		
		N	%	n	%	
Father	Low Education	27	39.1	42	60.9	0.539
	Highly Educated	13	31.7	28	68.3	
Mother	Low Education	27	40.9	39	59.1	0.312
	Highly Educated	13	29.5	31	70.5	

According to the characteristics of the father's occupation, it was found that 29.5% of children whose fathers worked as farmers experienced delayed tooth eruption, while for children whose fathers were not farmers, it was

found that 44.9% had delayed tooth eruption. Based on the statistical test, the value of $p=0.113$ ($p>0.05$) showed that there was no significant relationship between the father's occupation and tooth eruption status, while in the mother's work characteristics, 45.5% of children with mothers who do not work experience delayed tooth eruption and 35.4% of children whose mothers work. Based on the statistical test, the value of $p=0.524$ ($p>0.05$) showed that there was no significant relationship between the mother's occupation and the status of tooth eruption (table V).

Table V. Relationship of Parent's Occupation with Tooth Eruption Status

Parents	Occupation	Tooth eruption Status				P
		Delayed Eruption		Normal Eruption		
		N	%	n	%	
Father	Farmer	18	29.5	43	70.5	0.113
	Non Farmer	22	44.9	27	55.1	
Mother	Unemployed	5	45.5	6	54.5	0.524
	Employed	35	35.4	64	64.6	

Based on the characteristics of parents' income, it is known that 47.8% of children with parental income of less than or equal to one million rupiahs per month experience delayed tooth eruption, while children with parental income of more than one million per month who experience delayed tooth eruption are 18.6%. Based on the statistical test, the value of $p=0.002$ ($p<0.05$) showed that there was a significant relationship between parental income and tooth eruption status (table VI).

Table VI. Relationship between parental income and tooth eruption status

Parental Income	Tooth Eruption Status				P	OR	CI (95%)
	Delayed Eruption		Normal Eruption				
	n	%	n	%			
1.000.000	32	47.8	35	52.5	0.002	4.000	1.618-9.892
>1.000.000	8	18.6	35	81.4			

Furthermore, from the results of multivariate analysis with multiple logistic regression, it is known that the characteristics that are significantly related to the status of tooth eruption are nutritional status and parental income. The analysis results also show that, statistically, children with stunting nutritional status have a 6.9 times chance of experiencing delayed tooth eruption compared to children who are not stunted. In addition, children with parents with low income (less than one million rupiahs per month) are also 4.8 times more likely to experience delayed tooth eruption when compared to children with parents with higher income (more than one million rupiahs per month) (table VII).

Table VII. Characteristics that are Significantly Associated with Tooth Eruption Status

Variable	B	Sig.	Exp(B)	95% C.I Exp(B)
Nutritional status	1.938	0.000	6.944	2.682-17.977
Parent's Income	1.581	0.002	4.861	1.763-13.403

DISCUSSION

Delayed eruption can occur to one or multiple teeth. Delayed local eruption can be caused by trauma, dental abnormalities, or systemic disease. Trauma can cause ankylosis, dilaceration, concretion, cyst eruption, and premature exfoliation of primary teeth. The dental abnormalities in the form of supernumerary teeth, regional odontodysplasia, and fusion (Schuurs, 1992). Delay in multiple teeth or overall eruption can be caused by endocrine disorders, nutritional disorders, and some systemic diseases. Endocrine disorders such as hypothyroidism, hypoparathyroidism, and hypopituitarism. Systemic diseases that can cause delayed eruption include hemifacial hypertrophy and odontomaxillary dysplasia, cleidocranial dysplasia, down syndrome, achondroplastic dwarfism, trichodonto-osseous-syndrome, pycnodisostosis, and pituitary gigantism (11).

Nutritional status is a balance between nutritional intake and nutritional requirements needed for metabolism. Adequate nutrition in the body is influenced by the type, time and method of food consumption which will then affect the growth and development of children (10). The results of anthropometric measurements in this study showed that 32.7% of children experienced stunting, which means that there are many children in Tuah Negeri District who experience nutritional deficiencies. This percentage is quite high when compared to the percentage of stunting under five in Indonesia in 2020, which is 11.6% (12).

The nutritional disorders, such as deficiency of protein, vitamin D, and calcium-phosphorus. These nutrients are essential for physical growth and development, including the growth and development of teeth. Statistically, there is a significant relationship between nutritional status and tooth eruption status. This is because the percentage of stunted children experiencing delayed tooth eruption is 63.9%, while in children who are not stunted, only 23% of teeth are delayed in tooth eruption. Nutrition greatly affects the growth and development of the body. During the growth period of protein, calcium and phosphorus are needed by the body. Lack of these nutrients during growth will cause growth retardation in bone maturity, thus causing stunted tooth eruption (13).

The early stages of tooth growth are influenced by a number of factors, such as calcium, phosphorus, fluorine, and vitamins in the diet. During tooth development, protein deficiency, especially in large amounts, can lead to

smaller molar sizes, delayed mandibular development, and delayed eruption. In addition to carbohydrates, protein is also needed by the body to produce energy. The presence of protein in the body plays a very important role, especially during the developmental stages, including the prenatal and postnatal periods. Vitamin D deficiency results in disturbances in bone structure, such as incomplete calcification due to inadequate absorption of calcium and phosphorus, causing delayed eruption, both in children and adults. Vitamin D is needed in the absorption and regulation of calcium as the main function is the mineralization of bones and teeth. Vitamin D regulates calcium and phosphorus levels in the blood. In addition, another function of vitamin D which is assisted by thyroid and parathyroid hormones is to regulate the absorption and supply of calcium and phosphorus in bone, including alveolar bone. Trabeculae in alveolar bone become weak due to decreased function of vitamin D which interacts with osteoblasts that forms new bone tissue (14).

Calcium and phosphorus are the main nutrients that play a role in the formation of dentin and tooth enamel. Lack of calcium and phosphorus intake will affect the development and growth of bones and teeth. In addition, magnesium also functions to prevent tooth decay by retaining calcium in tooth enamel and flour, which plays a role in the mineralization and hardening of tooth enamel. A good tooth structure formation will only be achieved if the child has adequate nutrition (13). Deficiency of calcium and phosphorus can affect the amount of calcium contained in the alveolar bone which in turn affects the process of replacing primary teeth and delays eruption of permanent teeth. Similarly, when phosphorus deficiency occurs during tooth development, the calcification process is incomplete and can result in delayed eruption. Calcium and phosphorus function is to store and maintain serum levels in required amounts. Serum calcium and phosphorus levels have a reciprocal relationship, if the calcium level increases, the phosphorus level decreases, and vice versa. This relationship acts as a protective mechanism to prevent high concentrations of the combination of the two which can further influence soft tissue calcification and hard tissue formation. Children with good nutritional status, tends to have faster teeth eruption than children with poor nutritional status. In children with poor nutrition, the process of stunted bone growth will result in the process of maturation of the periodontal bone that supports the teeth being hampered so that children can experience delays in tooth eruption (14).

This result is in accordance with the results of research in the work area of the Tamansari Public Health Center, Tasikmalaya City, in children aged 4-30 months, a significant relationship was found between eruption time and age where the eruption time of the deciduous teeth in stunting toddlers was slower than normal toddlers

(15), and research on 11- to 13-year-old Haitians which states that malnutrition that happened during early years and continued through childhood affects teeth exfoliation and teeth eruption (16).

Nutritional deficiency that occurred in this study may be caused by the low economic status of parents. 47.8% of children with a parental income of less than or equal to one million rupiahs per month experienced delayed tooth eruption, while in children with a parental income of more than one million per month, who experienced delayed tooth eruption was 18.6%. Based on the statistics, there was a significant relationship between parental income and tooth eruption status in elementary school children in Tuah Negeri District, Musi Rawas Regency. The economic status of the family, especially income, also affects the working conditions of the parents, the condition of the family's residence and the fulfilment of basic needs, one of which is food needs. Lack of family ability to provide nutritious and adequate food can lead to a lack of nutritional intake in children so that children are vulnerable to stunting (17).

These results are consistent with research on school-age stunting children in Lubuk Kilangan District, Padang City, which states that the prevalence of stunting in children who have just entered school has a significant relationship with mother's education and family economic level. Most children who are prone to stunting come from large families with low purchasing power, poor housing conditions, do not have a clean water supply that meets health requirements, and low parental education (18). Similarly, research on stunting incidence in elementary school children in Nanggalo Subdistrict, Padang City, stated that there was a significant relationship between mother's education, family economic status, and feeding patterns on the incidence of stunting in elementary school children (19). This study examines several determinants that can be a risk of delayed tooth eruption in children, but this research activity was carried out during the COVID-19 pandemic, so there were many limitations in regards of time and participation during this research thus resulting in relatively small sample size and limited variables that related to teeth eruption to study. For further research, researcher can study other factors, such as parental knowledge, history of trauma, systemic diseases and endocrine disorders that are closely related to tooth eruption.

CONCLUSION

Characteristics of children that are significantly related to the status of tooth eruption are nutritional status and parental income. Children with stunting nutritional status are 6.9 times more likely to experience delayed tooth eruption when compared to children who are not stunted. In addition, children with low-income parents are also 4.8 times more likely to experience delayed

tooth eruption when compared to children with higher-income parents.

ACKNOWLEDGEMENTS

Gratitude to the Musirawas District Health Office and Air Beliti Health Center of Tuah Negeri District for facilitating this research.

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