

# The Comparison of Dental Caries Severity on Stunting and Non-stunting Toddlers in Kalisat, Jember, Indonesia

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## ABSTRACT

**Background and Objectives.** Nutritional deficiency in stunting toddlers is closely related to the calcium deficiency which is the most important component of the formation of bone and tooth structure. Deficiency of calcium can delay tooth eruption and increase the risk of dental caries. Little is known about the difference in dental caries severity on stunting and non-stunting toddlers in Kalisat, Jember, Indonesia. The study aims to examine the differences between the severity of dental caries on stunting and non-stunting toddlers.

**Methods.** This was an analytic observational study with a cross-sectional approach conducted in the working area of Kalisat Health Center, Jember, Indonesia. The population was stunting and non-stunting toddlers aged 25-60 months. The samples were selected using clustered random sampling technique (100 stunting toddlers and 100 non-stunting toddlers). Variables in this research were dental caries and incidence of stunting. The measurement of dental caries in toddlers was carried out by identifying the worst type of dental caries in toddlers, which occurred as pulp irritation (IP), pulp hyperemia (HP), pulp gangrene (GP), and radix gangrene (GR). Data analysis was descriptive. Mann Whitney U-test was used with 0.05 (p-value) as a test to analyze the differences between stunting and non-stunting toddlers' dental caries.

**Results.** Stunting toddlers had more cases of pulp gangrene and radix gangrene than non-stunting toddlers. Mann Whitney U-Test showed the p-value was 0.038 ( $p < 0.05$ ) which meant there were differences in dental caries between stunting and non-stunting toddlers.

**Conclusion.** Most of the stunting toddlers had more severe dental caries than the non-stunting toddlers.

*Keywords: dental caries, stunting, toddler*

## INTRODUCTION

According to the Basic Health Research, the prevalence of stunting toddlers in Indonesia is 30.8% in 2018.<sup>1</sup> Toddler is a child under 5 years old. Stunting is a condition of growth failure of children under five years old due to chronic malnutrition that occurs starting from babies in the womb due to nutritional deficiencies that accumulate over a long period of time so that it will be physically visible at the age of toddlers around 0-5 years.<sup>2</sup> Jember is a district that has a relatively high stunting disorder and has challenges in dealing with problems regarding stunting. Toddlers under five years old who experienced stunting in the working area of Kalisat Health Center were 31.81% in 2019.<sup>3</sup> Nutritional intake that is not optimal and lasts a long time can cause changes in brain metabolism that results to low thinking power. The low nutritional status also has an impact on the

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quality of education because toddlers with low nutritional status tend to fall asleep easily, lack enthusiasm, and think less optimally. Chronic malnutrition influences the behavior of stunting toddlers in maintaining oral health so that problems in dental and oral health easily arise.<sup>4</sup> Stunting cases in Jember regency have not been solved well. This is proven by the increase of stunting cases in recent years.<sup>3</sup>

Stunting has negative impact on the growth and development of toddler's teeth due to lack of nutrients including calcium and phosphorus as the main components of teeth. Dentition is influenced by a number of factors, namely Calcium (Ca), Phosphorus (P), Flourine (F), and vitamins.<sup>5,6</sup> Calcium is the most important component in the formation of bone and tooth's structure. Calcium deficiency can cause delayed eruption of teeth and disruption of dental health, such as caries, so the risk of caries is higher in stunting toddlers.<sup>7</sup>

Dental disease in children is a common issue. According to the Basic Health Research Data in Indonesia during 2018, it was reported that the prevalence of caries was 81.1% in 3-4 year-old toddlers and 92.6%.in 5-9-year old children<sup>1</sup> Dental caries lead to loss of appetite and impaired digestion, resulting in less than optimal growth.<sup>8</sup> That unbalanced dietary intake also manifests the lack of vitamins A and B as an initial sign affecting the oral mucosa,<sup>9</sup> which in turn triggers dental germination and mineralization before occurring the enamel hypoplasia and dental caries. The caries can be aggravated by chronic malnutrition in early childhood.<sup>10</sup>

Toddler age is a good indicator to measure their overall health condition including nutritional status.<sup>5</sup> It is the "golden age" in which toddlers are in the stage of rapid growth and development which increased at the age of five, so it requires food that is rich in energy and nutrients.

The positive correlation between stunting and the severity of dental caries is shown from the results of the study by Rahman et al.,<sup>7</sup> and the research of Andriani et al<sup>11</sup>.

Little is known about dental caries differences on stunting and non-stunting toddlers in Kalisat, Jember, Indonesia. Hence, the research attempted to examine the differences between the severity of dental caries on stunting and non-stunting toddlers.

## MATERIALS AND METHODS

### Participants

This study was an analytical observational research with cross-sectional approach. The population in this study were toddlers aged 25-60 months in the Kalisat Health Center, Jember, Indonesia; with population size of 1663 toddlers. There were 12 Health Centers in Kalisat, Jember. Clustered-random sampling technique was used in five villages namely Gambiran, Glagahwero, Patempuran, Sumberkalong, and Sumberketempa. The inclusion criteria were: 25-60 months old toddlers in the area of Kalisat Public Health Center and toddlers whose mothers had filled the consent form. The exclusion criteria were: toddlers with systemic disease and

toddlers with physical and mental disabilities. The identities of the participants were kept anonymous for privacy and to avoid conflict of interest. Informed consent was obtained.

Each member of the population was assigned a number before all numbers were selected randomly. Afterwards, we obtained 200 toddlers as the sample size consisting of 100 stunted toddlers and 100 non-stunted toddlers. Whether the toddler is stunted or non-stunted is determined by using the government's rules. It uses Anthropometric Index (z-score) TB/U of Z-score < - 2,0 SD. The measurement of dental caries in toddlers under five was performed by eight dentists using mouthmirrors and dental explorer. A dental examination was performed with the most severe caries categorized into pulp irritation (IP), pulp hyperemia (HP), pulp gangrene (GP), and radix gangrene (GR). To determine stunting and non-stunting, height for age became a common and primary measurement for midwives to confirm the incident among samples. The tools and materials used were mouth glass, probe, questionnaire, microtoise, informed consent form, mask, and stationery.

This research had received ethical approval from the Ethics Committee of Health Research of Faculty of Dentistry, Universitas Jember, Indonesia (1028/UN25.8/KEPK/DL/2020).

### Data Collection

The collected data were classified into categorical data based on the variables. The variables were age of toddlers (categorized into 25-36 months, 37-48 months, and 49-60 months), maternal level of education (categorized into unschooled, elementary school, junior high school, and senior high school), type of toddlers (categorized into with caries and without caries), and presence of caries (categorized into no caries, most severe on IP, HP, GP, and GR). Those were presented descriptively in the form of frequency and percentage. Dental caries is the only independent variable in the hypothesis testing analytically using Mann-Whitney with 0.05 (p-value) to analyze its difference in the incident of stunting and non-stunting.<sup>12</sup>

### Statistical Analysis

The data were analysed by statistical descriptive and displayed in distribution tables based on the respondent's characteristics that were then analysed using Mann Withney U-test (p-value 0.05) with the ordinal data scale.

The sample size was calculated using Slovin's formula.<sup>13</sup>

$$n = \frac{N}{1 + Ne^2}$$
$$n = \frac{1663}{1 + 1663(0.1)^2}$$
$$n = 94.3$$
$$n = 100$$

## RESULTS

The distribution of stunting and non-stunting toddlers based on toddler's age and maternal level of education is presented in Table 1. It shows that the frequency of toddlers under five years old who experienced stunting and non-stunting were mostly at the age of 25-36 months. Meanwhile, the least stunted and non-stunted toddlers were at the age of 49-60 months.

There were eight parents in the stunting group and one parent in the non-stunting group who did not go to school. Both groups have 56 parents each who went to primary school. There were 24 parents in the stunting group and 31 parents in the non-stunting group who attended junior

high school. Both groups have 12 parents each who went to high school.

The distribution of stunting and non-stunting toddlers based on the status of toddlers' caries and caries severity can be seen in Table 2. This table shows that there were 46 toddlers with caries in the non-stunting group and 59 in the stunting group. Meanwhile, there were 54 non-caries toddlers in the non-stunting group and 41 in the stunting group. There were more toddlers (n=25) with most severe caries in the stunting group as compared to the non-stunting group with only 18 toddlers.

The differential test on stunting and non-stunting dental caries severity was performed using Mann Whitney U-Test and were shown in Tables 3a and 3b. Table 3a showed the mean

**Table 1.** Distribution of Stunting and Non-stunting Toddlers based on Toddler's Age and Maternal Level of Education

Toddler's Age (months)	Stunting		Non-stunting	
	Frequency	Percentage	Frequency	Percentage
25-36	57	57	61	61
37-48	33	33	26	26
49-60	10	10	13	13
Total = 200	100	100	100	100

Maternal Level of Education	Stunting		Non-stunting	
	Frequency	Percentage	Frequency	Percentage
Unschooling	8	8	1	1
Elementary school	56	56	56	56
Junior high school	24	24	31	31
Senior high school	12	12	12	12
Total = 200	100	100	100	100

**Table 2.** Distribution of Stunting and Non-stunting Toddlers based on Status of Toddler's Caries and Caries Severity

Type of Toddlers	Stunting		Non-stunting	
	Frequency	Percentage	Frequency	Percentage
Toddlers with Caries	59	59	46	46
Toddlers without Caries	41	41	54	54
Total = 200	100	100	100	100

Caries Severity	Stunting		Non-stunting	
	Frequency	Percentage	Frequency	Percentage
No Caries	41	41	54	54
Most Severe on IP	11	11	14	14
Most Severe on HP	12	12	9	9
Most Severe on GP	11	11	5	5
Most Severe on GR	25	25	18	18
Total = 200	100	100	100	100

**Table 3a.** Ranks of Caries Category Based on Mann Withney U-Test

Category	N	Mean Rank	Sum of Ranks
Non-stunting	100	92.53	9252.50
Stunting	100	108.48	10847.50
Total	200		

**Table 3b.** Result of Mann Withney U-Test

Statistics Test <sup>a</sup>	
Mann-Whitney U	4202.500
Wilcoxon W	9252.500
Z	-2.078
Asymp. Sig. (2-tailed)	0.038

<sup>a</sup> Grouping Variable: Category

rank of stunting group (108.48) was higher than the non-stunting group (92.53). This was resulted by SPSS (Statistical Program for Social Science) software that analysed the mean rank by inserting the data from the category of Caries Severity. Table 3b was presented to show further information about caries severity of stunting and non-stunting toddlers. The results of the Man Whitney U-Test showed a p-value of 0.038 ( $p < 0.05$ ), which meant there was a difference in dental caries severity between stunting and non-stunting toddlers.

## DISCUSSION

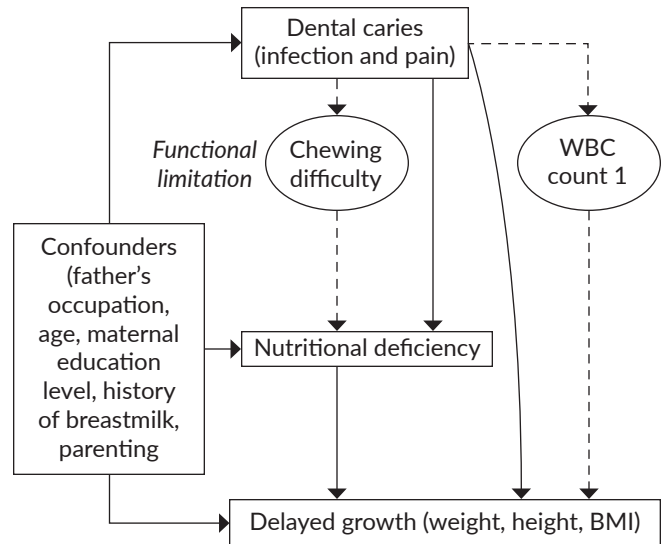
Parents' work has a big role in nutritional problems. It is closely related to family income which affects the purchasing power of the family. Family with limited income is likely to be unable to meet their food needs in quality and quantity. Nevertheless, the adequate family income can improve the meal composition culminating to support toddler's growth and development as parents can provide all the toddler's needs, both primary and secondary.<sup>14</sup>

Toddlers aged 24-59 months are considered as vulnerable group in malnutrition. At this age, they are supposed to have relatively rapid growth process, however stunting can disturb this process. It occurs especially at the age of 2 to 3 years and raises the lack of energy intake, poor nutrition, and infection. Similar condition was reported by Ibrahim and Faramita, where the highest prevalence of stunting was at the age of 24-35 months, both boys and girls.<sup>15</sup>

Mothers with higher education level tend to have a basic knowledge and proper filter of information from public or mass media, such as leaflet and television program, to maintain toddler's health. It is also useful to select food with nutrient density to achieve good nutritional status so that toddlers have optimal growth and development. For that reason, the higher the mother's education, the better her knowledge of nutrition. Conversely, the lower the mother's education, the less knowledge of nutrition will be.<sup>16</sup>

The study of Simorangkir et al., which was conducted on 82 normal toddlers and 62 stunted toddlers aged 6-8 years, found that the average of def-t was 6.15 which belongs to high category. 52.4% of the stunting toddlers belonged to the high caries.<sup>17</sup> Patient's physiological factors involved in that result and were related to the condition of their teeth were prone to dental caries because of chronic malnutrition.<sup>18</sup>

The high level of dental caries in toddlers leads to poor oral and dental health status indicated by pain in the teeth, mouth, and jaw. Bacterial invasion that has reached the tooth pulp can cause throbbing pain before disturbing the physical activities and oral functions as integrated part of nutrient absorption in the body. The pain of untreated dental caries culminates to decreased appetites, chewing problems, adversity of eating some foods and drinking hot/cold beverages, weight loss, short sleep durations, and change in learning activities. All negative impacts will contribute to stunting and affect the quality of life of toddlers.<sup>6,19</sup>



**Figure 1.** Conceptual framework of the association between dental caries and delayed growth.<sup>22</sup>

Infection and caries pain affect the general condition of the toddler. It is likely that increase production of glucocorticoids in response to pain will decrease growth hormone secretion and will escalate the metabolic rate during infection. This is a possible cause of the delayed growth and development among toddlers with caries.<sup>20</sup> Asriawal and Jumriani states that there is a significant relationship between nutritional status and the level of dental caries. Toddlers with moderate to severe dental caries were stunted more than those with low and very low levels of dental caries.<sup>8</sup>

According to the result of Mann Whitney U-test, there was a difference between dental caries on stunting and non-stunting toddlers. It gives negative impact in the health of the toddler's body, especially impaired chewing function causing disruption of absorption and digestion of food as well.<sup>21</sup> The association between dental caries and delayed growth is explained in Figure 1.<sup>22</sup> The result of Mann Whitney U-test is also in line with the research by Simorangkir et al. that toddlers with high caries are 2.15 times more likely to be stunted than children with low caries, with as many as 87% of stunted children experience dental caries.<sup>23</sup> Caries is a risk factor for stunting in toddlers.<sup>24</sup> Toddlers with dental disease have five times the possibility of a decrease in nutritional status so that they become underweight.<sup>25</sup>

Stunting in children occurs due to a high history of caries (52.4%) and low protein intake (54%). The results of the Chi square test showed that there was a relationship between caries experience ( $p=0.004$ ; PR=2.150, CI=1.216-3.799), and protein intake ( $p=0.001$ ; PR=2.376, CI=1.338-4.219) with the incident of stunting.<sup>17</sup> A longitudinal study examining the relationship between dental caries and growth retardation in children under 2 years in Cambodia showed that severe tooth decay is associated with the severity of stunting.<sup>26</sup>

The dental caries and its pain on chewing can boost the risk of malnutrition in children. The systemic response mechanism is indicated by the number of white blood cells that can cause growth failure. Infection caused by dental caries can decrease appetite and nutrient absorption, which ultimately results in a deficit of micronutrients in the body. The infection incident that causes a decline in appetite is associated with the occurrence of dental caries producing pain spontaneously as a consequence of chewing mechanism. Its disruption rises the lack of nutritional intake of poor nutritional status. If it does so, stunting will appear in children.<sup>26</sup>

## CONCLUSION

There are differences in dental caries severity between stunting and non-stunting toddlers in working area of Kalisat Health Center, Jember, Indonesia. The number of the stunting toddlers with dental caries are more than the non-stunting toddlers. Most of the stunting toddlers had more severe dental caries than the non-stunting toddlers.

This study has potential limitation since it is just a quantitative research that compares the caries severity of stunting and non-stunting toddlers. The researchers did not conduct a laboratory study. Hence, it is recommended for future researchers to conduct a laboratory study on the characteristics of saliva, and the macro and micronutrient of saliva so that it can be studied from various points of view.

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## Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

## Author Disclosure

All authors declared no conflicts of interest.

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