

## RESEARCH ARTICLE

## OPEN ACCESS

Manuscript received July 13, 2024; revised July 31, 2024; accepted July 31, 2024; date of publication August 29, 2024

Digital Object Identifier (DOI): <https://doi.org/10.35882/ijahst.v4i4.375>

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**How to cite:** Shahila Nailil Muna, Isnanto, and Agus Marjianto, "The Relationship Between Maternal Nutrition During Pregnancy and Primary Tooth Caries in Stunted Toddlers: A Study at Umbulsari Community Health Center", International Journal of Advanced Health Science and Technology, vol.4, no.4, pp. 236 - 241, August. 2024

# The Relationship Between Maternal Nutrition During Pregnancy and Primary Tooth Caries in Stunted Toddlers: A Study at Umbulsari

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**ABSTRACT** Particularly during the 5th week of gestation when primary tooth enamel begins forming. Interruptions during this vital phase can cause inadequate enamel formation, which heightens the likelihood of cavities in toddlers. A study conducted observed dental examinations of 10 stunted toddlers, all of whom exhibited dental caries. This prompted an investigation into whether maternal nutrition during pregnancy correlates with primary tooth caries in stunted toddlers. The research, a retrospective case-control study using purposive sampling of 90 respondents, utilized maternal BMI data and assessed primary tooth caries incidence. Analysis using Spearman's non-parametric correlation test indicated a significant relationship ( $p=0.001$ ,  $r=0.351$ ) between maternal nutritional status and primary tooth caries. Findings from the Umbulsari Community Health Center revealed that most mothers had below-normal nutritional status during pregnancy, and stunted toddlers averaged 7.3 dental caries. It was concluded that there was a relationship between maternal nutritional status during pregnancy and primary tooth caries in stunted toddlers at the Umbulsari Community Health Center with a weak correlation coefficient and the direction of correlation between variables was negative or inversely proportional. Thus, ensuring proper maternal nutrition during pregnancy is essential for optimal primary tooth development and reducing the risk of dental caries.

**INDEX TERMS** Nutritional status, dental caries, stunting

## I. INTRODUCTION

Toddlers represent a critical phase that significantly shapes children's future growth and development [1]. The progress and maturation of toddlers directly impact their overall growth and development [2]. If the nutritional status of a toddler is not met, it will cause health problems which can result in suboptimal growth and development of the toddler. According to the Minister of Health Regulation No. 2 of 2020, the nutritional status of toddlers is divided into 4, weight according to age, height according to age, weight according to height, and body mass index according to age. These assessment standards must be used by all health workers in Indonesia [3].

Based on the 2018 Riskesdas assessment, nutritional status problems related to height according to age amounted to 30.8% of sufferers. This number will decrease in 2022, namely 21.6%. However, this figure still makes the problem of the nutritional status of height according to age a priority

among other nutritional health problems [3]. This is because the percentage of incidence of problems with height nutritional status according to age is still far above WHO standards [4]. Apart from that, nutritional status problems are one of the causes of toddler deaths every year [5].

The problem of nutritional status of height according to age is usually called stunting. In East Java province, it was found that 38.2% of toddlers were stunted [6]. This province is ranked first in the largest population on the island of Java. According to 2023 data from the Coordinating Ministry for PMK, Jember Regency in East Java has the highest rate of stunting, with a prevalence of 34.9% [7]. This indicates that Jember Regency is categorized as experiencing chronic community nutrition issues.

Dental caries in stunted toddlers is still very high, especially if nutrition during tooth formation is not met[8]. The formation of deciduous teeth in toddlers occurs during the

5th to 15th week of the mother's pregnancy. During the prenatal period, the mother is obliged to get several nutrients for the growth and development of the fetus. The nutrients that mothers must obtain during pregnancy include folic acid, protein, iron, also the highly valuable for the formation of tooth structure which are vitamin D and calcium, as it could cause Developmental Defects of Enamel (DDE) for the toddler if mothers did not get enough vitamin D and calcium during their pregnancy [9] [10].

Developmental Defects of Enamel (DDE) is an imperfection in the tooth hard tissue/enamel that occurs during odontogenesis. DDE can be characterized by the presence of white spots on tooth enamel, partial loss of tooth enamel (enamel hypoplasia), and discoloration of tooth enamel [11]. Research by RJ et al. (2021) indicates that enamel hypoplasia can increase a tooth's vulnerability to caries. This research was also conducted by Nota et al., (2020) who stated that 95% of toddlers who experienced enamel hypoplasia also experienced dental caries [12]. Enamel hypoplasia is an abnormality in the hard tooth tissue or enamel which is known as a reduction in the amount of tooth enamel due to damage to ameloblast cells. Ameloblast cell damage is caused by a lack of nutritional intake during tooth formation [13]. Thus, it is important to investigate whether there is a correlation between maternal nutritional status during pregnancy and the occurrence of primary tooth caries in stunted toddlers.

Cases of caries in toddlers are still very high. According to RISKESDAS in 2018, as many as 51.2% of toddlers aged 1-5 years experienced dental caries. This prevalence number makes the incidence of dental caries in toddlers rank first when compared with other vulnerable ages [6]. In stunted toddlers, the prevalence of dental caries is greater than in other toddlers. Research by Simorangkir et al. (2020) found that 52.4% of stunted children in Pantai Labu District had dental caries, with a deft score above 4 [14]. These findings underscore a significant association between stunting and the occurrence of tooth caries. Furthermore, research by RJ et al. (2021) conducted in Manitoba demonstrates a link between mother's nutritional status during pregnancy and the prevalence of dental caries [13].

Based on a preliminary data survey conducted on August 5 2023, the results of dental examinations of 10 stunted toddlers at the Umbulsari Community Health Center, Jember Regency showed that all toddlers had dental caries with an average of 5.7. This score shows that the caries rate in stunted toddlers at the Umbulsari Community Health Center, Jember Regency is still high [15].

Due to various factors suggesting a connection between maternal nutritional status during pregnancy and the incidence of dental caries, researchers highlight the need to investigate this relationship, particularly in relation to caries among stunted toddlers in the Umbulsari Community Health Center, Jember Regency.

## II. METHODS

This research is a bivariate correlation analytical study with a retrospective type. Its aim is to investigate the relationship between variables and analyze the collected data. One of the variables is derived by examining data on past events. The target population consists of mothers of stunted toddlers and the stunted toddlers themselves, within the jurisdiction of the Umbulsari Community Health Center in Jember Regency, chosen through purposive sampling. The inclusion criteria for respondents are mothers with toddlers aged 24-60 months as of January 2024, and mothers who bring their toddlers to visit the Integrated healthcare facilities, parents who are willing to participate and mothers with toddlers diagnosed with "stunting" nutritional status. Conversely, the exclusion criteria cover mothers of toddlers younger than 24 months or older than 60 months, those who do not visit the Integrated Healthcare Center, parents who are unwilling to participate, and mothers whose toddlers do not have "stunting" nutritional status.

The results of this inspection will be documented on an inspection sheet using the def-t data measuring scale. In addition, the recording of the BMI of mothers of stunted toddlers during pregnancy which is recorded in the KIA book or mother's cohort book will be checked and recorded on the examination sheet. After data collection is complete, a correlation test will be carried out using the Spearman non-parametric correlation test.

This research was conducted at the integrated service post at the Umbulsari Health Center, Jember Regency, located on Jl. KH. Agus Salim, Krajan Village, District. Umbulsari, Jember Regency, East Java Province. This study received ethical approval from the Surabaya Ministry of Health Polytechnic, with the approval number EA/2155/KEPK-Poltekkes\_Sby/V/2024.

## III. RESULT

A total of 90 samples were analyzed, consisting of respondents who met all the specified inclusion criteria. These criteria included mothers with toddlers aged 24-60 months as of January 2024, mothers who brought their toddlers to the newest service post, parents willing to participate, and mothers with toddlers diagnosed with "stunting" nutritional status.

**TABLE 1**  
**Respondent Characteristics**

Characteristics	Frequency (f)	Percentage (%)
Gender		
Boy	47	52.2
Girl	43	47.8
Age		
24-33 months	31	34.4
34-43 months	30	33.3
44-53 months	20	22.2
54-60 months	9	10.1

Nutritional Status		
Short	67	74.4
Very short	23	25.6

According to the data in TABLE 1, most of the respondents were male with a percentage of 52.2% with an average age of 24-33 months, namely 34.4%. There were 67 respondents under five who were classified as short nutritional status. According to the data in TABLE 2, most mothers fall within the 18-25 years age range, and approximately 33 of them have completed their education up to junior high school.

Characteristics	Frequency (f)	Percentage (%)
Age		
<18 years	1	1.1
18-25 years	51	56.7
26-33 years	29	32.2
>33 years	9	10
Mother's Latest Education		
Elementary School	24	26.7
Junior High School	33	36.7
Senior High School	27	30
Diploma/Bachelor	6	6.6

TABLE 2

#### Characteristics of The Respondent's Mother (Stunted Toddler Mother)

In the maternal nutritional status variable during pregnancy, 48 mothers were found to be in the deficient category, with a percentage of 53.3%. Apart from that, in the dental caries variable, the majority of respondents were in the range of 9 –

Characteristics	Frequency (f)	Percentage (%)
Maternal Nutritional		
Status Less	1	1.1
Normal	51	56.7
Overweight	29	32.2
Obese	9	10
Dental Caries		
<4	24	26.7
4-8	33	36.7
9-13	27	30
14-18	6	6.6
>18	0	0
d(decay)	476	68.9
e(ekstraktion)	184	31.1
f(filling)	0	0
Mean deft : 7.3		

13 teeth with an average deft of 7.3.

TABLE 3

#### Characteristics of Research Variables

TABLE 4

#### Analysis of the Relationship between Maternal Nutritional Status During Pregnancy and Dental Caries in Stunted Toddlers

Research Variable	n	r	$\rho$ Value
Maternal Nutritional Status During Pregnancy (BMI)	90		
Deciduous Dental Caries in Stunted Toddlers Aged 24-60 Months	90	-0.351	0.0001

In this study, bivariate analysis utilized the SPSS version 16.0 software to determine whether there exists a correlation between maternal nutritional status during pregnancy and dental caries in stunted toddlers at the Umbulsari Health Center in Jember district. The research employed the non-parametric Spearman correlation test, using an ordinal scale to measure maternal nutritional status variables during pregnancy and an interval scale for dental caries in stunted toddlers. According to the findings, the  $\rho$  value was (0.001), which is less than (0.05), indicating a significant relationship between maternal nutritional status during pregnancy and the occurrence of dental caries in stunted toddlers. The correlation coefficient obtained was -0.351, indicating a weak negative correlation between the variables, suggesting an inverse relationship.

#### IV. DISCUSSION

According to Sapitri et al (2022) nutritional status is an indicator in measuring the success of meeting nutritional needs [16]. It is crucial to monitor maternal nutritional status during pregnancy because the mother's nutritional status can easily change. This is supported by the explanation of Nugraha et al (2019), namely that during pregnancy, the mother's energy metabolism escalates due to the heightened demand for energy and other essential nutrients [17].

Kurdanti et al (2020) stated that BMI is a good anthropometry used to measure nutritional status compared to LiLA and fundal heigh [18]. Findings from research conducted at the Umbulsari Community Health Center, indicate that a significant proportion of mothers had poor nutritional status during pregnancy as determined by BMI calculations. These results align with those of Susanto and Ardianto (2021), who also observed suboptimal maternal nutritional status during pregnancy [19]. Similarly, research by Fitriani et al (2020) and Handayani et al (2022) identified instances where the nutritional status of some mothers of stunted toddlers during pregnancy fell below normal levels [20] [21]. Additionally, Cetin et al. (2019) discovered that the majority of pregnant women in five developed countries (USA/Canada, UHaK, Germany, Australia, and Japan) experienced malnutrition issues, potentially impacting their nutritional status [22].

Maternal nutritional status during pregnancy is influenced by dietary factors. According to UNICEF (2021), diet quality can be evaluated based on meal frequency, food variety, and portion sizes [23]. Research by Gaspersz et al (2020) shows that 83% of pregnant women with poor eating patterns experience an increase in suboptimal nutritional status [24]. Apart from that, the mother's nutritional status is also influenced by care. According to the theory put forward by UNICEF (2021), good care encouraged by adequate health services can influence the nutritional status of the mother [23]. Community health centers, as outlined in Minister of Health Regulation No. 75 of 2014, are pivotal in enhancing public

health by implementing health promotion, disease prevention, and treatment initiatives [25]. The Umbulsari Community Health Center is located in Umbulsari Village and has 3 community clinics located in Tanjungsari Village, Gadingrejo Village and Mundurejo Village as well as 2 community health centers located in Gunungsari Village and Sukoreno Village. Moreover, family support during pregnancy significantly impacts maternal care, as evidenced by research by Novitasari et al (2019), highlighting the family's influential role in maternal nutritional status during pregnancy [26].

Dental caries is tooth decay or infection of the teeth which is characterized by white spots on the teeth. According to Hasiru et al (2019), the first sign of tooth cavity formation is the presence of white spots which then change color to brown and eventually form a hole [27]. Research conducted by Fadhillah et al (2021) suggests a link between toddlers' nutritional status and the incidence of dental caries among them [28]. Aviva et al (2020) also observe that toddlers with inadequate nutritional status tend to have a higher rate of tooth caries compared to those who are better nourished [8].

Research conducted at the Umbulsari Community Health Center revealed that the prevalence of dental caries in primary teeth among stunted toddlers was exceptionally high. These results align with studies by Fadhillah et al (2021) who also examined dental caries in stunted toddlers by obtaining results in the very high def-t category [28]. Apart from that, Achmad et al (2020) and Simorangkir (2020) conducted research related to dental caries in stunted toddlers with results in the very high def-t category [28] [14]. This is supported by research from Rohanawati et al (2019), which revealed that stunted toddlers are more vulnerable to dental caries in their primary teeth compared to other children [30]. According to WHO (2013), deciduous dental caries can be said to be very high if the number of defects exceeds 6 teeth [15]. def-t is an indicator that has been determined by WHO to measure the caries index in children who still have deciduous teeth [31].

Dental caries develops as a result of bacterial presence in the mouth. Bacteria that cause dental caries include *Streptococcus mutans* and *Lactobacillus* according to Achmad & Adam (2019) [32]. This idea is supported by the theory of Kidd & Bechal (1991) which suggests that streptococcus mutans and lactobacillus are cariogenic bacteria because of their ability to convert carbohydrates into acids by fermentation [33]. Another factor that causes caries to occur is time. According to Kidd & Bechal's (1991) theory, dental caries occurs over a period of months or years, because it is impacted by the ability of saliva to reattach minerals during the process of caries formation [33]. Parianti (2021) emphasizes that maintaining oral hygiene and dental health can help to prevent dental caries [34]. Furthermore, Mulyati et al. (2022) highlight that the consumption of cariogenic foods can stimulate acid production by *Streptococcus mutans* and *Lactobacillus* bacteria, leading to demineralization [35]. This aligns with Kidd & Bechal's theory (1991), which identifies

food as one of the contributors to dental caries development [33].

Another factor that causes caries to occur is the host. n RJ et al's (2021) research, results were obtained in the form of the idea that imperfect tooth formation can cause dental caries [13]. The formation of deciduous teeth begins at 5 weeks of gestation according to Wangidjaja (2017) [36]. Therefore, maintaining maternal nutritional status during pregnancy is highly important to ensure proper formation of deciduous teeth in children. This happens because the tooth formation period occurs during the 5th week of pregnancy, during which time it is very necessary to provide balanced nutrition, especially vitamin D and calcium so that toddlers' teeth are not vulnerable to dental caries, this was stated by Wangidjaja (2017) and Djameluddin (2020)<sup>(34)(10)</sup>. This research supports Kidd & Bechal's theory (1991), which identifies host factors as contributors to dental caries development [33].

Maternal nutritional status during pregnancy plays a crucial role in the development of dental caries in toddlers' primary teeth. According to Aviva et al. (2020), some toddlers experience dental caries because the mother's nutritional needs during the formation of the toddler's deciduous teeth are not optimal [8]. To maintain a stable nutritional status, pregnant women are required to fulfill their daily nutritional diet. According to the Indonesian Ministry of Health (2023), the nutrients that must be met during pregnancy include: folic acid, protein, iron, vitamin D and calcium [37]. Vitamin D and calcium are the specifically needed nutrients for the formation of milk tooth structure. According to research by Djameluddin et al. (2020), it was concluded that if during the prenatal period, the mother does not get enough vitamin D and calcium nutrition, this can cause toddler's deciduous teeth to experience Developmental Defects Of Enamel (DDE) [10].

According to Collignon et al. (2022) DDE is a defect in the hard tissue matrix of the tooth [38]. Vélez-León et al (2022) suggested that Developmental Defects of Enamel (DDE) can be characterized by the presence of white spots on tooth enamel, partial loss of enamel (enamel hypoplasia) and discoloration of tooth enamel [11]. Enamel hypoplasia can cause teeth to be susceptible to caries, this is because part of the tooth enamel has been eroded. According to RJ et al. (2021), enamel hypoplasia is caused by damage to ameloblast cells, where this damage is caused by a lack of nutritional intake during tooth formation [13].

According to the results of the correlation test which was carried out using the Spearman correlation test conducted with 90 respondents, the results showed that H1 was accepted and H0 was rejected. Apart from that, it was also found that the correlation coefficient between the two variables was quite close. These results led to the conclusion that there exists a connection between maternal nutritional status during pregnancy and deciduous dental caries in stunted toddlers at the Umbulsari health center. The correlation falls within the weak category, and the

relationship between the variables shows a negative or inverse proportionality. With the results of this research, it is hoped that the public will pay more attention to the nutrition of pregnant women so that children's primary teeth are not easily affected by dental caries. This study did not examine which specific nutrients are beneficial for the formation of primary teeth. Future research is expected to address this issue.

## V. CONCLUSION

Based on research on the correlation between maternal nutritional status during pregnancy and primary tooth caries in stunted toddlers at the Umbulsari Community Health Center, it can be concluded that:

- This study seeks to investigate the correlation between maternal nutritional status during pregnancy and the occurrence of primary tooth caries in stunted toddlers.
- The nutritional status of mothers during pregnancy with stunted toddlers at the Umbulsari Community Health Center predominantly falls below 18.5 kg/m<sup>2</sup>, categorizing them as underweight.
- Primary tooth caries in stunted toddlers at the Umbulsari Community Health Center are mostly in the 9-13 tooth interval range and are included in the very high category.
- There is a weak correlation between maternal nutritional status during pregnancy and dental caries in primary teeth of stunted toddlers at the Umbulsari Community Health Center, suggesting that other factors might have a stronger impact.
- The direction of correlation between variables is negative or inversely proportional, so if the variable value of maternal nutritional status during pregnancy is high, then dental caries in stunted toddlers will be lower.
- It is anticipated that this study will serve as a useful reference for future research.

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