Factors affecting delayed tooth eruption among children aged 6-24 Months: a cross-sectional study

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ABSTRACT

Introduction: Nutritional status is one of the most important things that parents must pay attention to, especially when the child is in the golden period of growth, which consists of the period of growth and development, including tooth eruption. Tooth eruption is influenced by various factors, one of which is nutritional factors. Mothers' health status may then determine their children's primary dentition status, and also the child's status itself. This study aims to analyze factors related to delayed tooth eruption in children aged 6–24 months. **Methods:** This research was a cross-sectional study conducted among 464 children aged 6–24 months. The sampling method employed was a total sampling technique undertaken in 10 villages within the Pandeglang district, West Java. Tooth eruption time used the Primary Tooth Development figure by the American Dental Association (ADA). Statistical analysis was performed using chi-square and logistic regression. Research ethics were obtained from YARSI University. **Results:** There was a significant relationship between delayed tooth eruption and mother's Body Mass Index (BMI), nutritional status of children, and gender, with a value of $\rho<0.05$. Female sex (AOR=1.51), stunting (AOR=1.86), and underweight (AOR=1.78) increased the odds of delayed eruption. **Conclusion:** Nutritional status influences eruption timing. Integrating oral assessments into routine child growth monitoring could improve early detection of developmental risks in children aged 6 – 24 months.

Keywords

Delayed primary tooth eruption, nutritional status, children aged 6 – 24 months

Faktor-faktor yang mempengaruhi keterlambatan erupsi gigi pada anak usia 6-24 bulan: studi cross-sectional

ABSTRAK

Pendahuluan: Status gizi merupakan faktor krusial yang perlu diperhatikan oleh orang tua, terutama pada masa perkembangan awal anak, yang meliputi periode pertumbuhan pesat, perkembangan fisiologis, serta erupsi gigi. Erupsi gigi dipengaruhi oleh berbagai faktor, salah satunya adalah faktor gizi. Status kesehatan ibu menentukan status gigi sulung anak-anak mereka, demikian pula status anak itu sendiri. Penelitian ini bertujuan untuk menganalisis faktor-faktor yang berhubungan dengan keterlambatan erupsi gigi pada anak usia 6 - 24 bulan. **Metode:** Penelitian ini merupakan penelitian potong lintang yang dilakukan di antara 464 anak usia 6 - 24 bulan. Metode pengambilan sampel yang digunakan adalah teknik total sampling yang dilakukan di 10 desa di kabupaten Pandeglang, Jawa Barat. Waktu erupsi gigi menggunakan angka Perkembangan Gigi Sulung oleh *American Dental Association* (ADA). Analisis statistik dilakukan dengan menggunakan chi-square dan regresi logistik. **Hasil**: Terdapat hubungan yang signifikan antara keterlambatan erupsi gigi dengan IMT ibu, status gizi anak, dan jenis kelamin, diperoleh nilai p=0,05. Jenis kelamin perempuan (AOR=1,51), stunting (AOR=1,86), dan berat badan kurang (AOR=1,78) meningkatkan kemungkinan erupsi tertunda. **Simpulan**: Status gizi secara memengaruhi waktu erupsi. Mengintegrasikan pemeriksaan gigi ke dalam pemantauan pertumbuhan anak secara rutin dapat meningkatkan deteksi dini risiko pada anak usia 6-24 bulan.

Kata kunci

Erupsi gigi sulung terlambat, status gizi, anak usia 6 – 24 bulan

INTRODUCTION

Nutritional status is one of the most important things that parents must pay attention to, especially when the child is in the golden period of growth, which consists of the period of growth and development, including tooth eruption. The problem of malnutrition that has received a lot of attention recently is the problem of chronic malnutrition in the form of short or "stunting" children. Stunting remains a significant global health issue, despite a decline in its prevalence over time. The global prevalence of stunting in toddlers was 22.3%, or 148.1 million children, in 2022. More than half of the world's stunted toddlers came from Asia (76.6 million).[1,2] The Indonesian report based on SKI 2023 stated that 21.5% of children experienced stunting (short).[3]

Poor nutritional status in children can have lasting effects on biological function, thus influencing tooth eruption.[4] Malnutrition in early childhood increases susceptibility to dental problems such as defects in odontogenesis, delayed eruption, and salivary gland changes. Consequently, nutritional disorders significantly affect dental formation and may lead to hypoplastic enamel, which is more prone to caries. Based on the literature review by Setiawan et.al., malnutrition is one of the factors that influences the delay in the eruption of children's permanent teeth. Children with below average body weight and height tend to experience slower tooth eruption than those with normal growth parameters.[5,6]

Childhood body mass index is associated with early dental development and eruption in a longitudinal sample from the Iowa Facial Growth Study.[7] Research conducted in Kabupaten Sidenreng Rappan among 323 primary school children demonstrated a significant relationship between nutritional status (malnutrition) and tooth eruption.[8] Moreover, children with higher socioeconomic backgrounds tend to experience earlier tooth eruptions compared to those from lower socioeconomic groups, likely due to better access to health and nutritional services.[5]

Tooth eruption is the normal movement of teeth towards the oral cavity from their growth position in the alveolar bone. Eruption is the process of tooth development, which moves from the position of the tooth germ through the alveolar into the oral cavity.[9] The eruption of primary teeth typically starts between 4 and 8 months of age, with the appearance of the lower incisors, and is usually completed between 24 and 36 months when the second deciduous molars emerge. However, the timing of the eruption can vary for up to six months. Delayed tooth eruption refers to the emergence of a tooth into the oral cavity at a time that differs substantially from the expected normal range.[10]

Disturbances in tooth development, specifically the timing or sequence of eruption, can lead to complications such as malocclusion, crowding, impaired oral hygiene, periodontal disease, and the need for orthodontic treatment. Variations in the eruption timing of the first primary tooth are considered multifactorial. Differences in the timing of primary tooth eruption have been observed across various ethnic groups and between males and females. Nonetheless, environmental influences also play a major role. Factors such as maternal smoking during pregnancy, infant birth weight and length, nutritional status at birth and during early life, gestational age, feeding practices, and socioeconomic conditions have all been identified as significant contributors to tooth eruption patterns. Delayed eruption is commonly seen in premature infants with low birth weight or systemic conditions like hypothyroidism, whereas accelerated eruption tends to occur in children born to mothers who smoked during pregnancy and in those affected by obesity or diabetes mellitus.[9,11]

Pandeglang Regency, Banten, is among the districts in Indonesia with a high prevalence of nutritional problems, including stunting. In 2017, approximately 46,000 toddlers were reported to experience stunting.[12] Six sub-districts and 10 villages in Pandeglang Regency have been designated as the locus of stunting problems, namely Koroncong, Saketi, Banjar, Sindangresmi, Cipeucang, and Kaduhejo Sub-districts. In

Bayumundu Village, Kaduhejo District, the stunting rate reached 37.9% based on Posyandu monitoring data.[13]

Universitas YARSI assists in overcoming stunting by conducting research and community service activities in 10 villages as the locus of stunting, namely Kadu Maneuh, Koroncong, Pakuluran, Pasirkarag, Tegalongok, Banyu Mundu, Pasirdurung, Langensari, Koncang, and Kadugadung in Pandeglang Regency. This study offers a novel contribution by embedding oral developmental assessment into stunting intervention programs in high-prevalence stunting areas. By analyzing delayed primary tooth eruption in infants aged 6–24 months within designated stunting locus villages, the research introduces oral health indicators as part of early stunting surveillance, an approach that has not been systematically implemented in community-based stunting programs. This study aimed to analyze factors related to delayed tooth eruption in children aged 6–24 months.

METHODS

An observational, analytical, cross-sectional study was carried out in the Pandeglang District involving 464 children aged between 6 and 24 months. The research period was started from August 2019 to December 2019. The population was all children aged 6-24 months in selected villages in Pandeglang Regency. The sample size was based on calculations of 246; we used 464 children as the total sample. We asked mothers to fill in an informed consent form if they were willing to take part in the research activities. The exclusion criteria were children aged<6 months or>24 months, or experiencing infectious diseases such as TB, diarrhea, etc., or having difficulty in taking anthropometric measurements of children. This study used a questionnaire and anthropometric examination for the mother and child.

The outcome variable was delayed primary tooth eruption, and the exposure variables were as follows gender, parents' work status, parents' education, family income, parents' smoking at home, stunting status at birth, children's weight status, children's height status, and mother's weight status. Data on stunting at birth may rely on maternal recall, potentially introducing recall bias. The researcher conducted validity and reliability tests on the questionnaire and conducted interviewer training to avoid potential bias in this study.

The children's body weight was measured using a calibrated electronic scale while they were barefoot and dressed in light clothing, accompanied by their mother or caregiver. Body height was assessed with a non-flexible measuring tape accurate to 0.1 cm. Each measurement was taken twice, and the average value was used to calculate height-for-age, weight-for-height, and weight-for-age indices. Nutritional status was determined according to World Health Organization (WHO) guidelines.

Table 1. Primary tooth development

Tooth	Expected Age of Eruption	Age Cut-off (Upper Limit)
Maxillary Central Incisor	8–12 months	12 months
Maxillary Lateral Incisor	9–13 months	13 months
Mandibular Central Incisor	6–10 months	10 months
Mandibular Lateral Incisor	10–16 months	16 months
Maxillary Canine (Cuspid)	16-22 months	22 months
Mandibular Canine (Cuspid)	17-23 months	23 months
Maxillary First Molar	13-19 months	19 months
Mandibular First Molar	14-18 months	18 months
Maxillary Second Molar	25-33 months	33 months
Mandibular Second Molar	23-31 months	31 months

Children within ±2 standard deviations (SD) of the mean were classified as having normal nutritional status, those with z-scores between –2 and –3 as mildly malnourished, and those below –3 SD as severely malnourished.[14] The nutritional status of the mother was classified using the BMI WHO categories.[15] Children's oral examination was done to record the number of erupted teeth. Delayed tooth eruption was determined using the Primary Tooth Development figure by the American Dental Association (ADA) (Table 1.).[16]

Delayed tooth eruption was assessed for each child. It is determined by whether a certain minimum number of teeth have not erupted by the upper age cut-off specified in the ADA time table guidelines. For example, for maxillary central incisors, eruption occurs between 8 and 12 months, maxillary lateral incisors erupt between 9 and 13 months, and mandibular central incisors erupt between 6 and 10 months.

The eruption limits used are 12 months for maxillary central incisors, 13 months for maxillary lateral incisors, and 10 months for mandibular central incisors. Therefore, at least the mandibular central incisors should have erupted by 10 months, and the mandibular and maxillary central incisors should have erupted by 12 months. By 13 months, the maxillary central incisors and lateral incisors and the mandibular central incisor should have erupted. If there are still unerupted teeth at that age, the child is classified as having delayed eruption of primary teeth.

Data analysis was carried out using SPSS version 23.0 software. The Chi-squared test and multivariate logistic regression analysis were used in the analysis. We used a backward stepwise selection method to determine the final set of variables included in the multivariable logistic regression model. The backward stepwise method was started by including all candidate variables in the model ($p \leq 0.25$). Variables with the highest p-values above a predetermined threshold of 0.05 were removed one by one, and the model was refitted after each step.

The process continued until all remaining variables had a statistically significant impact on the dependent variable (delayed tooth eruption) or until all variables were retained based on their contribution to the model. The Hosmer-Lemeshow test was performed to assess the goodness-of-fit of the final multivariable logistic regression model. The test evaluates whether the observed event rates match the expected event rates in subgroups of the data. A p-value greater than 0.05 indicates a good fit between the observed and expected outcomes.

RESULTS

In this research, the total sample was 464 children aged 6-24 months, with a gender ratio of 47% being girls and 53% being boys. The rates of children with the age of ≤12 months was 42,5% and the age of >12 months was 57,5%. The mean age of mothers was 29 ± 6.3, with a minimum age of 18 years old and a maximum age of 47 years old. Most mothers had a formal education of lower than senior high school (75,9%), and only 24,1% of them had a formal education of at least senior high school. As many as 25% and 31% of children were underweight and stunted (Figure 1). Undernourished mothers were 9,2%, while more than one-third of mothers (34,9 %) were obese (Table 1).

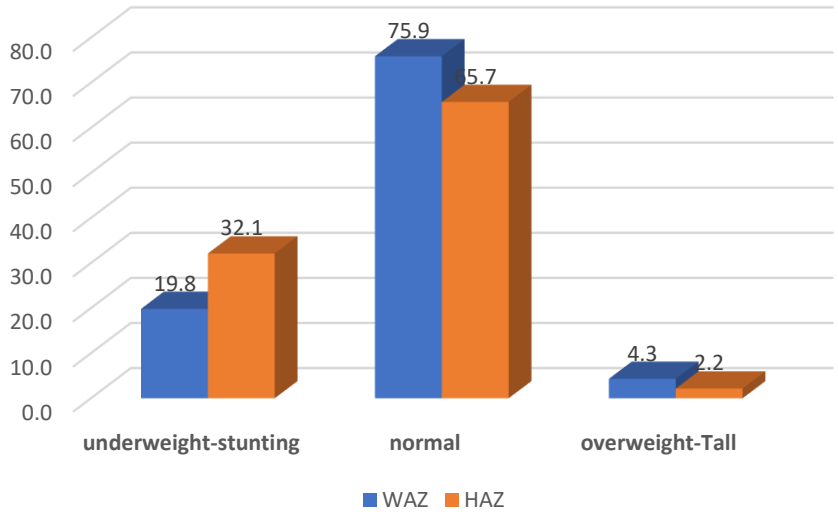

Figure 1. Distribution of weight and height based on child age

Table 1. Distribution of mothers' weight status

Mother's weight status (BMI)	n	Percent
Very thin (<17)	15	3.2
light thin (17 - 18.4)	28	6.0
Normal (18.5 - 25)	259	55.8
Light Obese (25.1-27.0)	70	15.1
Obese (>27.0)	92	19.8
Total	464	100.0

Based on the results of bivariate analysis, a significant relationship was found between the variables: child's gender, Height status (Height/Age), Weight status (Weight/Age), Mother's weight status (BMI), and delayed eruption of primary teeth (p<0,05). When we looked at the Odds Ratio (OR), girls were more at risk of experiencing delayed eruption compared to boys. Underweight and Stunting children were more at risk of experiencing delayed eruption. Low birth weight (LBW) babies, underweight mothers, mothers' work status, father's education, parents' smoking at home, and stunting status at birth, had a higher risk of having delayed eruption than normal babies, although the relationships were not significant.

Table 2. Bivariate analysis between socio-demographic variables, nutritional status and the eruption of children's primary teeth

Variables	Tooth Eruption		p Value	OR (95% CI)
	Delayed Eruption	Normal eruption		
Gender				
Girl	134 (61.5)	84 (38.5)	0.033	1.50 (1.03-2.16)
Boy	127 (51.6)	119 (48.4)	Reference	Reference
Mother's work status				
Not working	235 (57.7)	172 (42.3)	0.085	1.64 (0.93-2.89)
Working	25 (45.5)	30 (55.5)	Reference	Reference
Father's work status				
Not working	13 (46.4)	15 (53.6)	0.259	0.65 (0.30-1.40)
Working	245 (57.1)	184 (42.9)	Reference	Reference
Mother's Education				
< Senior high school	198 (56.3)	154 (43.8)	0.868	1.04 (0.68-1.59)
≥ Senior high school	62 (55.4)	50 (44.6)	Reference	Reference
Father's Education				
< Senior high school	193 (57.4)	143 (42.6)	0.379	1.20 (0.80-1.82)
≥ Senior high school	65 (52.8)	58 (47.2)	Reference	Reference
Family income				

< GNP	168 (55.1)	137 (44.9)	0.937	1.02 (0.66-1.58)
≥ GNP	59 (54.6)	49 (45.4)	Reference	Reference
Parents smoking at home				
Yes	215 (58.0)	156 (42.0)	0.272	1.31 (0.81-2.13)
No	41 (53.3)	39 (46.7)	Reference	Reference
Stunting status at birth				
Stunting	43 (58.1)	31 (41.9)	0.280	1.35 (0.66-1.89)
Normal	100 (50.8)	97 (49.2)	Reference	Reference
Height Status				
Stunting	100 (67.1)	49 (32.9)	0.002	1.90 (1.26 – 2.86)
Tall	3 (30.0)	7 (70.0)	0.175	0.40 (0.10 – 1.57)
Normal	158 (51.8)	147 (48.2)	Reference	Reference
Weight Status				
Underweight	63 (68.5)	29 (35.5)	0.015	1.87 (1.15 – 3.05)
Overweight	9 (45.0)	11 (55.0)	0.598	0.71 (0.29 – 1.75)
Normal	189 (53.7)	163 (46.3)	Reference	Reference
Birth weight				
Low birth weight	37 (64.9)	20 (35.1)	0.159	1.51(0.85-2.69)
Normal	224 (55.0)	183 (45.0)	Reference	Reference
Mother's Weight Status				
Underweight	33 (68.8)	15 (31.3)	0.251	1.55 (0.80 – 2.99)
Overweight–Obese	73 (48.0)	79 (52.0)	0.045	0.65 (0.44 – 0.97)
Normal	155(58.7)	109(41.3)	Reference	Reference

In multivariate logistic regression analysis, variables such as gender, maternal BMI, child nutritional status, and stunting remained in the final model because they were significantly associated with delayed tooth eruption, with adjusted odds ratios of 1.80 for stunting and 1.78 for underweight. Overweight BMI-for-age was associated with reduced odds (OR=0.64), 1.52 for gender, 1.34 for LBW, and 1.40 for underweight mothers (LBW and underweight mothers were not significant). The Hosmer-Lemeshow p-value was 0.968, indicating that the final model adequately fits the data and provides a reliable prediction of delayed tooth eruption (Table 3 and Figure 2).

Table 3. Factors associated with delayed tooth eruption

Predictor	Category	B	p-value	Adjusted OR (95% CI)
Height-for-age	Stunting vs. Normal	0.587	0.007	1.80 (1.18–2.75)
	Tall vs. Normal	–0.837	0.237	0.43 (0.11–1.74)
Weight-for-age	Underweight vs. Normal	0.578	0.024	1.78 (1.08–2.95)
	Overweight vs. Normal	–0.358	0.453	0.70 (0.27–1.78)
Mothers' BMI	Underweight vs. Normal	0.338	0.326	1.40 (0.72–2.75)
	Overweight-obese vs. Normal	–0.440	0.037	0.64 (0.43–0.97)
Low Birth Weight	LBW vs. Normal	0.292	0.344	1.34 (0.73-2.45)
Gender	Female vs. Male	0.418	0.032	1.52 (1.04–2.23)

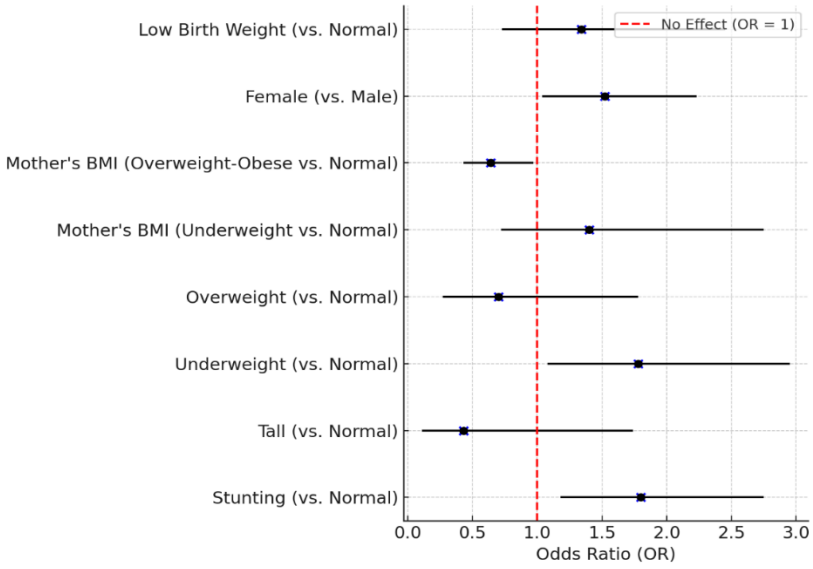

Figure 2. Forest Plot Factors Associated with Delayed Tooth Eruption

DISCUSSION

The timing of the first primary tooth eruption, as shown in Table 1, is influenced by multiple factors rather than a single cause. Various conditions may interact, either cumulatively or synergistically, with delayed tooth eruption.[10] Tooth eruption is a biological process influenced by both systemic and environmental factors, beginning in utero and continuing through early childhood. The conceptual framework for delayed tooth eruption was structured through three interrelated pathways: Maternal Nutritional status, child nutritional status, and socioeconomic and environmental factors.[10]

The logistic regression analysis conducted for factors associated with delayed tooth eruption in children highlights the significant influence of several demographic and maternal variables. As seen in table 3, among the predictors, stunting and underweight were the most significant factors, with adjusted odds ratios (OR) of 1.80 and 1.78, respectively. This suggests that children who are stunted or underweight are more likely to experience delayed tooth eruption compared to their peers who are of normal height and weight. These findings align with previous studies that show a strong relationship between poor nutritional status and delayed developmental milestones, including dental eruption.

Table 3 demonstrates that underweight children often experience delays in the eruption of their teeth, likely due to nutritional deficiencies that affect both dental and skeletal development. This relationship underscores the importance of ensuring adequate nutrition in early childhood to support both growth and oral health. Studies generally indicate a positive relationship between an infant's weight and the number of erupted teeth. Reis et al. 2021 in their study found that underweight children had more than 3 times higher chance of presenting delayed tooth eruption than normal weight children.[17] Verma et al. also identified a direct link between an infant's body mass index and tooth eruption.[18] This shows that BMI or the present weight of the child has a direct relationship with tooth eruption, where eruption time increases as BMI decreases. Socioeconomic status is also related, as children from higher socioeconomic backgrounds tend to have more age-appropriate teeth. Poor children are more frequently affected by malnutrition and show delayed tooth emergence.[18] Wu et al. proposed that adequate nutrition during early infancy can prevent delays in the eruption of the first primary tooth.[11]

Shaweesh and Al-Batayneh, along with Vejdani et al., examined the association between children's growth parameters, height, and weight, and the eruption of deciduous teeth.[19,20] Findings from Shaweesh and Al-Batayneh revealed that body weight had a stronger correlation with the timing of tooth eruption compared to height.[19] Meanwhile, the study by Vejdani et al. involving children aged 3 to 15 months in Rasht, Iran, reported delayed eruption of primary teeth and identified a significant association between height-for-age and the eruption of the first deciduous teeth in boys, though no such relationship was found in girls. Their findings further suggested that the timing of primary tooth eruption can serve as an indicator of a child's nutritional status.[20]

Essential nutrients such as calcium, phosphorus, vitamin C, and vitamin D are critical for both growth and dental development. A deficiency in these nutrients, common in stunted children, can lead to delays in tooth eruption. Research indicates that children experiencing stunting are more likely to have delayed tooth eruption compared to their adequately nourished peers. Nutritional deficiencies can negatively impact both the quantity and quality of saliva, thereby influencing the tooth eruption process. Chronic malnutrition disrupts tooth development, leading to enamel hypoplasia and delayed eruption.[5,21]

Studies in India have reported a significant association between poor nutritional status and delayed eruption of primary teeth. Furthermore, malnutrition and growth stunting have been shown to have a stronger link with delayed tooth eruption compared to wasting. Ali et al. conducted a study in Iraq involving children aged 4 to 48 months and found that the z-scores for height-for-age and weight-for-age were positively correlated with the number of erupted deciduous teeth. The findings indicated that children with greater height and body weight tended to have more erupted teeth compared to their peers. This suggests that children with normal growth and adequate nutrition experience earlier and more complete tooth eruption.[22] In Setiawan et al review article, it was stated by Gaur and Kumar that a child's height shows a stronger correlation with the number of erupted primary teeth than body weight, likely because tooth eruption is closely connected to overall skeletal growth.[5]

A study conducted in South Sumatra, Indonesia, found that among 94 primary school children, 33% were identified as stunted; of those stunted, 67.7% experienced delayed tooth eruption with an Odds Ratio of 2.63, indicating that stunted children were 2.6 times more likely to have delayed tooth eruption than those without stunting ($p=0.034$).[6] Another study in East Java, Indonesia, focused on toddlers aged 19–60 months and reported that stunting affects the timing of primary tooth eruption.[23] Stunted children not only face challenges in growth but also in dental development, which can have long-term implications for their overall health and well-being. Chronic malnutrition associated with stunting can lead to deficiencies in essential nutrients that are critical for dental development, resulting in delayed eruption and developmental issues such as dental hypoplasia.[5]

Maternal nutritional status plays an important role in determining the timing and sequence of primary tooth eruption in children because maternal nutritional status (BMI) affects fetal growth and the development of tooth germs during pregnancy. Maternal underweight often reflects inadequate nutrient intake, which can adversely affect fetal growth and development. Nutrient deficiencies—particularly in calcium, phosphorus, vitamin D, and protein—may impair odontogenesis and delay the eruption of primary teeth. Maternal malnutrition during pregnancy significantly affects enamel formation and mineralization, contributing to dental hypoplasia and delayed eruption. Maternal food intake during early pregnancy is important for the offspring's bone and dental development.[24]

The results of this study indicated that underweight mothers had 1.4 times of their children experiencing delayed eruption compared to mothers of normal weight, although the relationship was not significant because of the small sample size. Several studies have

shown that underweight mothers are more likely to have infants who experience delayed eruption of their primary teeth.[25,26] Research by Amalia et al. at the Umbulsari Public Health Center in January 2024, involving 78 mothers and their toddlers aged 24 to 52 months, showed a significant association between maternal nutritional status and the timing of primary tooth eruption (ρ=0.035), indicating that suboptimal maternal nutrition may contribute to delayed dental development in stunted children.[25] Study by Badruddin et al. found that maternal nutritional status had a significant influence on both the onset and the duration of primary tooth eruption ($p<0.05$). Inadequate maternal nutrition was associated with a delayed initiation of tooth eruption as well as a prolonged eruption period. Children born to mothers with poor nutritional status showed significantly later eruption onset and longer eruption duration compared with those whose mothers had adequate nutritional status.[26]

Poor maternal nutrition during pregnancy can lead to premature birth, low birth weight (LBW), and impaired infant growth, all of which are recognized as factors contributing to delayed tooth eruption. Birth weight is often used as an indicator of maternal nutritional status and intrauterine health, and primary tooth eruption may reflect maternal nutrition during pregnancy.

Studies showed that infants with LBW typically experience slower primary tooth eruption, highlighting the role of maternal nutrition in fetal skeletal and dental development.[10] Maternal underweight can indirectly affect dental milestones by limiting fetal nutrient availability and influencing postnatal growth. As tooth eruption is closely linked to overall physical and skeletal development, ensuring adequate maternal nutrition before and during pregnancy is crucial for promoting healthy growth and timely tooth eruption.

The relationship between low birth weight (LBW) and the eruption of deciduous teeth has been examined in several studies, indicating that LBW is associated with delayed tooth eruption.[11] Birth weight has an influence on tooth eruption and shows an inverse linear relationship of lower birth weight corresponding to later eruption. Several studies have examined the relationship between LBW and delayed tooth eruption, consistently finding that lower birth weight is associated with later tooth eruption. Research also suggests that prematurity, which often accompanies LBW, contributes to delayed eruption.[18] In this study, a positive association was observed between LBW and delayed eruption of deciduous teeth in children under 24 months, with an adjusted odds ratio (AOR) of 1.34, although the p-value was not statistically significant due to the small sample size. This delay is likely influenced by inadequate nutritional factors during pregnancy and early life.

The relationship between gender and the eruption of primary teeth has been explored in various studies, indicating notable differences in the timing of tooth eruption between males and females. A study in China by Wu et al. with 1,296 mothers in their first trimester from the Affiliated Obstetrics and Gynecology Hospital of Nanjing Medical University between May 2014 and September 2015 found that the timing of the first primary tooth eruption occurred earlier in male infants compared to females.[11] Verma et al. in India also found early eruption of teeth in boys compared to girls, although deciduous dentition was completed in both sexes at the same time.[18]

Many studies reported no significant differences in the timing of tooth eruption between genders, as seen in the study by Al-Batayneh et al. in Jordan, which covered a total of 1,988 children.[27] However, girls often surpass boys in the total number of erupted teeth by about 15 months. This suggests a complex dynamic where boys may start earlier, but girls eventually have more teeth. The mechanisms underlying these gender differences in tooth eruption timing are not entirely understood but may be influenced by hormonal factors, genetic predisposition, and environmental conditions. Various maternal and neonatal factors can also influence this relationship, highlighting the complexity of dental development processes. Malnutrition and poor nutrition in early childhood affect tooth eruption and result in delayed emergence of teeth.

Factors like birth weight, BMI, and socioeconomic status have been observed to affect tooth eruption. Feeding habits also play a role in determining the number of teeth erupted in children.[18] Amalia et al. cited research by Lu et al., which found no significant correlation between pre-pregnancy BMI and the timing of deciduous tooth eruption in a large-scale study conducted in China, suggesting that other biological and environmental factors may influence this association. These findings highlight that the relationship is complex and population-dependent.[25]

Strengths of this study include a large sample size, use of standardized anthropometric indicators (PB/U, BB/U, BMI-for-age), and robust multivariable modeling with good calibration. The model demonstrated consistent and plausible associations between growth status and eruption timing. However, several limitations should be acknowledged. First, the cross-sectional design restricted causal inference. Second, dental eruption was assessed at a single time point, and longitudinal tracking might provide richer insight. Third, potential confounders such as micronutrient deficiencies (e.g., calcium, Vitamin D), systemic illness, or socio-economic variables were not included in the model.

CONCLUSION

The findings of this study highlight the critical role of nutritional status in influencing the timing of primary tooth eruption, reinforcing the need to view oral development as an integral component of early childhood growth assessment. Implication of this research is to enhance early detection of developmental and nutritional risks in children aged 6–24 months and integrate oral health evaluations, particularly eruption status of primary teeth, into routine child growth monitoring programs of posyandu or primary health care visits.

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