

## The Relation of Mothers' Nutritional Status to Primary Teeth Eruption Timing

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### Abstract

Primary dentition is developed starting from four months of pregnancy. Mothers' health status may then determine their children's primary dentition status. Nutrition is thus an essential factor in dental development, and the National Health Basic Survey 2013 showed that nutrition problems in Indonesia are still a concern. Delayed eruption is one way that nutrition problems affect the growth and development of teeth. This study aimed to analyze the relationship between mothers' nutritional status and their children's primary teeth eruption time. In total, 172 children under three years old were selected from a health screening in Depok Sub-district, West Java. Information about the mothers' nutrition was collected through the mother and child's health book. Primary teeth eruption phases were examined via the Hulland method. The prevalence of mothers with a poor nutritional status during pregnancy was 18%. Mothers' nutritional status significantly affected the initial timing and duration of the primary dentition eruption process ( $p < 0.05$ ). Children from mothers with poor nutritional status during pregnancy had later timing and longer eruption process duration in their primary teeth.

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### Introduction

Nutrition is defined as substances that the body requires to maintain human life. Nutrition is essential for dental growth and development. Maternal nutrient intake during pregnancy directly affects tooth development during the fetal growth period. Therefore, the nutritional status of pregnant women will determine their children's oral health.<sup>1</sup>

Nutritional status is a health condition associated with food and nutrient intake, absorption, metabolism, and excretion. Nutritional status measured by certain variables reflects the balance between nutrient intake and output. The measurement of nutritional status can thus help differentiate between good, excessive, and poor nutritional conditions.<sup>2</sup>

Indonesia is still experiencing nutrition problems, which are also common in many other developing countries. According to National Health Basic Research (Riskesdas), in 2013<sup>3</sup>, 24.2% of pregnant women presented with poor nutritional status. Meanwhile, even though protein is important for dental growth and development (especially during the tooth eruption period), the national prevalence of low protein consumption was 58.5%.

In dental health, determining the relationship between nutritional status and oral health is important, as there are frequently found typical characteristics of the various tissues in the oral cavity that are more sensitive to nutritional deficiencies. Therefore, when the body experiences a nutritional deficiency, the tissues in the oral cavity are often the first to show the effects of this nutritional deficiency.<sup>4</sup>

Tooth eruption is the emergence of tooth crown in the oral cavity, which grows axially from the jaw bone and penetrates the gingiva up to its functional position and reaches its occlusion contact.<sup>5</sup>

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Primary teeth eruption is affected by gestational age, postpartum nutrition, premature birth, and the severity of neonatal disease.<sup>6</sup> Tooth eruption also reflects the body's growth in general.<sup>7</sup> When tooth eruption is delayed, the body's growth in general can be said to be constrained.

Knowledge of the chronology and pattern of tooth eruption is very useful to improve standard criteria for preventive dental health care and to diagnose and perform dental health care in children.<sup>1</sup> Therefore, this study aimed to determine the effect of maternal nutritional status on primary teeth eruption timing. The results are expected to inform a recommendation on a preventive dental care model that is more effective and efficient and to inform an integrated nutrition improvement program for mothers during pregnancy and for children during their age of growth.

### Methods

The cross-sectional study was carried out as a health screening at five Posyandus in Beji and Tanah Baru Sub-districts, Depok, West Java. A Posyandu is a primary health care based vehicle that integrates mother and child health care at the sub-district level.

The health post is organized by Puskesmas (Community Health Centre) staff but run by local health cadres. In total, 335

mother-child pairs were enrolled at baseline for this study. Children under three years old and their mothers who had a complete health book were selected for the study. Information about the mothers' nutrition during pregnancy was collected through the health books. Maternal mid-arm circumference was recorded to determine the mothers' nutritional status during pregnancy. Primary teeth eruption phases were examined using the Hulland method.<sup>8</sup> The start of the eruption process was determined clinically as a gingiva bump through palpation (E1). The duration of eruption time was defined as the length between eruption initiation timing and the point at which at least half of the crown has erupted (E4). Calibration was carried out for the Hulland index and gained almost perfect agreement for inter-rater reliability.

The study protocol, letter of informational consent, and other supporting documents were approved by the Universitas Indonesia Faculty of Dentistry Ethical Review Board prior to use. Written informed consent was obtained from all mothers prior to their enrollment.

### Results

Out of 335 mother-child pairs enrolled at baseline, only 172 pairs qualified for analysis. The subject characteristics are described in the table below.

**Table 1.** Distribution of Sample Characteristics

	n (%)	Mean (SD)	Min - Max
Age			
Child		20.4(8.6)	6.3-36.9 months
Mother		29.7(5.5)	22-40 years
Child gender			
Female	80(46.5)		
Male	92(53.5)		
Mothers' educational level			
<Junior high	49(9.5)		
High School-Diploma	103(61.3)		
At least strata 1	49(29.2)		
Mothers' occupation			
Not working (housewives)	147(87.0)		
Working	22(13.0)		

The children's ages ranged from 6.3 to 36.9 months, with an average age of 20.4 (SD=8.6) months, whilst the mothers' average age was 29.7(SD=5.5) years. There were more male

child subjects than female. Regarding mothers' education levels, 61% were high school or diploma graduates. Most mothers were not working (87%).

**Table 2.** Nutritional Status of Mother and Child

	n (%)	Median
Child's nutritional status		Z Score height/age
Stunting	54(31.4)	-1.1(-8.5 – 8.9)
Normal	118(68.6)	
Mother's nutritional status		Maternal mid-arm circumference
Undernourished	31(18.0)	25.3(18.0-31.0)
Normal	141(82.0)	

The prevalence of mothers and children with poor nutritional status was 18.0% and 31.4%, respectively. The mean of Z score height/age was -1.1, which was considered normal. The

mean of maternal mid-arm circumference measurement exceeded 23.5, which was also considered normal.

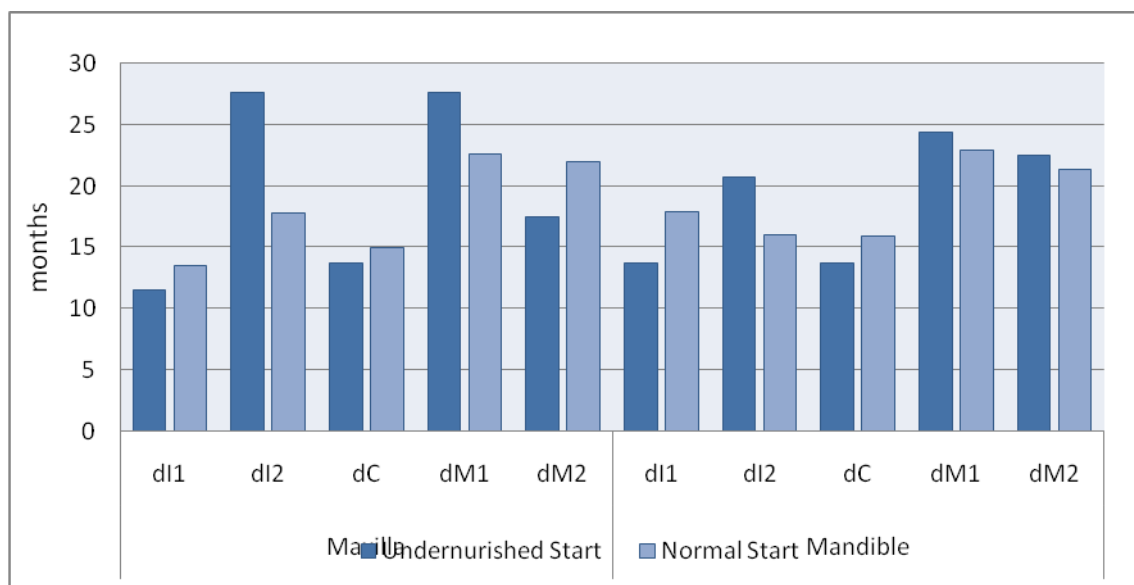
**Table 3.** Mean Age (Months) of P primary Dentition Eruption Time by Maternal Mother's Nutritional Status

	Undernourished		Normal		P value*	
	Start	Duration	Start	Duration	Start	Duration
Maxilla						
dl <sub>1</sub>	11.48	13.81	13.44	9.73		
dl <sub>2</sub>	27.56	11.80	17.73	7.08	.022	.030
dC	13.73	20.20	14.91	10.18		
dM <sub>1</sub>	27.56	13.35	22.63	5.40		
dM <sub>2</sub>	17.45	10.03	21.94	5.12		
Mandible						
dl <sub>1</sub>	13.71	18.62	17.86	5.23		
dl <sub>2</sub>	20.69	5.09	16.03	8.34		
dC	13.73	20.48	15.93	9.59		
dM <sub>1</sub>	24.36	15.99	22.90	4.50		
dM <sub>2</sub>	22.51	5.66	21.34	5.37		

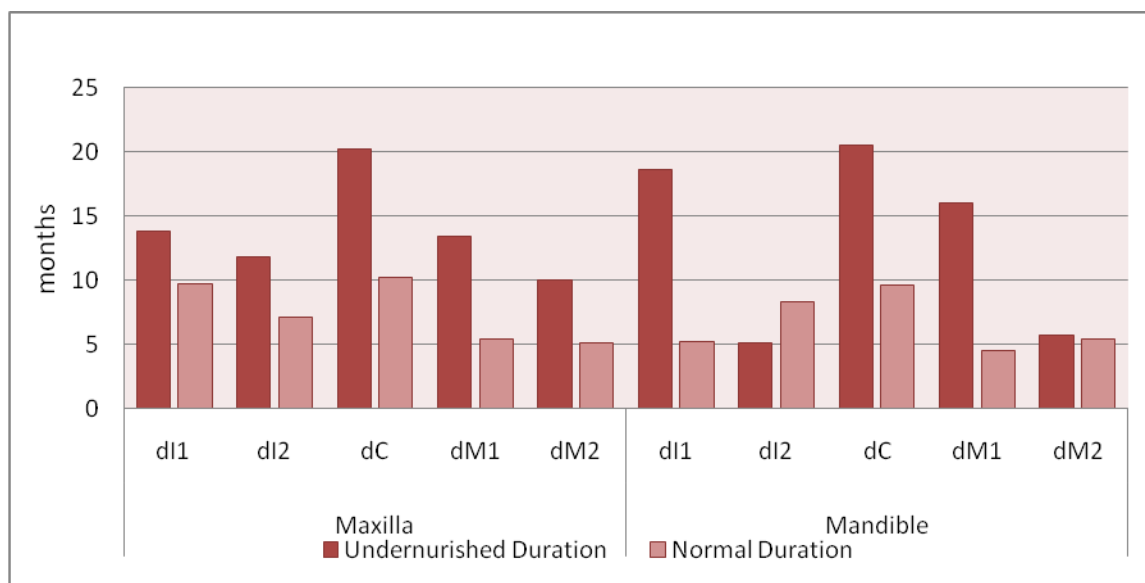
\*Mann-Whitney test

There was a significant difference in the eruption's commencement time (p=0.02) and the duration of the eruption process (p=0.03) between mothers with poor and good nutritional

statuses. Mothers with a poor nutritional status had a longer duration in the eruption process for most tooth types (Table 3), excluding the lower second deciduous incisive teeth.



**Figure 1.** Mean Age (Months) of Primary Dentition Eruption Starting Time by Maternal Nutritional Status.



**Figure 2.** Mean (Months) of Primary Dentition Duration Eruption Process by Maternal Mother's Nutritional Status.

### Discussion

Maternal nutrient intake during pregnancy affects primary teeth development during the fetal growth period. The mothers' nutritional status may thus determine the oral health of their children. The results of this study in Beji Sub-district were revealed using the Hulland method.<sup>8</sup> The Hulland method was used to classify the clinical stage of eruption. This method divides the stage of eruption into five stages, from E0 to E4. However, it is slightly

difficult to distinguish the E3 and E4 stages using this method because accuracy is essential in determining whether the teeth have erupted past 25% of the crown. The minimum age of each phase was thus used in this study to determine the eruption process duration.

This study proved that maternal nutrition status influences the commencement or starting time for tooth eruption and prolongs the eruption duration process. There was a significant difference between mothers' poor maternal nutritional status and children's commencement

eruption timing and duration ( $p < 0.05$ ). This result is supported by several studies that concluded that malnourished children experience delayed primary teeth eruption.<sup>9</sup>

This situation may occur due to the imbalanced intake of nutrients during pregnancy, leading to macro- and micro-nutrient deficiency. Macro-nutrient deficiency, such as protein deficiency, can affect the growth and development of teeth. One form of such a deficiency is delayed tooth eruption, as protein deficiency can lead to tooth formation disorders, an irregular pre-dentin layer, and hypoplasia. Besides macro-nutrient deficiencies, deficiencies of calcium and vitamins C, A, D, and E may also affect delayed tooth eruption. These nutrient deficiencies can lead to the imperfect formation and development of teeth, causing tooth eruption process delays or requiring more time to complete the process.

Various maternal nutritional status indicators were used to explore the relation between pregnancy health and tooth eruption. For example, this study measured maternal mid-arm circumference. Maternal women with nutrient deficiencies have a greater risk of preterm birth and low birth weight babies. Khalifa studied the relationship between the eruption of primary teeth for premature birth and low birth weight babies and revealed a significant difference ( $p = 0.0001$ ) among infants born prematurely with normal birth and low birth weight.<sup>6</sup> Another study by Georgia Ntani showed different results: the mother's nutritional status (determined by BMI) did not significantly ( $p > 0.05$ ) affect the time of her child's tooth eruption, but a significant difference was found based on gestational age and birth weight ( $p < 0.001$ ).<sup>10</sup>

Tooth eruption is influenced by various factors other than nutritional deficiencies, including genetic factors, race, local factors, gender, systemic factors, and congenital abnormalities.

## Conclusion

This study showed that children from mothers with poor nutritional status had later timing of tooth eruption and a longer eruption

process. This phenomenon might be due to a lack of energy and protein—factors that are essential to the development of primary teeth—during pregnancy. It is suggested to conduct another study with a bigger sample size in order to realize a good distribution for each tooth type. Since this was a cross-sectional study, a prospective study can be used to determine a more accurate eruption timing.

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